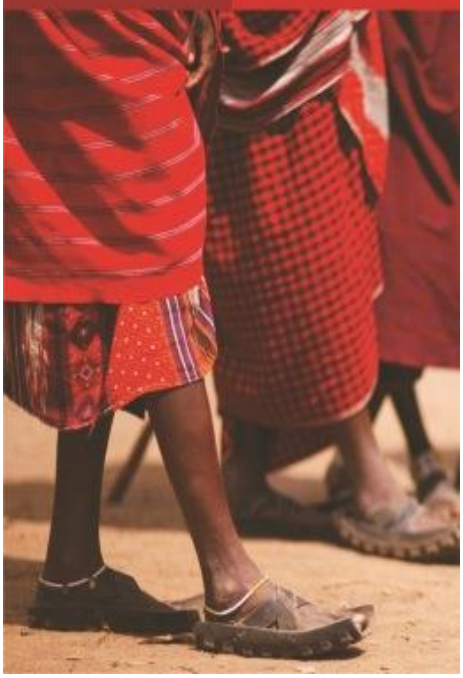

DIGBY WELLS
ENVIRONMENTAL

Environmental Authorisation and Integrated Water Use Licence Applications for the Proposed Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province

Wetlands Impact Assessment

Project Number:

SOU5014

Prepared for:

South32 SA Coal Holdings (Pty) Ltd

July 2018

Digby Wells and Associates (South Africa) (Pty) Ltd
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This document has been prepared by Digby Wells Environmental.

Report Type:	**Wetlands Impact Assessment**
Project Name:	**Environmental Authorisation and Integrated Water Use Licence Applications for the Proposed Water Treatment Plant at the Klipspruit Colliery, Mpumalanga Province**
Project Code:	**SOU5014**

Name	Responsibility	Signature	Date
Kathryn Roy	Report writing		20 July 2018
Kieren Bremner Pr.Sci.Nat (Pending)	Technical review		20 July 2018
Danie Otto Pr.Sci.Nat	EXCO review		20 July 2018

EXECUTIVE SUMMARY

Digby Wells Environmental (hereinafter Digby Wells) has been appointed by South 32 SA Coal Holdings (Pty) Ltd (hereinafter South32) as independent environmental consultants to compile an Environmental Authorisation and Integrated Water Use License Application (IWULA) for the South32 Klipspruit (KPS) Colliery Active Water Treatment Plant (WTP) to authorise all water uses in terms of Section 40 of the National Water Act, 1998 (NWA) (Act 36 of 1998).

A wetland specialist study was therefore required to confirm the presence of freshwater systems in the vicinity of the proposed WTP area and the associated infrastructure. An assessment of the ecological health and extent of any identified freshwater systems was also required. The assessment took place on the 9th of April 2018.

This report provides an assessment of the current state of the wetland and freshwater resources present in the vicinity of the proposed project. The Project area falls within the B20G quaternary catchment, which is regarded as Largely Modified (DWA, 2011). Two wetlands were identified within the 500m buffers surrounding the proposed project area. These are:

- A channelled valley bottom (Hydrogeomorphic (HGM) Unit 1) of 31.7 ha with a Present Ecological State (PES) of 'D' and a 'Moderate' (Ecological Importance and Sensitivity (EIS) 0.09 ha to be directly impacted on by infrastructure; and
- A hillslope seep (HGM Unit 2) of 11.5 ha with a PES of 'D' and a 'Moderate' EIS. 0.07 ha to be directly impacted on by infrastructure.

Both wetlands are impacted by the proposed pipeline routes and the associated infrastructure in such a way that the PES and EIS will be slightly reduced. Mitigation measures outlined in the report should be adhered to, to reduce the impacts and monitoring should take place as prescribed.

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GLOSSARY OF TERMS

Alien invasive vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome - usually international in origin.
Basal cover	The cross-sectional area of the plant that extends into the soil.
Base flow	Long-term flow in a river that continues after storm flow has passed.
Biodiversity	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Catchment	The area contributing to runoff at a particular point in a river feature.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Groundwater	Subsurface water in the saturated zone below the water table.
Intermittent flow	Flows only for short periods.
Indigenous vegetation	Vegetation occurring naturally within a defined area.
Perennial	Flows all year round.
Wetland	Defined according to the National Water Act, 1998 (Act No. 36 of 1998) (NWA) as: *"Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*

LIST OF ACRONYMS

AIP	Alien Invasive Plants
BRP	Bioregional Plan
CBA	Critical Biodiversity Areas
CMA	Catchment Management Agencies
DMR	Department of Mineral Resources
DWA	Department of Water Affairs (currently the Department of Water and Sanitation)
DWAF	Department of Water and Forestry (currently the Department of Water and Sanitation)
DWE	Digby Wells Environmental
DWS	Department of Water and Sanitation
EC	Ecological Class
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMF	Environmental Management Framework
EMO	Environmental Management Officer
ESA	Ecological Support Area
F	Facultative species
FD	Facultative dry-land species
FW	Facultative wetland species
GIS	Geographical Information System
Ha	Hectares
HGM	Hydro-geomorphic
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MRA	Mining Right Area
NEM:BA	National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystems Priority Areas
NWA	National Water Act, 1998 (Act No. 36 of 1998)
ONA	Other Natural Area

OW	Obligate wetland species
PA	Protected Area
PES	Present Ecological State
REC	Recommended Ecological Category
RQIS	Resource Quality Information Services
SANBI	South African National Biodiversity Institute
SFI	Soil Form Indicator
SWI	Soil Wetness Indictor
TUI	Terrain Unit Indicator
WMA	Water Management Areas
WRC	Water Research Commission
WUL	Water Use Licence

1 Introduction

Digby Wells Environmental (*hereinafter* Digby Wells) has been appointed by South 32 SA Coal Holdings (Pty) Ltd (*hereinafter* South32) to undertake a wetland assessment as part of the Environmental Impact Assessment (EIA) of the freshwater resources in the vicinity of the proposed Klipspruit (KPS) Colliery active Water Treatment Plant (WTP), located in Mpumalanga Province.

The WTP is to be established in the south-eastern corner of Klipspruit Colliery, adjacent to KPS project offices and within the operational area of Klipspruit Colliery. The intent is to treat and release mine affected water (10 Ml/day) from the Balancing Dam which will comply with the resource water quality objectives of the catchment. The release will be directly to the Saalklapspruit

Activities that are listed in terms of the Environmental Impact Assessment (EIA) Regulations[1] require environmental authorisation prior to commencing. The proposed activities at South32 constitute Listed Activities in terms of GN R 983 (Listing Notice 1) and GN R 984 (Listing Notice 2) as amended.

This specialist Wetlands Impact Assessment Report has been compiled in terms of Appendix 6 of the NEMA EIA Regulations, 2014, (as amended) in terms of the Scoping and EIA process, which is being followed in applying for Environmental Authorisation.

2 Details of the Specialist

This Specialist Report has been compiled by the following specialists:

Table 2-1: Details of the Specialist(s) who prepared this Report

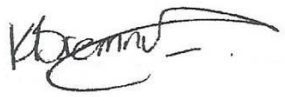
Responsibility	**Report Writer**
Full Name of Specialist	Kathryn Roy
Highest Qualification	MSc Restoration Ecology
Years of experience in specialist field	1.5
Responsibility	**Technical Review**
Full Name of Specialist	Kieren Jayne Bremner
Highest Qualification	MSc Aquatic Health
Years of experience in specialist field	10
Registration(s):	South African Council for Natural Scientific Professionals: *Professional Natural Scientist* (Reg. No. 119341))

[1] As published in Government Notices R982; 983; 984 and 985 on 4 December 2014, as Amended 7 April 2017.

2.1 Declaration of the Specialist

I, Kieren Jayne Bremner, as the appointed specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- in terms of the general requirement to be independent, other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity;
- in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;
- have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that have or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.



Signature of the specialist

Kieren Jayne Bremner

Full Name and Surname of the specialist

Digby Wells Environmental

Name of company

16-07-2018

Date

3 Project Background

South32 owns the Klipspruit Colliery (KPS), near Ogies in the Mpumalanga Province (refer to Figure 3-1 for the locality plan). Contaminated water that is being generated at KPS by mining activities exceeds the re-use capacity within the operations, whilst the storage capacity in mined out areas has reached its limits. The result of this is the risk of spillages or discharges to the natural environment. Effective management of this risk is essential to continued operations at KPS ensuring access to coal resources as well as securing and maintaining the requisite environmental licences and authorisations to operate and expand. Water treatment is thus required and South32 proposes to construct a modular WTP and ancillary infrastructure to treat mine-affected water (the Project). South32 has appointed Digby Wells as the independent Environmental Assessment Practitioner to undertake the environmental-legal application processes and Specialist studies relevant to this proposed project.

The WTP is to be established within the operational area of the mine in the south-eastern corner of the Mining Right boundary, adjacent to KPS project offices. The proposed WTP will be modular in design and constructed in three phases, starting at a capacity of 2Ml/day, upgradeable to 3.3Ml/day and then increments of 3.3Ml/day to 10Ml/day. Contaminated water will be abstracted from the Balancing Dam at KPS and pumped to the WTP. After treatment, clean water that complies with the Resource Water Quality Objectives (RWQO) for the Wilge River catchment is proposed to be discharged into the Saalklapspruit at the northern boundary of the KPS operation adjacent to the N12 national highway.

The treatment process will be based on the use of membrane desalination with brine softening and will consist of the following steps:

- Pre-treatment of the feed water using pH adjustment and disinfection to remove organics from the system that can cause fouling and scaling of the membranes;
- Removal of the dissolved metals by chemical oxidation followed by the removal of precipitates and suspended solids using flocculation and coagulation unit processes;
- Ultrafiltration (UF) will be used to remove fine particles from the feed water to the Reverse Osmosis (RO) unit processes. This is necessary to prevent fouling and scaling of the RO membranes; and
- Product water conditioning is required to ensure the pH meets the discharge requirements.

This process will produce gypsum sludge and brine. The gypsum sludge will be dewatered at the WTP and then loaded onto trucks for off-site disposal at a licenced waste management facility designed for this type of material. The brine will be recycled back into the treatment process until the salinity requires that a portion be depleted from the system. This small volume of brine will be stored in tanks within the proposed WTP footprint from where it will be pumped into road tankers and transported to a third-party waste management site licenced to receive this waste.

The infrastructure layout of the project is depicted in Figure 3-2 and the key infrastructure components of the project scope are as follows:

- A Feed Water Line comprising of a pump station and 1.5km High Density Poly Ethylene (HDPE) pipeline from the Balancing Dam to the WTP site capable of pumping 10Ml/day;
- A return water system from the WTP to the Balancing Dam along the same route as the Feed Water Line for the management of treated water that does not comply with the requirements for release to the catchment;
- A WTP Area with a footprint of approximately 1.5ha for the establishment and operation of a modular WTP with a maximum throughput of 10Ml/day. This includes the development and use of facilities for the storage and handling of hazardous chemicals used in the treatment process;
- A Discharge Line comprising of a 4km HDPE pipeline along the eastern boundary of KPS to transfer the treated water for discharge to the Saalklapspruit. Two pipeline routes are required to accommodate advancing mining and rehabilitation activities along the proposed pipeline servitude, and will be implemented at different stages of the project; and
- A dissipation structure at the proposed discharge point, alongside the N12 National Highway.

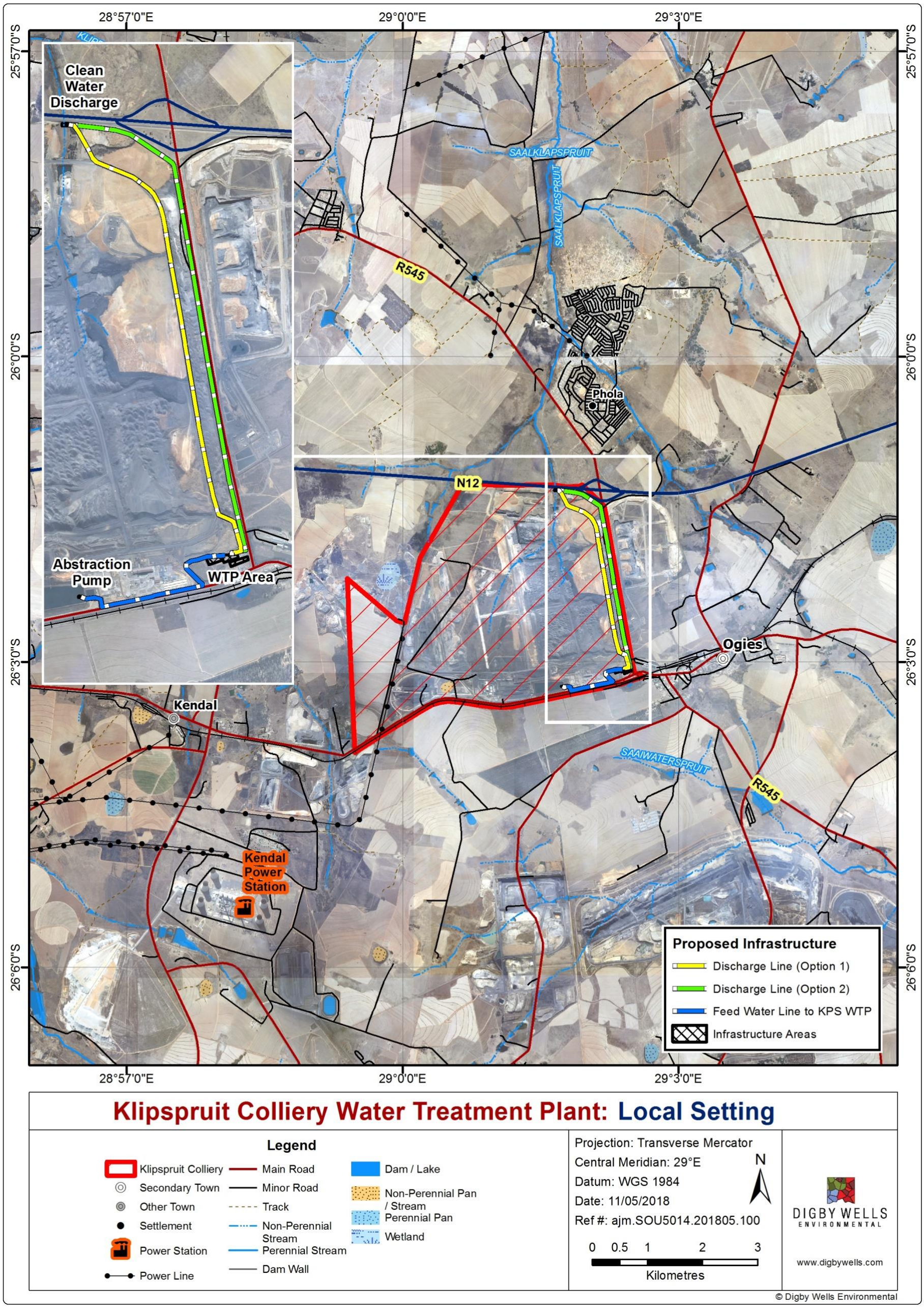


Figure 3-1: Local Setting

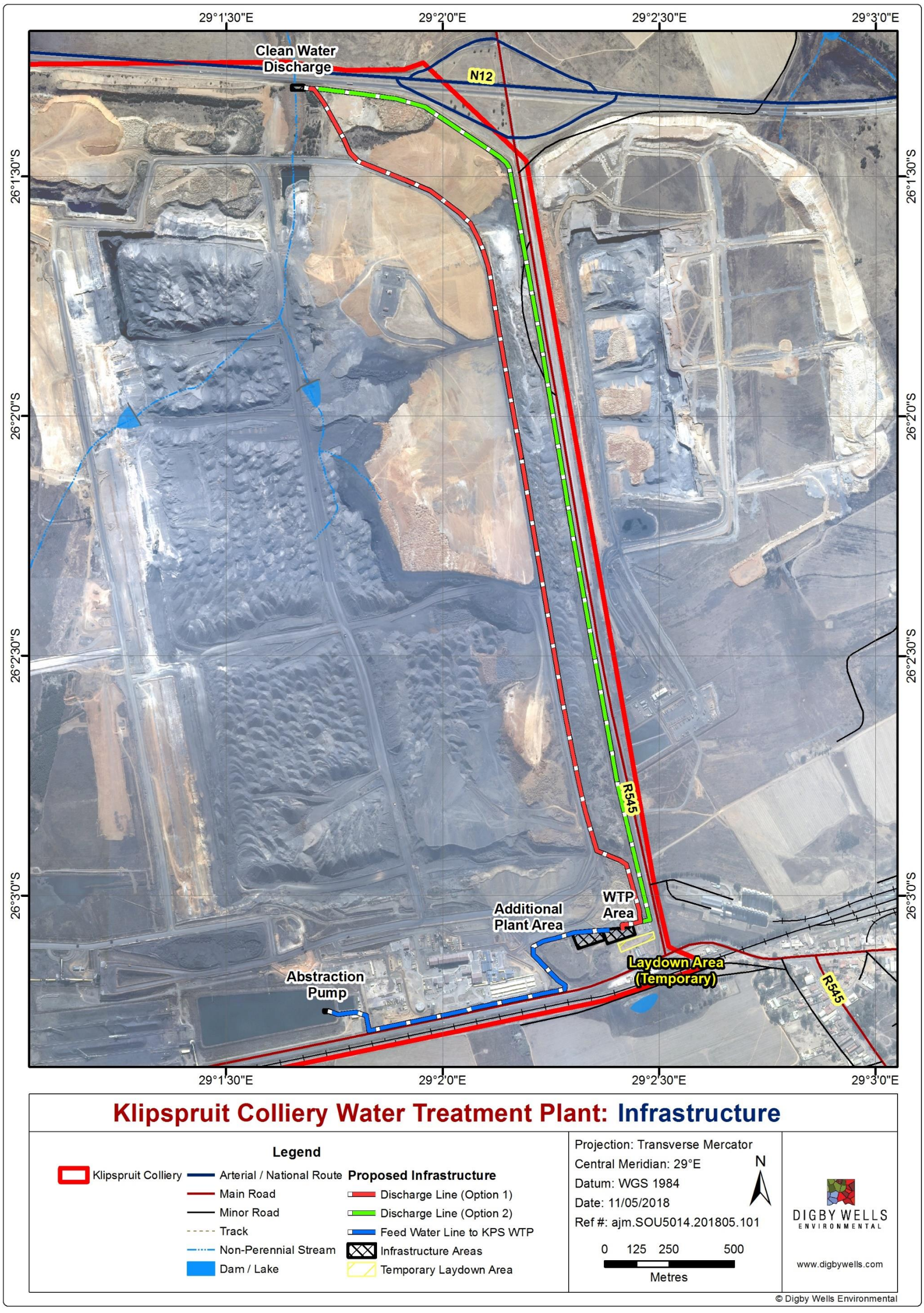


Figure 3-2: Infrastructure

4 Scope and Purpose of this Report

Digby Wells was commissioned by South32 to complete a Wetland Impact Assessment for the proposed KPS Colliery active WTP capable of treating mine affected water (10 Ml/day) from the Balancing Dam. The following actions are required for this Scope of Work:

- A detailed desktop assessment of the freshwater systems present in the vicinity of the proposed project area;
- The identification of wetlands within 500m of the proposed WTP according to the NFEPA database;
- A description of the catchment and surrounding land uses;
- A desktop floral assessment of the wetland vegetation present;
- A brief assessment of potential impacts to the wetlands from the proposed activities;
- Discussion of recommended mitigation measures to be taken into account; and
- Monitoring requirements will also be discussed and set out.

5 Site Locality

The proposed KPS Colliery active WTP is located in Mpumalanga Province. The WTP is to be established in the south-eastern corner of the KPS Colliery mine boundary, in close proximity to the KPS project offices, within the operational area of KPS Colliery. The locality can be seen in Figure 5-1. All freshwater systems within a 500m radius of the proposed WTP were investigated.

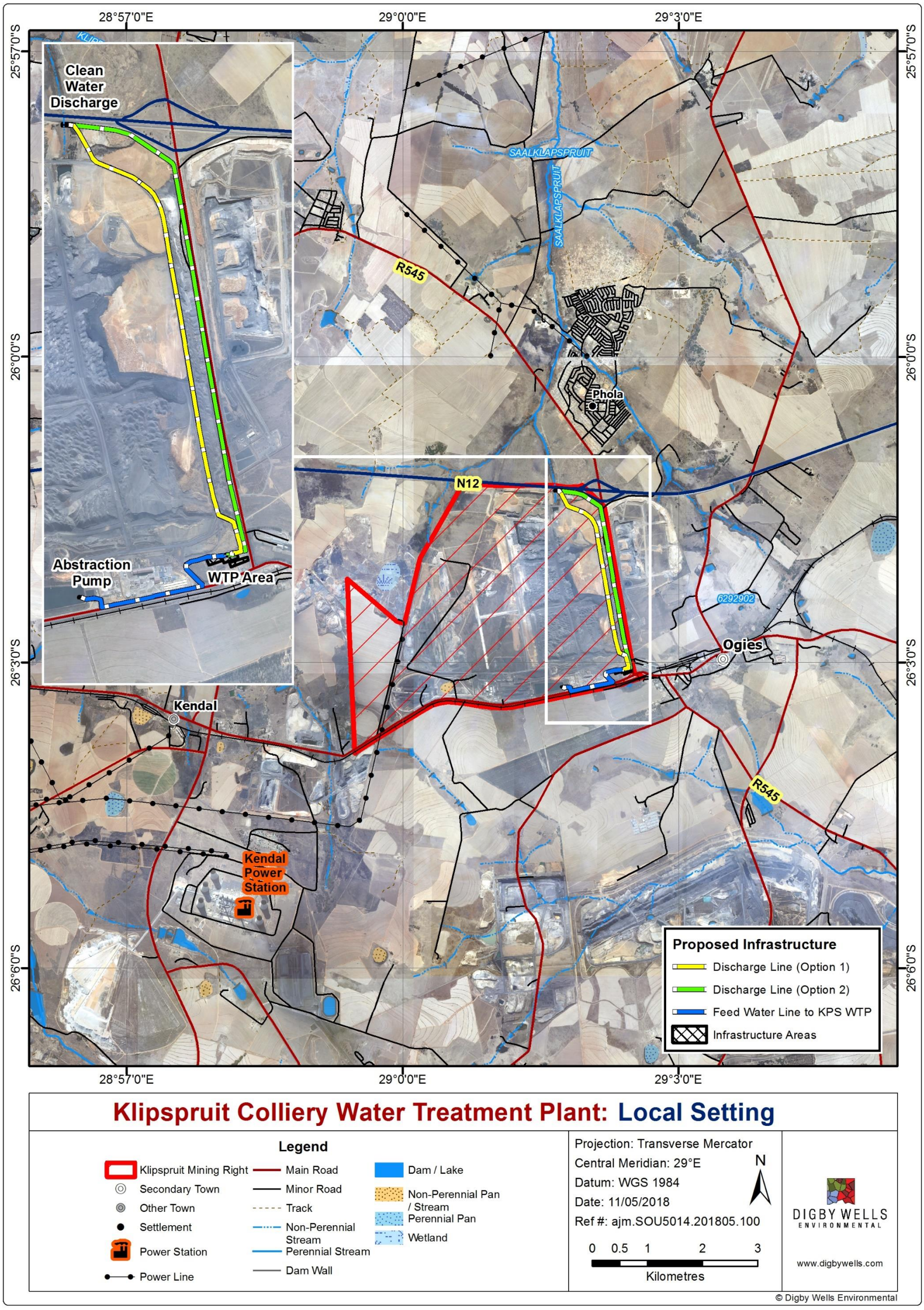


Figure 5-1: Local Setting

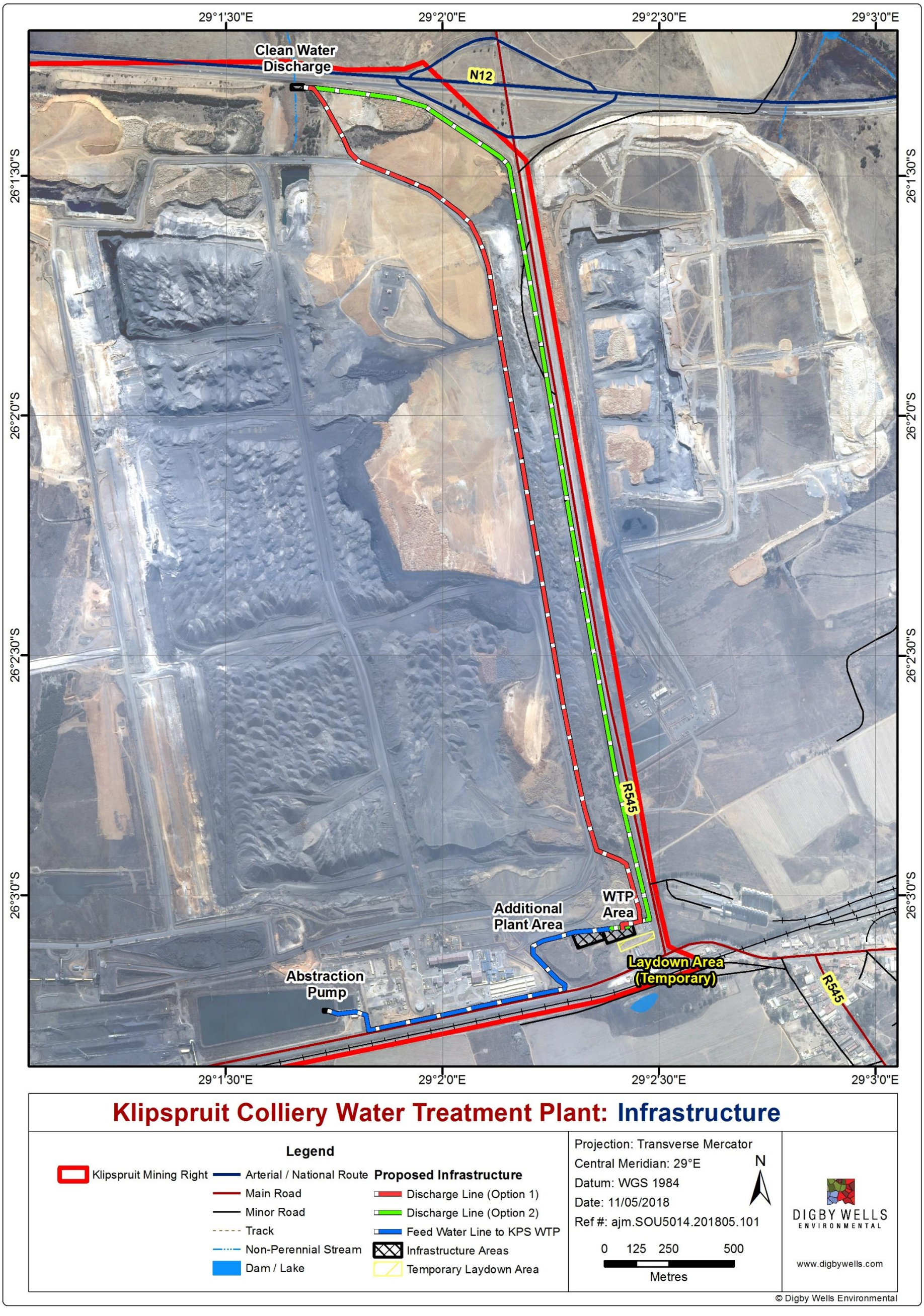


Figure 5-2: Infrastructure

6 Methodology

6.1 Literature Review and Desktop Assessment

For the purposes of this Project, wetland areas were identified and preliminary wetland boundaries were delineated at the desktop level using detailed aerial imagery (Southern Mapping, 2015) along with 5m contours. Baseline and background information was researched and used to understand the area on a desktop level; this included but was not limited to:

- Policies and legal framework;
- National Freshwater Ecosystems Priority Areas (NFEPA) (Nel *et al.,* 2011);
- Mining and Biodiversity Guideline;
- Water Management Areas (WMA) and Quaternary Catchments; and
- Mpumalanga Biodiversity Sector Plan (MBSP).

6.1.1 Policy and Legal Framework

The wetlands assessment aims to support the following regulations, regulatory procedures and guidelines:

- Section 24 of the Constitution of the Republic of South Africa ,1996 (Act No. 108 of 1996);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA);
- Section 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); and
- Department of Water and Forestry (DWAF) Guidelines for the Delineation of Wetlands (2005).

6.1.2 National Freshwater Ecosystem Priority Areas (NFEPA)

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 (FEPA's) include the nationally delineated wetland areas that are classified into hydrogeomorphic (HGM) NFEPA project types and ranked in terms of their biodiversity importance. These layers were assessed to evaluate the importance of the wetland areas located within the Project area.

Whilst being an invaluable tool, it is important to note that the NFEPA's were delineated and studied at a desktop and low resolution level. Thus, the wetlands delineated via the field assessment may differ from the NFEPA data layers. The NFEPA assessment does, however, hold significance from a national perspective. As mentioned above, the NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity and Table 6-1 below indicates the criteria considered.

Table 6-1: NFEPA Wetland Classification Ranking Criteria

Criteria	Rank
Wetlands that intersect with a RAMSAR site.	1
▪ Wetlands within 500 m of an IUCN threatened frog point locality; ▪ Wetlands within 500 m of a threatened water-bird point locality; ▪ Wetlands (excluding dams) with the majority 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 (PES) AND associated with more than three other wetlands (both riverine and non-riverine wetlands were assessed for this criterion); and Wetlands in C condition (PES) 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

6.1.3 Mining and Biodiversity Guideline

The Mining and Biodiversity Guideline was developed collaboratively by the South African Biodiversity Institute (SANBI), the Department of Environmental Affairs (DEA), the Department of Mineral Resources (DMR), the Chamber of Mines and the South African Mining and Biodiversity Forum in 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 listed in Table 6-2 below, each with associated risks and implications.

Table 6-2: Mining and Biodiversity Guideline Categories (SANBI, 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 seen as 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.

6.1.4 Mpumalanga Biodiversity Sector Plan

The Mpumalanga Biodiversity Sector Plan (MBSP) is a spatial tool that forms part of the national biodiversity planning tools and initiatives that are provided for in 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 (MTPA, 2013). 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). 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 and mining. Wetlands represent ecosystems of high value for delivering, managing and storing good quality water for human use, and they are vulnerable to harmful impacts. It is therefore in the interest of national water security that all wetlands are protected by law. The management objectives of these areas are summarised below.

Table 6-3: 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 gazetted 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. ESA 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 authorisation 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	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

Map category	Definition	Desired management objectives
	prioritised for biodiversity, they are still an important part of the natural ecosystem.	permissible land-uses, but some authorisation may still be required for high-impact land-uses.
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 prioritised 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 maximise ecological functionality and authorisation is still required for high-impact land-uses. Moderately modified areas (old lands) should be stabilised and restored where possible, especially for soil carbon and water-related functionality.

6.1.1 Wetland Identification, Delineation and Classification

The wetland delineation procedure considers four attributes to determine the limitations of the wetland, in accordance with DWAF guidelines (now Department of Water and Sanitation (DWS) (2005)). The four attributes are:

- Terrain Unit Indicator – helps to identify 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.

6.1.2 Terrain 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, aerial photographs and engineering and town planning diagrams (DWAF, 2005). The HGM Unit system of classification focuses on the hydro-geomorphic setting of wetlands which incorporates geomorphology; water movement into, through and out of the wetland; and landscape / topographic setting. Once wetlands have been identified, they are categorised into HGM Units as shown in Table 6-4.

Table 6-4: Description of the various HGM Units for Wetland Classification

Hydromorphic wetland type	Diagram	Description
Floodplain		Valley bottom areas with a well-defined stream channel, 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 characterised 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.
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 sub-surface water. An outlet is usually absent and so this type of wetland is usually isolated from the stream network.

6.1.3 Soil Form Indicator

Hydromorphic soils are taken into account for the Soil Form Indicator (SFI) which will display unique characteristics resulting from prolonged and repeated water saturation (DWAF, 2005). The continued saturation of the soils results in the soils becoming anaerobic and thus resulting in a change of the chemical characteristics of the soil. Iron and manganese are two soil components which are insoluble under aerobic conditions and become soluble when the soil becomes anaerobic and thus begin to leach out into the soil profile. Iron is one of the most abundant elements in soils and is responsible for the red and brown colours of many soils.

Resulting from the prolonged anaerobic conditions, iron is dissolved out of the soil, and the soil matrix is left a greying, greenish or bluish colour, and is said to be “gleyed”. Common in wetlands which are seasonally or temporarily saturated is a fluctuating water table, resulting in alternation between aerobic and anaerobic conditions in the soil (DWAF, 2005). Iron will return to an insoluble state in aerobic conditions which will result in deposits in the form of patches or mottles within the soil. Recurrence of this cycle of wetting and drying over many decades concentrates these insoluble iron compounds. Thus, soil that is gleyed and has many mottles may be interpreted as indicating a zone that is seasonally or temporarily saturated (DWAF, 2005).

6.1.4 Soil Wetness Indicator

In practice, the Soil Wetness Indictor (SWI) is used as the primary indicator (DWAF, 2005). 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 (DWAF, 2005). A feature of hydromorphic soils are coloured mottles which are usually absent in permanently saturated soils and are most prominent in seasonally saturated soils, and are less abundant in temporarily saturated soils (DWAF, 2005). The hydromorphic soils must display signs of wetness within 50cm of the soil surface, as this is necessary to support hydrophytic vegetation.

6.1.5 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 and Marneweck, 1999; DWAF, 2005). This is summarised in Table 6-5 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 (DWAF, 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 6-5 becomes more important. If vegetation was to be used as a primary indicator, undisturbed conditions and expert knowledge are required (DWAF, 2005). Due to this uncertainty, greater emphasis is often placed on the SWI to delineate wetland areas. In this assessment, where possible, the SWI has been relied upon to delineate wetland areas due to the high level of anthropogenic impacts characterising the wetlands and freshwater resources of the general area. The identification of indicator vegetation species and the use of plant community structures have been used to validate these boundaries.

Table 6-5: Classification of Plant Species According to Occurrence in Wetlands (DWAF, 2005)

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.

6.1.6 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 Kotze *et al.* (2007) to determine the integrity (health) of the characterised HGM units for the Project area. A Present Ecological State (PES) analysis was conducted to establish baseline integrity (health) for the associated wetlands. The health assessment attempts to evaluate the hydrological, geomorphological and vegetation health in three separate modules to attempt to estimate similarity to or deviation from natural conditions.

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 of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State 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 Present State categories are provided in Table 6-6.

Table 6-6: Impact Scores and Present Ecological State Categories used by WET-Health

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 recognisable.	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 Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or 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 6-7).

Table 6-7: 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	↓

Change Class	Description	HGM change score	Symbol
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 as a whole 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, Present State, Trajectory of Change and Health for individual HGM Units and for the entire wetland.

6.1.7 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 Rountree and Kotze, (2012), in Rountree *et al.* (2012) 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 6-8.

Table 6-8: 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 which 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

6.1.8 Impact Assessment Methodology

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

The severity of an impact is determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact is 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 will be incorporated into the Environmental Management Programme (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:

Significance = CONSEQUENCE X PROBABILITY X NATURE

Where

Consequence = intensity + extent + duration

And

Probability = likelihood of an impact occurring

And

Nature = positive (+1) or negative (-1) impact

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 6-10. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 6-11).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 6-9: Impact assessment parameter ratings

Rating	Intensity/ Replacability		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.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
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.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
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 immediat 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.

Rating	Intensity/ Replacability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
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 6-10: Probability/consequence matrix

Significance																																						
-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
-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
-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
-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
-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
-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
-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 6-11: 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) (-)

7 Determining the Baseline Environment

7.1 Drainage and Quaternary Catchment

The water resources of South Africa are divided into quaternary catchments, which are regarded as the principal water management units in the country (DWA, 2011). A quaternary catchment is a fourth order catchment in a hierarchical classification system in which the primary catchments are the major units. The primary drainages are further grouped into or fall under Water Management Areas (WMA) and Catchment Management Agencies (CMA). DWS has established nine WMAs and nine CMAs as contained in the National Water Resource Strategy 2 (2013) (DWA, 2013) in terms of Section 5 subsection 5(1) of the National Water Act, 1998 (Act No. 36 of 1998). The establishment of these WMAs and CMAs is to improve water governance in different regions of the country, to ensure a fair and equal distribution of the Nation's water resources, while making sure that the resource quality is sustained.

Figure 7-1 indicates the water resource management classification associated with the Project area. The Project area falls within the upper Olifants sub water management area and within the greater Olifants River Catchment (WMA2). It is associated with primary drainage B. The quaternary catchment is B20G, which is regarded as Largely Modified according to the DWS. Wetlands associated with the Saalklapspruit, a tributary of the Wilge River, which is linked to the Olifants River further downstream. Owing to the cumulative impacts on the Olifants River, as well as its link to important habitats in the Kruger National Park (KNP), the DWS has recently placed significant emphasis on the importance of conservation of watercourses associated with this catchment.

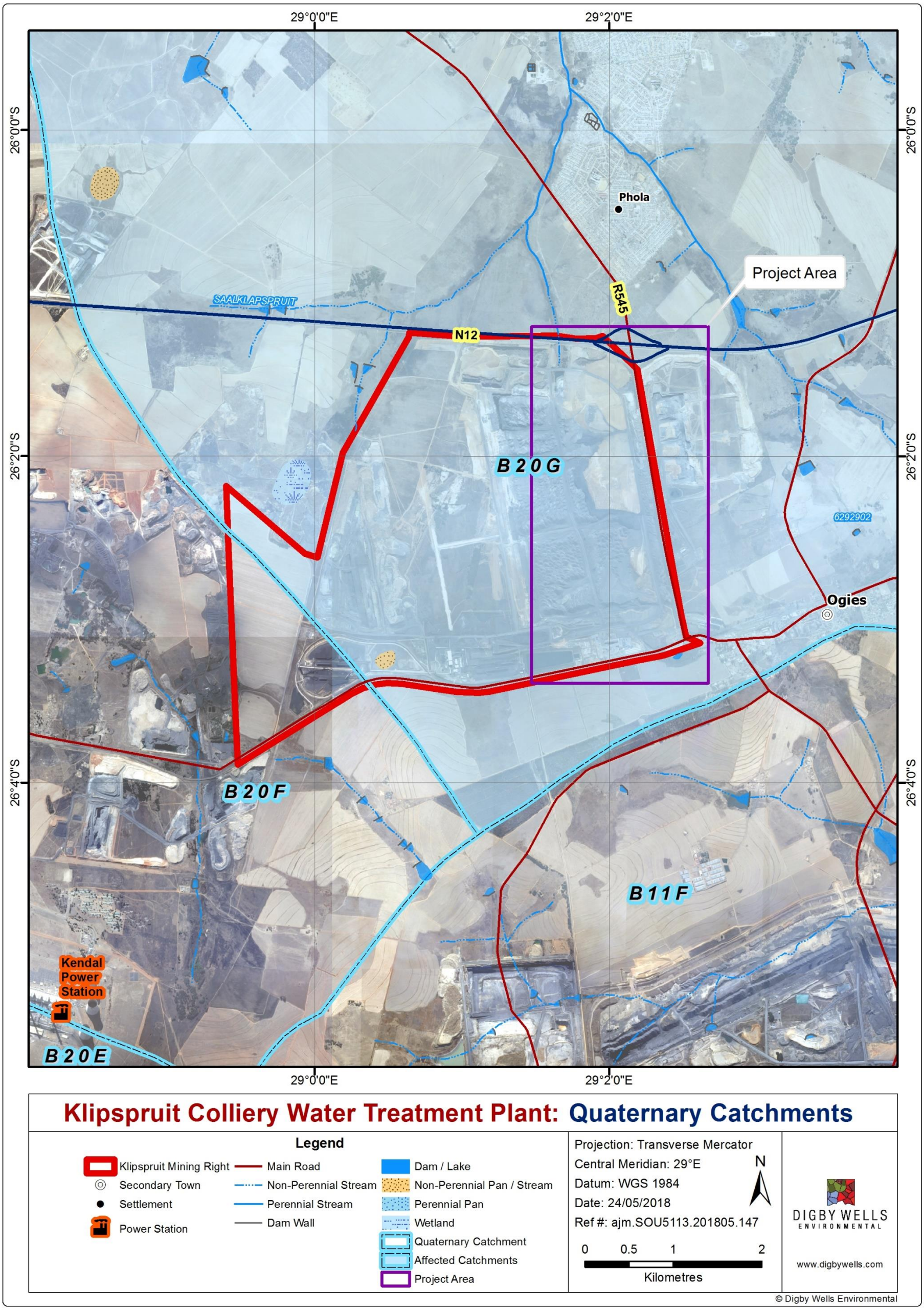


Figure 7-1: Quaternary Catchments

7.2 National Freshwater Ecosystem Priority Areas (NFEPA)

The NFEPA project provides information on wetland and river ecosystems for integrating into freshwater ecosystem and biodiversity planning and decision-making processes. The assessor considered the strategic spatial priorities for conserving the country's freshwater ecosystems and supporting sustainable use of water resources contained therein to evaluate the importance of the wetland areas (Nel *et al.* 2011). Figure 7-2 demonstrates the distribution of NFEPA wetlands in the vicinity of the Project area. The wetland types identified in the vicinity of the project area are a Channelled Valley Floor wetland situated on the northern portion of the WTP Project area and a Bench Depression situated within the mining rights area and to the left of the proposed WTP Project area.

The NFEPA wetlands have been ranked in terms of importance in the conservation of biodiversity. The Project wetlands are of Rank 2. Rank 2 wetlands are important wetlands that fall within 500 m of an IUCN threatened frog point locality or threatened water-bird point locality. Alternatively, they fall mostly within a sub-quaternary catchment that has sightings or breeding areas for threatened Wattled Cranes, Grey Crowned Cranes and Blue Cranes or has been identified by experts at the regional review workshops as containing wetlands of exceptional Biodiversity importance, with valid reasons documented or as containing wetlands that are good, intact examples from which to choose.

South32 has an approved wetland off-set strategy developed in 2015 for the KPSX titled, "Integrated Wetland Mitigation Strategy for the Proposed Klipspruit Extension Project - KPSX: Weltevreden and South Open Cast Coal Mining, Mpumalanga Province" (Wetland Consulting Services, 2015). This report includes wetlands to off-set in the KPS extension areas (namely KPSX: Weltevreden and KPSX: South) and South32 are currently implementing Phase 1 of the strategy at KPSX: South. However, the wetlands identified through NFEPA are not included in this offset as they form part of the Klipspruit Operational area and no longer exist due to mining in the area.

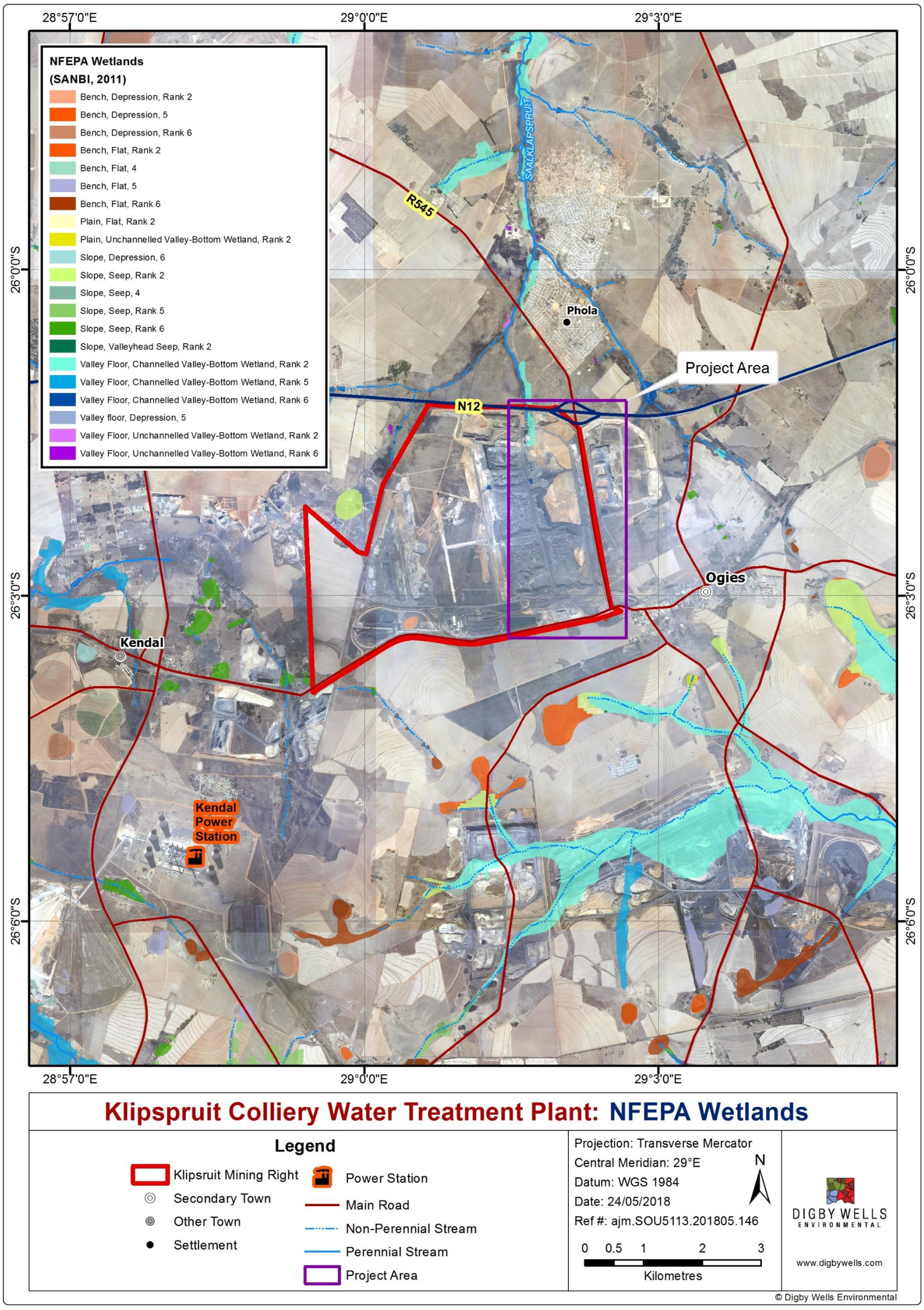


Figure 7-2: NFEPA Wetlands

7.3 Mining and Biodiversity Guidelines

The Mining and Biodiversity Guideline (2013) can be seen as a cumulative finding of all available biodiversity and ecological related information with a final mapped area. The assessment looks at NFEPA and regional biodiversity plans such as the MBSP. This is shown in Figure 7-3 below.

The majority of the proposed WTP area is designated as ‘Highest Risk for Mining’, with comparatively smaller sections designated as ‘Moderate Risk for Mining’. However, as for the NFEPA wetlands, most of this area has already been transformed by mining.

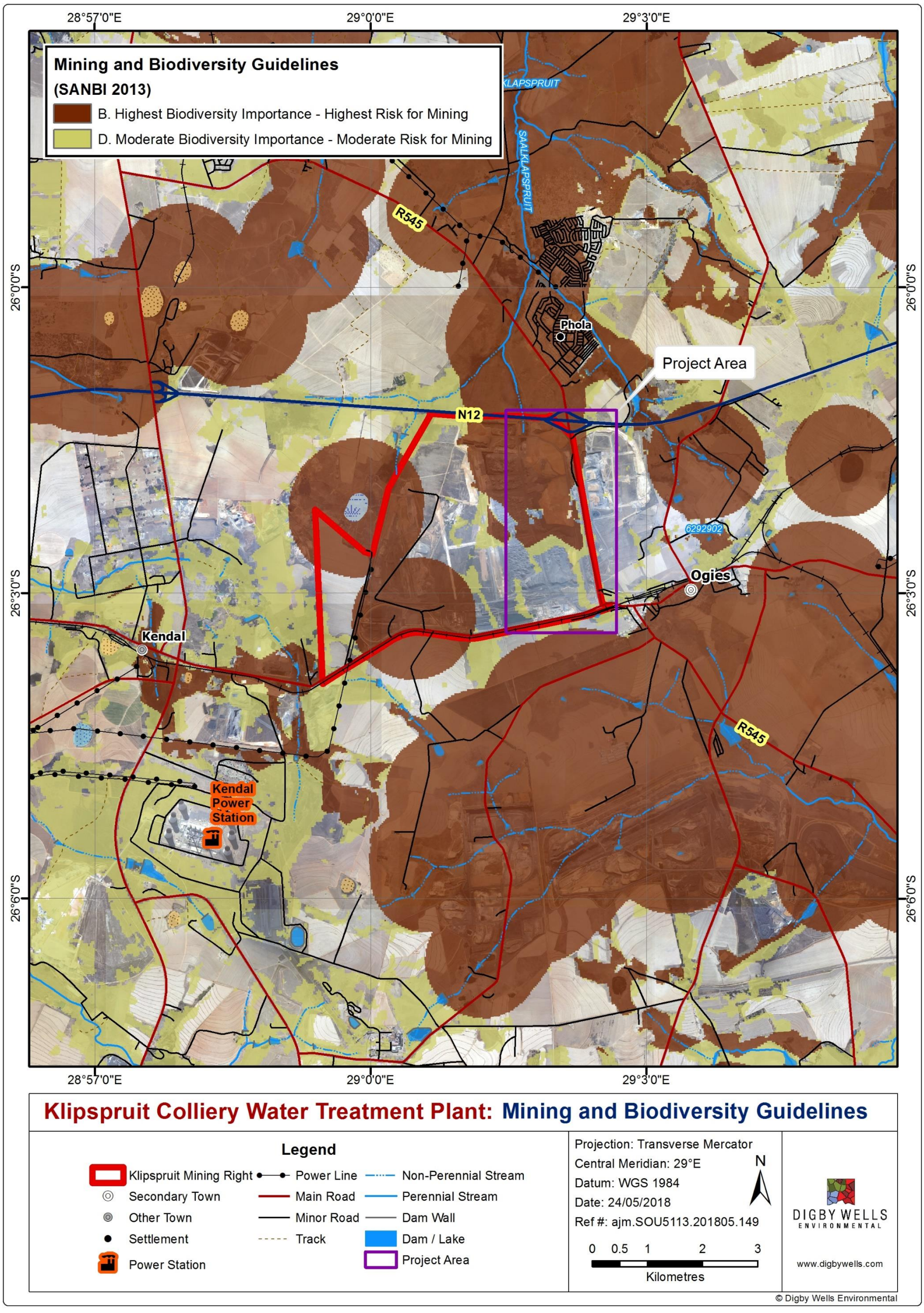


Figure 7-3: Mining and Biodiversity Guideline

7.4 Mpumalanga Biodiversity Sector Plan

The MBSP (2013) is a spatial tool that forms part of the national biodiversity planning. The proposed WTP traverses only moderately and heavily modified areas.

The proposed WTP does not traverse ‘CBA Irreplaceable’ or ‘CBA Optimal’ areas. According to the guidelines from the MSBP, CBAs must be kept in a natural state with no further loss of habitat; where only low-impact, biodiversity-sensitive land-uses are appropriate.

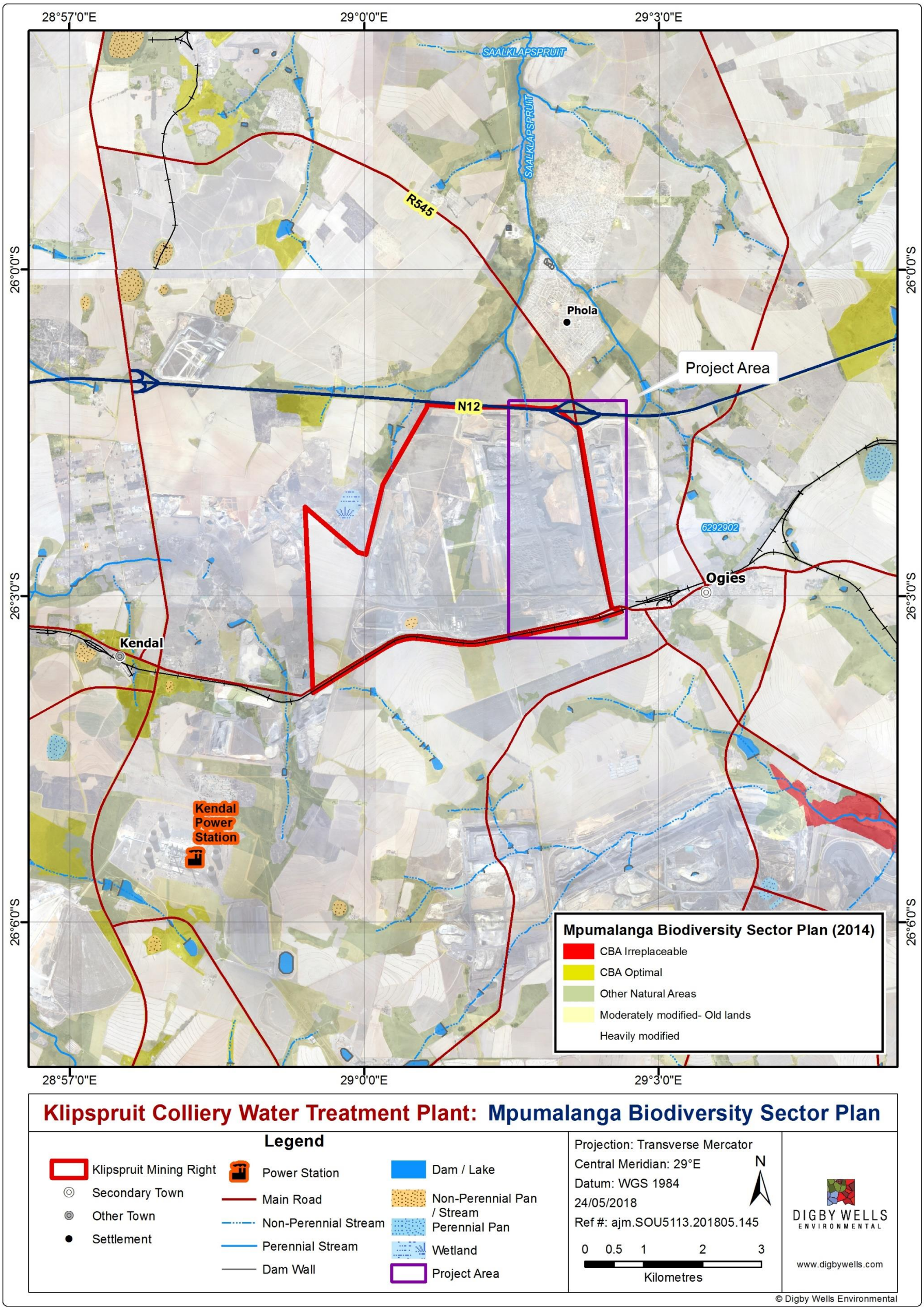


Figure 7-4: Mpumalanga Biodiversity Sector Plan

7.5 Regional Vegetation

The proposed WTP footprint falls within the Grassland Biome (Mucina and Rutherford, 2006), one of the nine South African plant Biomes and the second most bio-diverse biome in South Africa. The Grassland Biome is situated primarily on the central plateau of South Africa, and the inland areas of Kwa-Zulu-Natal and the Eastern Cape provinces. This biome is rich in flora and fauna diversity but is under threat due to rapid urbanisation and expansion of mining and industrial activities.

The Project area occurs in the Eastern Highveld Grassland regional vegetation type (Mucina and Rutherford, 2006) (Figure 7-5). It is an endangered vegetation type with a conservation target of 24%. Table 7-1 list the species characteristic of the Eastern Highveld Grassland.

Table 7-1: Plant Species Characteristic of the Eastern Highveld Grasslands

Plant Form	Species
Graminoids	*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. eckloniana, Andropogon appendiculatus, A. schirensis, Bewsia biflora, Ctenium concinnum, Diheteropogon amplectens, Harpochloa falx, Panicum natalense, Rendlia altera, Schizachyrium sanguineum, Setaria nigrirostris, Urelytrum agropyroides*
Herbs	*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, Vernonia oligocephala, Wahlenbergia undulata.*
Geophytic herbs	*Gladiolus crassifolius, Haemanthus humilis subsp. hirsutus, Hypoxis rigidula var. pilosissima, Ledebouria ovatifolia*
Succulent Herbs	*Aloe ecklonis*

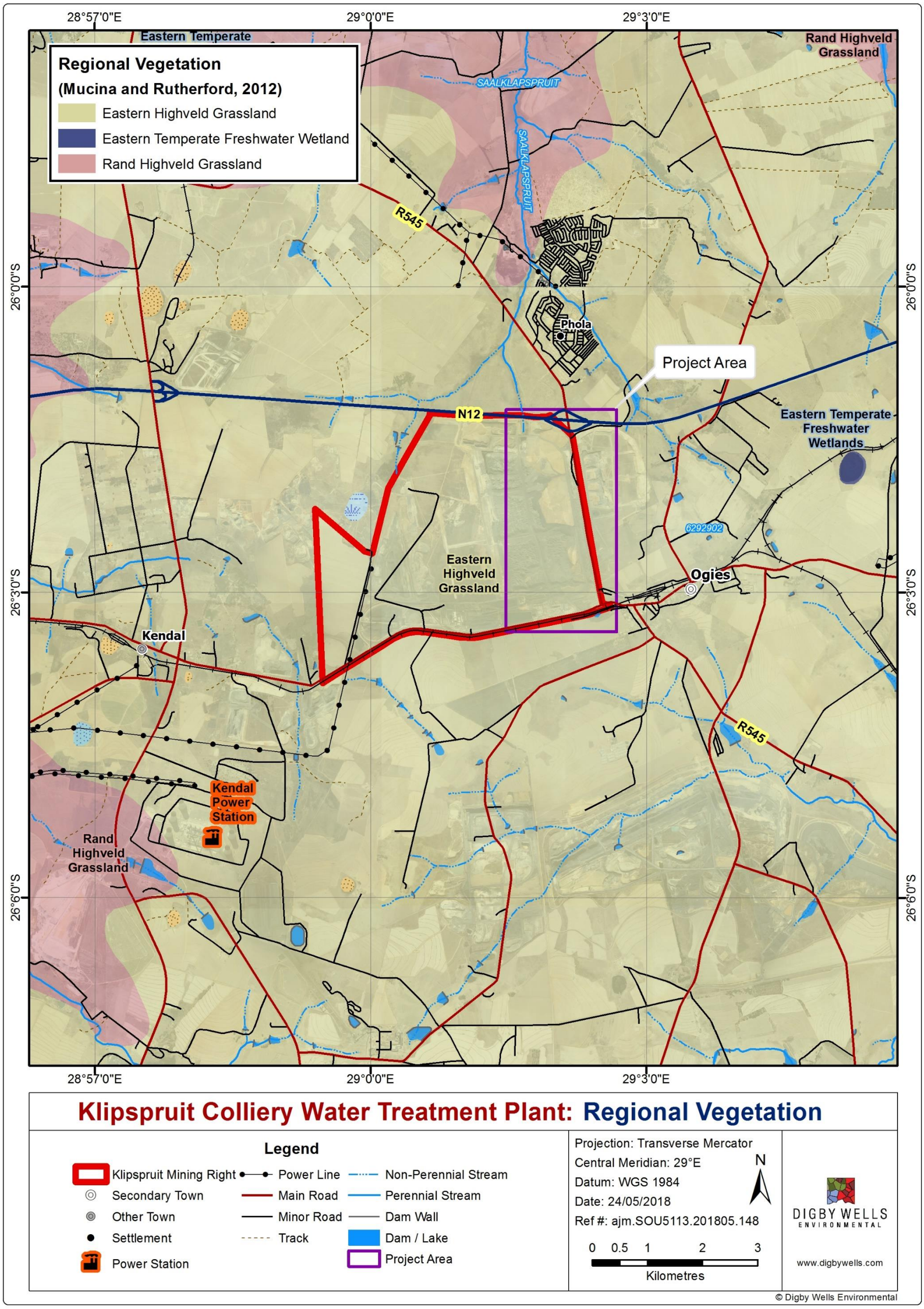


Figure 7-5: Regional Vegetation

8 Assumptions, Limitations and Gaps in knowledge

The following limitations were encountered during this study:

- Wetlands have been assessed only within the 500m area of the proposed pipeline routes and the location of the associated WTP; and
- With ecology being dynamic and complex, certain aspects, some of which may be important, may have been overlooked. However, wherever possible, it is expected that the Project area has been accurately assessed and considered, based on the field observations undertaken and the consideration of historical and existing studies and the desktop data available.

9 Existing Environment

9.1 Wetland delineation and classification

Two wetland systems totalling 43.3ha fall within the 500m buffer of the proposed pipeline routes; a large channelled valley bottom wetland that drains north into the Saalklapspruit system, and a hillslope seep which is located in the South East corner of the project area. The breakdown of the wetland types per area is detailed in Table 9-1 and illustrated in Figure 9-1.

Table 9-1: Wetland HGM Units

HGM Unit	HGM Unit Type	Area (ha)
1	Channelled Valley Bottom	31.7 ha
2	Hillslope Seep	11.5 ha

The buffer zones relating to the wetlands are illustrated in Figure 9-2. Zones of Regulation of 100m around each wetland have been assigned according to the regulations on use of water for mining and related activities aimed at the protection of water resources (GN 704 of 4 June 1999).

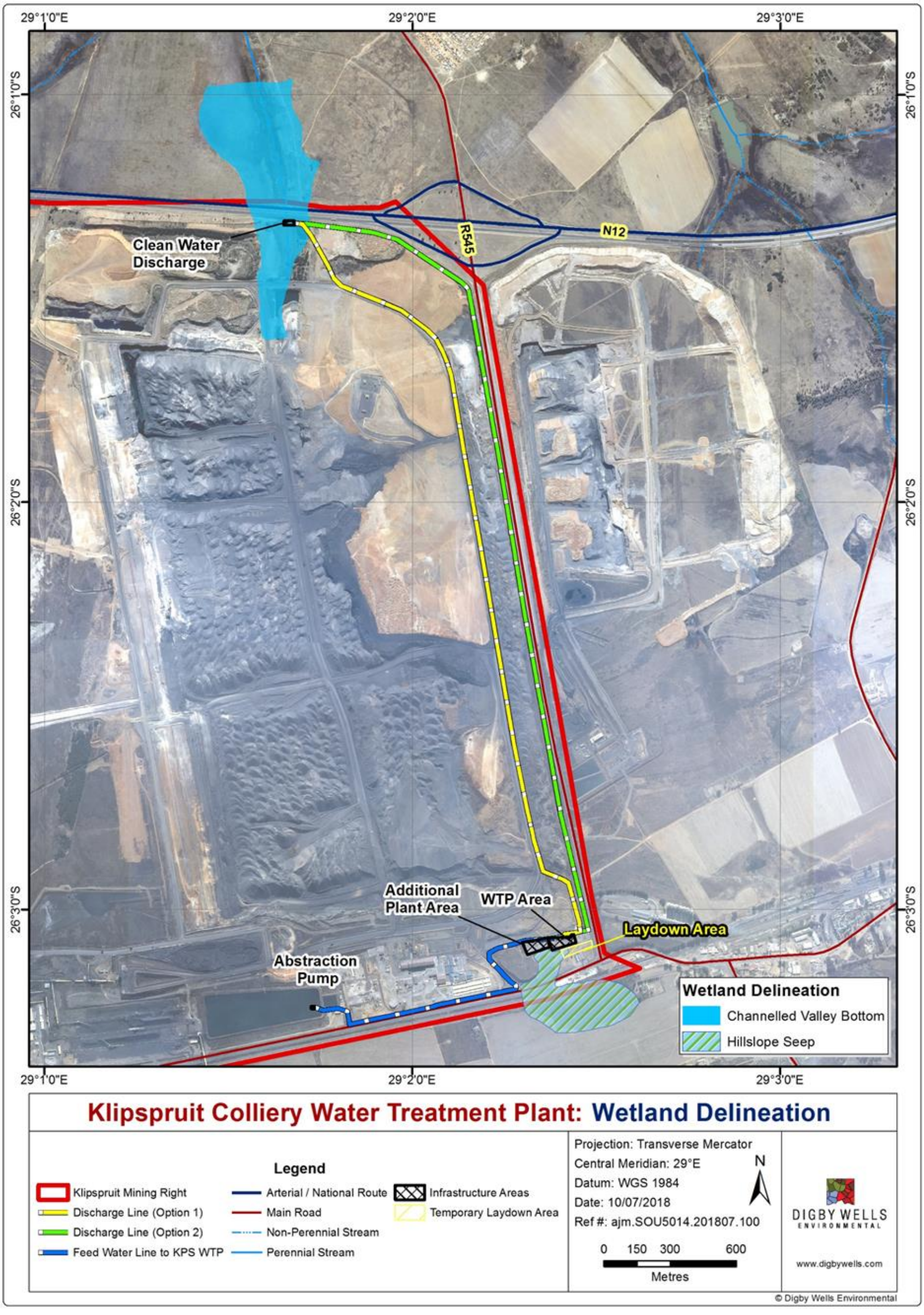


Figure 9-1: Wetland Delineation

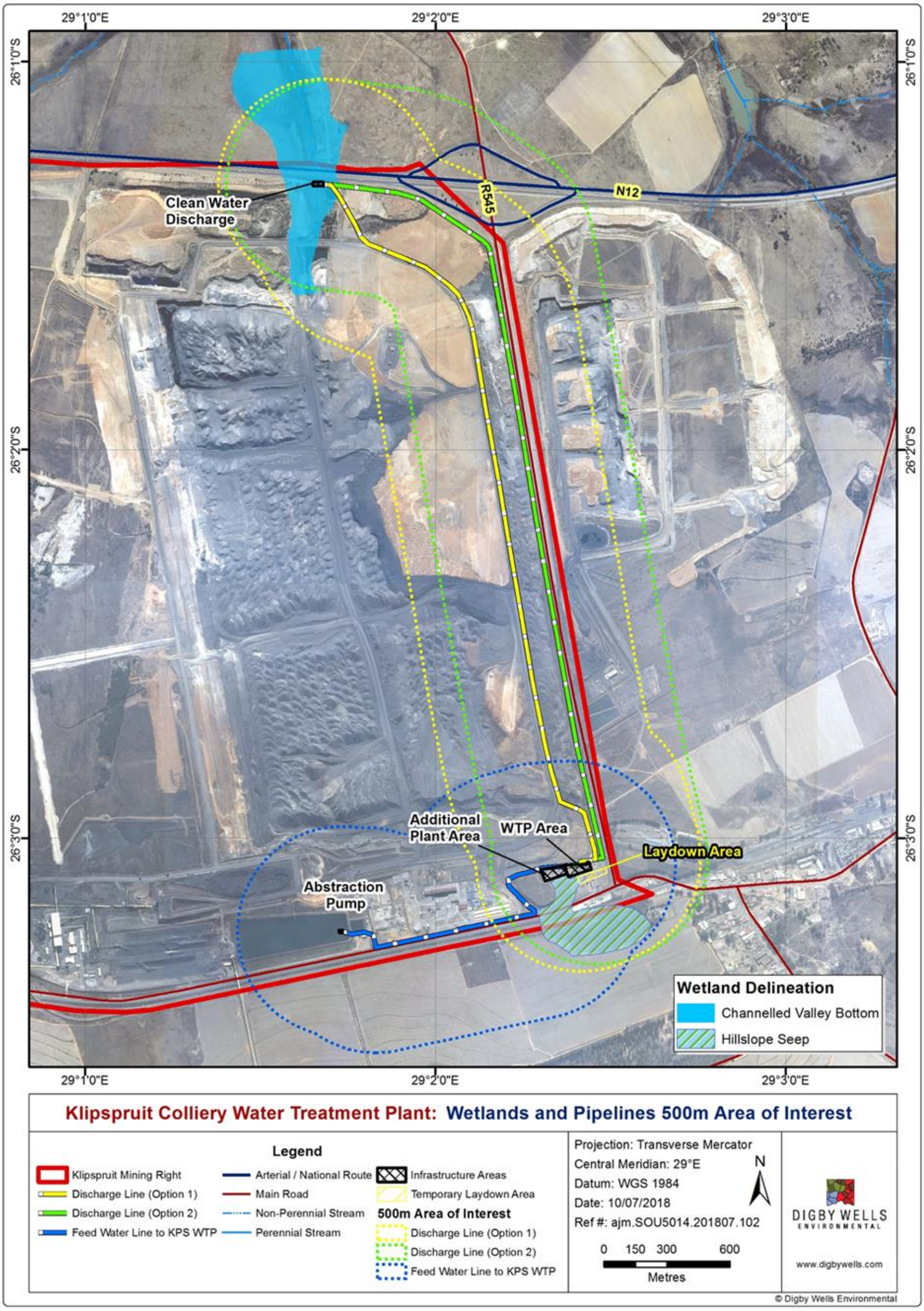


Figure 9-2: Wetland Regulation Zones

9.1.1 HGM Unit 1

HGM Unit 1 is a channelled valley bottom wetland covering 31.7 ha (Figure 9-3).

Most of the wetland upstream of the N12 has been destroyed as a result of current mining activities. Evidence of rehabilitation of a portion of this wetland was observed, including sloping and revegetation activities, however only one species (*Chloris* sp.) was present. This grass species is not an obligate or facultative wet species and is not suited to revegetation of wetland habitat. In the unmined wetland area (no rehabilitation activities observed), *Typha capensis* (Common Bulrush) and the invasive *Acacia mearnsii* (Black Wattle) were dominant.

Downstream of the N12, the wetland is less modified and is dominated by *Paspalum dilatatum* (Dallis Grass), *Juncus effusus (*Common Rush*), Eragrostis gummiflua* (Gum Grass)*, Typha capensis*, and *Andropogon eucomus* (Snowflake Grass).

The current impacts observed include the following:

- Complete destruction of portions of the wetland due to mining activities, however, some of these areas are in the process of being rehabilitated;
- The rehabilitated area has been vegetated with *Chloris* sp. only, resulting in a homogenous environment and has hindered the ability of the system to maintain biodiversity;
- Although culverts allow for the freeflow of water underneath roads, some impact in terms of sedimentation upstream of the N12 and erosion downstream of the N12 were observed;
- Stormwater is directed into the wetland downstream of the N12, thus increasing the potential for contamination by pollutants such as hydrocarbons;
- Cattle-grazing activities were noted downstream of the N12. Resulting impacts such as overgrazing, trampling and erosion. Furthermore, increased sedimentation of the systems due to exposed substrate was evident. Sedimentation alters the natural hydrological and geomorphological functioning of wetlands and may have an impact on aquatic life;
- Impaired water quality may be further aggravated due to additional loading of phosphates and nitrates from cattle grazing within the 500m area of interest; and
- Disturbance has led to the establishment of alien and invasive plant species (e.g. *Acacia mearnsii*, *Persicaria* as seen in Figure 9-3), further limiting the ability of the hydromorphic grasslands to function.

;

Figure 9-3: HGM unit 1 (A: Habitat downstream of the N12, illustrating the storm water drains; B: Invasion by *Persicaria* downstream of the N12; C and D: Habitat upstream of the N12)

9.1.2 HGM Unit 2

A hillslope seep wetland covering approximately 11.5 ha (Figure 9-4). The wetland is largely disturbed with major impacts to hydrology, geomorphology and vegetation.

The current impacts observed include the following

- A railway crossing and the R555 transect the wetland, which has resulted in fragmentation of the natural system, altered hydrology, compaction of soils in some places and loss of vegetation;
- Stockpiling and the digging of trenches within the wetland has altered the topography of the site, thereby modifying the pattern of flow to a large extent, increasing sedimentation and erosion and facilitating the growth of Alien Invasive Plants (AIPs); and

- AIPs are prolific in the area due to clearing of vegetation and soil disturbance. This has impacted the ability of wetlands to maintain biodiversity.

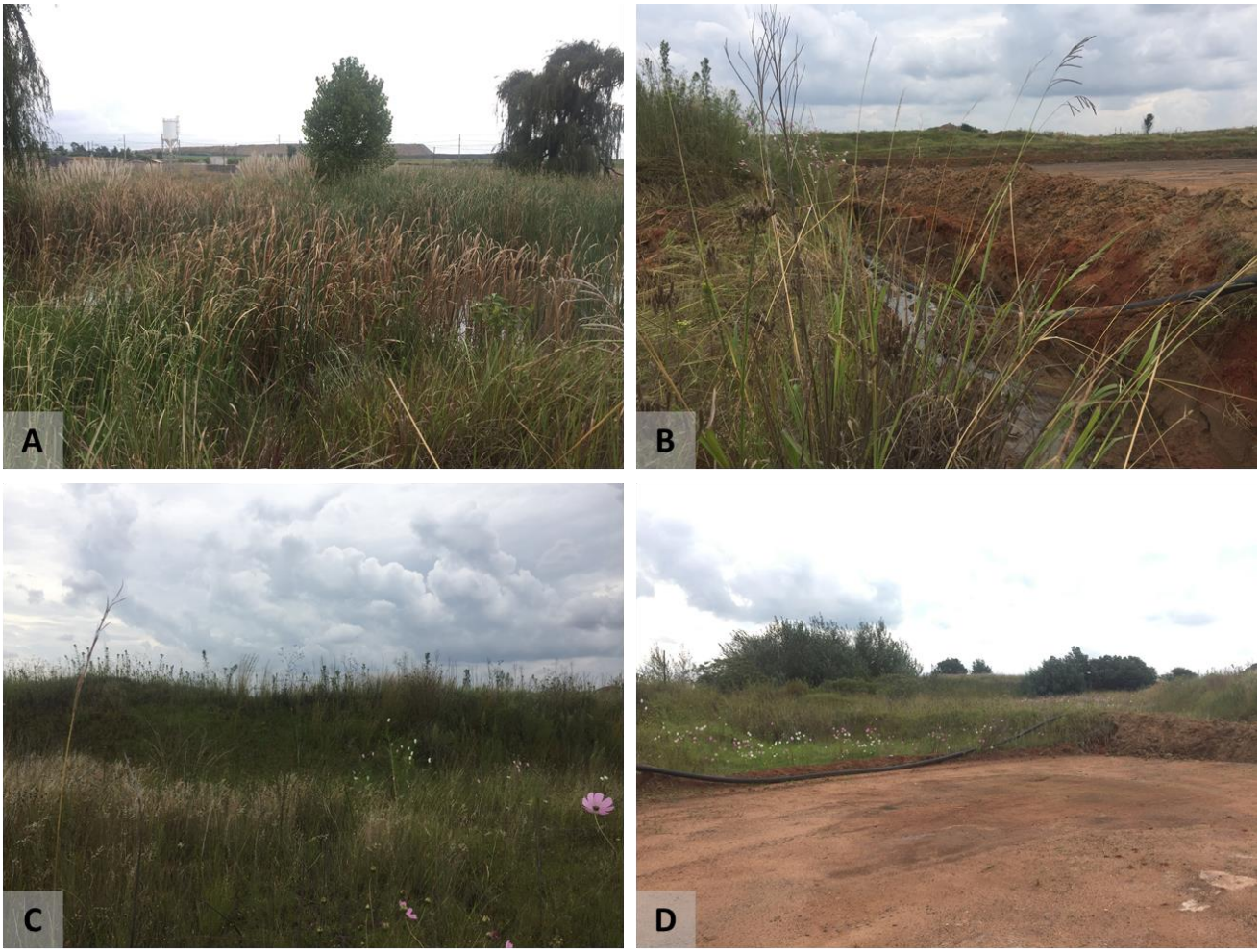


Figure 9-4: HGM Unit 2 (A: Wetland vegetation remaining, including *Typha capensis*; B: A trench dug to drain the wetland; C: Soil stockpiling altering topography; D: cleared areas)

9.2 Sensitivity of the Site

9.2.1 Present Ecological State

Table 9-2 indicates the PES scores for the various HGM Units. The wetlands within the Project area are categorised as *Largely Modified* (Category D) (Table 9-2).

The mining activities observed in the upstream portion of HGM unit 1 have resulted in significant alterations to the hydrology and geomorphology of the system. However, recent rehabilitation activities (infilling, sloping) may have a positive impact to this system in the future, should these be completed and implemented correctly. Impacts related to the N12 road crossing have also resulted in altered water retention and distribution patterns.

Similarly, significant alterations to the geomorphology and hydrology of HGM unit 2 were observed due to the road, railway crossings and the various excavations observed at the time of the assessment.

Table 9-2: Present Ecological Health Scores

HGM Unit	Hydrological Health Score	Geomorphological Health Score	Vegetation Health Score	Final Ecological Health Score	PES Score
1	6.5	2.2	5.3	4.94	D
2	6	0.5	7.6	4.85	D

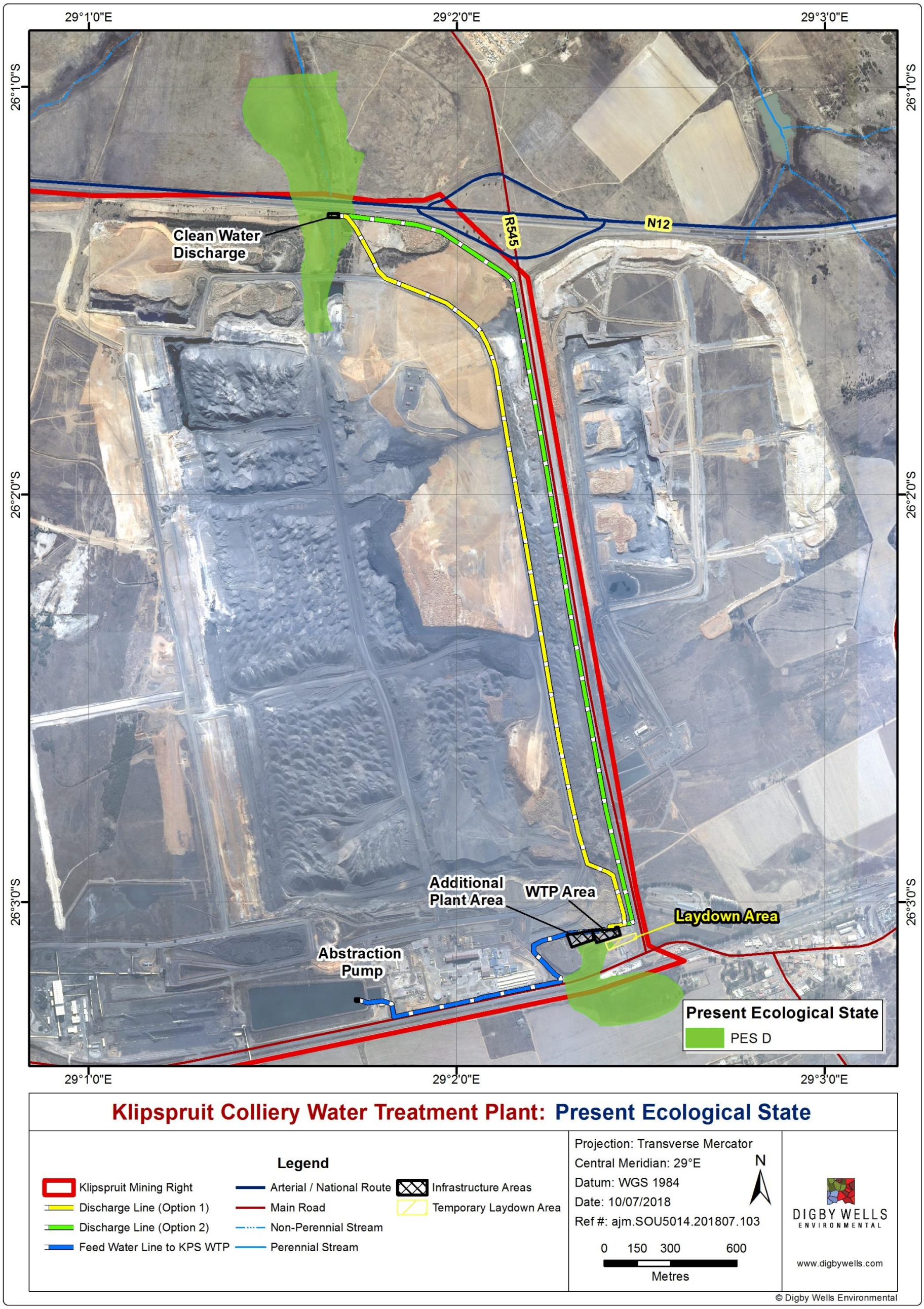


Figure 9-5: Present Ecological State

9.2.2 Ecological Importance and Sensitivity

Table 9-3 indicates the EIS scores for the various HGM Units with the final EIS score for the wetlands being *Moderate*.

Although the wetlands are modified, they do still provide *Marginal* (HGM unit 2) to *Moderate* (HGM unit 1) hydrological importance services, such as flood attenuation and assimilation of toxicants and nitrates.

The Ecological Importance and Sensitivity category is *Moderate* for both HGM units. Although the wetlands are largely transformed, the wetlands do provide some habitat for indigenous fauna and flora, more so HGM Unit 1, where the downstream portion still has some large areas of intact vegetation which could provide habitat for red data species.

In general, the values are *Moderate* for 'Direct Human Benefits'. Some agricultural activities occur on the edges of the wetlands; however impacts related to these activities are minor. HGM unit 1 provides water to the Phola area, and the area is used extensively for grazing.

Table 9-3: EIS Scores

HGM Unit	Ecological Importance & Sensitivity	Hydrological/Functional Importance	Direct Human Benefits	Final EIS Score	Final EIS Category
1	1.7	1.5	1.8	1.8	Moderate
2	1.8	0.9	1	1.8	Moderate

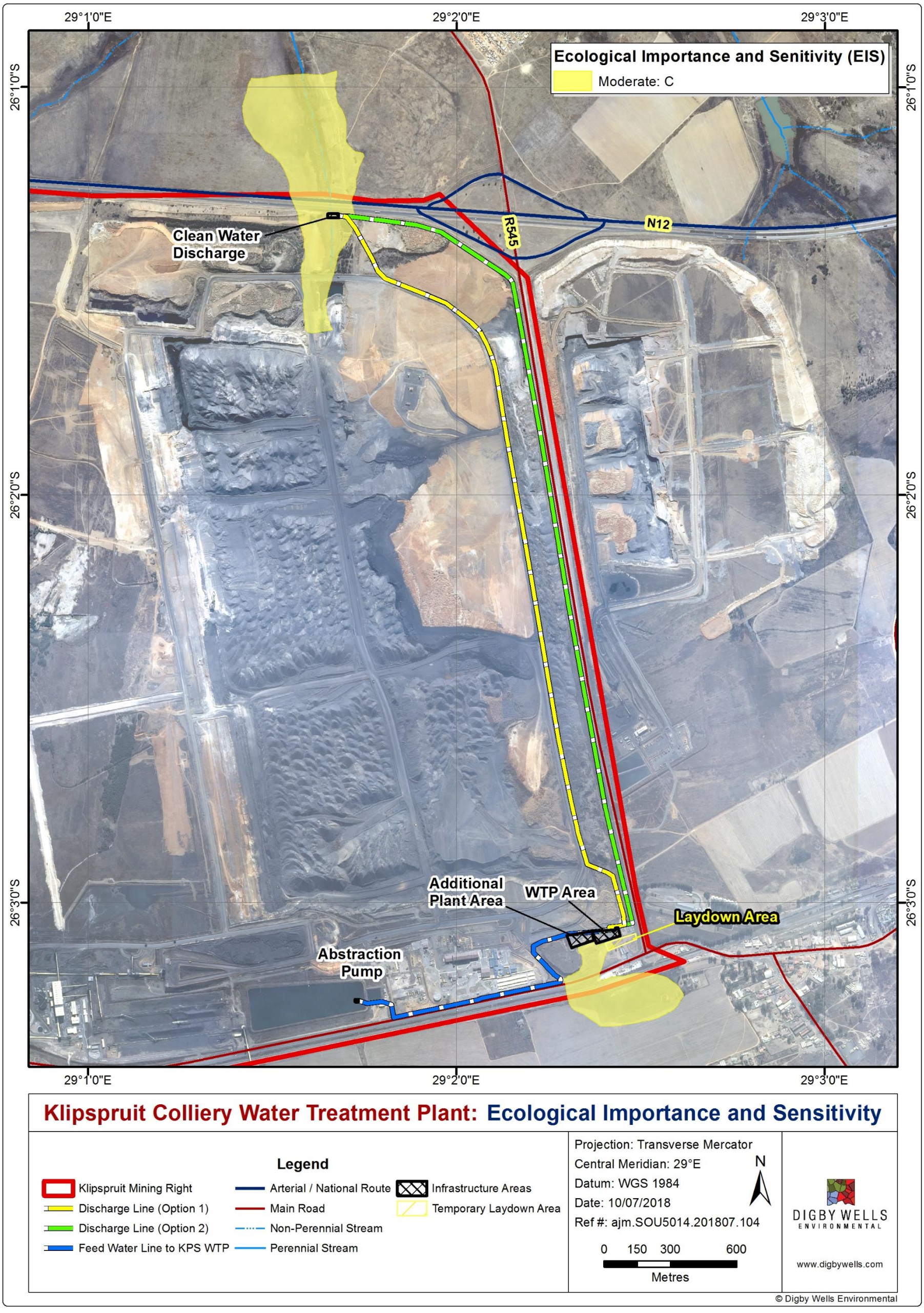


Figure 9-6: Ecological Importance and Sensitivity

10 Impact Assessment

10.1 Discussion of Potential Impacts

The activities assessed for the wetlands impact assessment are listed in Table 10-1. This section includes an impact assessment for activities associated with the proposed pipeline for the conveyance of treated water.

The Project area (comprising the pipeline route, WTP and associated infrastructure, and 500m buffer) affects two wetland HGM units.

Table 10-1: Project Activities

Activity	Phase of Project
Site clearing, soil disturbance, crossing of wetland and river areas, increased vehicular movement, stockpiling of topsoil, storage and dumping of building materials associated with the development and construction of the various proposed activities.	Construction phase
Operational and maintenance activities associated with the WTP and associated infrastructure	Operational phase
Decommissioning of infrastructure and rehabilitation of impacted land.	Decommissioning, closure and rehabilitation phase

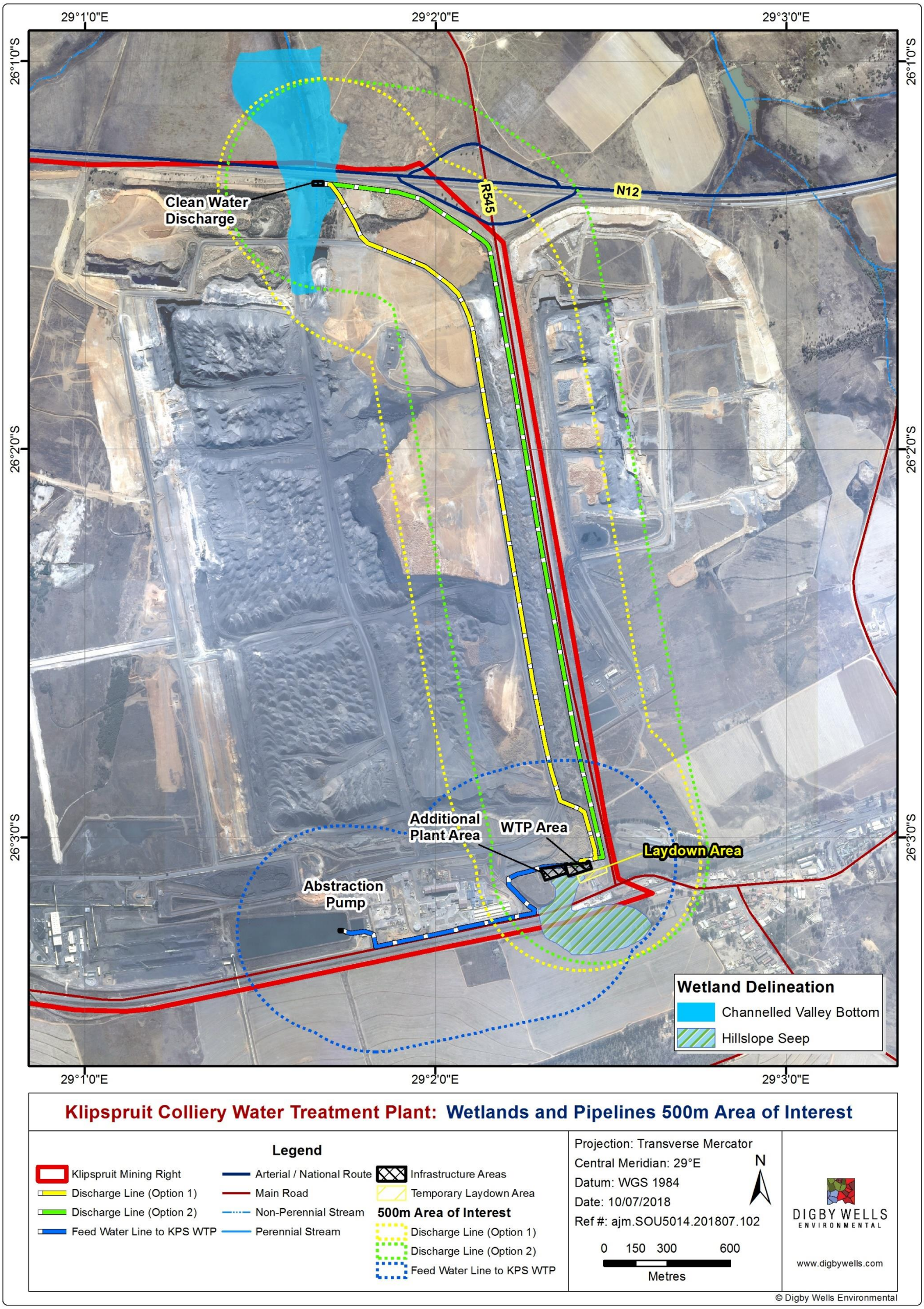


Figure 10-1: Impact Assessment – 500m Area of Interest

10.2 Construction Phase

10.2.1 Impact Description

The main activities during the construction phase that could result in impacts to the freshwater ecology of the area are associated with the site clearing and construction of the various proposed infrastructures. Activities include site clearing, soil disturbance, topsoil stockpiling, storage and dumping of building materials, compaction of soils and crossing of the wetland and river systems.

Associated impacts include erosion and sedimentation, the potential further loss of biodiversity and habitat, fragmentation of the systems present and potential loss of catchment yields and surface water recharge to the systems further downstream. Among the impacts associated with the proposed construction phase are minor potential impacts to soil and water quality as a result of the ingress of hydrocarbons.

Larger impacts include compaction of soils, potential loss of vegetation and the increased potential for erosion and sedimentation in the vicinity of any cleared areas and resulting in impacts further downstream. Removal of vegetation and disturbance of soils in the vicinity of the construction footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and AIPs, which are already prolific in the area, further altering the natural vegetation profiles of the freshwater resources encountered in the vicinity of the project footprint.

Table 10-2 summarises potential impacts to the freshwater ecology identified during the construction phase.

Table 10-2: Impact assessment parameter ratings for the construction phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Site access and disturbance			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed	Moderate (negative) – 78
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium-term impacts.	
Probability	Almost certain (6)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered highly probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed.	Minor (negative) - 40
Extent	Limited (3)	Impacts will be limited only to the local area and will be rehabilitated accordingly on completion of the decommissioning phase.	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Probable (4)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are still considered probable.	
Nature	Negative		

10.2.2 Construction Phase Mitigation and Management Measures

The following mitigation and management measures have been prescribed for the construction phase:

- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- During the construction phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  - Where the track has a slope of less than 2%, berms every 50m should be installed;
  - Where the track slopes between 2% and 10%, berms every 25m should be installed;
  - Where the track slopes between 10%-15%, berms every 20m should be installed; and
  - Where the track has slope greater than 15%, berms every 10m should be installed.
- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- If it is absolutely unavoidable that any of the wetland areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the wetland features present takes place;
- All erosion noted within the construction footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Active rehabilitation, re-sloping, and re-vegetation of disturbed areas immediately after construction;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information);
- Implement and maintain a suitable Alien Invasive Plant (AIP) control programme to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones (see the Fauna and Flora Specialist Study for more information);
- Permit only essential personnel within the 100m zone of regulation for all freshwater features identified;

- No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No material may be dumped or stockpiled within any rivers, tributaries or drainage lines in the vicinity of the proposed pipeline;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the construction footprint;
- All vehicles must be regularly inspected for leaks;
- Re-fueling must take place at a diesel facility, on a sealed surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Wetlands should be monitored monthly during construction; and
- Appropriate sanitary facilities must be provided for the duration of the construction activities and all waste must be removed to an appropriate waste facility.

10.3 Operational Phase

10.3.1 Impact Description

The main activities during the operational phase that could result in impacts to the freshwater ecology of the area are associated with the storm water management systems, maintenance and operational activities such as discharge of the treated water.

Associated impacts include compaction of soils and hardening of surfaces, loss of catchment yield and surface water recharge, erosion and sedimentation, the potential loss of biodiversity and habitat, further fragmentation of the systems present. Further to this, the potential for ongoing contamination of the wetland systems and other freshwater resources present are deemed likely based on the ingress of hydrocarbons associated with increased vehicular activity. Any leaks associated with the proposed pipelines may also result in contamination of the freshwater systems present and may result in impacts to the water quality. Removal of indigenous vegetation is likely to give rise to an increased potential for encroachment by robust pioneer species and AIPs, further altering the natural vegetation profiles of the freshwater resources encountered in the vicinity of the project footprint. Hardened surfaces have the potential to result in sheet runoff and there is likely to be a loss in wetland service provision in terms of flood attenuation, sediment trapping and assimilation of toxicants and other pollutants. Storage of water, which is an important service, provided by wetlands in this area, will be compromised. Further alterations to the natural flow regimes will take place and is likely to result in the creation of preferential flow paths over time. Discharge of the water may result in contamination of the water, if not treated to the

catchment standard. The increased volume of water could result in erosion and further channelization of the wetland.

Table 10-3 summarises potential impacts to the freshwater ecology identified during the operational phase.

Table 10-3: Impact assessment parameter ratings for the operational phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Site access and roads			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the life of the project has been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	Spills as well as degraded habitat due to water quality deterioration will affect entire watercourses and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the project has been completed and the pipeline decommissioned.	Negligible (negative) – 18
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	

Dimension	Rating	Motivation	Significance
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present.	
Probability	Improbable (2)	Should the proposed project proceed, impacts to the ecological integrity of the systems present are considered unlikely.	
Nature	Negative		

10.3.2 Operational Phase Mitigation and Management Measures

The following mitigation and management measures have been prescribed for the operational phase:

- Leak detection will be necessary. Flow meters can be fitted at the start and end of the pipeline to detect if there are any water losses;
- Water should be treated and tested to ensure it meets appropriate standards before being released;
- Toxicological testing should be carried out biannually in the receiving environment. Please refer to the Aquatic Report (Digby Wells, 2018) for more information;
- Annual biomonitoring of wetland crossing points and at the point of discharge must take place;
- Aim to discharge the water diffusely to reduce channelization and erosion of the wetland downstream;
- Limit the footprint area of the operational activities to what is absolutely essential in order to minimise impacts as a result of any potential vegetation clearing and compaction of soils (all areas but critically so in freshwater areas);
- If it is absolutely unavoidable that any of the freshwater areas present will be affected, disturbance must be minimised and suitably rehabilitated;
- Ensure that no incision and canalisation of the freshwater features present takes place as a result of the proposed operational activities;
- All erosion noted within the operational footprint as a result of any potential surface activities should be remedied immediately and included as part of the ongoing rehabilitation plan;
- During the operational phase, erosion berms should be installed on roadways and downstream of stockpiles to prevent gully formation and siltation of the freshwater resources. The following points should serve to guide the placement of erosion berms:
  - Where the track has slope of less than 2%, berms every 50m should be installed;
  - Where the track slopes between 2% and 10%, berms every 25m should be installed;
  - Where the track slopes between 10%-15%, berms every 20m should be installed; and
  - Where the track has a slope greater than 15%, berms every 10m should be installed.

- A suitable AIP control programme must be put in place so as to prevent further encroachment as a result of disturbance to the surrounding terrestrial zones (see the Fauna and Flora Specialist Study for more information);
- All areas of increased ecological sensitivity should be designated as “No-Go” areas and be off limits to all unauthorised vehicles and personnel;
- No unnecessary crossing of the wetland features and their associated buffers should take place and the substrate conditions of the wetlands and downstream stream connectivity must be maintained;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any freshwater areas and their associated zones of regulation. All vehicles must remain on demarcated roads;
- All vehicles must be regularly inspected for leaks;
- Re-fuelling must take place on a sealed surface area away from freshwater features to prevent ingress of hydrocarbons into topsoil;
- All spills should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the operational activities and all waste must be removed to an appropriate waste facility;
- Monitor all systems for erosion and incision;
- All erosion noted within the footprint should be remedied immediately and included as part of an ongoing rehabilitation plan;
- Ensure soil management programme is implemented and maintained to minimise erosion and sedimentation;
- All soils compacted as a result of construction activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information); and
- Permit only essential personnel within the 100 m zones of regulation for all freshwater features identified.

10.4 Decommissioning and Rehabilitation Phase

10.4.1 Impact Description

Among the impacts associated with the decommissioning, closure and rehabilitation phase are minor potential impacts to soil and water quality as a result of the ingress of hydrocarbons and mechanical spills associated with moving machinery required for the decommissioning activities.

Larger impacts include compaction of soils, potential loss of natural vegetation and the increased potential for erosion and sedimentation in the decommissioned areas and resulting in impacts further downstream.

Any temporary storage or dumping of decommissioned infrastructure within wetland areas, has the potential to result in loss of stream connectivity, loss of refuge areas, alterations to the terrain profiles of the areas and the creation of preferential flow paths, which may result in sedimentation, alterations to the vegetation structure of the area, encourage alien vegetation encroachment and result in increased erosion and sedimentation potentials.

Removal of vegetation and disturbance of soils in the vicinity of the decommissioning footprint is likely to give rise to an increased potential for encroachment by robust pioneer species and alien invasive vegetation species, further altering the natural vegetation profiles of the wetlands encountered in the vicinity of the decommissioning footprint.

Table 10-4: Impact assessment parameter ratings for the Decommissioning and Rehabilitation Phase

Dimension	Rating	Motivation	Significance
Activity and Interactions: Decommissioning of all infrastructure			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the decommissioning, rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 27

Dimension	Rating	Motivation	Significance
Extent	Limited (2)	Impacts will be limited only to the project footprint area and will be rehabilitated accordingly on completion of the decommissioning phase.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		
Activity and Interactions: Rehabilitation measures			
Prior to Mitigation/Management			
Duration	Project life (5)	The impact will cease after the rehabilitation of the project has been completed.	Minor (negative) – 52
Extent	Greater municipal area (4)	General scouring from sedimentation, as well as degraded habitat due to water quality deterioration will affect entire watercourse and river reaches.	
Intensity x type of impact	Serious medium term environmental effects (4)	Due to the sensitivity of the flora wetland systems in general and the already degraded nature of the systems present, should no management or mitigation measures be employed, activities could result in serious medium term impacts.	

Dimension	Rating	Motivation	Significance
Probability	Probable (4)	Should no precautionary measures be implemented, further impacts to the flora and wetlands present are considered probable.	
Nature	Negative		
Post-Mitigation			
Duration	Project life (5)	The impact will cease after the rehabilitation and closure phases of the project have been completed.	Negligible (negative) – 24
Extent	Very limited (1)	Impacts will be limited only to isolated parts of the site where rehabilitation is taking place.	
Intensity x type of impact	Minor effects on the biological or physical environment (2)	Due to the impacted nature of the systems present, should the appropriate precautions and management or mitigation measures be employed, the project could result in only a minor ecological impact to the wetland systems present and in the long term may have positive impacts.	
Probability	Unlikely (3)	Should the proposed project proceed, and the appropriate management and mitigation measures be implemented, impacts are considered unlikely.	
Nature	Negative		

10.4.2 Decommissioning and Rehabilitation Phase Mitigation and Management Measures

The following mitigation and management measures have been prescribed for the decommissioning phase:

- Ensure that sound environmental management is in place during the proposed decommissioning phase;
- Limit the footprint area of the decommissioning and rehabilitation activities to what is absolutely essential in order to minimise impacts as a result of vegetation clearing and compaction of soils (all areas but critically so in wetland areas);
- All erosion noted within the decommissioning and rehabilitation area footprint should be remedied immediately and included as part of the ongoing rehabilitation plan;
- All soils compacted as a result of decommissioning activities should be ripped/scarified (<300mm) and profiled (see the Soil Specialist Report for more information);
- Permit only essential personnel within the 100m zones of regulation for all freshwater features identified;
- Wherever possible, restrict decommissioning activities to the drier winter months to avoid sedimentation of the freshwater resources further downstream;
- No material may be dumped or stockpiled within any wetland areas (or the buffers) in the vicinity of the proposed decommissioning footprint;
- Wetlands and their associated zones of regulation are to be clearly demarcated and avoided wherever possible;
- An AIP management plan to be implemented and managed for the life of the proposed decommissioning, rehabilitation, closure and post-closure phases (see the Fauna and Flora Specialist Study for more information);
- As much vegetation growth as possible should be promoted within the proposed development area during all phases. In order to protect soils, vegetation clearance should be kept to a minimum;
- Monitor all systems for erosion and incision;
- All areas where active erosion is observed should be ripped, re-profiled and seeded with indigenous grasses;
- No vehicles or heavy machinery may be allowed to drive indiscriminately within any wetland areas and their associated zones of regulation. All vehicles must remain on demarcated roads and within the project area footprint;
- All vehicles must be regularly inspected for leaks;

- Re-fueling must take place at a diesel facility on a sealed and bunded surface area away from wetlands to prevent ingress of hydrocarbons into topsoil;
- All existing litter, debris should be removed from the wetland areas and littering should be prohibited on an ongoing basis;
- All spills from machinery should be immediately cleaned up and treated accordingly;
- Appropriate sanitary facilities must be provided for the duration of the rehabilitation activities and all waste must be removed to an appropriate waste facility;
- Ongoing wetland rehabilitation is necessary both within and in the vicinity of the proposed decommissioning, rehabilitation and closure footprint; and
- Appropriate wetland monitoring techniques must take place on an annual basis for a period of at least 3 years post closure during the summer/wet season in order to identify any emerging issues, trends or improvements in the receiving environment.

10.4.3 Cumulative Impacts

The wetlands and other freshwater resources in this area are currently largely impacted as a result of various cumulative impacts from historical mining activities in the area. In addition, other impacts present in the vicinity of the proposed project area include agricultural cultivation, grazing activities, road and railway crossings and the associated servitudes.

11 Conclusion

This report provides an assessment of the current state of the wetland and freshwater resources present in the vicinity of the proposed project. The Project area falls within the B20G quaternary catchment, which is regarded as Largely Modified (DWA, 2011). Two wetlands were identified within the 500m buffers surrounding the proposed project area. These are:

- A channelled valley bottom (HGM Unit 1) of 31.7 ha with a PES of ‘D’ and a ‘Moderate’ EIS. 0.09 ha to be directly impacted on by infrastructure; and
- A hillslope seep (HGM Unit 2) of 11.5 ha with a PES of ‘D’ and a ‘Moderate’ EIS. 0.07 ha to be directly impacted on by infrastructure.

Both wetlands will be impacted by the proposed pipeline routes and the associated infrastructure in terms of a reduction in PES and EIS. From a wetlands perspective, the impacts of both are similar and thus there is no favoured option. Mitigation measures outlined in the report should be adhered to, to reduce the impacts. Should these be adhered to, it won’t be necessary to add these wetlands to the current offset strategy. Monitoring should take place as prescribed.

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