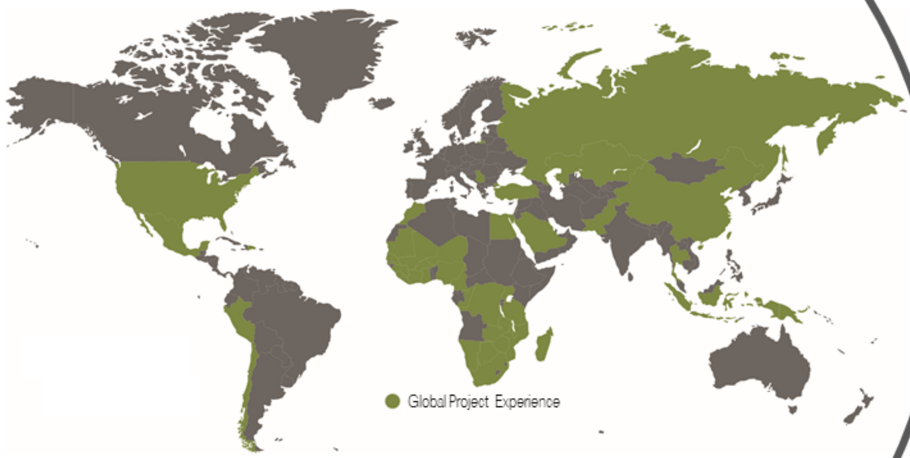

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Environmental Authorisation for Proposed Additional Infrastructure at the Universal Coal Development III (Pty) Ltd, Ubuntu Colliery, Nkangala, Mpumalanga Province

Wetland and Aquatic Impact Assessment

Prepared for:
Universal Coal Development III (Pty) Ltd

Project Number:
UCD6097

DMRE Reference Number:
MP 30/5/1/1/2/10027 EM

April 2021

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Report Type:	Wetland and Aquatic Impact Assessment
Project Name:	Environmental Authorisation for Proposed Additional Infrastructure at the Universal Coal Development III (Pty) Ltd, Ubuntu Colliery, Nkangala, Mpumalanga Province
Project Code:	UCD6097

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Experience (years):	4
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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.

April 2021

Signature of the Specialist *April 2021*

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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

Universal Coal Development III (Pty) Ltd (hereafter Universal Coal) secured a mining right (MP 30/5/1/1/2/10027 MR) for the formerly known Brakfontein Colliery in 2017. The Environmental Management Plan (EMP) was also approved at the same time. Subsequently, the Colliery name was amended in January 2019 to reflect the name change of the mine to Ubuntu Colliery.

The wetlands were delineated in 2012 and were reassessed during 2020. The wetlands impacted on due to the new proposed activities were:

- Hillslope seepage wetland connected to a watercourse;
- Valley bottom wetlands with a channel; and
- Hillslope seep wetland.

The Hydrogeomorphic Units (HGM) units were considered to have an ecological state ranging between **'Moderately Modified'** and **'Greatly Modified'.** The assessed HGM units were all determined to be of **'Intermediate**' importance. Overall, the largest ecosystem services include sediment trapping, toxicant removal, erosion control and some data exist (previous studies) for research purposes, the need for which is amplified by the surrounding agricultural and mining activities.

The Ecological Importance and Sensitivity (EIS) scores for the 2020 Wetland Assessment were regarded all as '**Moderate**'. This indicates that the wetlands are ecologically important and sensitive, and that 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, the Wilge River and Kromdraaispruit in this case.

The potential impact due to the opencast mining activities on the wetlands is major to moderate if mismanaged.

The main potential impacts associated with the proposed development include:

- Direct loss of wetland areas;
- Loss of biodiversity;
- Erosions and sedimentation of wetland areas;
- Water quality contamination and deterioration;
- Habitat loss because of poor water quality;
- Erosion of wetland crossings associated with the road diversion;
- Accidental spills causing soil and water contamination;
- Increased Alien Invasive Plants (AIPs);
- Siltation of wetlands due to erosion; and
- Change in habitat and potential change in species composition.

Assessment of the associated aquatic ecosystems was based on a desktop literature review wherein the 2012 Aquatic Impact Assessment undertaken by Digby Wells was utilised as the primary source of information and for baseline information pertaining the riverine systems in the Project Area.

Riverine systems associated with the proposed infrastructure establishment are the main stem Wilge River and the Wilge tributary which drains the northern portions of the Mining Right Area (MRA). Of the reviewed water quality data, a monitoring site (Site 4 or UCBSW2) located along the Northern Tributary, south of the OC1 opencast pit, appear to be of particular concern. *Ex situ* water quality trend data obtained from previously undertaken surface and groundwater assessments within the Project Ares indicate fluctuating pH levels (around ~6 and 9) with no particular reported 'red flags' at sampling sites associated with the current proposed Project. Exceedances in electrical conductivity, magnesium, sodium, chlorine and nitrate were recorded at Site 4 (or UCBSW2) during one or more of the quarterly surveys since 2018 to date. Elevated levels of nitrates are suspected to be resulting from agricultural activities. Sources for exceedances in the other water quality parameters could not be determined at the time of writing, however may be associated with the mining activities (Pollution Control Dam and overburden for example), further investigations are however required to confirm this.

During the 2012 Aquatic Ecology Assessment however, the overall *in situ* water quality was determined to be fair. Only pH levels at Site 1 (located along an upstream Wilge River reach and drains the southern portions of the MRA) and Site 2 (located upstream of the MRA along an unnamed tributary of the Wilge) were recorded below the recommended guidelines.

The findings from the 2012 August Index of habitat Integrity assessment indicate the overall instream and riparian habitat associated with the study area was determined to be in a largely modified state (Ecological Category D) with anthropogenic activities such as mining and agriculture being the major impacts.

Site 4 (or UCBSW2) was deemed unsuitable for sampling of aquatic biota due to the lack of flow and availability of habitat at the time of the survey. The availability of aquatic macroinvertebrate habitat was scored as 'Good' at all the sites except at Site 1 which was scored as 'Poor'. High levels of sedimentation and low flow conditions were observed at Site 1 at the time of the 2012 survey. This site also lacked the stones-in-current biotope, consequently, habitat availability and quantity were seen as the limiting factors to macroinvertebrate diversity. At all the other sites, availability of all SASS5 biotopes were observed to be sufficient and not expected to be a limiting factor to macroinvertebrate communities.

The sampled aquatic macroinvertebrate community composition at four sites during the 2012 survey was of low diversity, only 18 of the approximately 30 expected taxa were collected. Community composition was dominated by taxa that are tolerant to water quality deterioration. The collected macroinvertebrate assemblage indicated some level of water quality deterioration at all sampled sites. The macroinvertebrate ecological condition was determined to be in a Seriously Modified condition (Ecological Category E) at each of the assessed sites.

This finding was attributed to the water quality modifications and low flows observed at the time of the study.

None of the expected fish species were sampled at the time of the August 2012 survey despite the use varying methods (including electro-narcosis and using a fyke net). This was suspected to have been caused by the cold temperatures experienced during the survey with the water temperature dropping to as low as 10 ºC. It was suspected that the fish, if present, remained inactive, thus could not be collected during the survey.

This report is based on data collected from a literature review and professional experience. Without a field survey for aquatic ecology to verify these findings, conclusions made are of low confidence.

The overall impacts of the Project were determined to be significant and may potentially lead to irreversible damage to wetland areas. The recommended mitigation measures will not restore wetland areas that are lost because of the Project; however, will be to rehabilitate and preserve un-impacted wetlands and improve their functioning.

It is recommended that rehabilitation, mitigation measures and wetland monitoring are correctly implemented to minimise potential impacts on the wetland functionality. A Wetland Offset Calculator should be applied to determine the total wetland loss and to compensate for significant residual adverse impacts.

Based on the understanding of the Project while considering the results of the impact assessment, Digby Wells does not object to the Project; taken into consideration the provided EMP, Monitoring Program, and Recommendations in the specialist studies are adopted. It is recommended that a Wetland Offset Strategy is implemented to determine the amount of wetland loss due to the proposed activities.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS, ABBREVIATIONS AND DEFINITION

°C	Degree Celsius
CARA	The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
cm	Centimetre
CMA	Catchment Management Agencies
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
Digby Wells	Digby Wells Environmental
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation, previously Department of Water Affairs and Forestry (DWAF)
EA	Environmental Authorisation
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
FEPA	Freshwater Ecological Priority Area
h	Hectare
HGM	Hydro-geomorphic
I&APs	Interested and Affected Parties
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use License Application
IWWMP	Integrated Water and Waste Management Plan
IXIA	Ixia Coal (Pty) Ltd
km	Kilometre
m	Metre
m.a.m.s.l.	Metres above mean sea level
MAP	Mean Annual Precipitation

MBSP	Mpumalanga Biodiversity Sector Plan
mm	Millimetre
MM	Mine Manager
MRA	Mining Right Area
MTPA	Mpumalanga Tourism and Parks Agency
NBA	National Biodiversity Assessment
NBF	National Biodiversity Framework
NDM	Nkangala District Municipality
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)
OC1	Open Pit
ONA	Other Natural Area
PA	Protected Area
PCD	Pollution Control Dam
PES	Present Ecological State
PPP	Public Participation Process
Ramsar	Wetlands of International Importance
RE	Remaining Extend
ROM	Run of Mine
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SEP	Stakeholder Engagement Process
SFI	Soil Form Indicator
STP	Sewage Treatment Plant
SWI	Soil Wetness Indicator
TUI	Terrain Unit Indicator
UCD	Universal Coal PLC
NDM	Nkangala District Municipality

WET-EcoServices	Wetland Ecological Services
WET-Health	Wetland Ecological Health Assessment
WMA	Water Management Areas
WML	Water Management License
WRC	Water Research Commission
WUL	Water Use License
WWF	Worldwide Fund for Nature

Legal Requirement		**Section in Report**
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of-	5
	(i) the specialist who prepared the report; and	5
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	2
cA	And indication of the quality and age of the base data used for the specialist report;	6
cB	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	7
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	6
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	6
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	7.1
(g)	an identification of any areas to be avoided, including buffers;	7.1
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	7.1

Legal Requirement		Section in Report
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	0
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	7.1
(k)	any mitigation measures for inclusion in the Environmental Management Programme (EMPr);	8.7
(l)	any conditions/aspects for inclusion in the environmental authorisation;	14.2
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	11
(n)	a reasoned opinion (Environmental Impact Statement) -	14.2
	whether the proposed activity, activities or portions thereof should be authorised; and	14.2
	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	14.2
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	11.2
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	11.2
(q)	any other information requested by the competent authority.	n/a

1. Introduction

Universal Coal Development III (Pty) Ltd (Universal Coal) secured a mining right (MP 30/5/1/1/2/10027 MR) for the formerly known Brakfontein Colliery in 2017. The Environmental Management Plan (EMP) was also approved at the same time. Subsequently, the Colliery name was amended in January 2019 to reflect the name change of the mine to Ubuntu Colliery. The following approvals exist for the Ubuntu Colliery:

- Mining Right and EMP issued by the Mpumalanga Department of Mineral Resources and Energy (MP 30/5/1/1/2/10027 MR);
- The name changes of the colliery from Brakfontein Colliery to Ubuntu Colliery on 29 January 2019; and
- Water Use License (WUL) issued by the Department of Water and Sanitation on 22 February 2019 (03/B20E/ABCGIJ/4751).

This application focuses on the inclusion of additional infrastructure not previously considered in the original applications (i.e. Current EMP). This infrastructure triggers Listed Activities contemplated under the Environmental Impact Assessment (EIA) Regulations, 2014 (as amended) and thus the need for Environmental Authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

This Wetland and Aquatic Impact Assessment Report was compiled in support of the NEMA application and will form the basis for the EIA and the EMP report.

Note: The Ubuntu Colliery holds a Mining Right and EMP approved for mining. The subject of this report and application is only for the additional infrastructure.

1.1. Project Locality

The proposed Ubuntu Colliery Project Area is located within the western margins of the Witbank Coalfields under the jurisdiction of the Victor Khanye Local Municipality which is located in the Nkangala District Municipality, Mpumalanga Province (Table 1-1 and Figure 1-2). The site is located approximately 16 kilometres (km) north-east of Delmas and 14 km and 17 km north of Devon and Leandra respectively.

Table 1-1: Summary of the Ubuntu Colliery Project Location Details

Province	Mpumalanga	
Magisterial District/Local Authority (Figure 1-1**)**	Victor Khanye Magisterial District	
District Municipality	Nkangala District Municipality (NDM)	
Local Municipality	Victor Khanye Local Municipality (VKLM)	
Nearest Town	Devon (14 km), Delmas (16 km), Leandra (17 km)	
Property Name and Number	**Farm Name**	**Farm Portion**
	Brakfontein 264 IR/RE	0
	Brakfontein 264 IR	10
21 digit Surveyor General Code for each farm portion:	T0IR00000000026400000 T0IR00000000026400010	
GPS Co-ordinates (relative centre point of study area)	28°51'39.698"E	
	26°12'31.237"S	

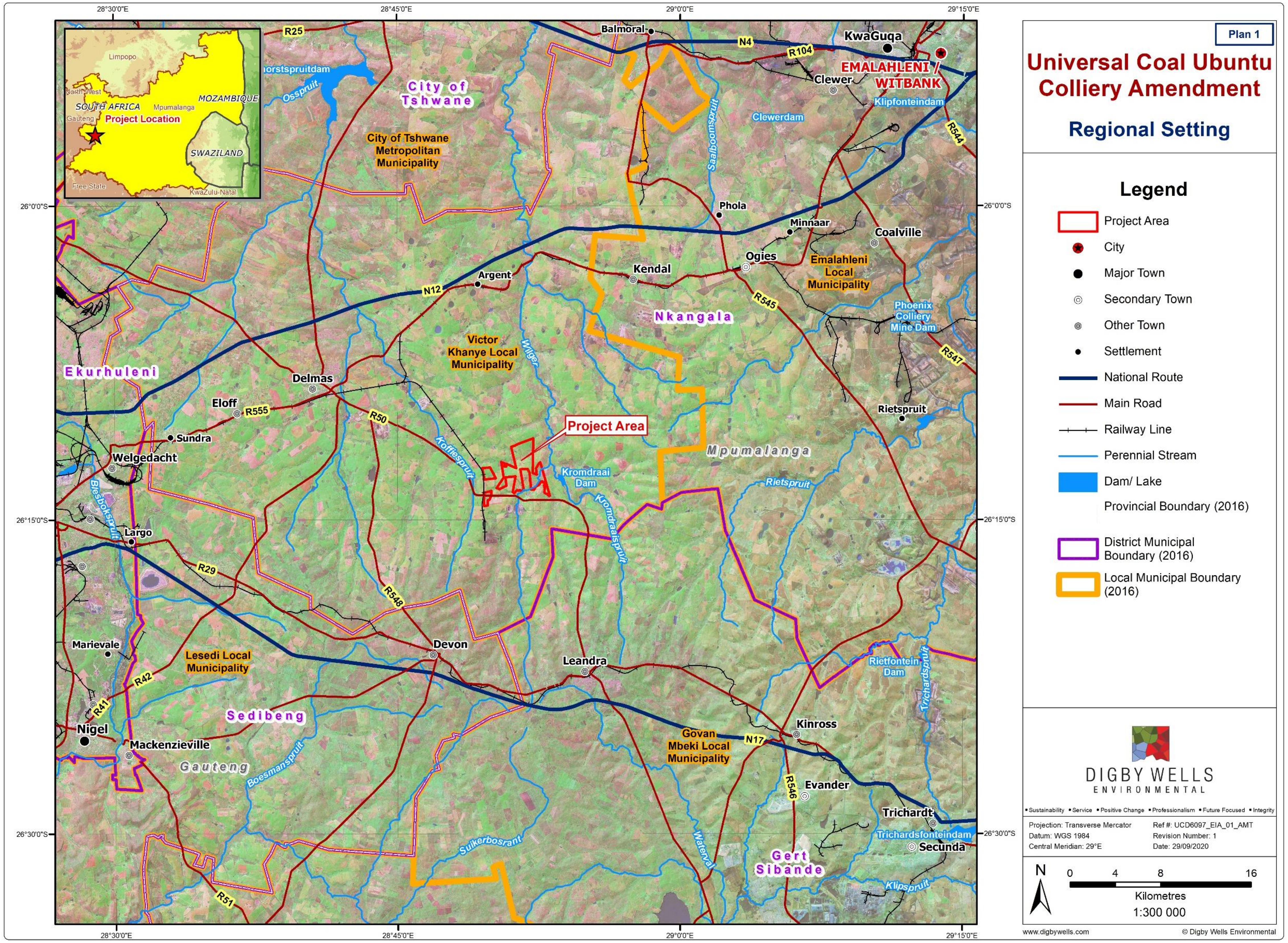

Figure 1-1: Regional Setting

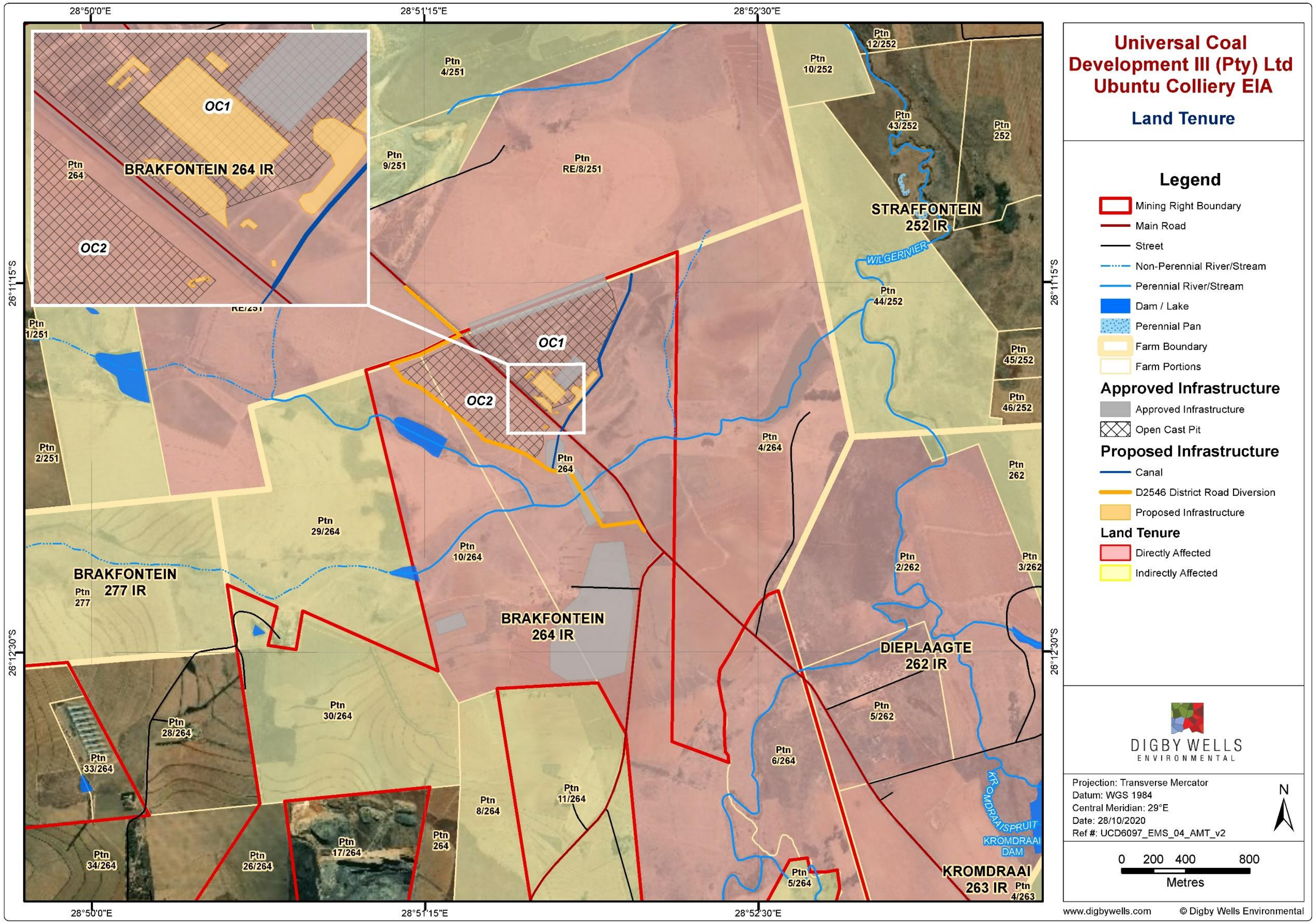

Figure 1-2 Land Tenure in the Project Area

1.2. Project Background

The purpose of this application is to authorise the establishment of additional infrastructure within the Mining Right Boundary of the Ubuntu Colliery. This include:

- Section 1.2.1 below summarises the approved infrastructure;
- Section 1.2.2 describes the proposed infrastructure that requires authorisation for this application process, and
- Section 1.2.3 provides the Listed and Specified activities per project phase.

The area pertaining to the infrastructure amendments (hereinafter Project Area) is currently approved for opencast mining at the open pit (OC1). The footprint of OC1 will be reduced to accommodate the additional infrastructure as listed below.

1.2.1. Approved Infrastructure

The authorised infrastructure (as per the approved EMP) includes the following:

- Parking and offices;
- Weighbridge;
- Run of Mine (RoM) pads;
- Pollution Control Dams (PCDs);
- Opencast mining;
- Culvert;
- Mine equipment workshop and stores; and
- Wash bay facility.

The original approval did not involve processing infrastructure on site as the coal was planned to be transferred to Kangala Colliery for further processing (including crushing, screening, and washing). This has subsequently proven to be impractical. Crushing and screening is currently taking place in the approved pit area with a mobile crushing and screening plant.

1.2.2. New Infrastructure (The Project)

Further to on-site crushing and screening, the following new infrastructure requires environmental authorisation (Figure 1-3):

- Guard house and access control gate
- Control room
- Toilet facilities
- LDV and main access road
- Heavy duty truck access road
- Storm water diversion berm/trench

- Haulage truck queueing area
- Hard park area
- Brake test ramp area
- Diesel depot area
- Product stockpile
- Perimeter fencing
- Crushing facilities and stockpile area
- Diversion of D2546 District road
- Access control and boom gate
- Topsoil safety berm
- Lab office
- Sewage Treatment Plant (STP)
- Contractors camp site
- Water Treatment Plant (WTP)
- 45 000 litre silo tank

The following should be further noted pertaining to the above infrastructure:

- The new infrastructure shall be established on environmentally authorised land;
- The WTP will treat borehole water sourced from areas in the project footprint. The treated water will be for domestic use. The daily throughput of the WTP will be 12m^3 p/day; and
- The specific designs for the diversion of district road D2546 will be confirmed. It is proposed to have a reserve of 30 m and length of 2,5 km.

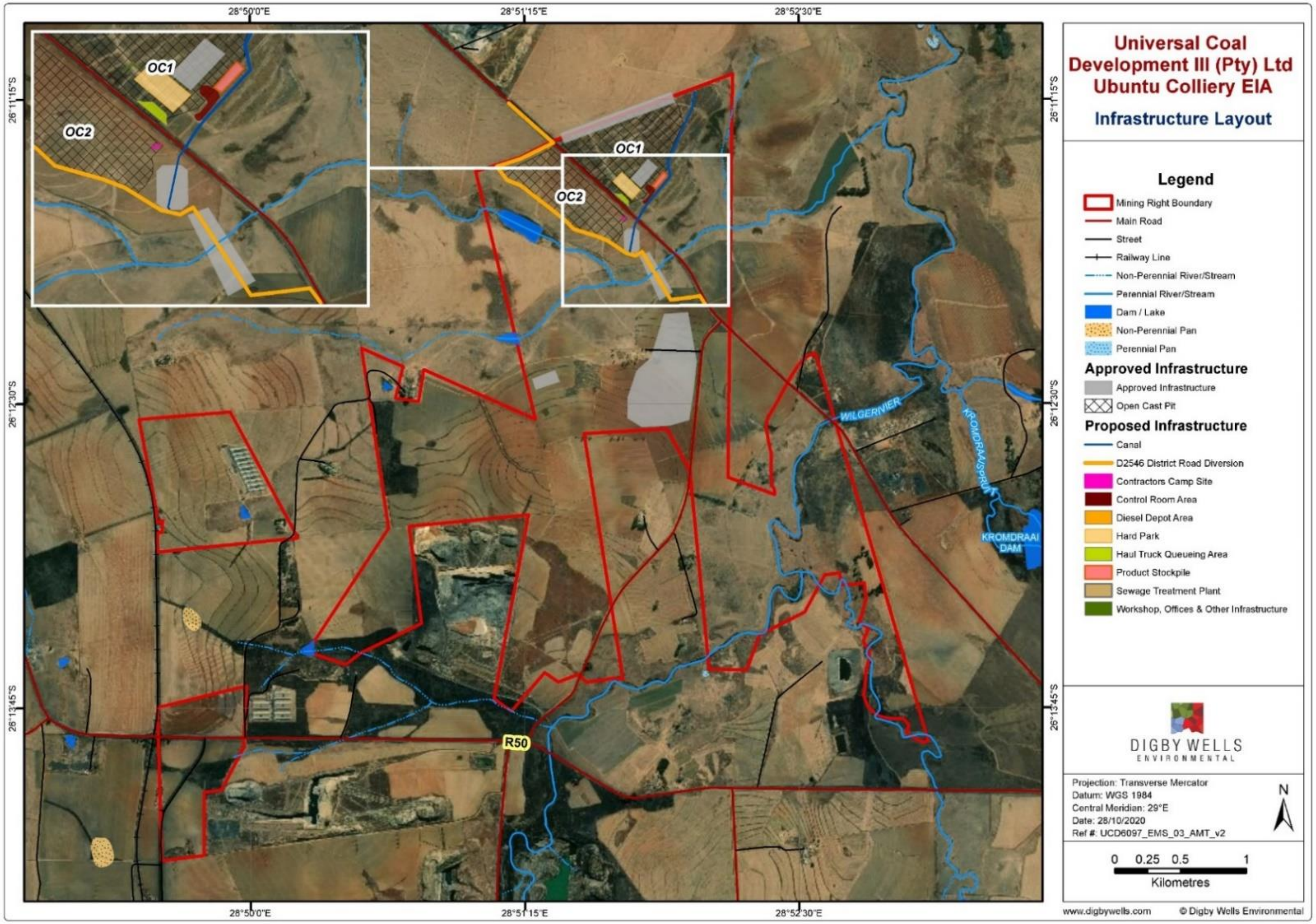

Figure 1-3 New Infrastructure (The Project)

1.2.3. Proposed Activities

The construction, operation and decommissioning phases of the Project shall comprise of the activities in Table 1-2. These Project activities will be used for the Wetland Impact Assessment.

Table 1-2: Project Phases and Associated Activities

Phase	Activity
Construction	Surface preparation for infrastructure
	Construction of surface infrastructure
Operational	Operation and maintenance of infrastructure
	Use and maintenance of haul roads (incl. transportation of coal to washing plant)
Decommissioning	Demolition and removal of all infrastructure (incl. transportation off site)
	Rehabilitation (spreading of soil, revegetation, and profiling/contouring)
	Installation of post-closure water management infrastructure

1.3. Alternatives Considered

Alternatives to consider ensuring minimal impacts to the wetlands include:

- Minimize the surface infrastructure footprint within the wetlands;
- Locate infrastructure outside of wetlands and their associated 100 m buffer zones and 500 m zones of regulation as far as possible;
- Restrict access to remaining and unimpacted wetlands;
- Avoid construction and access/movement within remaining wetlands and their associated zones of regulation;
- Where construction in wetlands and buffer zones cannot be avoided (road, powerline, STP, WTP, etc.), take precautions to prevent soil and water contamination, erosion and sedimentation by modifying and stabilizing slopes with vegetation;
- Minimize quantity of water utilised for operations;
- Improve wastewater and sewage qualities to meet approved qualities before discharging it into the freshwater systems (please see the Surface Water Impact Assessment Report);
- Implement a wetland monitoring program;
- Reduce waste materials and waste outputs; and

- Consider the proposed Diversion of D2546 District road with the least impacts and crossings of wetlands.

2. Scope of Work

The Scope of Work for the Wetland Impact Assessment comprised updating the previous report, which includes:

- **Desktop Assessment:** Review of historical reports, previous delineations, catchment data, regional background information and identifying additional freshwater resources within the Project Area;
- **Wetland Delineation Verification:** Identification and characterisation of wetlands and buffer zones within the Project Area;
- **Wetland Health Assessment:** Assess and update the previous report of the Present Ecological State (PES), wetland service provision (ES), and Ecological Importance and Sensitivity (EIS);
- **Sensitivity Mapping:** Update and provide recommendations on buffer zones according to the guidelines set out in the ‘Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries’ (Macfarlane, D.D., *et al*, 2014); (Macfarlane, et al., 2014);
- **Impact Assessment:** Update of the proposed activities based on the findings of the desktop and field assessments concerning the proposed activities and infrastructure; and
- **Mitigation and Management Plan:** Update and provide recommendations to develop a rehabilitation and management plan for the Life of Mine (LoM).

3. 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 Environmental Impact Assessment are detailed in Table 3-1.

Table 3-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law	Applicability
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: • Amendment of the Alien and Invasive Species Lists, 2020 published (GNR 627 in GG 43386 of 3 June 2020); • National Environmental Management: Biodiversity Act, 2004: 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).	• A Wetland Impact Assessment was undertaken in 2012 and updated in this report as part of the EIA Phase; • The Project activities are set out in Section 1.2.3 to abide by the guidelines set out in NEM:BA; • Areas of concern are indicated and possible alternatives to avoid these areas; and • Required mitigation measures is included in the EMP as part of the EIA Phase.
Section 24 of the Constitution of the Republic of South Africa,1996 (Act No. 108 of 1996) Wetlands are protected under the Act that states that everyone has the right to an environment that is not harmful to their health or wellbeing. 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.	• A Wetland Impact Assessment was undertaken as part of the EIA Phase; • Environmental Management Plan and Monitoring Program is included in the EIA Phase; • Recommendations to prevent, avoid, and rehabilitate possible impacts were assessed.

Legislation, Regulation, Guideline or By-Law	Applicability

<u>The National Water Act, 1998 (Act No. 36 of 1998) (NWA)</u>
• Section 19 of the National Water Act (NWA), 1998 (Act 36 of 1998):
  ◦ The prevention and remediation of the effects of pollution.
• Section 21 (c), (g) and (i) of the National Water Act (Act 36 of 1998):
  ◦ The use of water.
	• A Wetland Impact Assessment was undertaken as part of the EIA Phase. The EIA identified possible water usages, impacts, and possible prevention strategies;
	• Environmental Management Plan and Monitoring Program is included in the EIA Phase;
	• Recommendations to prevent, avoid, and rehabilitate possible impacts were assessed.

<u>National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).</u> 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 (1)(a) and (b) of NEMA state 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.	• Activities that will influence the Wetlands of the proposed Project Area are listed in Section 1.2.3 and have been identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation before being undertaken.

Legislation, Regulation, Guideline or By-Law	Applicability
Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005) To delineate any wetland the following criteria are used as 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).	• This guideline is a tool for wetland practitioners, at all levels, to improve procedures for mapping wetlands using a set of standards for data collection and storage,. Data feed into national-level databases such as the National Wetland Inventory, and that informs national policy tools such as National Freshwater Ecosystem Priority Areas (NFEPA). • It also includes tips on recognising, digitising, and classifying wetlands and human impacts on wetlands from desktop imagery and in the field.
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. 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.	• Provides background information about wetlands and natural resource management as well as tools that can be used to guide decisions around wetland management.

Legislation, Regulation, Guideline or By-Law	Applicability
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'.	• Will help greatly to ensure that healthy freshwater ecosystems continue to form the cornerstone of the implementation of our water resource classification system and the development of catchment management strategies throughout the country. They also inform planning and decisions about land use and the expansion of the protected area network. By highlighting which ecosystems should remain in a healthy and well-functioning state, the maps provide a tool to guide our choices for the strategic development of water resources and to support sustainable development.
SANBI, in collaboration with the DWS report on "Wetland offsets: a Best-Practice Guideline for South Africa" (SANBI and DWS, 2016) This guideline serves as a practical tool to aid in the consistent application of wetland offsets in South Africa. The guideline is primarily aimed at wetland offsets required as part of water use authorisation processes (e.g. in an application for a Water Use Licence under the National Water Act) where compensatory actions are required to achieve water resources management and biodiversity conservation objectives. The guideline is equally relevant for use in EIA processes (e.g. as part of the environmental authorisation process in terms of the NEMA or an application for a mining license or development of	• The guideline provides practical guidance for determining the size and characteristics of a wetland offset and determining the requirements for its implementation, once a decision on the need for a wetland offset has been taken through the water use authorisation process by the DWS.

Legislation, Regulation, Guideline or By-Law	Applicability
an Environmental Management Programme under the Mineral and Petroleum Resources Development Act). Wetland offsets are enduring measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse impacts on wetlands. They are implemented to address any anticipated significant residual impacts arising from development projects after appropriate avoidance, minimisation, and rehabilitation measures have been considered. The goals of wetland offsets are to achieve 'No Net Loss' and preferably a net gain concerning the full spectrum of functions and values provided by wetlands. These include: • Water resource and ecosystem service value, especially concerning regulating and supporting functions pertinent to water resource management and disaster risk reduction, such as flood control and water quality enhancement, but also including direct services such as food and water provisioning and cultural services such as spiritual, recreational, and cultural benefits that sustain communities; • Ecosystem conservation, especially in terms of meeting national, provincial and local objectives for habitat protection and avoiding a deterioration in ecosystem threat status; and • Species of conservation concern, to ensure that the status of threatened, rare or keystone wetland dependant species is maintained or improved.	
General Authorisation in Terms of Section 39 of the National, Water Act, 1998 (Act No. 36 Of 1998). The GA defines a 'regulated area of a water course' for Section 21(C) Or Section 21(I) of the Act water uses in terms of this notice as:	• Wetland delineations and sensitivity maps include a 500 m "regulated area of a water course', also known as a 500 m 'zone of regulation'

Legislation, Regulation, Guideline or By-Law	Applicability
• The outer edge of the 1 in 100-year flood line and /or delineated riparian habitat whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • In the absence of a determined 1 in 100 year flood line or riparian area the area within 100m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench *(subject to compliance to section 144 of the Act)*; or • A 500 m radius from the delineated boundary (extent) of any wetland or pan.	

4. Assumptions, Limitations and Exclusions

The compilation of this Report is based on the following assumptions and limitations in Table 4-1.

Table 4-1: Limitations and Assumptions with Resultant Consequences of this Report

Assumptions and Limitations	Consequences
Wetland Ecology Assessment	
The wetland assessment is based on the original wetland assessment completed for the Ubuntu Project completed in 2012 (reference number: Digby Wells Environmental. An Ecological Assessment of The Wetland Systems of The Brakfontein Mining Operation, UNI1292). The 2020 assessment contained in this report is an update of the previous study.	The Wetland delineations and ecological status were updated from the previous report. Due to the age of the previous report and the dynamic nature of wetlands, the data may be different from the 2012 report, such as the Present Ecological State (PES), Ecological Importance and Sensitivity (EIS) and the Ecological Services (ES).
The area surveyed was based on the layout presented by Universal Coal in June 2020.	The study focused on the Brakfontein 264 IR/RE portion 0 and Brakfontein 264 IR portion 10 only with relevance to the newly proposed infrastructure. The systems that were not verified during the field survey were scrutinised at a desktop level using aerial imagery and contours and have been demarcated as such for transparency.
Wetlands situated within the 500 m zone of regulation were assessed mostly on a desktop level with very limited verification in the field.	Some discrepancies within the zone may occur. However, these systems were scrutinised at a desktop level using aerial imagery and contours and have been demarcated as such for transparency.
Both the 2012 and 2020 Wetland Assessments were conducted in winter and therefore some restrictions regarding vegetation, identification and flows in the systems.	Findings, recommendations, and conclusions provided in this report are based on the authors' best scientific and professional knowledge and information available at the time of compilation. The 2012 report was utilised to provide some information regarding vegetation species.
Aquatic Ecology Assessment	
No field work was undertaken, thus the assessment was based on desktop data analysis.	Desktop findings pertaining watercourses need to be verified on-site to enable an adequate Aquatic Impact Assessment.

Assumptions and Limitations	Consequences
The 2012 Aquatic Ecology Assessment, undertaken during the dry season, was the primary source of data utilised for the current project.	During the dry season, watercourses are typically in low or no flow. The selected assessment indices are designed for application within riverine systems with a moderate hydrology and diverse habitat availability.
A single dry season survey was undertaken.	To obtain a comprehensive understanding of the dynamics of the biota present within a watercourse, studies should include investigations conducted during different seasons. Some aquatic biota may have been missed due to the low flow conditions at the time of sampling.
The specific designs for the diversion of district road D2546 and culvert type was not yet confirmed at the time of writing.	The proposed reserve of 30 m and length of 2.5 km were considered for the current assessment.

5. Details of the Specialist

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

- **Kathryn Terblanche** is the Rehabilitation and Soils Manager. She received a Bachelor of Science in Ecology and Environmental Science and an Honours degree in Environmental Management from the University of Cape Town. She also has received her M.Sc. in Restoration Ecology through the University of KwaZulu-Natal. She joined Digby Wells in February 2016 to form part of the Mine Closure and Rehabilitation Department. Kathryn is responsible for development of site-specific rehabilitation plans, working closely with both the botany and soils specialists in Digby Wells.

  She has also undertaken various wetland and rehabilitation monitoring programmes within the mining and energy production sectors. Kathryn previously worked extensively with alien invasive species removal programmes, ecological restoration Projects and sustainable development programmes within the Government Sector. Her previous experience was gained in the Restoration Ecology Branch at the eThekwini Municipality in Durban.

- **Willnerie Janse van Rensburg** is a Soil Scientist in the Rehabilitation, Closure and Soils Division at Digby Wells. 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 five years' experience in the fields of Soil Science and Environmental Science. She has experience in completing soil surveys, land capability assessments, irrigation scheduling and provides recommendations on soil amelioration. Willnerie also completes wetland delineations and assessments. She has undertaken work in 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 an Assistant 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 in 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.

- **Byron Bester** is registered as a Professional Natural Scientist (Reg. No. 400662/15), holds a M.Sc. in Aquatic Health, is SASS-accredited practitioner and versed in the EcoStatus Determination process preferred by the RHP/REMP. He has approximately ten years' experience in environmental consulting, including astute project management and specialist resource management, as well as a broad specialist knowledge of various aspects of aquatic and wetland ecosystem assessment throughout South Africa and abroad (i.e. Botswana, Cote d'Ivoiré Democratic Republic of Congo, Ghana, Mali, Namibia, Senegal, Tanzania, and Zambia), including water quality assessment, sediment composition, aquatic macroinvertebrate community monitoring, 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.
- **Tebogo Khoza** holds a M.Sc. (Biodiversity and Conservation) and registered as a *Candidate Natural Scientist* with the South African Council for Natural Sciences Professions (Reg. no. 119651). He is an accredited SASS5 River Eco-Status Monitoring Programme practitioner with the Department of Water and Sanitation. He has recently joined the Digby Wells team as a Junior Ecologist, having 2 years' worth of experience in the environmental consulting industry with focus on aquatic-related studies wherein the various eco-status determination indices (including SASS5, IHAS, IHIA, MIRAI, FRAI etc.).

6. Methodology

This section provides the methodology used in the compilation of the Wetland Impact Assessment. A detailed methodology is described in Appendix A and is summarized in Figure 6-1 below.

The field assessment for the update of the wetland ecology associated with the proposed Ubuntu Project was carried out 8 and 9 July 2020.

The Aquatic Ecology Impact Assessment encompassed a desktop assessment utilising background information and historical information on the watercourses associated with the proposed Project. National and provincial spatial databases were reviewed in relation to the proposed Project (e.g. National Freshwater Ecosystem Priority Areas project, National Biodiversity Assessment, Present Ecological State/Environmental Importance and Sensitivity database, etc.).

The following previously undertaken studies were considered:

- An Aquatic Assessment of the local river systems of the Brakfontein Mining Operation, (Digby Wells Environmental, 2012a);
- Integrated Water and Waste Management Plan for the proposed Brakfontein Coal Mine, (Digby Wells Environmental, 2012b)
- Surface Water Specialist study for Brakfontein EIA / EMP, (Digby Wells Environmental, 2012c)
- Environmental Authorisation for Proposed Additional Infrastructure at the Universal Coal Development III (Pty) Ltd, Ubuntu Colliery, Nkangala, Mpumalanga Province, Wetland and Aquatic Impact AssessmentDigby Wells Environmental, 2020).

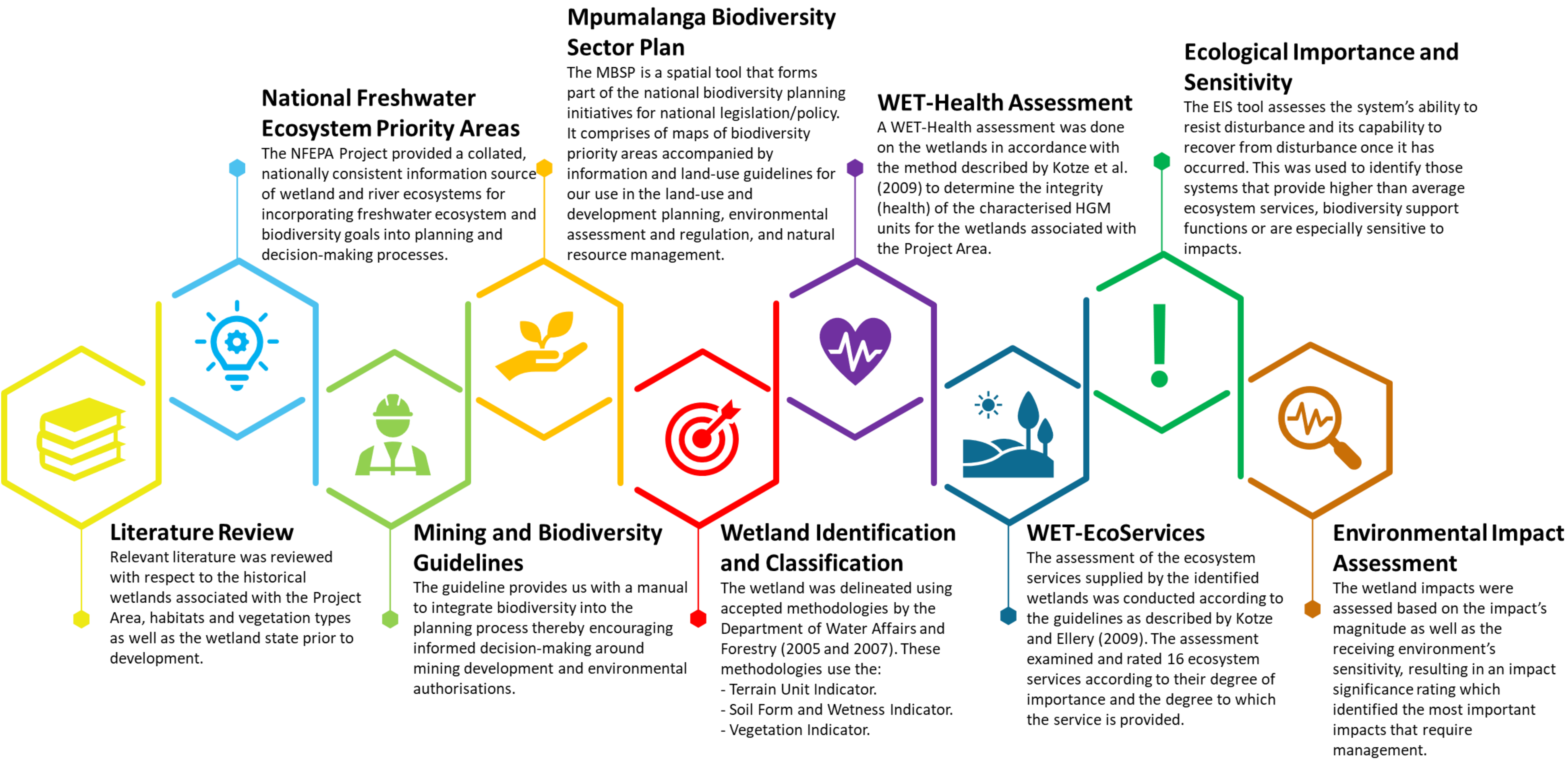

Figure 6-1: Wetland Assessment Methodology

7. Baseline Environment

The baseline assessment was conducted, followed by a site survey to verify the findings. The Baseline information is presented in Table 7-1 below for The Project:

Table 7-1: Baseline Environment of the Ubuntu Colliery Project Area

Bioregional Context (Darwell W. , Smith, Tweddle, & Skelton, 2009)		**Characteristics of the Highveld Ecoregion** (Kleynhans, Thirion, & Moolman, 2005)		**Plant Species Characteristic of the Eastern Highveld Grasslands** (Mucina & Rutherford, 2012) **(**Figure 7-1**)**	
Political Region	Mpumalanga	Terrain Morphology	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.	Graminoid Species	*Aristida aequiglumis, A. congesta, A. junciformis subsp. galpinii, Brachiaria serrata, Cynodon dactylon, Digitaria monodactyla, D. tricholaenoides, Elionurus muticus, Eragrostis chloromelas, E. capensis, E. curvula, E. gummiflua, E. patentissima, E. plana, E. racemosa, E. sclerantha, Heteropogon contortus, Loudetia simplex, Microchloa caffra, Monocymbium ceresiiforme, Setaria sphacelata, Sporobolus africanus, S. pectinatus, Themeda triandra, Trachypogon spicatus, Tristachya leucothrix, T. rehmannii, Alloteropsis semialata* subsp*. ecloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides.*
Level 1 Ecoregion	Highveld	Vegetation Types	Mixed Bushveld (limited); Rocky Highveld Grassland; Dry Sandy Highveld Grassland; Dry Clay Highveld Grassland; Moist Cool Highveld Grassland; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).	Herb Species	*Berkheya setifera, Haplocarpha scaposa, Justicia anagalloides, Pelargonium luridum, Acalypha angustata, Chamaecrista mimosoides, Dicoma anomala, Euryops gilfillanii, E. transvaalensis subsp. setilobus, Helichrysum aureonitens, H. caespititium, H. callicomum, H. oreophilum, H. rugulosum, Ipomoea crassipes, Pentanisia prunelloides* subsp*. latifolia, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
Freshwater Ecoregion	Southern Temperate Highveld	Altitude (m.a.m.s.l.) (modifying)	1 100-2 100, 2 100-2 300 (very limited)	Geophytic Herb Species	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula* var*. pilosissima, Ledebouria ovatifolia.*
Geomorphic Province	Mpumalanga Highlands	Mean Annual Precipitation (MAP) (mm) (Secondary)	400 to 1 000	Succulent Herb Species	*Aloe ecklonis.*
Vegetation Type	Eastern Highveld Grassland	Coefficient of Variation (% MAP)	<20 to 35	Low Shrub Species	*Anthospermum rigidum* subsp*. pumilum, Seriphium plumosum.*
WMA	Olifants	Rainfall Seasonality	Early to late summer	Status	Vulnerable.
Sub-WMA	Upper Olifants	Mean Annual Temp. (°C)	12 to 20	**MBSP Category** (MTPA, 2014) **(**Figure 7-3**)**	
Secondary Catchment	B20	Mean Daily Summer Temp. (°C): February	10 to 32	The Project Area has a large portion classified as 'Heavily Modified'. The remaining Project Area falls within the Other Natural Areas (ONAs). The dominant land use of the area is mining and agropastoral activities, relating to the heavily modified classification.	

<table>
<tr><th colspan="2">Bioregional Context (Darwell W. , Smith, Tweddle, & Skelton, 2009)</th><th colspan="2">Characteristics of the Highveld Ecoregion (Kleynhans, Thirion, & Moolman, 2005)</th><th colspan="2">Plant Species Characteristic of the Eastern Highveld Grasslands (Mucina & Rutherford, 2012) (Figure 7-1)</th></tr>
<tr><td>Quaternary Catchment (Figure 7-2)</td><td>B20E</td><td>Mean Daily Winter Temp. (°C): July</td><td>-2 to 22</td><td colspan="2"></td></tr>
<tr><td>Watercourse</td><td>Wilge River and Kromdraaispruit tributaries</td><td>Median Annual Simulated Runoff (mm)</td><td>5 to >250</td><td colspan="2">NFEPA Wetland Classification (Nel, et al., 2011) (Figure 7-4 and Figure 7-5)</td></tr>
<tr><td colspan="4">Mining and Biodiversity Guideline Category, DEA (2013) (Figure 7-6)</td><td>NFEPA Wetlands</td><td>Valley Floor: Channelled Valley Bottoms on the west of OC2 hereinafter named the Wilge River tributary. The proposed infrastructure will also affect the Kromdraaispruit tributary south of the area classified as a Valley Floor: Floodplain wetland.</td></tr>
<tr><td colspan="4">D: Moderate Biodiversity Importance – Moderate Risk for Mining.</td><td>River FEPA</td><td>Sub-Quaternary Catchment.</td></tr>
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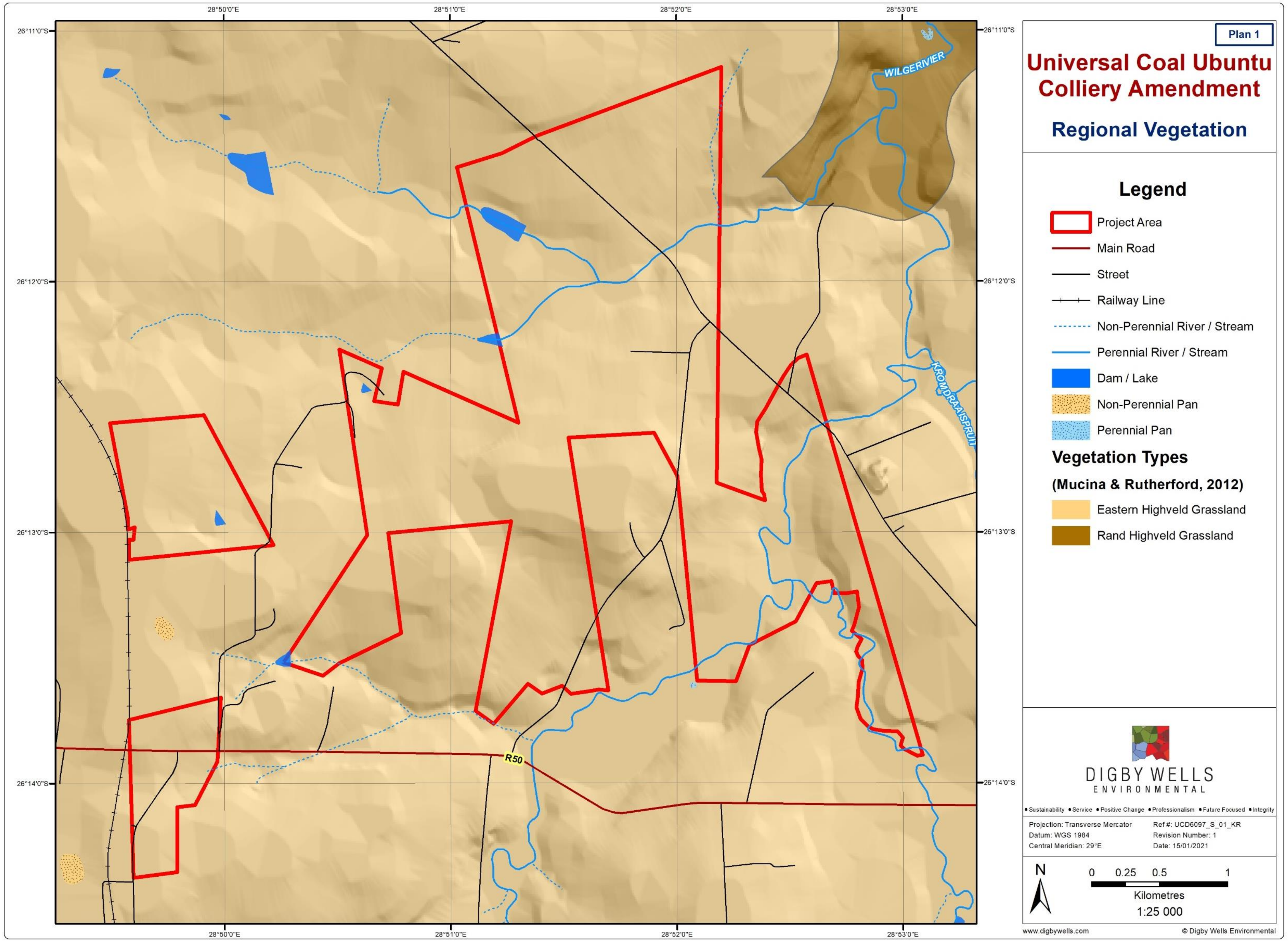


Figure 7-1: Regional Vegetation of Ubuntu Colliery

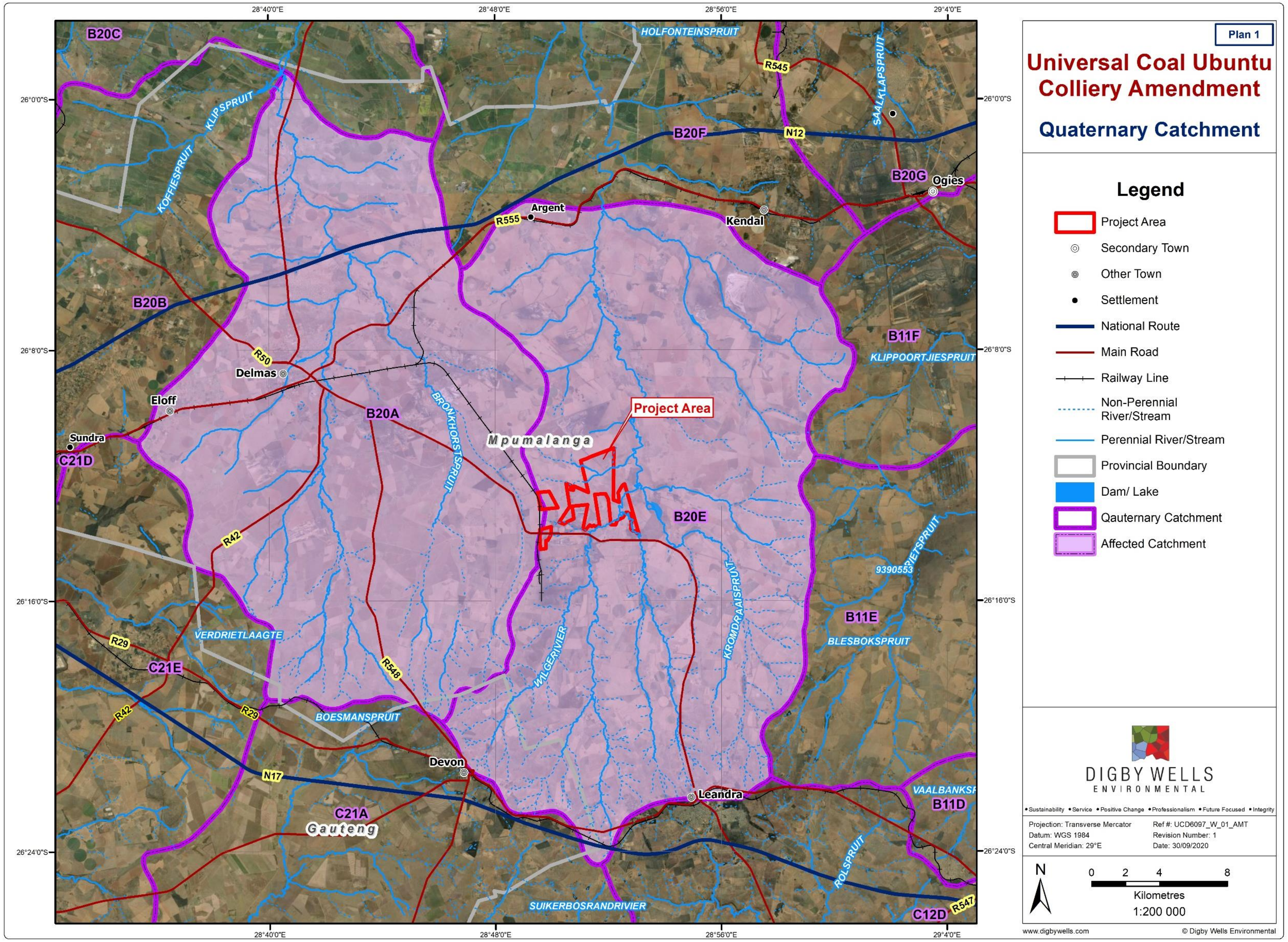


Figure 7-2: Quaternary Catchment of Ubuntu Colliery

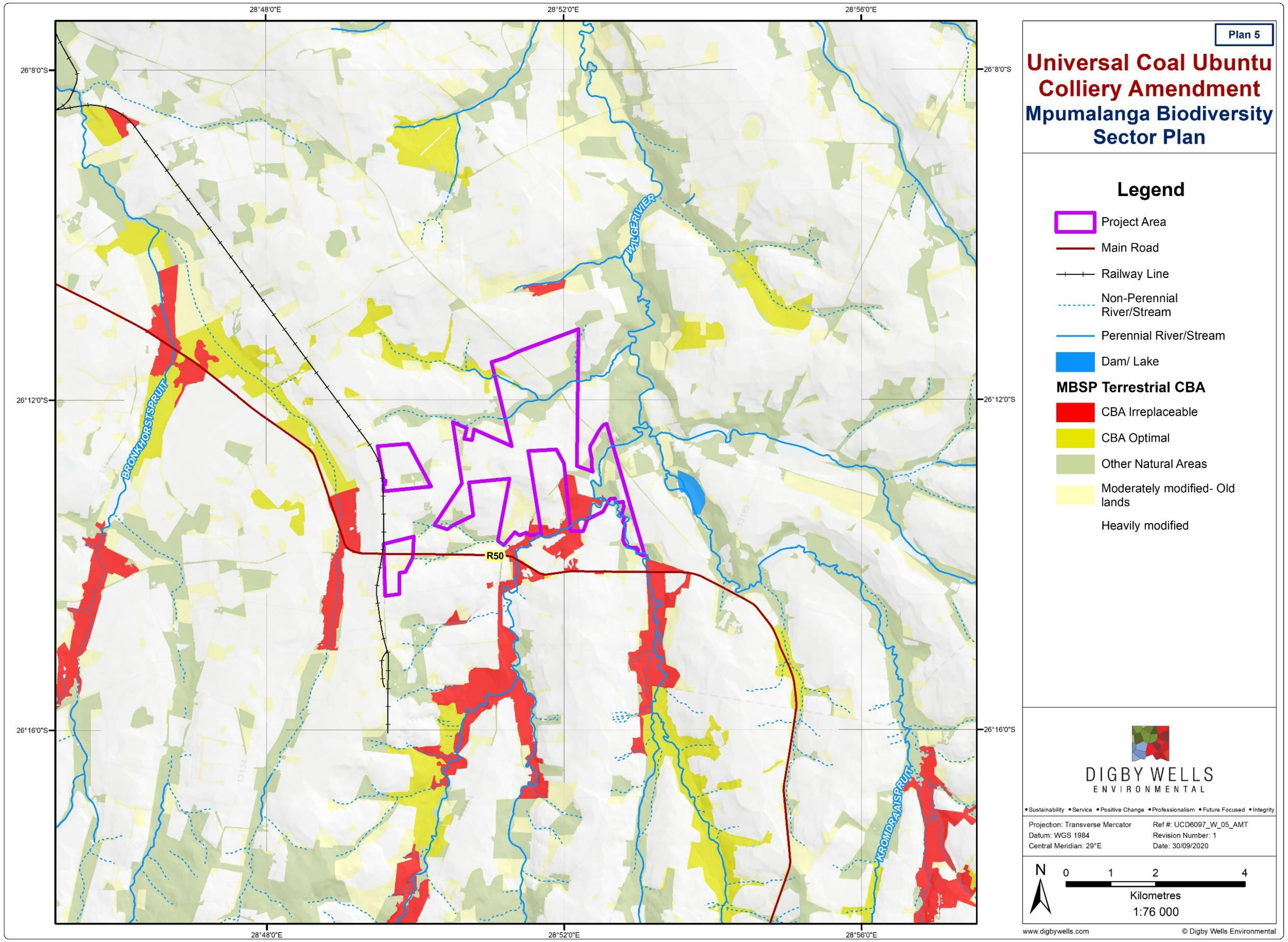


Figure 7-3: Mpumalanga Biodiversity Sector Plan (MBSP) of Ubuntu Colliery

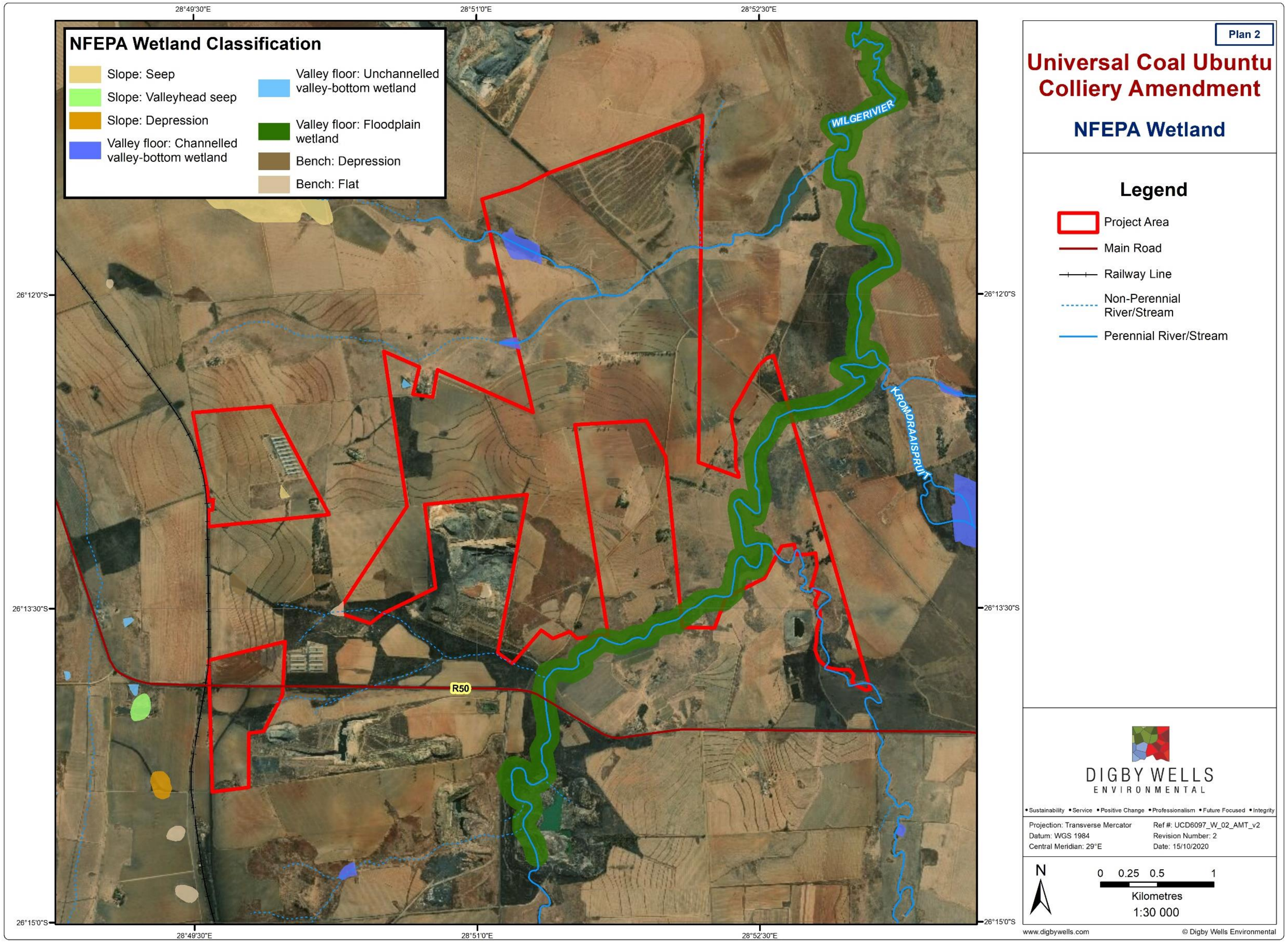


Figure 7-4: NFEPA Wetlands of Ubuntu Colliery

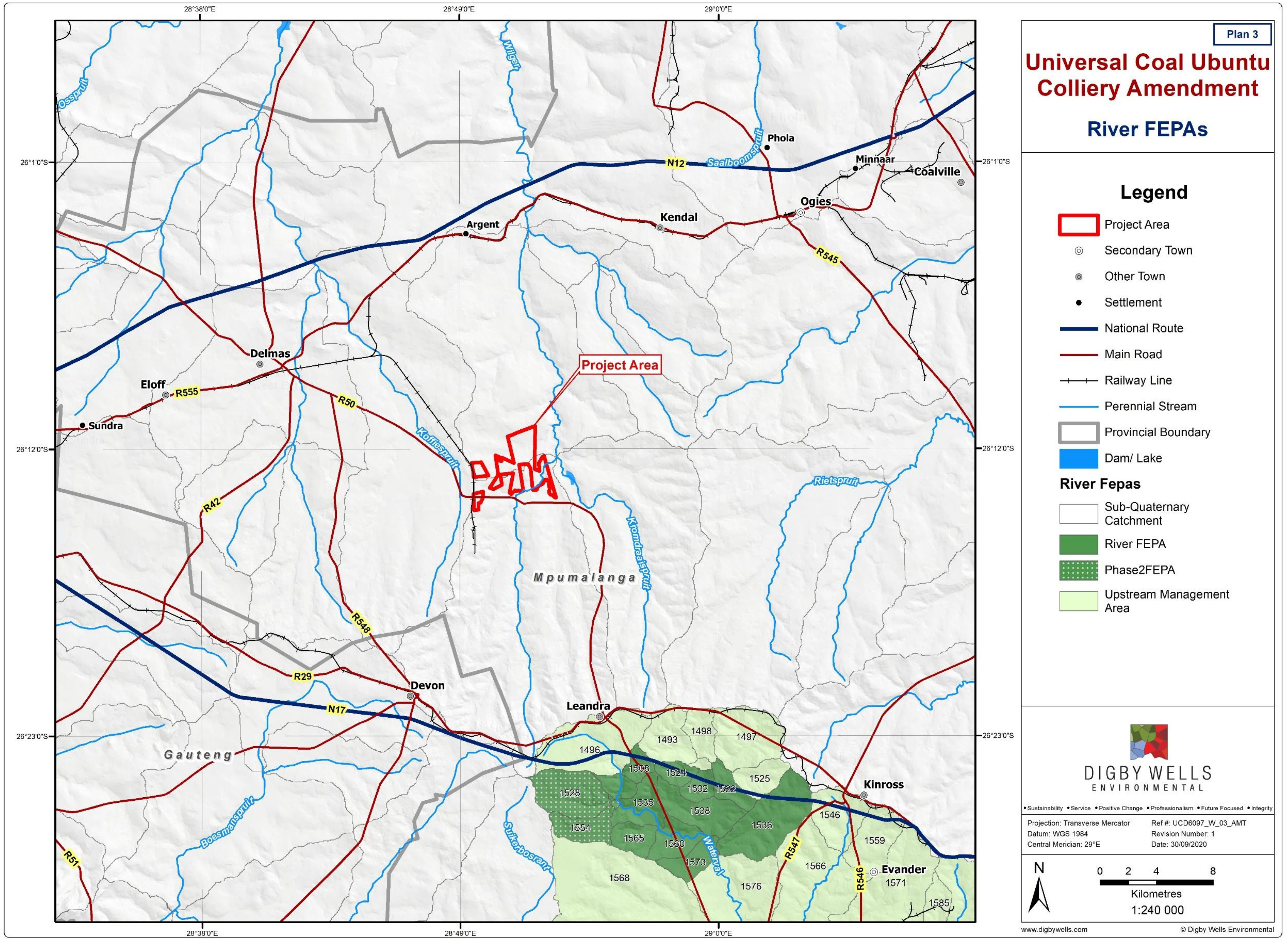


Figure 7-5: River FEPAs of Ubuntu Colliery

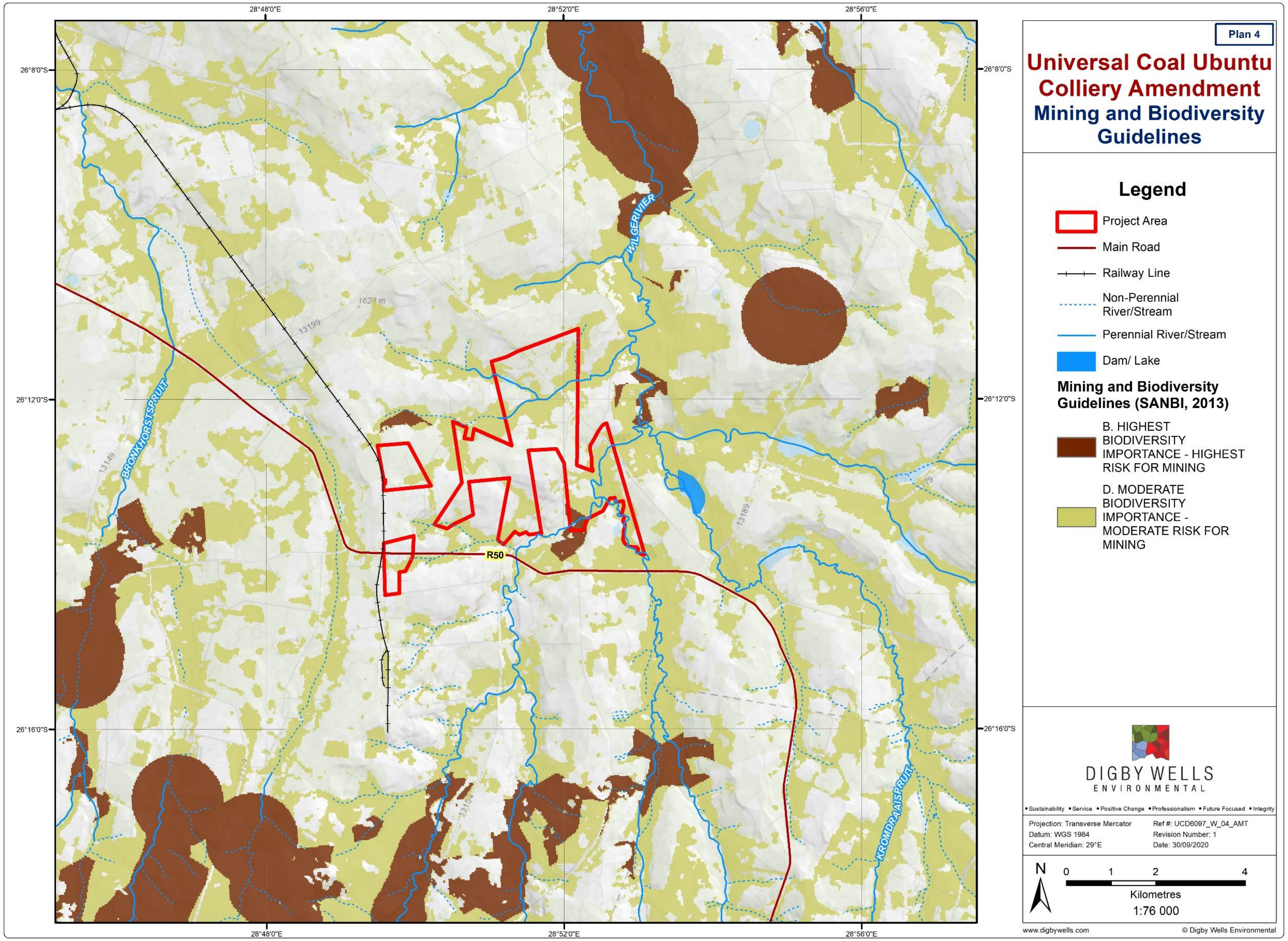


Figure 7-6: Mining and Biodiversity Guideline of Ubuntu Colliery

7.1. Aquatic Ecology (Desktop Information)

The Present Ecological State, Ecological Importance and Sensitivity (PES & EIS) information available for the considered aquatic ecosystems in the Department of Water and Sanitation 1:500 000 river layer (DWS, 2014) are discussed below. The catchment to be potentially impacted by the proposed Project is considered.

An unnamed tributary of the Wilge River (hereinafter Northern Tributary) and the Main-stem Wilge River are the main watercourses associated with the proposed Project footprint. The Northern Tributary cuts through and drains the northern parts of the MRA. Table 7-2 outlines the desktop aquatic-related data obtained for the Wilge River B20E-01383 SQR (DWS, 2014). Figure 7-2 displays the potentially affected Quaternary Catchment B20E.

Table 7-2: Desktop Aquatic Data Pertaining to the Wilge River

SQR Code/Aquatic Component	B20E-01383
Ecological Category	**C**
Category Description	Moderately Modified
Ecological Importance (EI)	High
Ecological Sensitivity (ES)	High

According to the desktop data obtained for the Wilge River B20E-01383 SQR (DWS, 2014), the reach appears to be in a Moderately Modified state (i.e. Ecological Category C). Mining, game reserves and agricultural land uses are present in the upper reaches of the Wilge River associated with the Project Area. According to the DWS (2014), impacts associated with mining and agricultural activities such as roads, low-water crossings, bed stabilization, canalization, water abstraction/increased flows, irrigation, exotic vegetation, inundation, vegetation removal, erosion and sedimentation appear to be affecting the current aquatic ecology associated with the Wilge SQR (DWS, 2014).

Both Ecological Importance and Ecological Sensitivity of the Wilge River SQR have been classified as “High”. It is expected to contain approximately 30 macroinvertebrate taxa as well as 9 indigenous fish species, all of which are Least Concern (LC) in terms of their IUCN conservation status.

7.1.1. Expected Macroinvertebrates

The expected macroinvertebrate taxa for the Wilge River SQR of concern are presented in Table 7-3.

Table 7-3: Expected Macroinvertebrate Taxa in the Wilge River

Family names		
Oligochaeta	Belostomatidae	Dytiscidae
Hirudinea	Corixidae	Gyrinidae
Potamonautidae	Gerridae	Chironomidae

Family names		
Hydracarina	Hydrometridae	Culicidae
Baetidae > 1 sp	Naucoridae	Dixidae
Caenidae	Nepidae	Muscidae
Coenagrionidae	Notonectidae	Psychodidae
Aeshnidae	Pleidae	Ancylidae
Gomphidae	Veliidae/Mesoveliidae	Lymnaeidae
Libellulidae	Lepidostomatiidae	Physidae

None of the expected macroinvertebrate taxa have a *high sensitivity* towards water quality and the assemblage is predominantly composed of taxa that have a *very low* and *low sensitivity* towards water quality. Thirteen taxa have a *very low sensitivity* and *low sensitivity*, respectively, towards water quality, and the remaining four taxa have a *moderate sensitivity*.

Based on the prevalence of agricultural fields in the adjacent land areas associated with the Project Area, the water in the associated aquatic ecosystems is expected to be of “large” modification (DWS, 2014). This deduction is further supported by the expected macroinvertebrate assemblage.

7.1.2. Expected Fish Species

The fish species expected in the reaches associated with the project area have been provided for in Table 7-4 (DWS, 2014). Additionally, each species sensitivity ratings towards physio-chemical conditions (DWS, 2014) have been provided for, together with their conservation statue according to the IUCN Red List of Threatened Species.

Table 7-4: Expected Fish Species in the Reaches Associated with the Project Area

Fish Species	Common Name	Tolerance / Sensitivity	Conservation Status
Enteromius anoplus	Chubbyhead Barb	2.6	LC
Enteromius neefi	Sidespot Barb	3.4	LC
Enteromius paludinosus	Straighfin Barb	3.3	LC
Clarias gariepinus	Sharptooth Catfish	1	LC
Pseudocrenilabrus philander	Southern Mouthbrooder	1.4	LC
Labeobarbus polylepis	Bushveld Smallscale Yellowfish	2.9	LC
Enteromius trimaculatus	Threespot Barb	1.8	LC
Chiloglanis pretoriae	Shortspine Suckermouth	4.5	LC

Fish Species	Common Name	Tolerance / Sensitivity	Conservation Status
Labeo cylindricus	African Carp	3.1	LC
Tolerance: 1-2=Tolerant; >2-3=Moderately Tolerant; >3-4=Moderately Intolerant; >4-5=Intolerant Conservation Status: LC = Least Concern			

A total of nine fish species are expected to occur within the Wilge River SQR B20E-01383 (DWS, 2014). According to Skelton (2001), all the species are indigenous to South Africa. Of the nine species, only one species is regarded as *intolerant* towards water quality changes, three species are regarded as *moderately intolerant*, two are *moderately* – and three are *tolerant* towards changes in water quality.

8. Findings and Discussion

Findings from the Wetland and Aquatic Ecology Assessments and separately discussed in the below sub-sections.

8.1. Wetland Ecology Assessment

The wetlands associated with the Ubuntu Colliery MRA was desktop delineated and confirmed during a rapid site survey in June 2012 and reassessed 8 and 9 July 2020. Dams and borrow pit areas were also delineated to measure the extent of these disturbances.

The wetland areas were previously delineated and reassessed in accordance with the DWAF (2005) guidelines, whereby features such as soil, vegetation and topography were considered. Some of the wetland soil features and characteristics used to assist with the delineation of wetland areas are presented in Figure 8-1. The 2012 delineated wetland areas for the entire MRA are presented in Figure 8-1 and for The Project illustrated in Figure 8-2 and Figure 8-3.

The wetlands in the study area are linked to both perched groundwater and surface water. A total of five different Hydrogeomorphic Units (HGM) types of natural wetland systems occur within the area assessed (Wetland Report, 2012). The five HGM units identified include:

- Seasonal pan wetland;
- Isolated hillslope seepage wetlands;
- Hillslope seepage wetlands connected to a watercourse;
- Valley bottom wetlands with a channel; and
- Floodplain.

The wetlands reassessed during the 2020 survey only focused on the wetlands within the new infrastructure area. It was determined that the wetland delineations from 2012 were accurate and was agreed upon. Evidence of the findings are described in the subsections below (Figure 8-2) and Figure 8-3.

The HGM include:

- Hillslope seepage wetland connected to a watercourse (north at OC1);
- Valley bottom wetlands with a channel (Channelled Valley Bottom); and
- Hillslope seep wetland (west at OC2).

The PES, WET-Ecoservices and EIS scores were re-calculated accordingly. This report includes a consolidation of the aforementioned assessments, along with the potential impacts The Project will have on the wetland systems of the area.

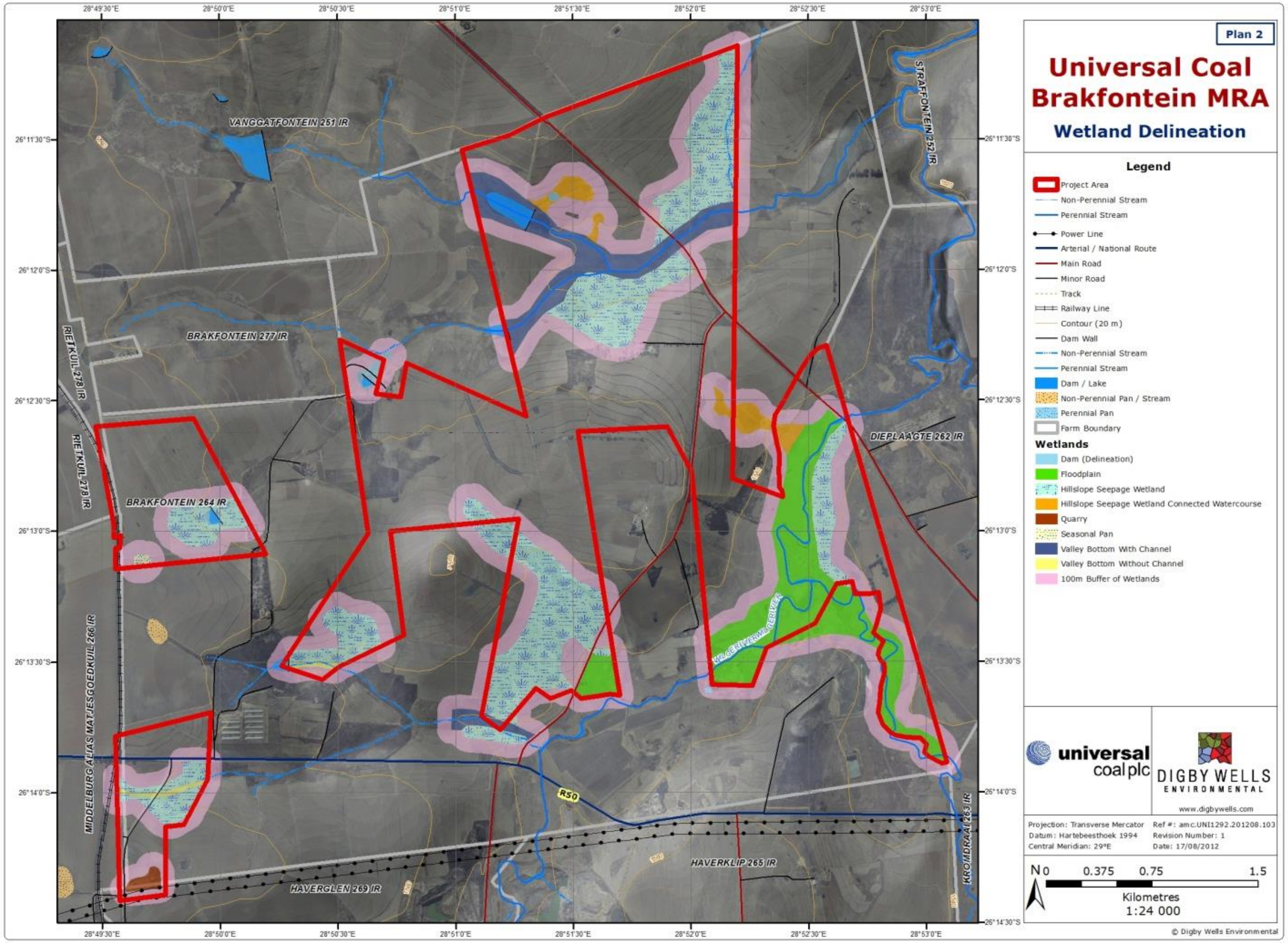


Figure 8-1 Delineated wetlands (2012)

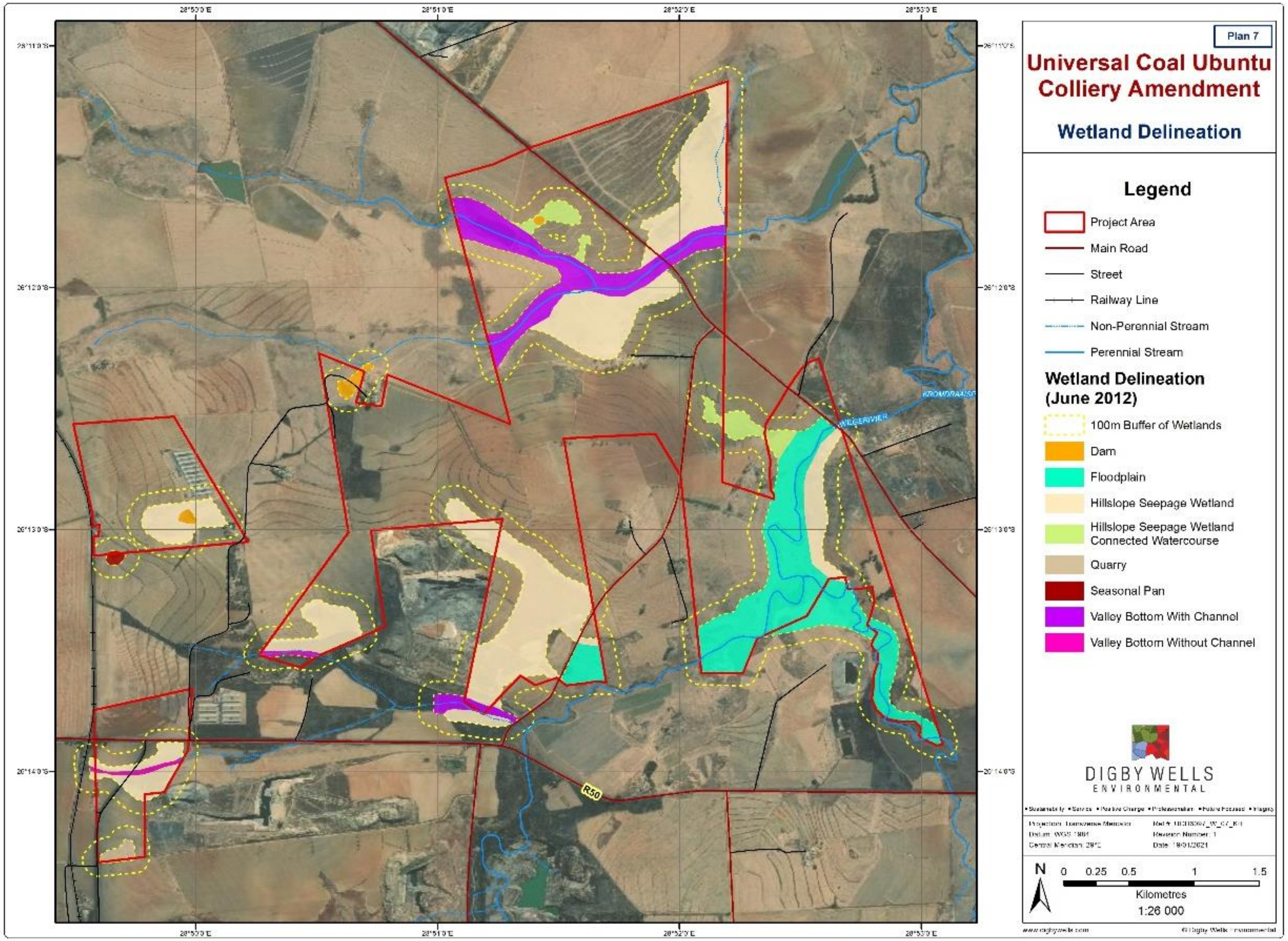


Figure 8-2 Wetland Delineations of the MRA (2021)

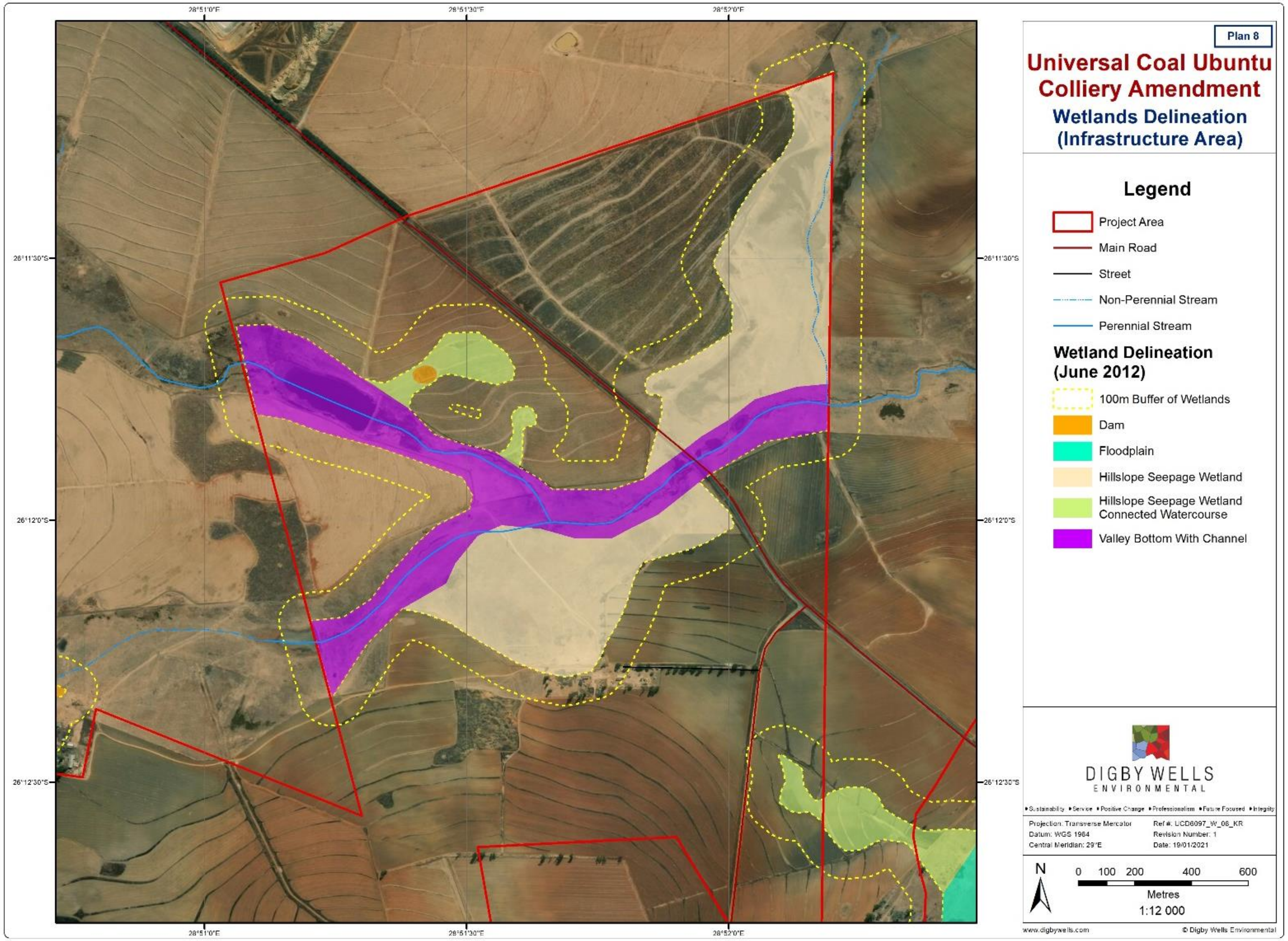


Figure 8-3 Wetland Delineations of The Project (2021)

8.2. Wetland Indicators

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) states the four wetland indicators as SWI, SFI, Vegetation and Terrain.

The wetland indicators used to delineate the wetlands and was reassessed during 2020 are described in the subsections below.

8.2.1. Terrain Unit Indicators

Terrain indicators help to identify areas in the landscape where wetlands are more likely to occur (Figure 8-4). The topography is typically the physical characteristics of an area with a variation of soils against the slope, each with its own characteristics because of its relative position in the landscape and terrain.

The topography of the Ubuntu Colliery Project Area is typical of the Highveld Ecoregion with gentle, rolling grassland slopes and many valley systems. Detailed imagery and contours, coupled with field verifications, allows the geomorphic setting of the wetland and catchments to be understood and the HGM to be determined. Terrain indicators are important for understanding the specific functionality of the wetland and determining the potential risks from anthropological activities on the wetland.

Wetlands in the crest were typically characterized as seep wetlands, whereas wetlands in the scarp, middle slope and foot slope terrain typically identified as valley head seeps, seep wetlands and valley bottom wetlands. Channelled valley bottoms were typically identified within the valley bottom terrain (Figure 8-4).

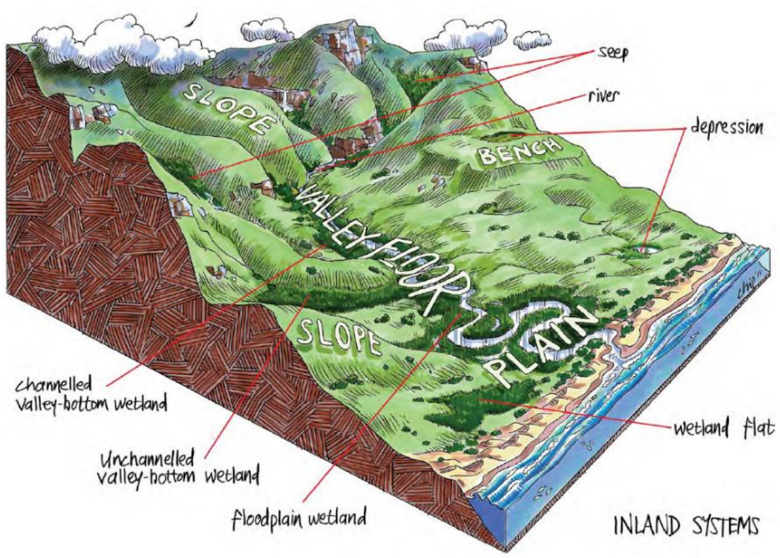


Figure 8-4: Terrain Morphological Units (Ollis, Snaddon, Job, & Mbona, 2013)

Typical terrain indicators identified in The Project area can be seen in Figure 8-5.

	
Gentle, rolling grassland slopes with many valley systems	Low-lying areas identified as valley bottom systems

Figure 8-5: Terrain Indicators (2020)

8.2.2. Soil Indicators

Soil indicators, including soil forms and soil wetness, such as mottling and gleying of soils, were used extensively throughout the Project Area to identify and confirm wetlands.

According to the Soil Study (Digby Wells, 2020), low-lying areas within the Project Area showed increased clay content and soil wetness. These soils were identified as wetland soils (hydromorphic soils) and are saturated for long periods with a fluctuation water table, changing the morphology of the soils. The land use in these areas were generally wetlands and used for cattle grazing and perennial grasslands. These soils are somewhat limited for cultivation and highly mobile (high erosion probability). Avalon, Pinedene, Hutton, and Clovelly soils are typically deep soils, dominated by a red to yellow-brown apedal (non-structure), sandy B-horizons with a clayey underlying material such as Soft-Plinthic. The clayey horizon increases the water holding capacity, organic material, and Cation Exchange Capacity (CEC) of the soil therefore increasing the agricultural potential. Glencoe soils consist of sandy, yellow-brown B-horizons to bleached B-horizons indicating interflow soils, high drainage, and high leaching potential, however, these soils have a high leachability and often low in soil organic material.

Hydromorphic soils are significant to the overall site sensitivity analysis. The low angled topographic slopes and resulting wide expansive drainage lines coupled with the presence of restrictive sedimentary layers (sandstone predominantly) have resulted in proportionately much larger areas of transition zone moist grasslands and wet based soils that meet the wetland classification both pedologically as well as ecologically.

	
Gleyed, leached cleyey soils with iron moteling	Sandy, apedal soils with iron motteling

Figure 8-6: Soil Indicators (2020)

8.2.3. Vegetation Indicators

Vegetation communities of the various wetlands and their respective HGM units were relatively variable. Large portions of the natural vegetation communities had been historically altered due to the predominant surrounding land-use activities such as cultivation and cattle grazing. Vegetation indicators were limited during the field assessment due to the seasonality of the assessment (winter), recent fires and excessive cattle grazing and cultivation.

Wetland plant species used in the identification and delineation of the HGM units included, but was not limited to, those tabulated in Table 8-1. Some wetland species identified on site are shown in Figure 8-7. Please refer to the Fauna and Flora Impact Assessment Report for a detailed plant species list.

Table 8-1 Vegetation Indicators Species List (Sieben & Mtshali, 2014)

Class	Abbreviation	Example
Obligate Wetland Species	OWS	*Agrostis lachnantha*, *Leersia hexandra, Phragmites australis, Paspalum distichum*
Facultative Wetland Species	FWS	*Andropogon eucomis, Hemarthria altissima, Hyparrhenia tamba, Paspalum urvillei*
Seasonal Wetland Species	SWS	*Setaria sphacelata; Aristida junciformis, Themeda triandra, Eragrostis gummiflua*

Class	Abbreviation	Example
Temporary Wetland Species	TWS	*Imperata cylindrica; Paspalum dilatatum*
Mostly Wetland Dependant Species	MWS	*Typha capensis, Juncus* sp., *Cyperus* sp., *Persicaria* sp.

Vegetation indicators were limited during the 2020 site survey. Species used to identify the wetlands are illustrated in Figure 8-7 below.

Imperata cylindrica, Themeda triandra in seasonal seep wetlands.

Agrostis lachnantha, Themeda triandra within valley bottom wetlands.

Figure 8-7 Vegetation Indicators (2020)

8.3. Description of Wetland Types

The general descriptions provided for the identified wetland units for the Ubuntu Mining Project areas are provided in the subsequent sections derived from the 2012 Wetland Report.

Hillslope seepage wetlands

The characteristic soil forms of the hillslope seepage wetlands which occur in The Project area are sandy. It is common for these soils to remain saturated for periods during the summer months (wet season).

Hillslope seepage wetlands connected to watercourses are wetland systems which are directly linked on the surface to watercourses. This type of system typically contributes to flow in the watercourses, even if this contribution is only on a seasonal basis (Figure 8-8).

	
Imperata cylindrica and Eragrostis Sp. in seep wetlands (north at OC1).	*Agrostis lachnantha, Themeda triandra* in seep wetlands (west at OC2).

Figure 8-8 Hillslope Seepage wetlands

Valley bottom wetlands with channels

According to Kotze et al. (2007), channelled valley bottom systems are characterised by less active deposition of sediment and an absence of oxbows and other floodplain features such as levees and meander scrolls. These wetland types tend to be narrower and have somewhat steeper gradients and the contribution from lateral groundwater input relative to the mainstream channel is generally greater (Kotze et al*.,* 2007). The valley bottom wetlands within The Project area are high in clays, leached and wet throughout the year (Figure 8-9).

	
CVB, east of OC1	CVB, south of OC2

Figure 8-9 Channelled Valley Bottom Wetlands

8.4. Wetland Ecological Health Assessment

The wetland Present Ecological State (PES) of the HGM units were assessed according to their hydrology, geomorphology and vegetation functionality and health. The 2012 and 2021 results are presented in the subsections below.

8.4.1. 2012 Results

An overall PES rating was done for the three indicators in 2012 for all the HGM units combined. The findings are presented in Table 8-2. Despite being discouraged to aggregate the scores for the three study components, an overall health assessment of the system was required. Thus, the adopted formula is as follows:

((Hydrology score) x 3 + (geomorphology score) x 2 + (Vegetation score) x 2) ÷7

This formula provides a score ranging from 0 (pristine) to 10 (critically impacted in all respects). The rationale for this is that hydrology is considered to have the greatest contribution to health.

Table 8-2: A summary of the WET-Health scores for the three indicator study components (2012)

Module	Impact Score	Category	Change Score	Change Symbol	Health Class
Hydrology	1.2	C	0	→	C→
Geomorphology	1.4	B	0	→	B→
Vegetation	2.7	C	0	→	C→
Overall Score	**1.7**	**C**	**0**	→	**C→**

The hydrological impacts associated with the wetland unit were considered to be negligible and as a result, the hydrology assessment identified no discernible modifications, or the modifications are of such a nature that they have no significant impact on the hydrological integrity (Category: C. Impacts which were identified and which may be impacting on the hydrology of the unit refer to typical changes in water-distribution and retention patterns within the HGM unit as a result of impeding structures. These structures include the road networks and small agricultural dams. The roads will impact on quantity and timing of flows to downstream portion of the HGM unit and the extent to which these dams or roads interrupt low and intermediate flows to downstream areas is slight. Additionally, the surface roughness of an HGM unit in its current state is moderately modified when compared with its natural state. The trajectory change for the hydrological condition of the system is likely to remain stable over the next five years.

The geomorphology of the wetland was determined to be slightly modified or natural (Category B). The effect of altered water inputs (increased flows and floodpeaks) on wetland geomorphological integrity was determined to be slight, with increases determined for both flows and floodpeaks. These effects may be attributed to the hardening of surfaces due to the road infrastructure as well as the increase in runoff potential due to the overgrazing of the area. The trajectory change for the geomorphological condition of the system is likely to remain stable over the next five years.

The vegetation composition associated with the HGM unit appears has been moderately altered (Category C). The wetland area is characterized by the loss of wetland vegetation replaced by crop farming. Loss of wetland vegetation has taken place especially in the seepage wetland. Small scale patches that can be more readily colonized by indigenous vegetation are more likely to have at least a little indigenous vegetation present than large, contiguous cultivated patches. The trajectory change for the vegetation condition of the system is likely to remain stable over the next five years.

The overall integrity of the wetland system was determined to be natural and the current health of the system is expected to remain stable over the next five years.

8.4.2. 2020 Results

The HGM units were considered to have an ecological state ranging between **'Moderately Modified'** and **'Greatly Modified'** (Ecological Category C and E; Table 8-3). According to the integrity (health) method described by Kotze *et al.* (2009) a **Category C** wetland has undergone a moderate change in ecosystem processes including loss of natural habitats, however the natural habitat remains predominantly intact; and a **Category D** wetland has undergone large modifications to the natural ecosystem processes and loss of natural habitat and biota and a Category E wetland are described as the change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.

Table 8-3: Wetland Ecological Importance and Sensitivity Scores

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final PES	PES Category
Hillslope Seep (north at OC1)	27	4.6	17.4	7.000	E
Channelled Valley Bottom	10.5	2.25	15.1	3.979	C
Hillslope Seep (west at OC2)	19.5	2.75	16.8	5.579	D

The wetlands within the Project Area are impacted by anthropogenic activities including mining and agriculture. These dominant land use activities impact the ecological, hydrological and geophysical functionality of the wetlands.

The dominant land use of the area includes:

- Mining;
- Dryland cultivation; and
- Intensive cattle grazing.

Opencast pit mines exist to the north-western area of the Project Area. Activities occurring at these operations appeared to be impacting directly and/or indirectly to the wetlands associated with the Project Area. Excavations and infilling changes the natural topography thus impacting the geomorphology, hydrology and vegetation of wetlands, whereas noise, air and light pollution may impact on the wetlands' ability to maintain biological diversity. Vegetation clearing due to infrastructure and agricultural activities increases the infestation of Alien Invasive Plants (AIPs) and bare soils facilitate an increased rate of surface and sub-surface flow of contaminants. Historical and current adjacent mining activities caused fragmentation, increased runoff, loss of habitat and changes to the natural wetland systems (Figure 8-10).

	
Agropastoral activities within hillslope seepage wetland, including cattle grazing and dryland cultivation	Agropastoral activities and mining activities within within hillslope seepage wetland,

Figure 8-10 Land use and Impacts to the Wetlands

At landscape level, The Project and surrounding areas were observed to consist of uniform vegetation dominated by grasses which suggests that the natural vegetation has been altered specifically for purposes of grazing. Cattle trampling and faecal water contamination were evident across the valley bottom wetland. The livestock farming activities have altered the ecological character of the wetlands by causing changes to the natural geomorphology, hydrology and vegetation. Wetland geomorphology is impacted upon through increased erosion caused by cattle trampling, this affects the wetlands' longitudinal and lateral slopes, which in turn affects the hydrology. The deposition of clastic (mineral particles) and organic (organic material) sediment creates variation in substratum characteristics which ultimately affect the biota and biotic heterogeneity (Breen & Ellery, 2008).

Other agro-pastoral activities include dams, trenches, infrastructure, road crossings and water extraction from the water bodies.

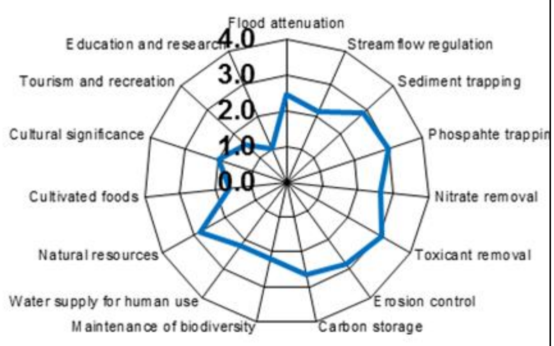
8.5. Wetland Ecological Services (WET-Ecoservices)

The general features of the wetlands were assessed in terms of functioning and the overall importance of each HGM unit was then determined at a landscape level.

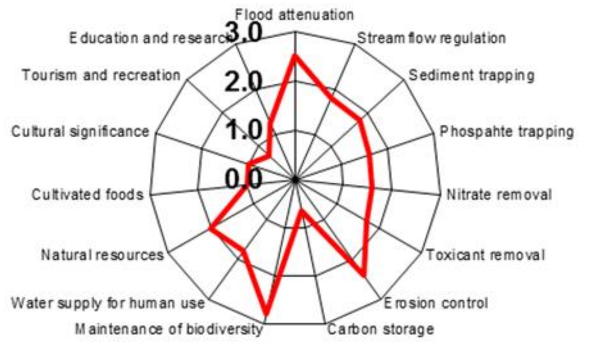
8.5.1. 2012 Results

The results from the 'Ecological Assessment of The Wetland Systems of the Brakfontein Mining Operation' (Digby Wells Environmental, 2012a) are displayed in Figure 8-11 and Table 8-4. The radial plots represent the relative importance of each ecosystem.

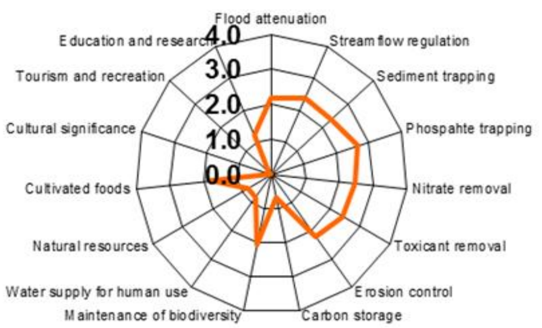
Floodplain



Channelled Valley Bottom



Seep



Seasonal Pan

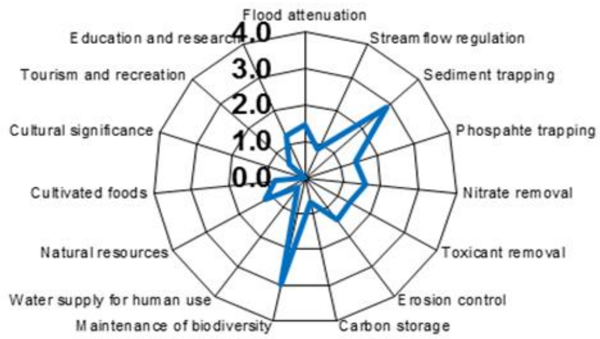


Figure 8-11 Wetland Ecological Service 2012

Table 8-4: Wetland Ecological Services – 2012 Results

Ecosystem Service	Floodplain	CVB	Seep	Seasonal Pan
Flood Attenuation	2.5	2.5	2.2	1.4
Streamflow Regulation	2.2	1.8	2.4	0.8
Sediment Trapping	3.0	1.8	2.3	2.9
Phosphate Assimilation	3.0	1.6	2.6	1.4
Nitrate Assimilation	2.7	1.6	2.5	1.6
Toxicant Assimilation	3.1	1.7	2.4	1.4
Erosion Control	2.8	2.4	2.2	1.4
Carbon Storage	2.7	0.7	0.7	0.7
Biodiversity Maintenance	2.7	2.8	2.1	3.0
Water Supply	2.2	1.8	0.8	0.3
Harvestable Resources	2.8	2.0	1.8	1.2
Cultivated Foods	1.6	1.0	0.0	0.8
Cultural Value	2.0	1.0	0.1	0.0
Tourism and Recreation	1.6	0.7	0.6	0.6
Education and Research	1.0	1.3	1.3	1.3
SUM	**35.9**	**24.7**	**24**	**18.8**
Average Score	**2.4**	**1.6**	**1.6**	**1.3**
Category	**Moderately High**	**Intermediate**	**Intermediate**	**Intermediate**

No ecological services determined to be of high importance were identified for any of the wetland systems. The highest percentage of services for each HGM unit was determined to be of an intermediate importance. Services considered to be of a moderately high importance were only determined for the two valley bottom wetlands, with 40% of the services identified for systems without a channel determined to moderately high in importance.

The moderately high important ecological services identified for the hillslope seepage wetlands, floodplain and the channelled valley bottom system pertain largely to water quality enhancement services, such as sediment and phosphate trapping, as well as nitrate and toxicant removal. This is to be expected owing to the diffuse nature of flow in such wetland units.

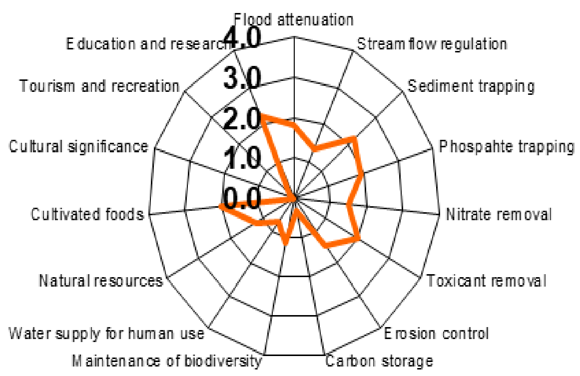
Both the channelled valley bottom and the floodplain units provide streamflow regulatory services which are of a moderately high importance. The flood plain system is a depositional environment with a gentle slope characterised by typical floodplain features such as ox-bow lakes, cut-off meanders, backwaters, natural levees, etc. the differences in the hydrological regime within the features of the floodplain create an environment suitable for a high species richness and therefore maintenance of biodiversity. Thus the maintenance of biodiversity for this unit was determined to be of a moderately high importance.

Overall, all four systems provide services of varying importance which should not be considered in isolation, nor can these units be considered individually. The removal or degradation of a unit will inadvertently impose increased stresses on the remaining units.

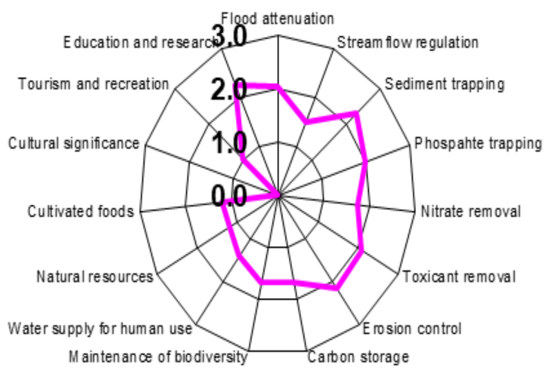
8.5.2. 2020 Results

The results from the 2020 Ecological Assessment of the wetland within the Project Area are displayed in Figure 8-12 and Table 8-5. The radial plots represent the relative importance of each ecosystem.

Hillslope Seep (north at OC1)



Channelled Valley Bottom



Hillslope Seep (west at OC2)

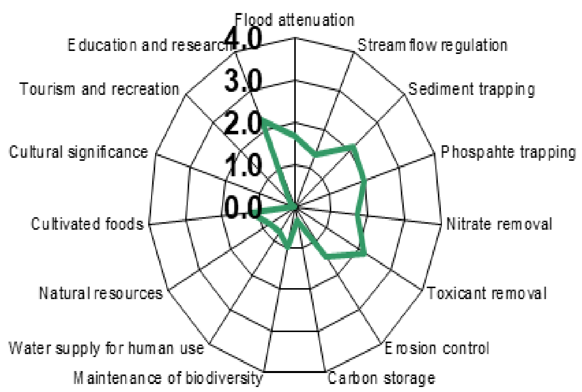


Figure 8-12 Wetland Ecological Services 2020

Table 8-5 Wetland Ecological Services 2020

Ecosystem Service	Hillslope Seep (north at OC1)	Channelled Valley Bottom	Hillslope Seep (west at OC2)
Flood Attenuation	1.8	2.0	1.7
Streamflow Regulation	1.3	1.5	1.3
Sediment Trapping	2.2	2.3	2.1
Phosphate Assimilation	1.9	2.0	2.0
Nitrate Assimilation	1.5	1.8	1.7
Toxicant Assimilation	2.0	2.1	2.2
Erosion Control	1.5	2.2	1.5
Carbon Storage	0.3	1.7	0.3
Biodiversity Maintenance	1.1	1.7	1.0
Water Supply	0.7	1.4	0.7
Harvestable Resources	1.2	1.2	0.8
Cultivated Foods	2.0	1.2	1.2
Cultural Value	0.0	0.0	0.0
Tourism and Recreation	0.1	1.0	0.1
Education and Research	2.3	2.3	2.3
SUM	**20.0**	**24.2**	**19**
Average Score	**1.3**	**1.6**	**1.3**
Category	**Intermediate**	**Intermediate**	**Intermediate**

The general features of the wetlands were assessed in terms of functioning and the overall importance of each HGM unit was then determined at a landscape level.

The assessed HGM units were all determined to be of ‘**Intermediate**’ importance. Overall, the largest ecosystem services include sediment trapping, toxicant removal, erosion control and some data exist (previous studies) for research purposes, the need for which is amplified by the surrounding agricultural and mining activities. In addition to the above-mentioned services, the wetlands were regarded as important for flood attenuations, sediment trapping, carbon storage and the maintenance of biodiversity. The CVB wetlands were regarded as important for the provisioning of sediment trapping (particularly those associated with mine impacts), water supply and biodiversity maintenance (those associated with agriculture impacts). The seepage wetlands were important in supplying water to dams and as a natural resource (grazing) for cattle.

8.6. Ecological Importance and Sensitivity (EIS)

The ecological importance of a wetland is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. On the other hand, ecological sensitivity refers to the wetland's ability to resist disturbance and is capability to recover from disturbance that has occurred (Department of Water Affairs and Forestry, 1999).

The EIS was not assessed during the 2012 assessment.

The EIS scores for the 2020 Wetland Assessment are indicated in Table 8-6, which were regarded all as '**Moderate**' EIS Categories. This indicates that the wetlands are ecologically important and sensitive, and that 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, the Wilge River and Kromdraaispruit in this case.

Table 8-6: Wetland Ecological Importance and Sensitivity Scores

HGM Unit	Ecological Importance & Sensitivity	Hydrological / Functional Importance	Direct Human Benefits	Final EIS	EIS Category
Hillslope Seep (north at OC1)	1.2	1.5	1.1	1.5	Moderate
Channelled Valley Bottom	1.7	1.9	1.2	1.9	Moderate
Hillslope Seep (west at OC2)	1.3	1.6	0.9	1.6	Moderate

8.7. Aquatic Ecology Assessment

The previously undertaken survey (Digby Wells Environmental, 2012b) focused on three watercourses including the Wilge River and its two tributaries, one cutting through the northern portion of the MRA (hereafter Northern Tributary) and the other cutting through the southern portions (hereafter Southern Tributary; Figure 7-2). A total of six sampling sites were assessed in August 2012, three sites along the main-stem Wilge River, a single site at the Southern Tributary, a single site at the Kromdraaispruit and a single site along at the Northern Tributary (Figure 8-13). Two of the six sites (sites 4 and 5) were deemed unsuitable for the application of the biomonitoring indices at the time of the survey, these sites lacked flow and the available habitat was insufficient for sampling. Site 4, located within the Northern Tributary, was the only site associated with the current proposed Project, however findings from other sites (i.e. sites along other water courses) are considered in the current report for purposes of gaining a better understanding of the conditions of the aquatic ecosystems in the larger Project Area.

Sampling of surface water and ground water in the surrounding watercourses has since been carried out from 2012 where a single survey was undertaken followed by more frequent sampling (on a quarterly basis) in 2018 to date. Three surface water monitoring sites are of particular concern for the current Project namely, UCBSW2 (Site 4 in the 2012 Aquatic Ecology Assessment report), UCBSW3 and UCBSW4. Site UCBSW2 lies along the Northern Tributary approximately 0.3 km south of OC1. Site UCBSW3 lies approximately 1.5 km downstream of Site UCBSW2 at a dam and Site UCBSW4 lies along the main stem Wilge River after the confluence with the Northern Tributary (Figure 8-14).

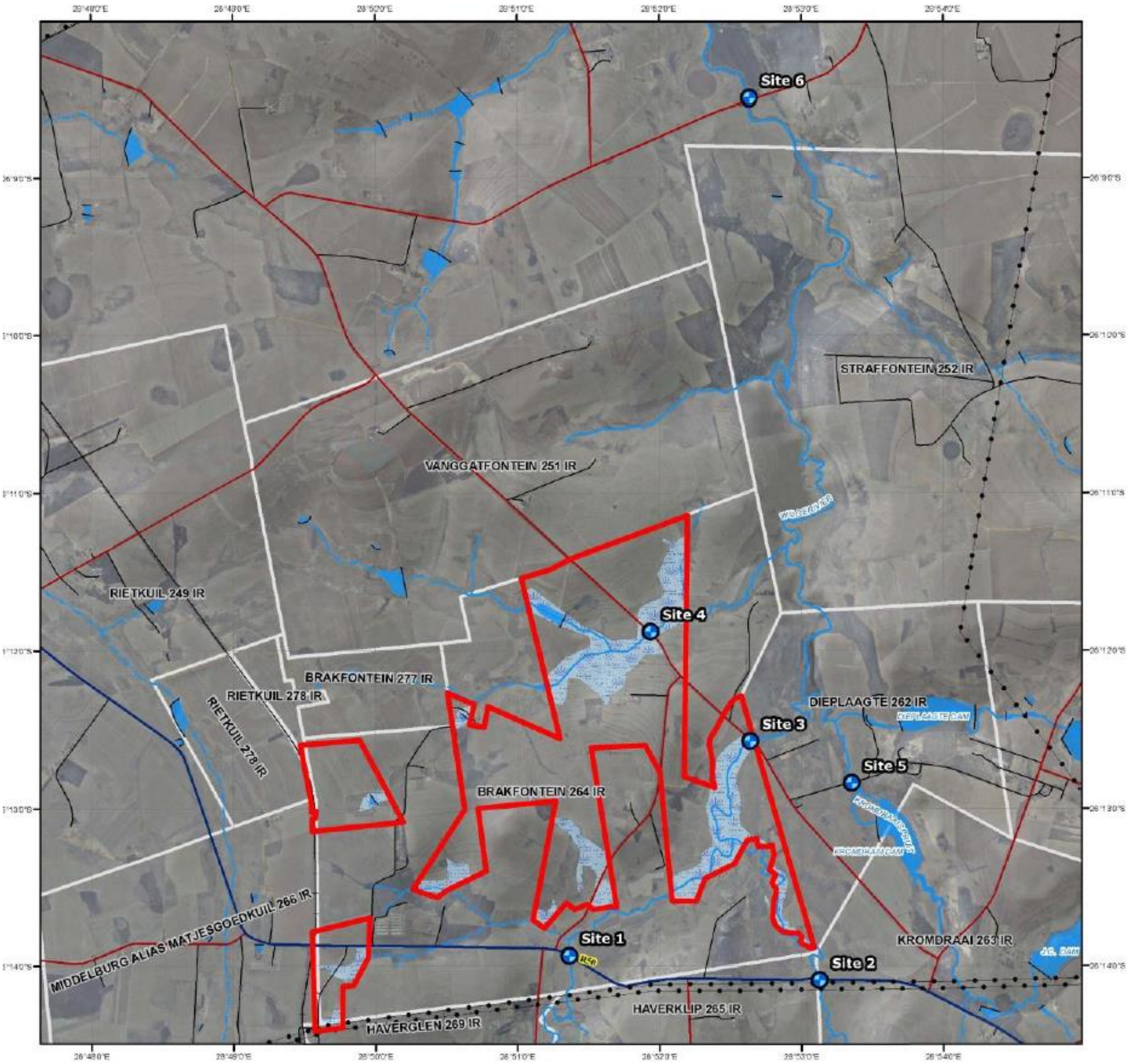


Figure 8-13: Biomonitoring sites assessed during the 2012 Aquatic Ecology Study (Digby Wells Environmental, 2012a)

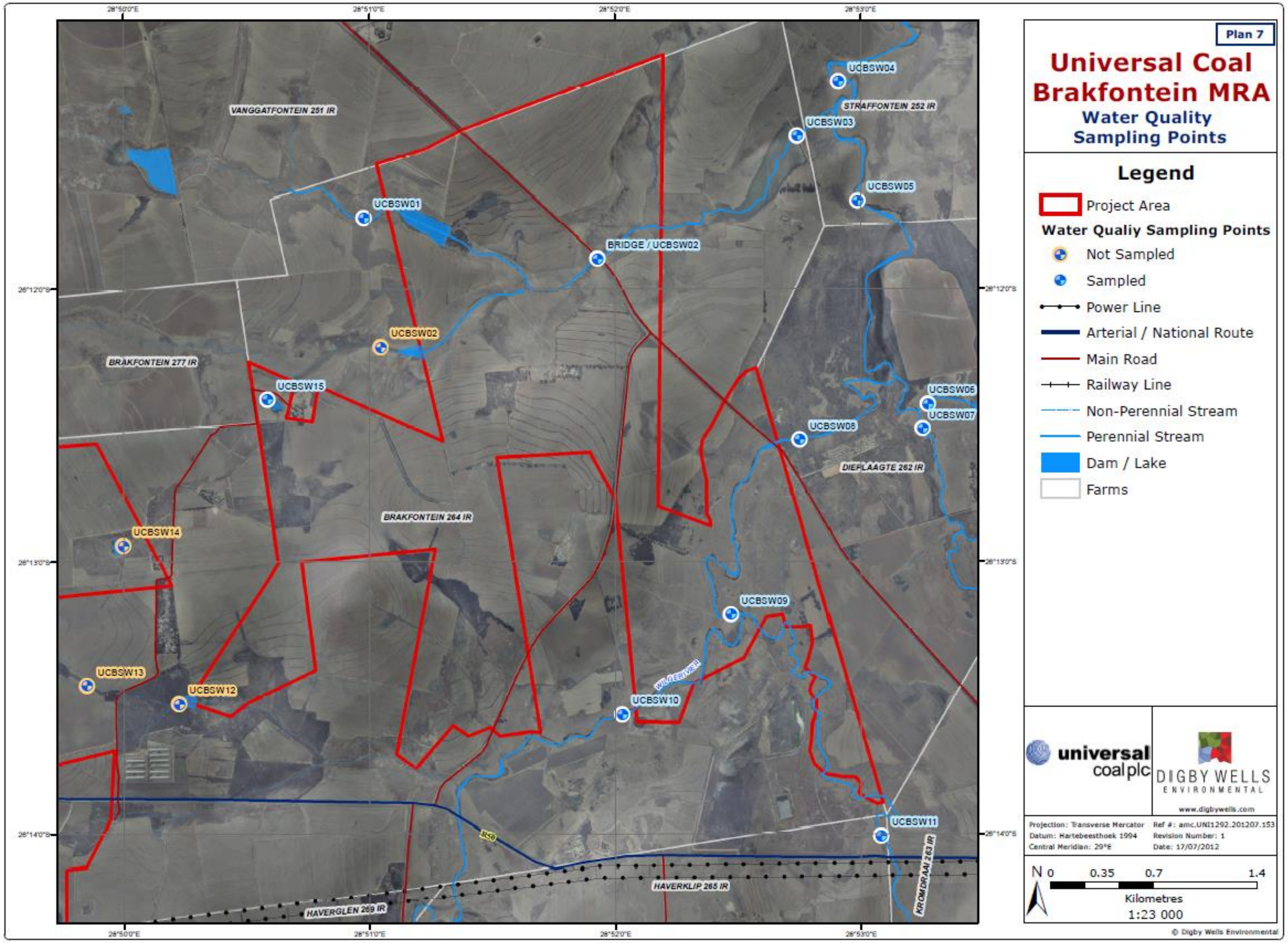


Figure 8-14: Surface and Groundwater monitoring sites around the Project Area (Digby Wells Environmental, 2012c)

8.7.1. *In situ* Water Quality (2012 findings)

Of the four assessed water quality indicators (Temperature, pH, electrical conductivity and dissolved oxygen), only pH levels at Site 1 (located along an upstream Wilge River reach and drains the southern portions of the MRA) and Site 2 (located upstream of the MRA along an unnamed tributary of the Wilge) were recorded below the recommended guideline of 6.5 – 9.0 (Alabaster and Lloyd, 1982). Thus, the overall *in situ* water quality was determined to be fair.

8.7.2. Ex situ Water Quality (trend data)

Trend data for the various water quality parameters has been reviewed and compiled in the Surface Water Impact Assessment undertaken by Digby Wells Environmental for the current Project and summarised below.

Trend data for pH levels around the Project Area have been observed to fluctuate around ~6 and 9 with no particular reported 'red flags' for the three sampling sites (UCBSW2, UCBSW3 and UCBSW4) associated with the current project. Levels of conductivity were observed to fluctuate with exceedances recorded at several sites including Site UCBSW2. Exceedances in the common cations: calcium, magnesium and sodium (Ca, Mg and Na) have been observed at several sites throughout the monitoring surveys with Site UCBSW2 recording exceedances in Mg and Na, and Site UCBSW4 recording exceedances in Mg only. Site UCBSW2 was one of only two sites which recorded chloride (Cl) levels exceeding the WUL limit. Throughout the monitoring period, the highest concentration in Cl (133 mg/l) was recorded at Site UCBSW2, however, levels dropped to within the WUL limits from the 2019 survey to date. Drastic exceedances in nitrate (NO_3-N) concertation were only recorded at Site UCBSW2 (61.1 mg/l in May 2020, 175.6 mg/l in June 2020 and 200 mg/l in July 2020). The source for the exponential exceedances could not be determined and further investigations were recommended. None of the three sites of concern recorded sulphate (SO_4) and total alkalinity levels above the WUL limits throughout the monitoring period.

All three sites of concern have recorded exceedances in some of the water quality parameters at some point with Site UCBSW2 recording the most number of exceedances. Elevated levels of nitrates are suspected to be resulting from agricultural activities. Sources for exceedances in the other water quality parameters could not be determined at the time of writing, however may be associated with the mining activities (PCD and overburden for example), further investigations are however required to confirm this.

8.7.3. Aquatic and Riparian Habitat

Through assessment of the Index of habitat Integrity (IHI), the overall instream and riparian habitat associated with the study area was determined to be in a largely modified state (Ecological Category D). Major impacts were those associated with anthropogenic activities such as mining and agriculture. Water quality modifications as a result of effluent, surface run-off and the abstraction of water were suspected to significantly influence the determined IHI Ecological Category.

8.7.4. Aquatic Macroinvertebrate Assessment

The following sections give insights into the available habitat that was sampled at each of the respective monitoring sites at the time of the 2012 survey, as well as findings from the South African Scoring System (SASS).

8.7.4.1. Integrated Habitat Assessment System

The availability of aquatic macroinvertebrate habitat was scored as 'Good' at all the sites expect at Site 1 which was scored as 'Poor'. High levels of sedimentation and low flow conditions were observed at Site 1 at the time of the 2012 survey. This site also lacked the stones-in-current (SIC) biotope, consequently, habitat availability and quantity were seen as limiting factors to macroinvertebrate diversity. At all the other sites, availability of all SASS5 biotopes were observed to sufficient and not expected to be a limiting factor to macroinvertebrate communities.

8.7.4.2. Benthic Communities and Composition

The sampled aquatic macroinvertebrate community composition at the four sites during the 2012 survey was of low diversity, only 18 of the approximately 30 expected taxa were collected. Community composition was dominated by taxa that are tolerant to water quality deterioration. The collected macroinvertebrate assemblage indicated some level of water quality deterioration at all the sites. A water quality assessment undertaken in June 2012 at the reaches associated with the study area indicated exceedances in some chemical constituents including nitrates, chloride, sulphate, ammonia and fluoride Table 8-7.

Table 8-7: Findings from the surface water quality analysis (Digby Wells Environmental, 2012c).

Constituent	Relevance	Nitrate	Chloride	alklinity	Sulphate	Ammonia	flouride
WQO Wilge River		0.3	15	70	15	0.2	0.2
UCBW11	Site 2	0.30	72.6	295	93.7	0.03	0.35
ECBW10	Site 1	0.36	24.4	250	110	0.05	0.34
UCBW8	Site 3	0.25	24.5	221	242	0.02	0.29
UCBW04	Site 6	1.61	21.8	198	88	0.59	0.30

8.7.4.3. Ecological Condition of the Aquatic Macroinvertebrate Assemblages

A site-based Macroinvertebrate Response Assessment Index (MIRAI) was carried out for the 2012 August survey. The determined MIRAI scores indicated *Seriously Modified* conditions (Ecological Category E) at each of the assessed sites. This finding was attributed to the water quality modifications and low flows observed at the time of the study. This was further supported by the fact that collected macroinvertebrate assemblages lacked taxa that are intolerant to low flow conditions.

8.7.5. Ichthyofaunal Assessment

Despite the use varying methods (including electro-narcosis and using a fyke net) to establish fish assemblages within reaches associated with the project area, none of the expected fish species were sampled at the time of the August 2012 survey. This was suspected to have been caused by the cold temperatures experienced during the survey with the water temperature dropping to as low as 10 ºC. It was suspected that the fish, if present, remained inactive and could not be collected during the survey.

9. Ecological Impact Assessment

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 on associated wetlands and aquatic ecosystems are discussed separately in the below subsections.

9.1. Wetland Impact Assessment

The potential impacts are discussed per aspect and per each phase of the Project i.e. the Construction Phase, Operational and Decommissioning/Closure Phases where applicable (Figure 9-1).

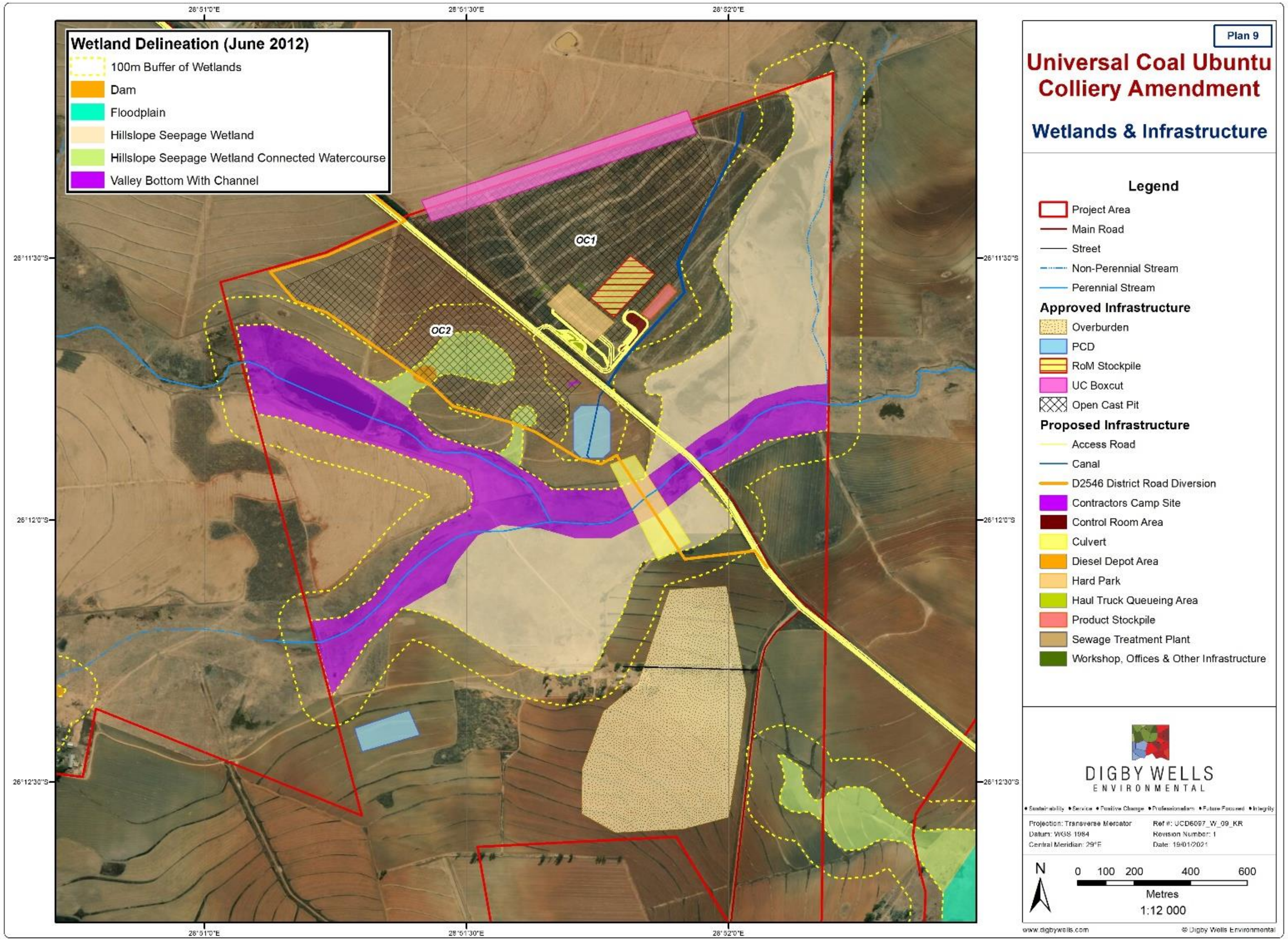


Figure 9-1 Wetland Delineations and Proposed Infrastructure

9.1.1. Construction Phase

Activities during the Construction Phase that may have potential impacts on the wetlands are described in Table 9-1 below.

Table 9-1: Interactions and Impacts of Activity

<table>
<tr><th>Interaction 1</th><th>Impact</th></tr>
<tr><td>Surface preparation for infrastructure</td><td>Direct loss of wetland areas;
Loss of biodiversity;
Erosion and sedimentation of wetland areas;
Water quality contamination and deterioration; and
Habitat loss because of poor water quality.</td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">The removal of vegetation and topsoil will result in the deterioration and/or loss of wetland areas. This will also alter the hydrological regime through preferential flow paths, increased runoff, erosion and sedimentation which could contribute to further loss of wetland habitat and biodiversity.
The altered water flows may increase the erosion risk of wetlands. Resultant in excess soil that may cause sedimentation of water resources.
The hillslope seep wetlands may be susceptible to erosion when the site is cleared of vegetation and stripped of soil;
The loss of wetlands may lead to a decrease in surface water flowing into the main river systems downstream of The Project;.
Spillage of hydrocarbon and hazardous materials from machinery/vehicles may cause water quality deterioration affecting the vegetation, biodiversity, aquatic faunal species and terrestrial faunal species at the point source as well as downstream of the contaminated area.</td></tr>
<tr><th>Interaction 2</th><th>Impact</th></tr>
<tr><td>Construction of surface infrastructure</td><td>Direct loss of wetland areas;
Habitat loss;
Loss of biodiversity;
Water contamination; and
Erosions and sedimentation of wetland areas.</td></tr>
</table>

Description
The establishment of mining infrastructure in the grasslands outside the wetland areas as well as the recommended buffer zones will restrict aquifer recharge through the destruction or hardening of aquifer recharge areas. The delineated wetlands within the study area are linked to perched aquifers which provide a water source through lateral seepage and interflow. The destruction of the aquifer recharge areas will result in the loss of the supported wetland areas. This in turn will result in a loss of ecological and hydrological functions that are provided by the wetlands to the catchment. These wetland areas contribute to the recharge of the Wilge River and Krondraaispruit systems. This activity will therefore result in flow patterns changing from slow diffuse flow to storm water flood peaks.

9.1.1.1. Management Objectives

The mitigation hierarchy includes firstly the avoidance of an impact. When it is not possible to avoid an impact, such as in the case of during the Construction Phase, the next step is or to minimize the impact and thereafter rectify or reduce the impact. When it is not possible to rectify or reduce the impact, offsets need to be implemented.

The aim during the Construction Phase is to:

- Minimize the impact footprint on the wetlands as it is not possible to avoid the impacts;
- Keep the impact size to a minimum with as little changes to the natural state of the wetlands as far as possible;
- Follow an approved storm water management plan to allow free flow of the CVB system and to avoid increased flow, erosion and sedimentation of the seep wetlands; and
- Prevent spillage, seepage and runoff of hydrocarbons and other hazardous materials to the wetland areas.

9.1.1.2. Management Actions

- Establish at least a 100 m buffer zone around the remaining wetlands to protect wetland areas from the proposed developments. This would require that development occur further than 100 m from a delineated wetland area;
- Revegetate the area as soon as possible to prevent erosion, sedimentation and habitat loss within the wetlands;
- Ensure topsoil stockpiles are vegetated to reduce erosion and sedimentation;
- Restrict access to the remaining wetlands;
- Place sediment trapping berms on the boundary of the 100 m buffer or end of development;
- Compile an offset calculation to determine the impacts and total amount of wetland habitat loss to determine the area of wetlands required for an n offset;
- Develop a Wetland Offset Strategy, Rehabilitation Plan and a Monitoring Plan for the wetlands; and

- Ensure well-functioning culverts at the road crossing and wetland crossings to ensure free flow.

9.1.1.3. Impact Ratings

Table 9-2 present the impact ratings associated the Construction Phase of the Project.

Table 9-2: Construction Phase Interactions and Impacts of Activity Rating

Interaction 1: Surface preparation for infrastructure			
Impacts: • Direct loss of wetland areas; • Loss of biodiversity; • Erosion and sedimentation of wetland areas; • Water quality contamination and deterioration; and • Habitat loss due to poor water quality.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Permanent (7)	Site clearing will have an impact on the wetlands beyond the life of mine. Direct habitat loss, loss of biodiversity, contamination and changes to the water quality and quantity of downstream wetlands.	Major (negative) - 126
Extent	Municipal Area (4)	The loss of wetland areas may lead to reduced water quality and quantity to an area beyond the Project Area, including the Wilge River and Kromdraaispruit.	
Intensity	Irreplaceable (7)	Site clearing will result in the complete loss of wetland area.	
Probability	Definite (7)	Some loss of wetland areas will definitely occur as they fall within the development footprint	
Nature	Negative		

Mitigation Measures			
• Establishment of at least a 100 m buffer zone around the remaining wetlands to protect wetland areas from the proposed developments. This would require that development occur further than 100 m from a delineated wetland area; • Revegetate the area as soon as possible to prevent erosion, sedimentation and habitat loss within the wetlands; • Restrict access to the remaining wetlands; • Place sediment trapping berms on the boundary of the 100 m buffer or end of development; • Do an offset calculation to determine the impacts and total amount of wetland habitat loss to understand the amount of wetlands to be offset; and • Develop a Wetland Offset Strategy, Rehabilitation Plan and a Monitoring Plan for the wetlands.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Permanent (7)	Wetlands will be permanently lost and impacted on due to soil stripping within some wetland areas.	Moderate (negative) - 105
Extent	Local (3)	When mitigation and rehabilitation measures are followed impacts such as erosion, sedimentation and increased AIPs should only be local	
Intensity	Serious Medium Term (5)	Site clearing will result in loss of wetland habitat. If mitigation measures are done, the impact should not be irreplaceable.	
Probability	Definite (7)	Loss of wetland areas will still occur; mitigation measures will attempt to limit the impacts on other wetland areas within the surrounding areas.	
Nature	Negative		
Interaction 2: Construction of surface infrastructure			
Impacts: • Direct loss of wetland areas; • Habitat loss; • Loss of biodiversity; • Water contamination; and • Erosions and sedimentation of wetland areas.			

<table>
<tr><th colspan="4">Prior to Mitigation/Management</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Permanent (7)</td><td>The road diversion, WTP, STP and other infrastructure will have an impact on the wetlands beyond the life of mine.</td><td rowspan="5">Major negative - 126</td></tr>
<tr><td>Extent</td><td>Municipal Area (4)</td><td>The loss of wetland areas may lead to reduce water quality and quantity to the municipal area.</td></tr>
<tr><td>Intensity</td><td>Irreplaceable (7)</td><td>Site infrastructure and mining will result in the complete loss of wetland area.</td></tr>
<tr><td>Probability</td><td>Definite (7)</td><td>Loss of wetland areas will definitely occur.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><th colspan="4">Mitigation Measures</th></tr>
<tr><td colspan="4">

Establishment of at least a 100 m buffer zone around the remaining wetlands to protect wetland areas from the proposed developments within the Project area. This would require that development occur further than 100 m from a delineated wetland area;
Ensure well-functioning culverts at the road crossing and wetland crossings to ensure free flow;
Reseed and vegetate the wetlands with wetland vegetation after construction to prevent erosion and sedimentation;
Prevent access to the remaining wetlands;
Place sediment trapping berms on the boundary of the 100 m buffer or end of development;
Do an offset calculation to determine the impacts and total amount of wetland habitat loss to understand the amount of wetlands to be offset; and
The development of a Wetland Offset Strategy and Rehabilitation plan for the wetlands in the Project area.

</td></tr>
</table>

Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (6)	Impacts will occur during the life of the project if well managed and mitigated	Minor (negative) - 70
Extent	Local (3)	Impacts will occur at the source of the impact and may only extent to the Project Area if mitigation measures are followed	
Intensity	Serious (5)	Loss of wetland habitat and functionality if mismanaged	
Probability	Likely (5)	It is likely that impacts would occur during the construction of the service infrastructure	
Nature	Negative		

9.1.2. Operational Phase

Activities during the Operational Phase that may have potential impacts on the wetlands are described in Table 9-3 below.

Table 9-3: Interactions and Impacts of Activity

Interaction 1	**Impact**
Operation and maintenance of infrastructure	• Water quality contamination and deterioration; • Habitat loss as a result of poor water quality; • Loss of biodiversity; and • Erosion and Sedimentation within the wetlands
Description	
During the operation of the mine, crushing and stockpiling is proposed which could impact the wetlands through sedimentation and contamination. Some of the wetlands will completely be removed therefore reducing water inputs to the downstream wetlands and freshwater bodies. These impacts will result in habitat and biodiversity deterioration and loss. Accidental spills of coal, oil, lubricants and hydrocarbons will lead to water contamination, impacting the wetland health and functionality.	

<table>
<tr><th>Interaction 2</th><th>Impact</th></tr>
<tr><td>Use and maintenance of haul roads (incl. transportation of coal to washing plant)</td><td>Erosion of wetland crossings associated with the road diversion;
Accidental spills causing soil and water contamination;
Habitat loss as a result of poor water quality;
Increased Alien Invasive Plants (AIPs);
Loss of biodiversity;
Siltation of wetlands due to erosion; and
Change in habitat and potential change in species composition.</td></tr>
<tr><th colspan="2">Description</th></tr>
<tr><td colspan="2">The use of the access roads will result in exposed soil surfaces for prolonged periods and the generation of loose soil which may be washed to wetland areas and cause sedimentation. The exposed soil surfaces will have the ability to increase water flow and as such may cause an elevated water flow to the wetland areas which may prompt the onset of erosion in wetland areas and erosion of the roads which could lead to sedimentation of wetlands. Accidental coal, oil, lubricant and hydrocarbon spills from trucks and the conveyor belt could lead to soil and water contamination within the wetlands and therefore loss of wetland health, habitat and biota.</td></tr>
</table>

9.1.2.1. Management Objectives

The management objectives are to limit the impacts to the wetlands that could occur on the site.

The aim during the Operational Phase is to:

- Implement measures to prevent drying out of the surrounding wetland areas and rivers due to dewatering and the loss of upstream wetland habitat;
- Prevent the loss of water supply to the lower-lying wetland areas and downstream aquatic systems; and
- Prevent the increased flow of water from the operational area. Dirty water or water runoff from mine related infrastructure should be stored in Pollution Control Dams (PCDs) and utilised as intended.

9.1.2.2. Management Actions

The following mitigation and management measures have been prescribed for the Operational Phase:

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- Only the designated access routes are to be used to reduce any unnecessary impacts to the wetlands;

- Wetland monitoring and rehabilitation should be conducted during the life of mine and beyond at selected locations on the project site to detect any high levels of pollutants, erosion, habitat loss, increased AIPs, health and functionality;
- Chemicals, such as paints, and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical's specific storage descriptions;
- All spills should be immediately cleaned up and treated accordingly;
- Any spillages of sewage effluent from the treatment plant or ablution facilities should be cleaned up immediately; and
- Limit operational activities to the operational area and no areas outside of the operational area should be disturbed.

9.1.2.3. Impact Ratings

The Operational Phase impacts are rated in Table 9-4 below.

Table 9-4: Operational Phase Interactions and Impacts of Activity Rating

Activity and Interaction 1: Operation and maintenance of infrastructure			
Impacts: • Water quality contamination and deterioration; • Habitat loss as a result of poor water quality; • Loss of biodiversity; and • Erosion and Sedimentation within the wetlands			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Permanent (7)	Impacts will have an permanent impact on some wetlands within The Project as well as downstream wetlands after mine closure.	Moderate (negative) - 119
Extent	Province/ Region (5)	Loss of wetlands in the will have a large impact to the systems downstream. Contamination may extend beyond the project area	
Intensity	Serious Medium Term (5)	Impacts, such as sedimentation and erosion of wetland areas will cause serious ecological changes to wetland function and health.	
Probability	Definite (7)	It is definite that wetlands will be lost and heavily impacted upon due to crushing and stockpiling of coal	
Nature	Negative		
Mitigation Measures			

- Restrict access to all remaining wetlands with at least a 100 m buffer;
- Maintain and monitor wetland functionality;
- Clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately;
- It is recommended that no new river/stream crossing be erected, there are several crossings within the site that can be improved for better wetland functionality and operational functionality and this will include the insertion of culverts;
- Construct sediment trapping berms on edges of the roads;
- Establish vegetation on berms and edges of the road to minimise the risk of erosion;
- Where possible, create a preferential flow of runoff and wastewater directed towards the PCD;
- Monitor the roads monthly to identify and rectify any areas that have begun to erode and where water may be flowing towards wetland areas; and
- It is recommended that all mitigation measures recommended by the Digby Wells Groundwater Report for the Ubuntu Coal Mine Project be followed to prevent dewatering of wetlands.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Project Life (5)	When mitigation measures are followed, impacts should only take place during the life of the mine, however, some wetlands will completely be removed.	minor negative (-72)
Extent	Local (3)	Will only take place on designated areas within the Project Area if mitigation measures are followed.	
Intensity	Serious loss /damage (4)	Some wetlands will completely be removed and impact downstream water systems	
Probability	Almost certain (6)	Impacts from the operation of the WTP, STP, wash bay etc. will definitely take place	
Nature	Negative		

<table>
<tr><td colspan="4">Activity and Interaction 2: Use and maintenance of haul roads (incl. transportation of coal to washing plant)</td></tr>
<tr><td colspan="4">Impacts:
Erosion of wetland crossings associated with the road diversion;
Accidental spills causing soil and water contamination;
Habitat loss as a result of poor water quality;
Increased Alien Invasive Plants (AIPs);
Loss of biodiversity;
Siltation of wetlands due to erosion; and
Change in habitat and potential change in species composition.</td></tr>
<tr><td colspan="4">Prior to Mitigation/Management</td></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Beyond project life (6)</td><td>Coal will be transported beyond the Project area and may have impacts outside the Project Area</td><td rowspan="5">Moderate (negative)
- 96</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Impacts will be at the point source</td></tr>
<tr><td>Intensity</td><td>Irreplaceable loss (7)</td><td>Pollutants that may enter the water may cause severe contamination of water resources.</td></tr>
<tr><td>Probability</td><td>Almost certain (6)</td><td>Contamination of water is likely to happen when spills occur, as well as erosion and sedimentation from access roads</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation Measures</td></tr>
<tr><td colspan="4">Implement quarterly monitoring of the wetland health and functionality and rehabilitation recommendations at the wetland crossings associated with the road diversion as well as downstream of the WTP, STP and wash plant;
Access roads must be maintained and monitored to prevent erosion, head-cut erosion, sedimentation, increased AIPs and loss of wetland habitat and functionality; and
Clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately.</td></tr>
</table>

Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Beyond Project Area (6)	Coal will be transported outside the Project Area	Minor (negative) - 48
Extent	Local (3)	Impacts will take place at the point source and mitigated	
Intensity	Moderate loss (3)	If maintenance and monitoring is implemented and remediated immediately then the intensity of the impact should be medium	
Probability	Probable (4)	Contamination of water is not likely to happen if mitigation measures are implemented.	
Nature	Negative		

9.1.3. Decommissioning Phase

Activities during the Decommissioning Phase that may have potential impacts on the wetlands are described in Table 9-5 below.

Table 9-5: Decommissioning Phase Interactions and Implications of Activity

Interaction 1	**Impact**
Demolition and removal of all infrastructure (incl. transportation off site)	• Water quality contamination and deterioration due to an increase in sedimentation; • Habitat loss as a result of poor water quality; • Loss of biodiversity; • Loss of wetland areas; • Soil erosion due to surface runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Siltation of wetlands due to erosion; and • Change in habitat and potential change in species composition.
Description	
Removal and demolition of infrastructure may lead to erosion and sedimentation of the wetlands. Erosion and sedimentation lead to loss of habitat, changes in vegetation growth and water contamination. Fuel, lubricants and explosives may lead to contamination if exposed to the wetland areas. This may cause loss of wetland health and biodiversity.	

Interaction 2	Impact
Rehabilitation (spreading of soil, revegetation, and profiling/contouring)	• Erosion due to exposed areas to wind and surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity of the wetlands; • Change in habitat and potential change in species composition; and • Increased AIPs.
Description	
The activities that will be performed during the final rehabilitation will entail the movement of material and shaping of the topography and will include the establishment of vegetation on exposed soil surfaces. The movement of material and large areas of exposed soil surfaces could result in erosion that may cause sedimentation of wetland areas. Impacts may lead to changes in wetland habitat, species composition and increased AIPs.	
Interaction 3	**Impact**
Installation of post-closure water management infrastructure	• Soil and water contamination from decant and spillage from WTP, STP etc; • Increased runoff and changes to the wetland functionality; • AIPs proliferation due to changes to the natural landscape, soils and wetlands; • Erosion and sedimentation in wetlands; and • Changes to the habitat, wetland functionality and biodiversity.
Description	
A permanent water management system must be in place to minimise the drainage of pollutants to the nearby water resources; removal of the system may lead to water runoff from polluted areas draining into the water resources. Furthermore, the backfilling of the water trenches will expose soils to surface runoff which could result in erosion and dispersion of soils that may cause sedimentation of wetland areas. Vehicle movement in the wetlands and adjacent access roads may lead to increased runoff, erosion and channel forming. There is also the possibility of decanting. This may lead to water and soil contamination and have large impacts on the wetland functionality and health.	

9.1.3.1. Management Objectives

The aim during the Decommissioning Phase is to:

- Rehabilitate the affected areas to near-natural conditions without resulting in additional impacts to the wetland ecology throughout the process.

Impacts to the Project Area that cannot be rectified and reduced will lead to additional areas to be offset. Avoidance of impacts is not possible during the Decommissioning Phase, however the Decommissioning Phase will include the mitigation and monitoring of impacts which will in return have a positive consequence to the impact assessment.

9.1.3.2. Management Actions

The following mitigation and management measures have been prescribed for the Decommissioning Phase:

- The road diversion should be permanent and not removed;
- The water/sewage treatment plant may have uses post-closure for the surrounding community, this should be considered before removal;
- Once trenches have been backfilled and infrastructure removed, vegetation should be established on the exposed soil surfaces to minimise the risk of erosion and sedimentation into the wetland areas;
- During the rehabilitation, temporary sediment trapping berms should be erected to prevent any sediment arising from rehabilitation activities washing into wetland areas;
- As far as possible, conduct decommissioning work of infrastructure during the dry season and re-seeding in the wet-season;
- Clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately;
- Continue with a wetland monitoring and rehabilitation plan beyond life of mine until final closure;
- Landscape and vegetate the exposed areas as soon as possible to prevent erosion and sedimentation within the wetlands;
- Shaping of landscape should be performed in a manner the will water to drain freely towards wetland area;
- Avoid creating narrow preferential flow paths as the this could lead to erosion; and
- The water management system will be only installed once the dirty areas have been cleaned and it is deemed there is no risk of water contamination.

9.1.3.3. Impact Ratings

The impact rating associated with activities related to the removal of surface infrastructure and rehabilitation of potentially affected areas have been predicted in Table 9-6 below.

Table 9-6: Decommissioning Phase Interactions and Impacts of Activity Rating

Interaction 1: Demolition and removal of all infrastructure (incl. transportation off site)

Impacts:

- Water quality contamination and deterioration due to an increase in sedimentation;
- Habitat loss as a result of poor water quality;
- Loss of biodiversity;
- Loss of wetland areas;
- Soil erosion due to surface runoff;
- Siltation of surface water resources leading to deteriorated water quality and quantity;
- Siltation of wetlands due to erosion; and
- Change in habitat and potential change in species composition.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Long Term (6)	Decommissioning of infrastructure will be short termed, however if spills or contamination occur it may lead to long term effects.	Moderate (negative) - 80
Extent	Beyond Project Area (6)	The activity will only be within the Project Area, however impacts can extend to beyond the project area	
Intensity	Serious Medium Term (4)	The pollutants and sediment may impact on wetland resources within the catchment area.	
Probability	Likely (5)	It is likely that pollution and sedimentation of wetland areas will occur.	
Nature	Negative		

Mitigation Measures			
• The road diversion should be permanent and not removed; • The water/sewage treatment plant may have uses post-closure for the surrounding community, this should be considered before removal; • Once trenches have been backfilled and infrastructure removed, vegetation should be established on the exposed soil surfaces to minimise the risk of erosion and sedimentation into the wetland areas; • During the rehabilitation, temporary sediment trapping berms should be erected to prevent any sediment arising from rehabilitation activities washing into wetland areas; • As far as possible, conduct decommissioning work of infrastructure during the dry season and re-seeding in the wet-season; • Clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately; and • Continue with a wetland monitoring and rehabilitation plan beyond life of mine until final closure.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	If mitigation and rehabilitation measures are followed, the impacts should only take place during the decommissioning phase	Minor (negative) - 40
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Serious Medium Term (4)	The pollutants and sediment may impact on wetland resources within the catchment area, however if mitigation measures are followed, the impacts should be minimum.	
Probability	Likely (5)	It is likely that pollution and sedimentation of wetland areas will occur.	
Nature	Negative		
Interaction 2: Rehabilitation (spreading of soil, revegetation, and profiling/contouring)			
Impacts: • Erosion due to exposed areas to wind and surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity of the wetlands; • Change in habitat and potential change in species composition; and • Increased AIPs.			

<table>
<tr><th colspan="4">Prior to Mitigation/Management</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Medium-term (3)</td><td>Rehabilitation impacts will only take place during the decommissioning phase</td><td rowspan="5">Minor (negative)
- 45</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Impacts will only be within the Project Area.</td></tr>
<tr><td>Intensity</td><td>Serious Medium Term (4)</td><td>Erosion, sedimentation and siltation may have a serious impact on the wetland functionality and health</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>It is likely that erosion and sedimentation of wetland areas will occur.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><th colspan="4">Mitigation Measures</th></tr>
<tr><td colspan="4">Landscape and vegetate the exposed areas as soon as possible to prevent erosion and sedimentation within the wetlands;
Shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas;
Avoid creating narrow preferential flow paths as the this could lead to erosion; and
As far as possible, conduct decommissioning of infrastructure work during the dry season and re-seeding in the wet season.</td></tr>
<tr><th colspan="4">Post-Mitigation</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Short Term (2)</td><td>Impacts will only occur during the decommissioning phase</td><td rowspan="5">Negligible (negative)
- 35</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>The activity will only be within the Project Area if well managed.</td></tr>
<tr><td>Intensity</td><td>Moderate loss (3)</td><td>Impacts will have medium term effects on the wetlands if managed and mitigated</td></tr>
<tr><td>Probability</td><td>Likely (5)</td><td>It is likely that sedimentation, erosion and changes to the wetlands occur</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
</table>

Interaction 3: Installation of post-closure water management infrastructure

Impacts:

- Soil and water contamination from decant and spillage from WTP and STP;
- Increased runoff and changes to the wetland functionality;
- AIPs proliferation due to changes to the natural landscape, soils and wetlands;
- Erosion and sedimentation in wetlands;
- Changes to the habitat, wetland functionality and biodiversity.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Medium-term (3)	Impacts will only take place during the decommissioning phase	Minor (negative) - 45
Extent	Limited (2)	Impacts will only be within the Project Area.	
Intensity	Serious Medium Term (4)	Erosion, sedimentation and siltation may have a serious impact on the wetland functionality and health	
Probability	Likely (5)	It is likely that erosion and sedimentation of wetland areas will occur.	
Nature	Negative		

Mitigation Measures

- The water management system will be only installed once the dirty areas have been cleaned and it is deemed there is no risk of water contamination;
- Once trenches have been backfilled and infrastructure removed, vegetation should be established on the exposed soil surfaces to minimise the risk of erosion;
- During the construction, temporary sediment trapping berms should be erected to prevent any sediment arising from rehabilitation activities washing into wetland areas; and
- Implement a monitoring plan beyond life of mine or until final closure.

Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impacts will only occur during the decommissioning phase	Negligible (negative) - 28
Extent	Limited (2)	The activity will only be within the Project Area and in specific areas if well managed.	
Intensity	Moderate loss (3)	Impacts will have medium term effects on the wetlands if managed and mitigated	
Probability	Probable (4)	It is likely that sedimentation, erosion and changes to the wetlands occur	
Nature	Negative		

9.2. Aquatic Impact Assessment

Focus of the impact assessment has been solely on the proposed Project including the establishment of new infrastructure and associated activities. The identified potential impacts that will negatively affect aquatic ecosystems are discussed below for the various phases of the Project (i.e. Construction Phase, Operational Phase, as well as Closure and Decommissioning Phase). It must be noted that the ratings have been determined based on the available site photos from the 2012 August Aquatic Ecology Assessment and the 2020 June Wetland Ecology Assessment.

For a detailed description of the Impact Assessment Criteria and Calculations used during the assessment below, the reader is referred to Appendix A.

9.2.1. Construction Phase

Land manipulation (and possible vegetation clearing) associated with the proposed surface preparation for infrastructure and the construction of surface infrastructure is the main foreseeable aquatic-related impact associated with the Construction Phase of the Project. There is also a risk of contaminants associated with construction activities and machinery entering the aquatic systems from the Project workings and storage sites.

9.2.1.1. Impact Description: Water and habitat quality deterioration associated with surface preparation and possibly vegetation manipulation/clearing

Land manipulation for infrastructure will most likely increase surface runoff, erosion and subsequently the amount of suspended and dissolved solids as well as pollutants (i.e. hazardous substances from the actual construction areas such as hydrocarbons, organic waste from lack of ablutions and domestic litter) entering the associated watercourses. This has the potential to negatively affect the water and habitat quality within the associated watercourses, i.e. the northern tributary of the Wilge and the main stem Wilge River.

Erosion of land in association with natural aquatic ecosystems will not only modify the morphology of the systems (e.g. channel and bank modifications) but also has the potential to impact on aquatic-related habitat which, in turn, has the potential to alter biological community structure. Erosion and runoff into the associated aquatic ecosystems can result in the sedimentation of habitat and overall increase in suspended solids content. This can directly alter aquatic habitats after deposition (Wood & Armitage, 1997), which in turn will negatively impact biotic community structure by displacing biota that favour the affected habitat. Suspended solids can also directly impact aquatic biota through the accumulation of silt on respiratory organs (i.e. gills) and by decreasing visibility (i.e. increasing turbidity) which will affect feeding habits of specific taxa.

Erosion and runoff from cleared land can also alter water quality by increasing turbidity, as aforementioned, and by increasing the number of contaminants entering the watercourses from the surrounding landscapes, such as fertilisers/nutrients and unearthed metals. This is expected to alter the physio-chemistry of water and deter water quality sensitive biota.

9.2.1.2. Management Objectives

The main objective for mitigation would be to limit the areas proposed for disturbance/vegetation clearance combined with keeping as far as possible from the banks of associated watercourses by creating buffer zones. Construction activities should be restricted to the immediate footprint associated with the proposed infrastructure.

9.2.1.3. Management Actions

General mitigation actions provided in the wetlands and surface water studies conducted by Digby Wells should be used to guide the effective management of aquatic resources potentially affected by the Project. However, more specific management actions for the Construction Phase are listed below:

- Construction activities must maintain a 100 m buffer zone from watercourses;
- Limit vegetation removal to the infrastructure footprint area only. Where removed or damaged, vegetation areas (riparian or aquatic related) should be revegetated as soon as possible;
- Bare land surfaces downstream of construction activities must be vegetated to limit erosion from the expected increase in surface runoff from infrastructure;
- Environmentally friendly barrier systems, such as silt nets or, in severe cases, use trenches downstream from construction sites to limit erosion and possibly trap contaminated runoff from construction;
- Storm water must be diverted from construction activities and managed in such a manner to disperse runoff and prevent the concentration of storm water flow;
- Water used at construction sites should be utilised in such a manner that it is kept on site and not allowed to run freely into nearby watercourses (i.e. use of a PCD);
- Construction chemicals, such as paints and hydrocarbons, should be used in an environmentally safe manner with correct storage as per each chemical’s specific storage descriptions;

- All vehicles must be frequently inspected for leaks;
- No material may be dumped or stockpiled within any rivers, drainage lines in the vicinity of the proposed establishment of new infrastructure;
- All waste must be removed and transported to appropriate waste facilities; and
- High rainfall periods (usually November to March) should be avoided during construction to possibly avoid increased surface runoff in attempt to limit erosion and the entering of external material (i.e. contaminants and/or dissolved solids) into associated aquatic systems.

9.2.1.4. Impact Ratings

Table 9-7 presents the impact ratings associated with land and vegetation clearing impacts predicted for the Construction Phase of the Project. It must be noted that the ratings have been determined based on the observations or site photos taken during the 2012 August survey and are related largely to impacts on the northern tributary of the Wilge and the main stem Wilge River.

Table 9-7: Impact assessment ratings for the Construction Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Surface preparation and construction of proposed infrastructure			
Impact Description: Land and vegetation manipulation/clearing for infrastructure in proximity to the watercourses potentially draining into the northern tributary of the Wilge River.			
Prior to Mitigation/Management			
Duration	Project life (5)	Once vegetation is cleared for infrastructure, no revegetation will occur until project closure.	Moderate (negative) – 78
Extent	Municipal (or catchment) (4)	Based on the close proximity of the proposed infrastructure establishment to the northern tributary of the Wilge River (~560 m), and a slope of ~3.3 % (or ~12º), extent of runoff is expected to be at the catchment level, i.e. direct impact on the Wilge River systems and downstream associated watercourses.	
Intensity x type of impact	Moderately high (-4)	Effects to biological or physical resources expected to occur within immediate proximity and potentially impact on downstream reaches.	

Dimension	Rating	Motivation	Significance
Probability	Highly Probable (6)	Due to the non-perennial nature of the northern tributary of the Wilge, the impact is likely to be significant during high-flow season only.	
Nature	Negative		
Post-Mitigation			
Duration	Project Life (5)	Once vegetation is cleared for infrastructure, no revegetation will occur until the closure phase of the Project or removal of the infrastructure.	Minor (negative) – 55
Extent	Local (3)	Runoff will be limited to specific isolated parts of the site following mitigation actions and if high rainfall periods are avoided for construction.	
Intensity x type of impact	Moderate (-3)	Loss of wetlands will impact on the geohydrology of the riverine systems, however If mitigation measures are all incorporated for the Construction Phase, the intensity of the impact should decrease to moderate.	
Probability	Likely (5)	Loss of wetland will occur; the likelihood of the impact occurring at the Wilge tributary is reduced by the mitigation actions and should only result in extreme cases or unexpected rainfall events.	
Nature	Negative		

9.2.1.5. Impact Description: Infrastructure construction over watercourses

Construction of the proposed diversion of the D2546 District road over the northern tributary of the Wilge River and the subsequent installation of culverts will have a direct impact on the geomorphology and hydrology of this system and an indirect impact on the downstream watercourses. Similar to the aforementioned impacts, road construction over watercourses will most likely result in clearing of vegetation, increased runoff at the site and an increase in erosion leading to sedimentation of the immediate site area and associated watercourses.

9.2.1.6. Management Objective

Key objectives for management must be to maintain the natural flow and connectivity as well as to limit direct construction activities within the watercourses of concern (i.e. direct contact with instream habitat and substrate.

9.2.1.7. Management Actions

Mitigation measures detailed for the site and vegetation clearing impact should be applied to areas leading up to the watercourse crossing points. However, the infrastructure construction over a watercourse needs additional attention due to the proximity of the activity to the aquatic ecosystems. The design as well as the physical construction of roads should not alter the natural hydrology and connectivity of the watercourses in any way (i.e. damming or creating barriers). Any infrastructure proposed to be in contact with the substrate/channel bottom should allow for the free flow of water and material. If hard surfaces are going to be used as foundation or if culverts are going to be installed, their base should not be noticeable above the natural channel bottom to maintain connectivity. Monitoring of the crossing points should also form part of the management actions to ensure correct flow occurs through the crossing point, especially during the wet season.

9.2.1.8. Impact Ratings

Table 9-8 presents the impact ratings associated with infrastructure construction over the watercourse during the Construction Phase of the Project.

Table 9-8: Predicted impact ratings for the proposed construction over watercourse

Dimension	Rating	Motivation	Significance
Activity and Interaction: Physical construction of infrastructure over natural aquatic ecosystems			
Impact Description: Vegetation removal for site access and potential hydrological disturbance of associated watercourses			
Prior to Mitigation/Management			
Duration	Beyond project life (6)	It is likely that the road crossing will remain after the life of the Project.	Moderate (negative) – 96
Extent	Municipal (or catchment) (4)	The impact of runoff, erosion and sedimentation is likely to extend to catchment scale.	
Intensity x type of impact	Very high (-6)	Two of the expected fish species (*E. trimaculatus* and *L. cylindricus*) are known to migrate over 50 km distances. Inadequate culverts causing a barrier to the migration of these species, if present, will have a very high impact in the particular fish populations.	

Dimension	Rating	Motivation	Significance
Probability	Highly probable (6)	Construction of infrastructure and installation of culverts will highly likely impact the watercourse.	
Nature	Negative		
Post-Mitigation			
Duration	Medium Term (6)	If no decommissioning is proposed for the road crossings, the impact will persist beyond the life of the Project.	Negligible (negative) – 30
Extent	Limited (2)	Construction over the dry season and adequate installation of culverts and associated infrastructure will limit the impact to immediate vicinity of construction.	
Intensity x type of impact	Low (-2)	If mitigation measures are implemented and adequate culverts are installed, the intensity of the impact should be low.	
Probability	Unlikely (3)	The likelihood of the impact occurring is reduced by the mitigation actions and should only result in unexpected significant rainfall/flooding events.	
Nature	Negative		

9.2.2. Operational Phase

A major foreseeable impact associated with the Operational Phase of the Project is increased runoff possibly resulting in erosion and sedimentation because of constructed impermeable surfaces. The use of chemicals on site and runoff containing contaminants (i.e. Operation and maintenance of infrastructure and transportation of coal to washing bay) also has the potential to enter nearby watercourses throughout the Operational Phase.

9.2.2.1. Impact Description: Water quality and habitat deterioration associated with an increase in runoff from the operational areas of the Project

Like the impacts described for the Construction Phase, the predicted increased runoff has the potential to increase flow rates, sediment input, erosion and contaminants in the associated watercourses. These influences will directly impact on water quality and aquatic habitat which in turn will negatively affect the aquatic biota.

Stormwater and water used on site (e.g. Sewage Treatment Plant and dust suppression water) has the potential to directly alter habitat and the morphology of the receiving aquatic ecosystems if allowed to flow freely from the MRA (e.g. through sedimentation). Uncontrolled runoff also has the potential to alter water chemistry and degrade water quality of the affected systems by collecting contaminants as it drains across the associated landscapes. This will consequently affect the aquatic ecology and water quality sensitive aquatic biota.

9.2.2.2. Management Objectives

Water should not be allowed to flow freely from the mining activities and associated infrastructure. Dirty water or water runoff from mine related infrastructure should be stored (in a PCD for example) and utilised as intended. Additionally, the proposed plan is to use mine-affected water for dust suppression on site. Again, this water should be controlled and not allowed to freely flow from the area of use. This may be a challenging task during dust suppression.

9.2.2.3. Management Actions

The following management actions are recommended to guide the effective management of stormwater and water generated on site:

- Runoff from dirty areas should be directed to the storm water management infrastructure (drains and PCDs) and should not be allowed to flow into the surrounding environment, unless DWS discharge authorisation and compliance with relevant discharge standards as stipulated in the NWA is obtained;
- Channelled water should not be dispersed in a concentrated manner. Baffles should be incorporated into artificial drainage lines/channels around the surface infrastructure to decrease the kinetic energy of water as it flows into the natural environment;
- Bare surfaces downstream from the developments where silt traps are not an option should be vegetated in order to attempt to limit erosion and runoff that might be carrying contaminants;
- Careful monitoring of the areas where dust suppression is proposed should be undertaken regularly. Areas concentrating water runoff should be addressed and not allowed to flow freely into associated watercourses; and
- Monitoring of the associated northern tributary of the Wilge (including infrastructure at the river crossing) and the main stem Wilge River reach should be done by an aquatic specialist in order to determine potential impacts where after new mitigation actions should be implemented as per the specialist’s recommendations.

9.2.2.4. Impact Ratings

Table 9-9 presents the impact ratings determined for the potential runoff from the proposed infrastructure and associated activities.

Table 9-9: Impact assessment ratings for the Operational Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Operation and maintenance of infrastructure. Use and maintenance of haul roads (incl. transportation of coal to washing plant).			
Impact Description: Uncontrolled contaminated runoff of stormwater or water generated from the mining operations from or through the surface infrastructure leading to water quality and habitat deterioration of watercourses.			
Prior to Mitigation/Management			
Duration	Project Life (5)	It is predicted that contaminant input will continue throughout the life of the Project whenever rainfall events occur.	Minor (negative) – 70
Extent	Municipal (or catchment) (4)	Based on the close proximity of the proposed infrastructure to the northern tributary of the Wilge River, extent of runoff is expected to be at the catchment level, i.e. direct impact on the Wilge River systems and indirect impact onto the downstream watercourses.	
Intensity x type of impact	High (-5)	Runoff, seepage and or leakage into watercourses is expected to impact functioning of the aquatic ecosystems.	
Probability	Likely (5)	The impact is likely to occur throughout the life of the Project but limited due to periodic rainfall events.	
Nature	Negative		
Post-Mitigation			
Duration	Project Life (5)	Runoff will continue throughout the Project life.	Negligible (negative) – 21
Extent	Very limited (1)	Runoff will most likely be largely restricted and captured after mitigation.	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Minimal to no loss - Negative (-1)	If mitigation measures are all incorporated for the Project, the intensity of the impact should decrease. However, contaminants are more difficult to manage compared to solid particles and may enter associated aquatic systems resulting in water quality deterioration.	
Probability	Unlikely (3)	The likelihood of the impact occurring is reduced by the mitigation actions and should only result in extreme rainfall events or if mitigation structures aren't maintained.	
Nature	Negative		

9.2.3. Closure and Decommissioning Phase

This phase entails removal of mine related infrastructure as well as rehabilitation of potentially affected areas and aquatic ecosystems.

9.2.3.1. *Impact Description: Demolition of infrastructure, rehabilitation and installation of post-closure water management infrastructure*

Demolition of infrastructure, using heavy machinery and rehabilitation activities entailing spreading of soil for profiling and contouring will most likely result in erosion and increased runoff in the areas near or in the associated watercourses. Water runoff during these activities may also be of poor quality which will also result in the deterioration of the quality of the affected ecosystems. Dirty water entering natural aquatic ecosystems from the decommissioning activities and associated areas have the potential to alter water chemistry and degrade water quality of the affected systems. This will consequently affect the aquatic ecology and aquatic biota.

9.2.3.2. *Management Objectives*

It is predicted that the natural morphology of the hillslope wetlands associated with the proposed surface infrastructure would have changed after the life of the Project. Therefore, the main management objective would be to restore the affected areas to natural/reference conditions without resulting in additional downstream impacts throughout the process.

9.2.3.3. Management Actions

The goal of mitigation should be to limit erosion and runoff from the footprint of the areas/infrastructure during decommissioning as well as during rehabilitation. The following measures may be utilised in attempt to reduce the decommissioning impacts:

- High rainfall periods should be avoided during decommissioning;
- Removed or damaged vegetation areas should be revegetated;
- Storm water must be diverted from decommissioning activities;
- Water used during decommissioning should be kept onsite and not be allowed to freely flow into nearby watercourses;
- Stored mine-affected water should be treated before decommissioning of any mine-related water retention areas, such as PCDs;
- Land reprofiling should be done during the dry season to allow for attempts to restore the morphology of the hillslope wetlands prior to rainfall/flow events;
- Ensure the revegetation activities use appropriate indigenous plant species.

9.2.3.4. Impact Ratings

The impact rating associated with activities related to the removal of surface infrastructure and rehabilitation of potentially affected areas have been predicted in Table 9-10 below.

Table 9-10: Impact assessment ratings for the Decommissioning/Rehabilitation Phase

Dimension	Rating	Motivation	Significance
Activity and Interaction: Physical removal of surface infrastructure and rehabilitation activities near and within drainage lines			
Impact Description: Water quality and habitat deterioration of watercourses in contact with heavy machinery and receiving runoff from surface workings			
Prior to Mitigation/Management			
Duration	Medium term (3)	The impact will only occur during decommissioning and until rehabilitation is complete.	Minor (negative) – 60
Extent	Catchment (4)	Based on the proximity of the proposed infrastructure to watercourses, the extent of runoff is expected to be localised to within the respective catchment.	
Intensity x type of impact	High (-5)	Runoff into watercourses is expected to result in erosion, increased sedimentation and contamination impacting functioning of the aquatic ecosystems.	

Dimension	Rating	Motivation	Significance
Probability	Likely (5)	The impact is likely to occur throughout the Decommissioning Phase but limited due to periodic rainfall events.	
Nature	Negative		
Post-Mitigation			
Duration	Medium Term (3)	Impacts will persist throughout the Decommissioning Phase until rehabilitation activities are complete.	Negligible (negative) – 15
Extent	Very limited (1)	If mitigation measures are adhered to, especially working in the dry season, runoff is expected to be restricted to the mitigation structures.	
Intensity x type of impact	Minimal to no loss - Negative (-1)	If mitigation measures are all incorporated for the Project, the intensity of the impact should decrease notably especially after rehabilitation.	
Probability	Unlikely (3)	The likelihood of the impact occurring is reduced by the mitigation actions and should only result in extreme rainfall events or if mitigation structures aren't maintained.	
Nature	Negative		

9.3. Cumulative Impacts

The Project Area is in the Wilge River sub-catchment area, approximately 16 km south west of the town of Delmas in the Mpumalanga Province. Numerous mining operations are currently active near the Project Area where the coal processing will take place.

The majority of South Africa's water resources are under severe pressure. Owing to the extent of mining operations within relatively proximity to the Project Area, the severity of the cumulative impact is considered to be severe should no mitigation methods be considered.

The land uses within and surrounding the Project Area have contributed to losses of wetland areas and continued impacts on the remaining areas. The alteration of the vegetation due to crop cultivation and cattle grazing that has led to overgrazing, the contamination of water resources as a result of industrial process and increased surface inflows, have all contributed to the physical impacts on the wetlands and rivers such as erosion and sedimentation.

The mining activities within the catchment have led to losses in wetland areas that may have facilitated increased water flow and also have increased the number of pollutants flowing into the water resources. The alteration of vegetation and surface flow has led to the onset of erosion in the wetland areas and this may be perpetuated further by mining and related activities within the Project Area. Mining may disturb the hydrological patterns further which could in turn lead to large scale desiccation of wetland areas and the direct loss of some of the wetland areas as a result of water flow being cut off.

9.4. Unplanned and Low Risk Events

There is a risk that wetland areas associated with the mining 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; and

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

Table 9-11 outlines mitigation measures that must be adopted in the event of unplanned impacts throughout the life of the proposed Project.

Table 9-11: Unplanned Events and Associated Mitigation Measures

Unplanned Risk	Mitigation Measures
• Chemical and (or) contaminant spills from mining 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 structural deterioration or accidents along the roadways and pipelines in the vicinity of wetlands.	• Install safety valves and emergency switches that can be used to seal off leakages from pipelines when noticed or triggered; • Ensure that spill kits and trained staff capable of using the kits are available on site in case of accidental spillages; and • Maintenance of roadways, river crossings and pipelines should be considered an ongoing process where leakages or issues with the pipe should be reporting to acting Environmental

Unplanned Risk	Mitigation Measures
	Control Officer (ECO) of the Project immediately after notice.

10. Environmental Management Plan

The EMP is described in Table 10-1 below.

Table 10-1: Environmental Management Plan

	Interaction	Potential Impact	Mitigation Measure	Mitigation Type	Time period for Implementation
Construction Phase	Surface preparation for infrastructure	• Direct loss of wetland areas; • Loss of biodiversity; • Erosions and sedimentation of wetland areas; • Water quality contamination and deterioration; and • Habitat loss because of poor water quality.	• Control through the establishment of at least a 100 m buffer zone around the remaining wetlands to protect wetland areas from the proposed developments. This would require that development occur further than 100 m from a delineated wetland area; • Remedy through revegetate the area as soon as possible to prevent erosion, sedimentation and habitat loss within the wetlands; • Control through restrict access to the remaining wetlands; • Control through place sediment trapping berms on the boundary of the 100 m buffer or end of development; • Remedy by doing an offset calculation to determine the impacts and total amount of wetland habitat loss to understand the amount of wetlands to be offset; and • Remedy by developing a Wetland Offset Strategy, Rehabilitation Plan and a Monitoring Plan for the wetlands.	*Modify, remedy, control, or stop* *Concurrent rehabilitation through the life of mine*	Daily/Monthly
	Construction of surface infrastructure	• Direct loss of wetland areas; • Habitat loss; • Loss of biodiversity; and • Erosions and sedimentation of wetland areas.	• Control through establishment of a 100 m buffer zone around the remaining wetlands to protect wetland areas from the proposed developments within the study area. This would require that development occur further than 100 m from a delineated wetland area; • Control through • Control by prevent access to the remaining wetlands; • Control and remedy by place sediment trapping berms on the boundary of the 100 m buffer or end of development; and • Remedy by the development of a Wetland Offset Strategy and Rehabilitation plan for the wetlands in the Project area.		
Operational Phase	Operation and maintenance of infrastructure	• Water quality contamination and deterioration; • Habitat loss as a result of poor water quality; • Loss of biodiversity; and • Erosion and Sedimentation within the wetlands	• Control by restrict access to all remaining wetlands with at least a 100 m buffer; • Remedy by maintain and monitor wetland functionality; • Remedy by clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately; • Control and remedy by recommended that no new river/stream crossing be erected, there are several crossings within the site that can be improved for better wetland functionality and operational functionality and this will include the insertion of culverts; • Remedy by construct sediment trapping berms on edges of the roads; • Remedy by establish vegetation on berms and edges of the road to minimise the risk of erosion; • Remedy by where possible, create a preferential flow of runoff and wastewater directed towards the PCDs; • Remedy by monitor the roads monthly to identify and rectify any areas that have begun to erode and where water may be flowing towards wetland areas; and • Control and remedy by recommended that all mitigation measures recommended by the Digby Wells Groundwater Report for the Ubuntu Coal Mine Project be followed to prevent dewatering of wetlands.	*Modify, remedy, control, or stop* *Concurrent rehabilitation through the life of mine*	Continuously

DIGBY WELLS ENVIRONMENTAL

	Interaction	Potential Impact	Mitigation Measure	Mitigation Type	Time period for Implementation
	Use and maintenance of haul roads (incl. transportation of coal to washing plant)	• Erosion of wetland crossings associated with the road diversion; • Accidental spills causing soil and water contamination; • Habitat loss as a result of poor water quality; • Increased Alien Invasive Plants (AIPs); • Loss of biodiversity; • Siltation of wetlands due to erosion; and • Change in habitat and potential change in species composition.	• Control and remedy by implementing quarterly monitoring of the wetland health and functionality and rehabilitation recommendations at the wetland crossings associated with the road diversion as well as downstream of the WTP, STP and wash plant; • Control by access roads must be maintained and monitored to prevent erosion, head-cut erosion, sedimentation, increased AIPs and loss of wetland habitat and functionality; and • Remedy by clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately.		
Decommissioning Phase	Demolition and removal of all infrastructure (incl. transportation off site)	• Water quality contamination and deterioration due to an increase in sedimentation; • Habitat loss as a result of poor water quality; • Loss of biodiversity; • Loss of wetland areas; • Soil erosion due to surface runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity; • Siltation of wetlands due to erosion; and • Change in habitat and potential change in species composition.	• Control and remedy by the water/sewage treatment plant may have uses post-closure for the surrounding community, this should be considered before removal; • Remedy by once trenches have been backfilled and infrastructure removed, vegetation should be established on the exposed soil surfaces to minimise the risk of erosion and sedimentation into the wetland areas; • Remedy by during the rehabilitation, temporary sediment trapping berms should be erected to prevent any sediment arising from rehabilitation activities washing into wetland areas; • Remedy by as far as possible, conduct decommissioning work of infrastructure during the dry season and re-seeding in the wet-season; • Remedy by clean up spillages of coal, oils, lubricants and hydrocarbons immediately, where large spills have occurred, remove the impacted soils and remediate immediately; and • Remedy by continue with a wetland monitoring and rehabilitation plan beyond life of mine until final closure.	*Modify, remedy, control, or stop* *Concurrent rehabilitation through the life of mine*	During Construction and Decommissioning Phases..
	Rehabilitation (spreading of soil, revegetation, and profiling/contouring)	• Erosion due to exposed areas to wind and surface water runoff; • Siltation of surface water resources leading to deteriorated water quality and quantity of the wetlands; • Change in habitat and potential change in species composition; and • Increased AIPs.	• Remedy by landscape and vegetate the exposed areas as soon as possible to prevent erosion and sedimentation within the wetlands; • Remedy by shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas; • Remedy by avoid creating narrow preferential flow paths as the this could lead to erosion; and • Remedy by as far as possible, conduct decommissioning of infrastructure work during the dry season and re-seeding in the wet season.		
	Installation of post-closure water management infrastructure	• Soil and water contamination from decant and spillage from PDCs; • Increased runoff and changes to the wetland functionality;	• Control and remedy by the water management system will be only installed once the dirty areas have been cleaned and it is deemed there is no risk of water contamination; • Remedy by once trenches have been backfilled and infrastructure removed, vegetation should be established on the exposed soil surfaces to minimise the risk of erosion;		

	Interaction	Potential Impact	Mitigation Measure	Mitigation Type	Time period for Implementation
		• AIPs proliferation due to changes to the natural landscape, soils and wetlands; • Erosion and sedimentation in wetlands; and • Changes to the habitat, wetland functionality and biodiversity.	• Remedy by during the construction, temporary sediment trapping berms should be erected to prevent any sediment arising from rehabilitation activities washing into wetland areas; and • Remedy by implementing a monitoring plan beyond life of mine or until final closure.		

11. Monitoring Programme

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. Separate monitoring programmes for associated wetlands and aquatic ecosystems are provided in the below sub-sections.

11.1. Wetlands monitoring Programme

Table 11-1 describes the monitoring plan which should be followed from the Construction Phase through to the Decommissioning and Monitoring phase. The table below includes each element of monitoring together with the frequency of monitoring and person responsible thereof.

The monitoring programme are based on the following points:

- External monitoring should commence from prior to the Construction Phase to ensure baseline information regarding soils and vegetation and to monitor any changes thereof;
- Throughout the Operational and Decommissioning Phases, bi-annual (twice a year) external monitoring of wetland health, soils and vegetation, preferable one survey after the rainy season (March to May) and one after the dry season (July to September) (Please see Aquatic Impact Assessment Report);
- Monitoring should be done in terms of:
  - Appendix 6 of the NEMA EIA Regulations, 2014, (as amended);
  - National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
  - National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA); and
  - The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).
- The Mine Manager (MM) and the Environmental Practitioner (EP) are responsible to report on results of the monitoring program; 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.

As the Project area contain wetland habitat, it is recommended that the WET-Health and WET-Ecoservices tools should be used to re-evaluate PES and eco-services on a quarterly basis by a suitably qualified wetland specialist for the duration of the Construction Phase, and annually for the duration of the Operational Phase. Upon closure and decommissioning, annual monitoring should take place for another three years to ensure no emerging impacts are identified, which may need to be addressed.

Table 11-1: Monitoring Plan

Monitoring Element	Comment	Requirement	Frequency	Responsibility
Wetland Health	• It is recommended that no mining take place within a 100 m buffer zone of the Wilgeriveer ands Kromdraaispruit tributaries or within the 1:100 year flood line whichever is largest; and • In addition to this, it is further recommended that a buffer zone of 500 m be assigned to the remaining wetland areas so as to prevent future impacts to these areas.	• As the proposed Project Area is comprised largely of wetland habitat, it is recommended that the WET-Health and WET-Ecoservices tools should be used to re-evaluate PES and EcoServices; • To compensate for the loss of wetland areas due to the destruction of aquifer recharge areas and the subsequent loss of ecological services due to the mining Project, a rehabilitation programme is recommended; • Wetland area size; • Wetland, habitat and aquatic health; and • Wetland physical attributes (functionality).	• Quarterly basis by a suitably qualified wetland specialist for the duration of the Construction Phase, and annually for the duration of the Operational Phase; and • Upon closure and decommissioning, annual monitoring should take place for another three years to ensure no emerging impacts are identified, which may need to be addressed.	• The MM and the EP should ensure wetland contamination monitoring on site, especially where hydrocarbons are stored and applied; • EP to give training to sub-contractors and all workers on the operational procedures and mitigation measures; and • The MM and the EP should be responsible to determine effectiveness of erosion control structures.

11.2. Aquatic Biomonitoring Programme

An aquatic biomonitoring programme has been developed for the monitoring and preservation of the aquatic ecosystems assessed for the Project. This programme is aimed at better determining the ecological health of the ecosystems as well as to act as an early detection tool for impacts that might severely affect the expected aquatic biota in the associated riverine systems.

Table 11-2 outlines the aquatic monitoring methods to be undertaken at monitoring points proposed to be established at some of the surface water monitoring sites (i.e. UCBSW2, UCBSW3 and UCBSW4) and an additional site along the main stem Wilge River before confluence with the Northern Tributary. Sampling must be undertaken on an annual basis by a qualified aquatic ecologist. The annual programme comprises of a single survey during the dry season (or low flow season) for the Study Area and a single survey during the wet season (or high flow) at the monitoring points indicated. This will determine the PES for the assessed aquatic ecosystems which will further determine whether the proposed Project is impacting the associated aquatic ecology and to what extent.

Table 11-2: Biomonitoring Programme

Method and Aquatic Component of Focus	Details	Goal/Target	*RQO
Water Quality: *In situ* water testing focusing on temperature, pH, conductivity and oxygen content.	Water quality should be tested on a biannual basis at each monitoring site to determine the extent of change from baseline results.	No noticeable change from determined baseline* water quality for each respective season	*C – Overall salt and sulphate concentrations need to be maintained to levels that do not threaten the ecosystem or agricultural users.
Habitat Quality: Instream and riparian habitat integrity; and Availability/suitability of macroinvertebrate habitat at each monitoring site.	The application of the IHI should be done on a reach basis for the northern tributary of the Wilge River as well as for the Wilge River; and The IHAS must be applied at each monitoring site prior to sampling.	The Ecological Category determined for each assessed site must be maintained (and improved; and The baseline IHAS scores should improve.	*≥ C (or ≥ 62) – Instream habitat must be in a Moderately Modified or better condition to sustain instream biota.
Macroinvertebrates: Macroinvertebrate assemblages must be assessed biannually.	This must be done through the application of the latest SASS5, incorporated with the application of the MIRAI	The baseline SASS5 scores should not noticeably deteriorate; and	*≥ C (or ≥ 62) – Instream biota moderately Modified or better condition and at sustainable levels.

Method and Aquatic Component of Focus	Details	Goal/Target	*RQO
	as outlined in this Aquatic Study.	Baseline Ecological Categories should not be allowed to drop in category for each assessed site.	Must be in a Largely Modified or better condition ≥ D (≥ 42)
Fish: Fish assemblages must be assessed biannually	Sampling of fish must be undertaken during the wet season at the associated Wilge River reaches utilising standard electro-narcosis techniques followed by the application of FRAI for applicable reaches.	Baseline Ecological Categories should not be allowed to drop in category for each assessed site. The main goal for the Project must be to conserve the expected sensitive and conservation important species.	
***RQO = Resource Quality Objective**			

The Project should not commence without inclusion of the above Aquatic Biomonitoring Programme

12. Stakeholder Engagement Comments Received

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the EIA process. The objectives of the Stakeholder Engagement Process (SEP) include the following:

- To ensure that I&APs are informed about the Project;
- To provide I&APs with an opportunity to engage and provide comment on the Project;
- To draw on local knowledge by identifying environmental and social concerns associated with the Project;
- To involve I&APs in identifying methods in which concerns can be addressed;
- To verify that stakeholder comments have been accurately recorded; and
- To comply with the legal requirements.

The Public Participation Process (PPP) has been completed in part, as a process separate to the Wetland Environmental Impact Assessment (Table 12-1).

Table 12-1 Stakeholder Engagement Comments

Date of Receipt	Method	Contributor	Organization/ Community	Comment	Response
25-Nov-20	Registration and Comment form received by Email correspondence	Frans Venter	Brakfontein Farm 264 IR Portion 4,29 &30	A dam exists downstream that is used for irrigation. What will be the effect on quality and runoff water?	During the EIA Phase, the Surface Water Impact Assessment will consider the impact on surface water quality and quantity that may be caused as a result of the proposed project. The preliminary water quality impacts identified during the Scoping Phase relate to spillages and leaks of fuels, oils and other potentially hazardous chemicals and sedimentation of downstream watercourses. Mitigation measures will be proposed to mitigate these risks, including the implementation of a stormwater management plan during the EIA Phase. The stormwater management plan to be compiled will ensure that all dirty water and runoff that is generated within the mine is contained as per the government regulations on the stormwater management in mines. Furthermore, ongoing water quality monitoring will be undertaken to assess any potential impacts on water quality as a result of the proposed project. With regards to water quantity, the Scoping Phase surface water assessment estimated approximately less than 0.09% loss of the runoff-contributing catchment area in proportion to the total catchment area. This is not anticipated to result in significant reduction in the water quantity reporting downstream. On this basis, the project is not likely to have significant impacts on the downstream dam.

13. Conclusion

13.1. Wetland Ecology

The wetlands were delineated in 2012 and were reassessed during 2020. The wetlands impacted on due to the new proposed activities were:

- Hillslope seepage wetland connected to a watercourse;
- Valley bottom wetlands with a channel; and
- Hillslope seep wetland.

The HGM units were considered to have an ecological state ranging between **'Moderately Modified'** and **'Greatly Modified'.** The assessed HGM units were all determined to be of **'Intermediate**' importance. Overall, the largest ecosystem services include sediment trapping, toxicant removal, erosion control and some data exist (previous studies) for research purposes, the need for which is amplified by the surrounding agricultural and mining activities.

The EIS scores for the 2020 Wetland Assessment were regarded all as '**Moderate**'. This indicates that the wetlands are ecologically important and sensitive, and that 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, the Wilge River and Kromdraaispruit in this case.

The overall impacts of the Project were determined to be significant and may potentially lead to irreversible damage to wetland areas. The loss of wetland areas leads to altered ecosystem functioning and the loss of biodiversity. The recommended mitigation measures will not restore wetland areas that are lost because of the Project; however, will be to rehabilitate and preserve un-impacted wetlands and improve their functioning.

It is highly recommended that concurrent rehabilitation, management, mitigation measures and wetland monitoring are correctly implemented to minimise potential impacts on the wetland functionality. A Wetland Offset Calculator should be applied to determine the total wetland loss and to compensate for significant residual adverse impacts.

13.2. Aquatic Ecology

Amongst the reviewed water quality results from various reports, none of the sites associated with the current proposed Project recorded exceedances *in situ* water quality. Only pH levels at Site 1 and Site 2 were recorded below the recommended guidelines during the 2012 Aquatic Ecology Assessment. The overall *in situ* water quality was thus determined to be fair. *Ex situ* water quality trend data obtained from previously undertaken surface and groundwater assessments within the Project Ares indicate fluctuating pH levels (around ~6 and 9) with no particular reported 'red flags' at sampling sites associated with the current proposed project. Of the sites sampled along watercourses associated with the proposed Project, Site UCBSW2, was of particular concern. Exceedances in electrical conductivity, magnesium, sodium, chlorine and nitrate were recorded at this site during one or more of the quarterly surveys since 2018 to date. Elevated levels of nitrates are suspected to be resulting from agricultural activities. Sources for exceedances in the other water quality parameters could not be determined at the time of writing, however may be associated with the mining activities (PCD and overburden for example), further investigations are however required to confirm this.

The findings from the 2012 August Index of habitat Integrity assessment indicate the overall instream and riparian habitat associated with the study area was determined to be in a largely modified state (Ecological Category D). Major impacts were those associated with anthropogenic activities such as mining and agriculture. Water quality modifications as a result of effluent, surface run-off and the abstraction of water were suspected to significantly influence the determined IHI scores.

The availability of aquatic macroinvertebrate habitat was scored as ‘Good’ at all the sites expect at Site 1 which was scored as ‘Poor’. High levels of sedimentation and low flow conditions were observed at Site 1 at the time of the 2012 survey. This site also lacked the stones-in-current biotope, consequently, habitat availability and quantity were seen as the limiting factors to macroinvertebrate diversity. At all the other sites, availability of all SASS5 biotopes were observed to be sufficient and not expected to be a limiting factor to macroinvertebrate communities.

The sampled aquatic macroinvertebrate community composition at four sites during the 2012 survey was of low diversity, only 18 of the approximately 30 expected taxa were collected. Community composition was dominated by taxa that are tolerant to water quality deterioration. The collected macroinvertebrate assemblage indicated some level of water quality deterioration at all sampled sites. A site-based Macroinvertebrate Response Assessment Index was carried out for the 2012 August survey. The determined MIRAI scores indicated *Seriously Modified* conditions (Ecological Category E) at each of the assessed sites. This finding was attributed to the water quality modifications and low flows observed at the time of the study.

None of the expected fish species were sampled at the time of the 2012 August survey despite the use varying methods (including electro-narcosis and using a fyke net). This was suspected to have been caused by the cold temperatures experienced during the survey with the water temperature dropping to as low as 10 ^{o}C. It was suspected that the fish, if present, remained inactive, thus could not be collected during the survey.

This report are based on data collected from a literature review and professional experience. Without a field survey to verify or groudtruth these findings, conclusions made are of low confidence.

14. Recommendations

The following actions are recommended to reduce adverse effects on the wetland resources and aquatic ecosystems of the Project Area

14.1. Wetland Ecology

(Table 14-1):

Table 14-1: Possible Impacts and Recommendations

Possible Impacts	Recommendations	Person Responsible
Loss of wetland vegetation and habitat.	A 500 m buffer around the remaining wetlands, where not possible at least a 100 m buffer around the wetlands. The establishment of hydrophytic plants and facultative hydrophytes that are native to the area.	Wetland ecologist and Botanist.
Soil disturbance, and decreasing biodiversity resulting in increased sedimentation and increased erosion in wetlands.	Improved vegetation cover and establish hydrophytic plants and facultative hydrophytes that are native to the area. Reduced risk of erosion and sedimentation.	Wetland ecologist, Botanist and Soil Scientist.
Linear infrastructures resulting in fragmentation of wetlands, the creation of preferential flow paths, and the onset of erosion.	Reduced risk of erosion, compaction, and the creation of preferential flow paths. Maintain linear infrastructure.	Wetland ecologist.
The presence of proposed road, dams/weirs in wetland areas promote flooding and prevent natural diffuse flow.	Natural diffuse flow through the wetland and reduced the occurrence of channelization.	Wetland ecologist and Botanist.
Erosion/ Sedimentation.	Reduced risk of erosion and sedimentation of downstream wetland areas by re-vegetation.	Wetland ecologist.
Increased run-off and sedimentation, the input of pesticides and fertilisers and reduced buffer capacity of wetlands due to crop farming and AIPs.	Employment of a protective vegetated buffer strip around the wetland.	Wetland ecologist and Botanist.
Livestock impacts.	Improved wetland integrity and functionality.	Wetland ecologist.

Possible Impacts	Recommendations	Person Responsible
Water quality impacts.	Improved water quality and prevention of pollution.	Wetland ecologist, Aquatic ecologist, and EP.

14.2. Aquatic Ecology

Based on the results of the current desktop-based aquatic study, the following actions have been recommended to allow for commencement of the proposed Project:

- A high-flow season (or wet season) aquatic survey must be undertaken prior to commencement of the Project to contribute to the updated baseline findings and to kick off the proposed monitoring programme;
- The developed Aquatic Biomonitoring Programme must be adopted on an annual basis, prior to the commencement of the Construction Phase of the Project. This programme should continue for the life of the Project and for at least three years post the Decommissioning Phase;
- The proposed Project must aim to maintain the stipulated Recommended Ecological Category (REC) of C (i.e. Moderately Modified) (or improve to better state) for the associated Wilge River and associated reaches; and
- The proposed Project should adopt a water and habitat quality preservation mindset throughout the life of the Project. In other words, the proposed activities should not result in the deterioration/degradation of aquatic habitat (i.e. riparian and instream habitat) and water quality within the associated aquatic ecosystems.

15. Reasoned Opinion Whether Project Should Proceed

The overall impacts of the Project were determined to be significant and may potentially lead to irreversible damage to wetland areas. Based on the Impact Assessment significance ratings, the proposed mining activities will have a major impact on the wetlands and its environment. Some wetlands will be lost as well as have a major effect on the wetlands and freshwater systems downstream of the Project Area. It is recommended to do a Wetland Offset Assessment to calculate the total wetland lost and determine the number of wetlands to be offset. The removal of wetlands in the headwaters of the catchment may cause loss of water inputs to the lower catchment and therefore have major effects on the downstream biodiversity, aquatic systems, fauna and flora.

However, it is highly recommended that rehabilitation, management, mitigation measures and monitoring of the freshwater resources are correctly implemented. Offsetting, wetland rehabilitation and monitoring must be used to minimise potential impacts on the remaining wetlands and associated catchments to maintain the wetland health and functionality. Wetland management and monitoring requirements as set out in Section10 and Section 11 should form part of the conditions for environmental authorisation.

It is recommended to include at least a 500 m zone of regulation buffer around the remaining wetlands to any activities, such as construction and infrastructure. Wetlands and natural water resources are a valuable natural asset, especially within the Highveld area.

In light of the low confidence in the Aquatic Ecology Assessment, a high-flow season (or wet season) aquatic survey must be undertaken prior to commencement of the Project to contribute to the updated baseline findings and thereafter aid in providing an adequate reasoned opinion whether the proposed Project should proceed.

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Appendix A: Methodology

17. Methodology

17.1. Literature Review and Desktop Assessment (Wetland Ecology)

Relevant literature was reviewed with respect to the historical wetlands associated with the Ubuntu Colliery, 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 the purpose of 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 metre (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);
- Mining and Biodiversity Guidelines, DEA et al. (2013);
- Mpumalanga Biodiversity Sector Plan (MTPA, 2014);
- An Ecological Assessment Of The Wetland Systems Of The Brakfontein Mining Operation (Digby Wells Environmental, 2012a);
- Environmental Impact Assessment Report for the Proposed Brakfontein Coal Mine (Digby Wells Environmental, 2012b); and
- Wetland Offsets: A Best Practice Guideline for South Africa (SANBI and DWS, 2016).

Relevant and available historical studies conducted within, or surrounding the Project Area, the South African National Biodiversity Institute (SANBI), Water Management Areas (WMA) and Quaternary Catchments, the National Spatial Biodiversity Assessment, Governmental reports such as the Mpumalanga State of the Environment Report (2003), Vegetation types of South Africa (Mucina & Rutherford, The Vegetation of South Africa, Lesotho and Swaziland., 2012), and Fauna distribution and identification books of South Africa (Friedman & Daly, 2004; Skinner & Chimimba, 2005) were some of the platforms used to identify and create a background study of the area.

17.1.1. 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 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 were 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 17-1 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 17-1: NFEPA Wetland Classification Ranking Criteria (Nel et al., 2011)

Criteria	Rank
Wetlands that intersect with a Ramsar site.	1
• 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

17.1.2. Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by SANBI, the DEA, the Department of Mineral Resources (DMR), the Chamber of Mines and the South African Mining and Biodiversity Forum (2013). The purpose of the guideline was to provide the mining sector with a manual to integrate biodiversity into the planning process thereby encouraging informed decision-making around mining development and environmental authorisations. The aim of the guideline is to explain the value for mining companies to consider biodiversity management throughout the planning process. The guideline highlights the importance of biodiversity in managing the social, economic and environmental risk of the proposed mining Project. The country has been mapped into biodiversity priority areas including the four categories each with associated risks and implications (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013) (Table 17-2).

Table 17-2: Mining and Biodiversity Guideline Categories (DEA et al., 2013)

Category	Risk and Implications for Mining
Legally Protected	Mining prohibited; unless authorised by ministers of both the DEA and DMR.
Highest Biodiversity Importance	Highest Risk for Mining: the EIA process must confirm significance of the biodiversity features that may be a fatal flaw to the proposed Project. Specialists must provide site-specific recommendations for the application of the mitigation hierarchy that informs the decision-making processes of mining licences, water use licences and environmental authorisations. If granted, authorisations should set limits on allowed activities and specify biodiversity related management outcomes.
High Biodiversity Importance	High Risk for Mining: the EIA process must confirm the significance of the biodiversity features for the conservation of biodiversity priority areas. Significance of impacts must be discussed as mining options are possible but must be limited. Authorisations may set limits and specify biodiversity related management outcomes.
Moderate Biodiversity Importance	Moderate Risk for Mining: the EIA process must confirm the significance of the biodiversity features and the potential impacts as mining options must be limited but are possible. Authorisations may set limits and specify biodiversity related management outcomes.

17.1.3. Mpumalanga Biodiversity Sector Plan (MBSP)

The MBSP is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for national legislation and policy. The MBSP was published in 2014 by the Mpumalanga Tourism and Parks Agency (MTPA) and comprises a set of maps of biodiversity priority areas accompanied by contextual information and land-use guidelines for use in land-use and development planning, environmental assessment and regulation, and natural resource management. Strategically the MBSP enables the province to:

- Implement the NEM:BA, 2004 provincially, and comply with requirements of the National Biodiversity Framework, 2009 (NBF) and certain international conventions;
- Identify those areas of highest biodiversity that need to be considered in provincial planning initiatives; and
- Address threat of climate change (ecosystem-based adaptation).

The publication includes terrestrial and freshwater biodiversity areas that are mapped and classified in Protected Areas (PAs), Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) or Other Natural Areas (ONAs) (Table 17-3).

Wetlands in Mpumalanga Province have been extensively degraded and, in many cases, irreversibly modified and lost through a combination of inappropriate land-use practices, development, agriculture and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good water quality for anthropological and animal use yet they are vulnerable to undesirable impacts. It is therefore in the interest of national water security that all wetlands are protected by law.

Table 17-3: Mpumalanga Biodiversity Sector Plan Categories

Map Category	Definition	Desired Management Objectives
PA	Those areas that are proclaimed as protected areas under national or provincial legislation, including gazette protected environments.	Areas that are meeting biodiversity targets and therefore must be kept in a natural state, with a management plan focused on maintaining or improving the state of biodiversity.
CBAs	Areas that are required to meet biodiversity targets, for species, ecosystems or ecological processes. CBA Wetlands are those that have been identified as FEPA wetlands that are important for meeting biodiversity targets for freshwater ecosystems.	Must be kept in a natural state, with no further loss of habitat. Only low-impact, biodiversity-sensitive land-uses are appropriate.
ESAs	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of protected areas or CBAs and for delivering ecosystem services. ESAs Wetlands are those that are non-FEPA and ESA Wetland Clusters are clusters of wetlands embedded within a largely natural landscape that function as a unit and allow for the migration of species such as frogs and insects between individual wetlands.	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.
ONAs	Areas that have not been identified as a priority in the current systematic biodiversity plan but retain most of their natural character and perform a range of biodiversity and ecological infrastructural functions. Although they have not been prioritized for biodiversity, they are still an important part of the natural ecosystem.	An overall management objective should be to minimise habitat and species loss and ensure ecosystem functionality through strategic landscape planning. These areas offer the greatest flexibility in terms of management objectives and permissible land-uses, but some authorisation may still be required for high-impact land-uses.

Map Category	Definition	Desired Management Objectives
Heavily or Moderately Modified Areas	Areas that have been modified by human activity to the extent that they are no longer natural, and do not contribute to biodiversity targets. These areas may still provide limited biodiversity and ecological infrastructural functions, even if they are never prioritized for conservation action.	Such areas offer the most flexibility regarding potential land-uses, but these should be managed in a biodiversity-sensitive manner, aiming to maximize ecological functionality and authorization is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilized and restored where possible, especially for soil carbon and water-related functionality.

17.2. Wetland Identification, Delineation and Classification

The total Project Mining Rights Area (MRA) encompasses large wetland areas. Due to the size of the MRA, a detailed desktop delineation was done prior the field assessment for budget and time purposes. The site survey was therefore done for ground truthing purposes to verify the desktop delineations as well as compiling data and information to assess the wetland health, ecological state and importance and sensitivity.

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:

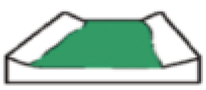
- **Terrain Unit Indicator**: Identifies those parts of the landscape where wetlands are more likely to occur;
- **Soil Form Indicator**: Identifies the soil forms, which are associated with prolonged and frequent saturation;
- **Soil Wetness Indicator**: Identifies the morphological "signatures" developed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

17.2.1. 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 individual 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 close, 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 17-4.

Table 17-4: 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 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 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, which are characterised by 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 either very limited or through diffuse sub-surface flow but with no direct link to a surface water channel.

Hydromorphic Wetland Type	Diagram	Description
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.

17.2.2. Soil Indicators

17.2.2.1. Soil Form Indicators

Hydromorphic soils are characterized as soils that has 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 soils 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 influences 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 are 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.

17.2.2.2. 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 increased and reduced 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 is deposited leading to formation of red/green mottles and concretions. These soil profiles are commonly known as leached soils, gleysol, E-horizons or Albic horizons. Resulting from the prolonged anaerobic conditions, the soil matrix is left a grey, greenish or bluish colour, and is said to be “gleyed”. 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).

17.2.3. 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, Guidelnes 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 17-5 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). 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 17-5 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 17-5: 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))

17.3. Wetland Ecological Health Assessment (WET-Health)

According to Macfarlane et al. (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 1 WET-Health assessment was done on the wetlands in accordance with the method described by (Macfarlane, Kotze, & Ellery, 2009) to determine the integrity (health) of the characterised HGM units for the wetlands associated with the Ubuntu Colliery. 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 and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions. The overall health score of the wetland is calculated using Equation 1, which provides a score ranging from 0 (pristine) to 10 (critically impacted in all respects).

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 to 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 17-6 (Macfarlane, Kotze, & Ellery, 2009).

$$Wetland\ Health = \frac{3(Hydology) + 2(Geomorphology) + 2(Vegetation)}{7}$$

Equation 1: Overall Wetland Ecological Health Score

Table 17-6: Impact Scores and Present Ecological State Categories (WET-Health; Macfarlane et al., 2009)

Impact Category	Description	Combined Impact Score	PES Category
None	Unmodified, natural.	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota has taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E
Critical	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	F

As is the case with the PES, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit, within the wetland itself or from processes downstream of the wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (Table 17-7) (Macfarlane, Kotze, & Ellery, 2009).

Table 17-7: Trajectory of Change Classes and Scores Used to Evaluate Likely Future Changes to the Present State of the Wetland

Change Class	Description	HGM Change Score	Symbol
Substantial Improvement	State is likely to improve substantially over the next 5 years.	2	↑↑
Slight Improvement	State is likely to improve slightly over the next 5 years.	1	↑
Remain Stable	State is likely to remain stable over the next 5 years.	0	→
Slight Deterioration	State is likely to deteriorate slightly over the next 5 years.	-1	↓
Substantial Deterioration	State is expected to deteriorate substantially over the next 5 years.	-2	↓↓

Once all HGM units have been assessed, a summary of health for the wetland needs to be calculated. This is achieved by calculating a combined score for each component by area-weighting the scores calculated for each HGM unit. Recording the health assessments for the hydrology, geomorphology and vegetation components provide a summary of impacts, PES, Trajectory of Change and Health for individual HGM units and for the entire wetland.

17.4. 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 by Kotze et al. (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value and, by extension, 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 (Table 17-8).

Table 17-8: Classes for Determining the Likely Extent to Which a Benefit is Being Supplied

Score	Rating of the Likely Extent to Which the Benefit is Being Supplied
<0.5	Low
0.6-1.2	Moderately Low
1.3-2	Intermediate
2.1-3	Moderately High
>3	High

17.5. 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 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 17-9.

Table 17-9: 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 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

17.6. 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.

17.6.1. 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

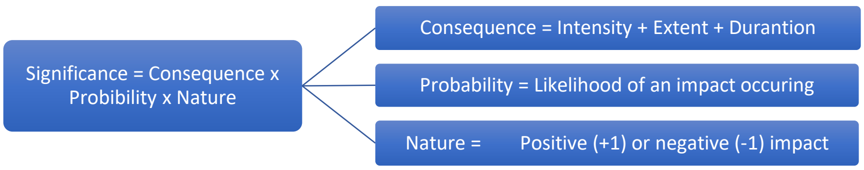
Table 17-12. The weight assigned to the various parameters was then multiplied by +1 for positive and -1 for negative impacts.

17.6.2. 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 17-11, which is extracted from

Table 17-12. The description of the significance ratings is discussed in Table 17-13.

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.



17.6.3. 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 17-10.

Table 17-10: 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, mining 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 mine closure. 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 17-11: 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 17-12: Probability/Consequence Matrix

		Significance																																				
Probability	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 17-13: 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) (-)

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