WETLAND BASELINE & RISK ASSESSMENT FOR THE PROPOSED SBPM SOLAR FACILITY

Northam, Limpopo & North West Provinces

May 2022

CLIENT

savannah environmental

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany.com

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Background

The Biodiversity Company was appointed to undertake a wetland baseline and risk assessment for the proposed SBPM Solar Facility for Siyanda Bakgatla Platinum Mine in Northam, Limpopo Province. The project infrastructure is located in both the Limpopo and also North West provinces. The project is located 6.5 km west from Northam. The Northam focus area has been identified by the potential development area for the construction and operation of solar and battery facilities consisting of 251 Ha.

The approach was informed by the Environmental Impact Assessment Regulations. 2014 (GNR 326, 7 April 2017) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The approach has taken cognisance of the recently published Government Notices 320 (20 March 2020) in terms of NEMA, dated 20 March: "*Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Themes in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for Environmental Authorisation*" (Reporting Criteria). The National Web based Environmental Screening Tool has characterised the aquatic theme sensitivity of the project area as "Low" and "Very High".

This assessment has been completed in accordance with the requirements of the published General Notice (GN) 509 by the Department of Water and Sanitation (DWS). This notice was published in the Government Gazette (no. 40229) under Section 39 of the National Water Act (Act no. 36 of 1998) in August 2016, for a Water Use Licence (WUL) in terms of Section 21(c) & (i) water uses. The GN 509 process provides an allowance to apply for a WUL for Section 21(c) & (i) under a General Authorisation (GA), as opposed to a full Water Use Licence Application (WULA). A water use (or potential) qualifies for a GA under GN 509 when the proposed water use/activity is subjected to analysis using the DWS Risk Assessment Matrix (RAM). This assessment will implement the RAM and provide a specialist opinion on the appropriate water use authorisation.

This report, after taking into consideration the findings and recommendations provided by the specialist herein, should inform and guide the Environmental Assessment Practitioner (EAP) and regulatory authorities, enabling informed decision making, as to the ecological viability of the proposed project.

1.2 Project Description

1.2.1 SBPM PV RE project

Main Street 1886 Proprietary Limited proposes the development of the Solar Photovoltaic (PV) facility and associated infrastructure on a site bordering the eastern end of the Siyanda Bakgatla Platinum Mine area near Northam. The solar PV facility will comprise several arrays of PV panels, a Battery Energy Storage System (BESS), and associated infrastructure with a contracted capacity of up to 100MW.

The purpose of the proposed project is to generate electricity for exclusive use by the Siyanda Mine, following which any excess power produced will be distributed to the national grid, if applicable. The construction of the PV facility aims to reduce the Siyanda Mine's dependency on direct supply from Eskom's national grid for operation activities, while simultaneously decreasing the mine's carbon footprint.

A preferred project site with an extent of ~1138 ha and a development area of 574 ha has been identified by Main Street 1886 Proprietary Limited as a technically suitable area for the development of the Solar PV Facility. The study area is located on Portion 4 of Farm Grootkuil 409. The project site falls within the Thabazimbi Local Municipality within the Waterberg District Municipality in the Limpopo Province. The site is located ~6.5 km west of the town of Northam and is accessible via the Swartklip Road which branches off the R510 provincial route.

Infrastructure associated with the solar PV facility will include:

- 100MW Solar PV array comprising PV modules and mounting structures.
- Inverters and transformers.
- Cabling between the project components.
- Battery Energy Storage System.
- On-site facility substation and power lines between the solar PV facility and the Mine and Eskom substation.
- Site offices, Security office, operations and control, and maintenance and storage laydown areas.
- Access roads, internal distribution roads.

Grid connection solution.

To evacuate the generated power to the Siyanda Mine, the grid connection solution consisting of the following is proposed:

The power generated by the solar PV facility will be transferred to the three step up transformers at the on-site/plant substation. Power will then be delivered from each step-up transformer as follows:

- two 6.6 km, 33 kV transmission lines to the Mortimer substation with four step down transformers (33/6.6 kV; 10 MVA).
- two 4.7 km, 33 kV transmission lines to the Fridge substation with two step down transformers (33/6.6 kV; 10 MVA).
- two 2.9 km, 33 kV transmission lines to the Ivan substation with three step down transformers (33/11 kV; 10 MVA).

The grid connection is proposed on the following properties:

- Portion 3 of Farm Grootkuil 409.
- Portion 4 of Farm Grootkuil 409.
- Portion 5 of Farm Grootkuil 409.

The development area of 574ha is larger than the area needed for the construction of a 100MW PV facility and will provide the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities by the development footprint of ~240 ha.

1.3 Specialist Details

Report Name	**WETLAND BASELINE & RISK ASSESSMENT FOR THE PROPOSED SBPM SOLAR FACILITY**	
Reference	**Siyanda PV**	
Submitted to	savannah environmental	
Report Writer & Fieldwork	**Rian Pienaar**	[signature]
	Rian Pienaar is an aquatic ecologist (Cand. Sci. Nat. 135544) with experience in wetland identification and delineations. Rian completed his M.Sc. in environmental science at the North-West University Potchefstroom Campus. Rian has been part of wetland studies for road and culvert upgrades, power station and dam construction.	
Reviewer	**Andrew Husted**	[signature]

	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

1.4 Terms of Reference

The following tasks were completed in fulfilment of the terms of reference for this assessment:

- The delineation, classification and assessment of wetlands within 500 m of the project area;
- Conduct risk assessments relevant to the proposed activity;
- Recommendations relevant to associated impacts; and
- Report compilation detailing the baseline findings.

1.5 Assumptions and Limitations

The following assumptions and limitations are applicable for this assessment:

- The focus area was based on the spatial files provided by the client and any alterations to the area and/or missing GIS information would have affected the area surveyed;
- Only the SBPM area and a 20 m corridor around the powerlines have been ground truthed with the surrounding 500 m regulated area being covered via desktop studies; and
- The GPS used for the survey has a 5 m accuracy and therefore any spatial features may be offset by 5 m.

1.6 Key Legislative Requirements

1.6.1 National Water Act (NWA, 1998)

The DWS is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998) (NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means;

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS. Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) and (i).

1.6.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

2 Methods

A wetland site visit was conducted during the period 21st to the 25th of February 2022, this would constitute a wet season survey.

2.1 Identification and Mapping

The wetland areas were delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 2-1. The outer edges of the wetland areas were identified by considering the following four specific indicators:

- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;
- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
    - The soil forms (types of soil) found in the landscape were identified using the South African soil classification system namely; Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991);
- The Soil Wetness Indicator identifies the morphological "signatures" developed in the soil profile as a result of prolonged and frequent saturation; and
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.

Vegetation is used as the primary wetland indicator. However, in practise the soil wetness indicator tends to be the most important, and the other three indicators are used in a confirmatory role.

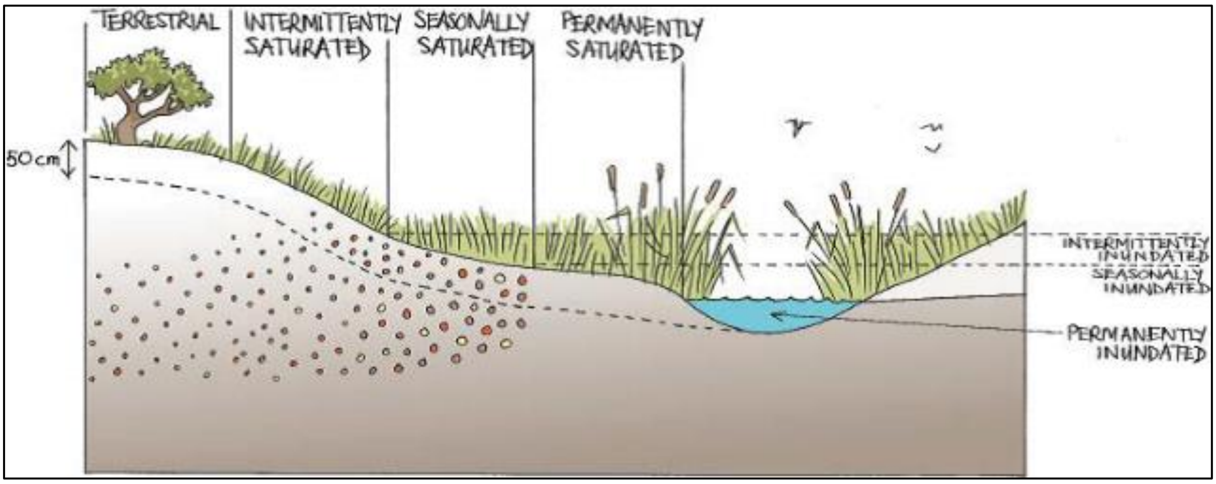

Figure 2-1 Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

2.2 Delineation

The wetland indicators described above are used to determine the boundaries of the wetlands within the project area. These delineations are then illustrated by means of maps accompanied by descriptions.

2.3 Functional Assessment

Wetland Functionality refers to the ability of wetlands to provide healthy conditions for the wide variety of organisms found in wetlands as well as humans. Eco Services serves as the main factor contributing to wetland functionality.

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices (Kotze *et al*. 2008). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the services are provided (Table 2-1).

Table 2-1 Classes for determining the likely extent to which a benefit is being supplied

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

2.4 Present Ecological Status

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 Ecological Status (PES) score. This takes the form of assessing the spatial extent of impact of individual activities/occurrences and then separately assessing the intensity of impact of each activity in the affected area. The extent and intensity are then combined to determine an overall magnitude of impact. The Present State categories are provided in Table 2-2.

Table 2-2 The Present Ecological Status categories (Macfarlane, et al., 2008)

Impact Category	Description	Impact Score Range	PES
None	Unmodified, natural	0 to 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 may have taken place.	1.0 to 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.	2.0 to 3.9	C
Large	Largely Modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.0 to 5.9	D
Serious	Seriously Modified. The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognizable.	6.0 to 7.9	E
Critical	Critical Modification. The modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.0 to 10	F

2.5 Importance and Sensitivity

The importance and sensitivity of water resources is determined to establish resources that provide higher than average ecosystem services, biodiversity support functions or are particularly sensitive to impacts. The mean of the determinants is used to assign the Importance and Sensitivity (IS) category as listed in Table 2-3.

Table 2-3 Description of Importance and Sensitivity categories

IS Category	Range of Mean	Recommended Ecological Management Class
Very High	3.1 to 4.0	**A**
High	2.1 to 3.0	**B**
Moderate	1.1 to 2.0	**C**
Low Marginal	< 1.0	**D**

2.6 Ecological Classification and Description

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) will be considered for this study. This system comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis *et al.,* 2013).

2.7 Buffer Requirements

The "Preliminary Guideline for the Determination of Buffer Zones for Rivers, Wetlands and Estuaries" (Macfarlane *et al.,* 2014) was used to determine the appropriate buffer zone for the proposed activity.

3 Results and Discussion

3.1 Desktop Baseline

3.1.1 Project Area

The proposed solar project is located on the boarder of the North West and Limpopo provinces approximately 6 km west of Northam and approximately 14 km south-west of Thabazimbi, Limpopo Province. The project area is situated in the A24E quaternary catchment within the Limpopo Water Management Area (WMA) (see Figure 3-1).

3.1.2 Vegetation Types

The two feasibility areas are right next to each other, and it falls within the Savanna Biome as per the SANBI classification (Mucina and Rutherford, 2006; SANBI 2018). The Savanna Biome is the largest in southern Africa, occupying 46% of its area, and over one-third of the area of South Africa. The project areas are situated within the Dwaalboom Thornveld of the Savanna Biome (Mucina & Rutherford 2006, BGIS SANBI 2018).

3.1.2.1 Dwaalboom Thornveld (SVcb 1)

Dwaalboom Thornveld is restricted to Limpopo and North-West Provinces within flats north of the Dwarsberge and associated ridges west of the Crocodile River in the Dwaalboom area, including a patch around Sentrum. South of the ridges, it extends eastwards from the Nietverdiend area, north of the Pilanesberg to the Northam area at an altitude range of between 900 and 1,200 m AMSL. Its main vegetation and landscape features include plains with a layer of scattered, low to medium-high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species. There is a continuous herbaceous layer dominated by grass species.

3.1.2.2 Important Plant Taxa in Dwaalboom Thornveld

Based on Mucina and Rutherford's (2006) vegetation classification, important plant taxa are those species that have a high abundance, a frequent occurrence (not being particularly abundant) or are prominent in the landscape within a particular vegetation type. They note the following species are important taxa in the Dwaalboom Thornveld vegetation type:

Table 3-1 Important taxa in the Dwaalboom Thornveld vegetation type

Dwaalboom Thronveld vegetation unit (SVcb 1)	
Growth Form	**Species**
Trees	*Vachellia erioloba*, *Vachellia erubescens*, *Vachellia nilotica*, *Vachellia tortilis subsp heteracantha*, *Senegalia fleckii*, *Senegalia burkei*, *Searsia lancea*
Shrubs	*Diospyros lycioides subsp. lycioides, Grewia flava, Mystroxylon aethiopicum subsp. burkeanum, Agathisanthemum bojer*
Graminoids	*Aristida bipartite*, *Bothriochloa insculpta, Digitaria eriantha subsp eriantha*, *Ischaemum afrum*, *Panicum maximum and Cymbopogon pospischilii*

3.1.2.3 Conservation Status

According to Mucina and Rutherford (2006) Dwaalboom Thornveld is classified as Least Threatened. Although the target for conservation is 19%, only 6% of this vegetation type is currently under statutory conservation in reserves such as the Madikwe Game Reserve (approximately 150 km west of the project area). Cultivation and to a lesser extend urbanisation have resulted in the transformation of approximately 14% of Dwaalboom Thornveld and exotic invasive plants are present. Incidences of erosion are low to very low (Mucina & Rutherford, 2006).

3.1.3 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ea 70 land type. The Ea land type consists of one or more of the following soils: Vertic, Melanic and red structured diagnostic horizons, of which these soils are all undifferentiated.

The Rustenburg Layered Suite as well as the Bushveld Igneous Complex are present in this region with a lot of mafic intrusive rocks present. The underlying geology of this region is a granite-gneiss terrane (Archaean) and it is covered partly with chemical and clastic sediments and volcanics derived from Rayton and Silverton formation which both form part of the Pretoria Group. Vertic clays had developed in the area due to the presence of norite and gabbro rocks. The land types Ea and Ae are mostly present in these areas (Mucina and Rutherford, 2006).

3.1.4 Climate

The SVcb 1 vegetation type is characterised by a summer rainfall with a Mean Annual Precipitation (MAP) that ranges between 500 mm and 600 mm. Of the savanna vegetation units that are located outside Kalahari bioregions, this unit has the highest mean annual potential evaporation. In the winter season frost is frequent (Mucina & Rutherford, 2006).

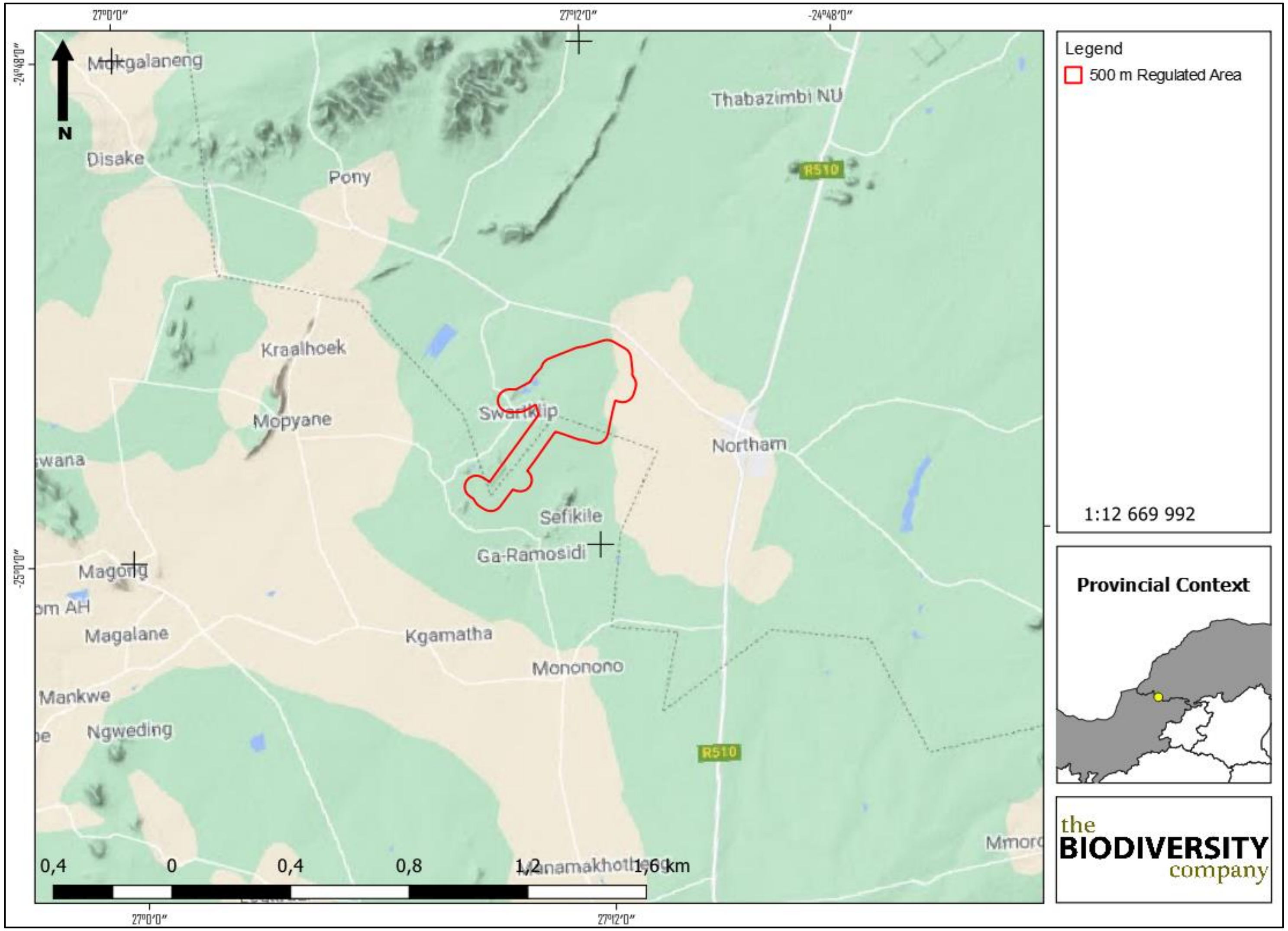

Figure 3-1 Location of the project area

3.1.5 South African Inventory of Inland Aquatic Ecosystems

This spatial dataset is part of the South African Inventory of Inland Aquatic Ecosystems (SAIIAE) which was released as part of the National Biodiversity Assessment (NBA 2018). National Wetland Map 5 includes inland wetlands and estuaries, associated with river line data and many other data sets within the South African Inventory of Inland Aquatic Ecosystems (SAIIAE, 2018).

Three wetland types were identified by means of this data set, including a channelled valley bottom wetland, a couple of depressions and a hillslope seep (see Figure 3-2). The conditions of these wetlands are classified as "D/E/F" (heavily/critically modified).

3.1.6 National Freshwater Ecosystem Priority Area Status

In an attempt to better conserve aquatic ecosystems, South Africa has categorised its river systems according to set ecological criteria (i.e., ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al.,* 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

Figure 3-2 shows the location of the project area in relation to wetland FEPAs. Based on this information, the project area does not overlap with a FEPA river or wetland.

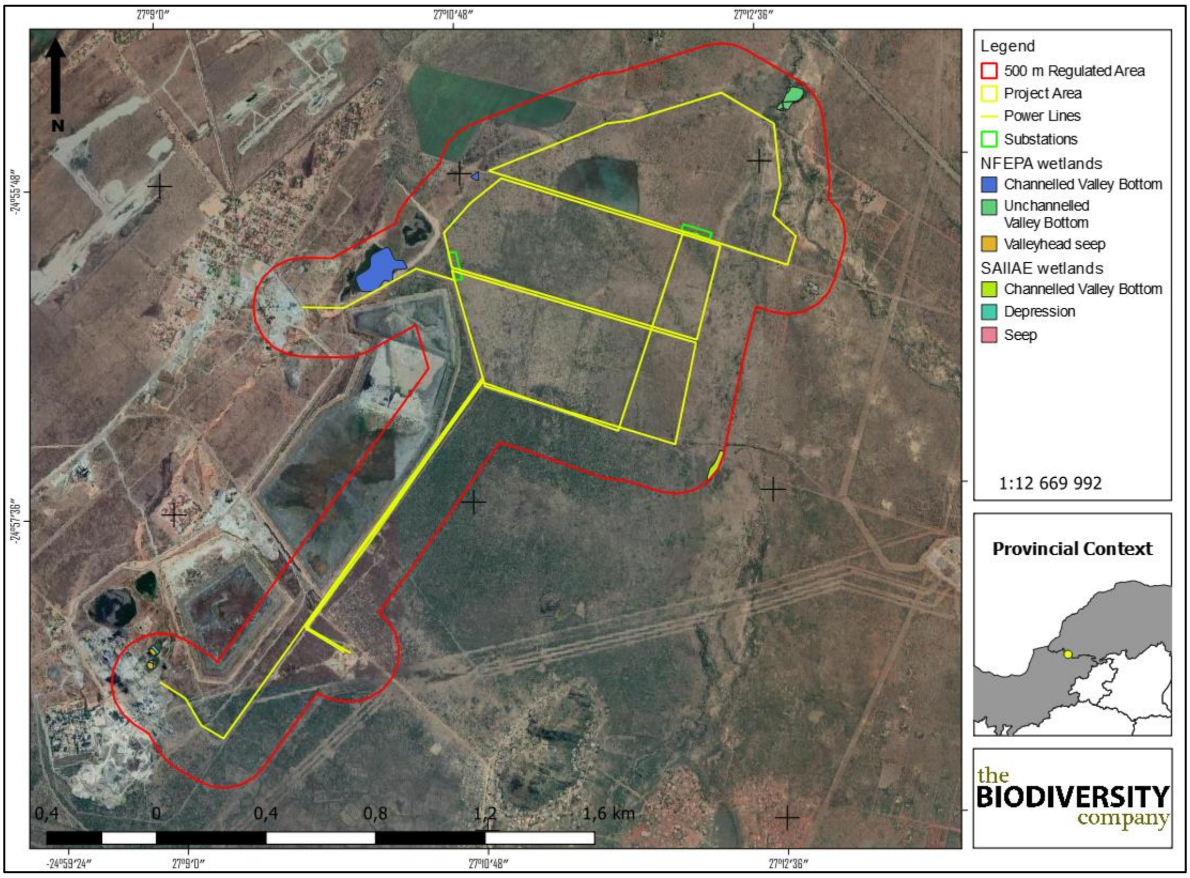

Figure 3-2 SAIIAE and NFEPA wetland areas located within 500 m regulated area

3.1.7 Topographical Inland Water and River lines

The topographical inland and river line data for "2427" quarter degree was used. This data set indicates multiple inland water areas such as dams and large reservoirs as well as various non-perennial river lines located within the 500 m regulated area. These areas indicate potential wetland areas (see Figure 3-3).

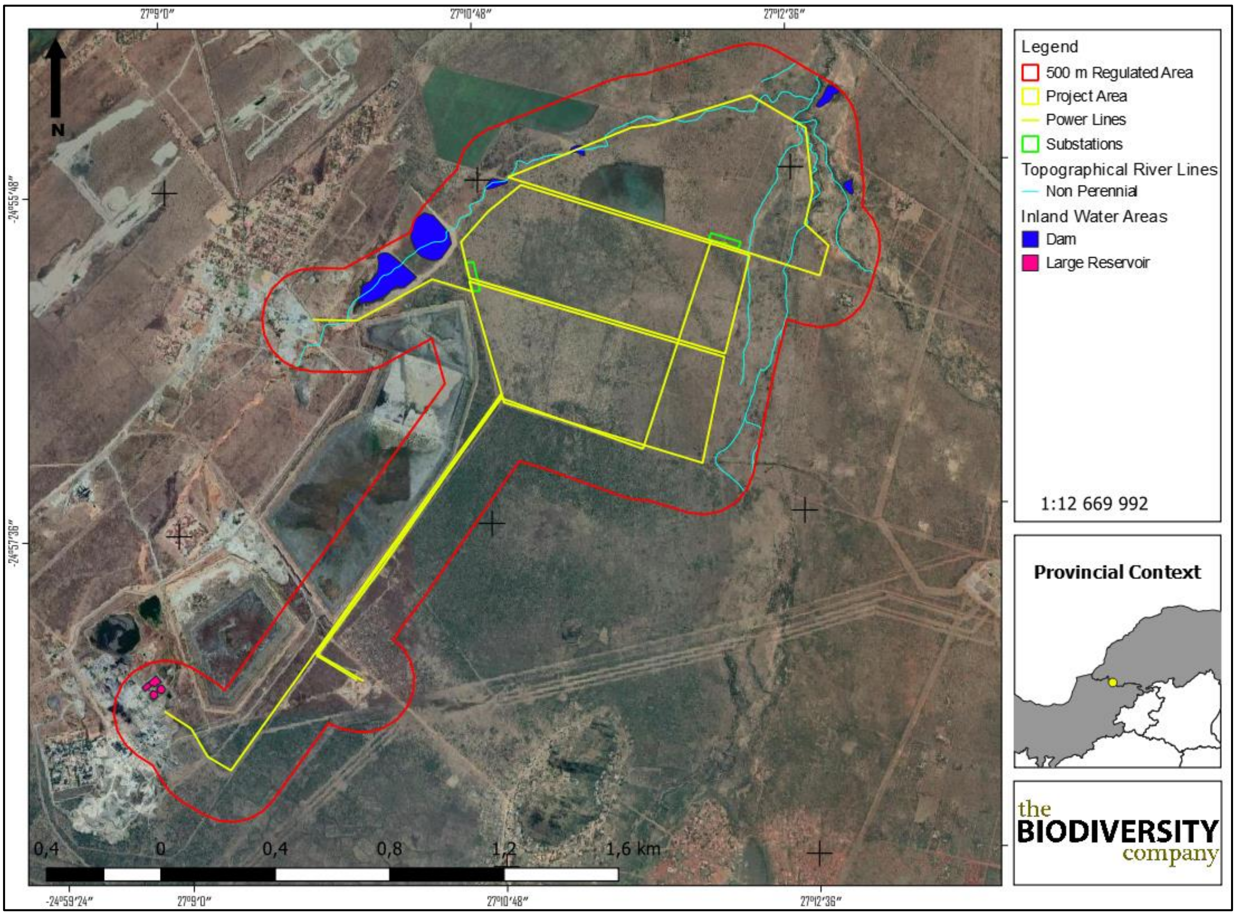

Figure 3-3 Topographical River Lines and Inland Water Areas located within the 500 m Regulated Area

3.1.8 Terrain

The terrain of the 500 m regulated area has been analysed to determine potential areas where wetlands are more likely to accumulate (due to convex topographical features, preferential pathways, or more gentle slopes).

3.1.8.1 Digital Elevation Model (DEM)

A Digital Elevation Model (DEM) has been created to identify lower laying regions as well as potential convex topographical features which could point towards preferential flow paths. The 500 m regulated area ranges from 975 to 1068 metres above sea level (MASL). The lower laying areas (generally represented in dark blue) represent the area that will have the highest potential to be characterised as wetlands (see Figure 3-4).

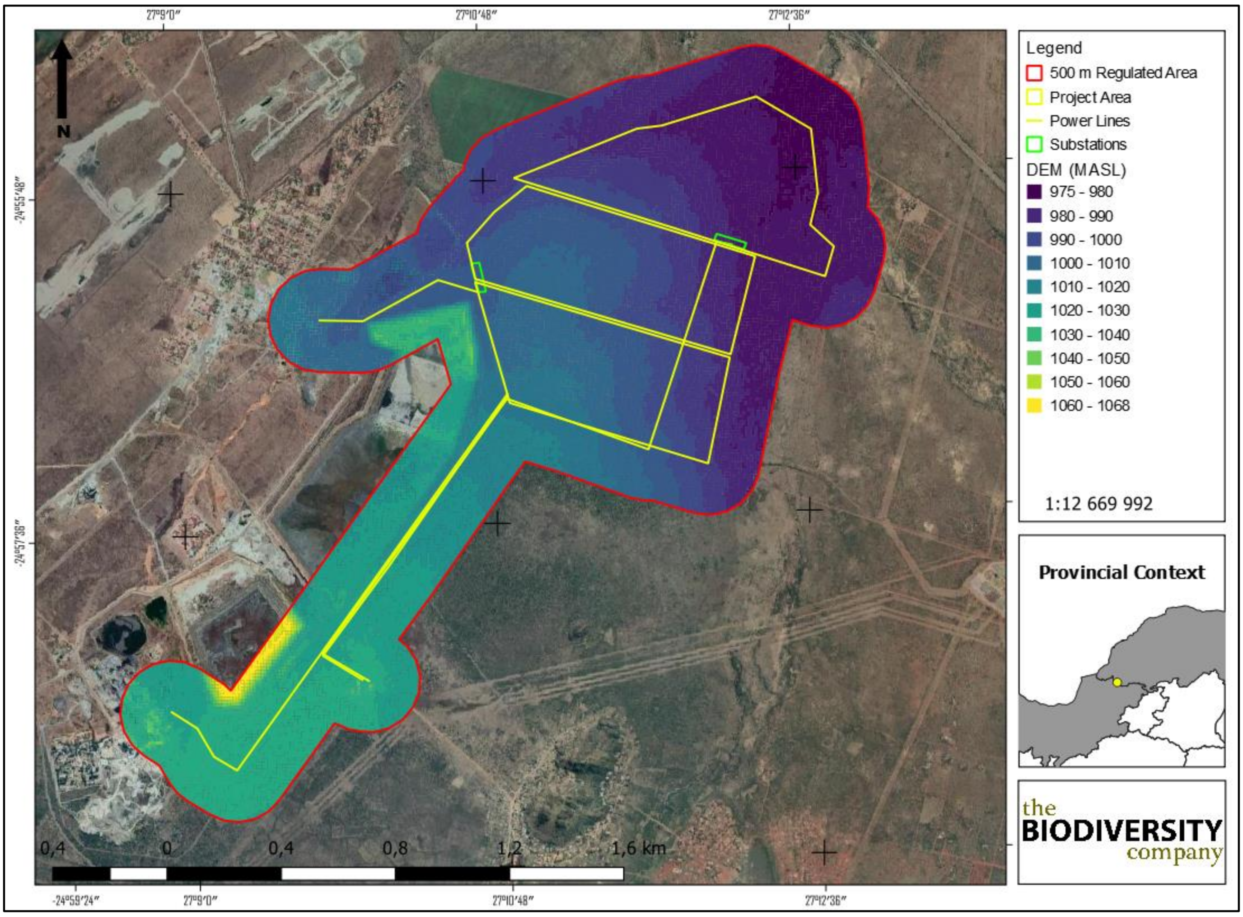

Figure 3-4 Digital Elevation Model of the 500 m regulated area

3.1.8.2 Slope

The slope percentage of the 500 m regulated area is illustrated in Figure 3-5. The slope percentage ranges from 0 to 48.5% due to the mining activities located inside the 500 m regulated area. Most of the 500 m regulated area is characterised by slopes ranging between 0 – 3% which classifies the area as gently sloped. Besides the fact that hillslope seeps are likely to occur on any slope percentage, wetlands in general tend to accumulate in flatter areas.

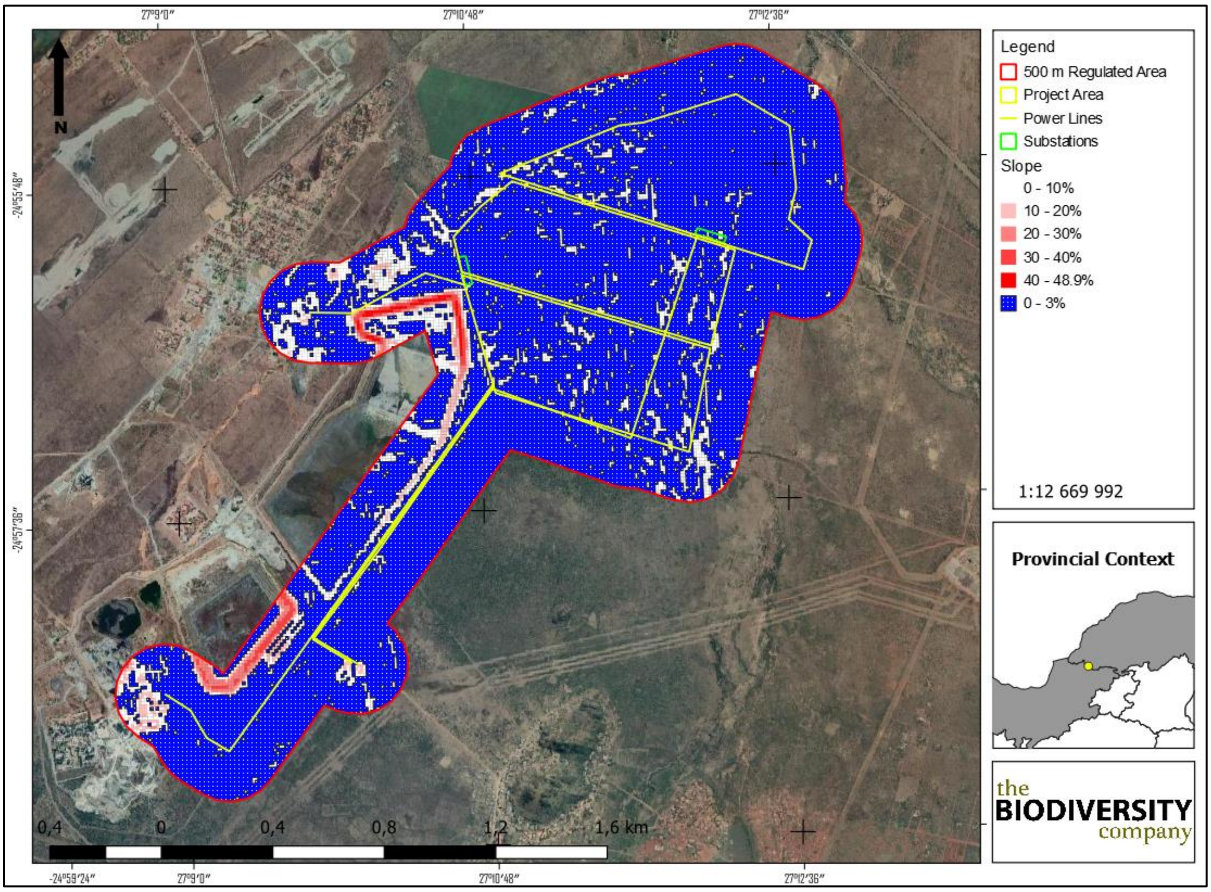

Figure 3-5 The slope percentage of the 500 m regulated area

3.1.9 Literature Review

ENVASS conducted an updated biodiversity assessment for the Siyanda Bakgatla development that were conducted in 2020 is based on a 2006 baseline study conducted by Engelbrecht and Grosel (2006). Six (6) habitat units were delineated for the project, these include 1) Historically Cultivated, 2) Mixed Bushveld, 3) Tailing Storage Facility (TSF)/Waste Rock Dump (WRD), 4) Urban/Mining Area, 5) Vachellia Thornveld and 6) Watercourses (Figure 3-6).

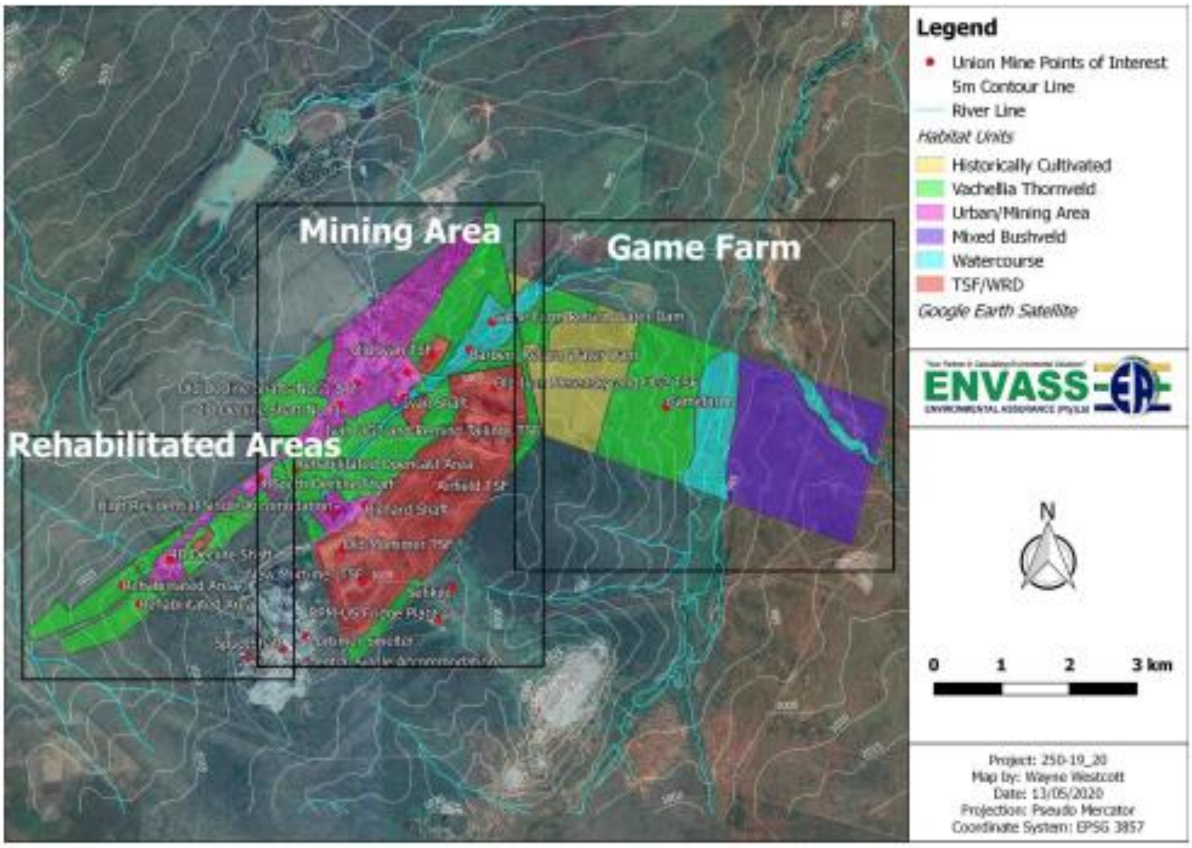

Figure 3-6 Map illustrating the delineated habitats according to the literature review

3.2 Field Assessment

3.2.1 Delineation and Description

During the site visit, four HGM units were identified within the 500 m regulated area (see Figure 3-8). The wetland areas were delineated in accordance with the DWAF (2005) guidelines (see Figure 3-7 and Figure 3-8). Three HGM units have been identified as unchannelled valley bottom wetlands and the other as a hillslope seep wetland. Along with the wetlands multiple drainage features as well as artificial wetlands and a few dams were also delineated. Although these systems do not classify as a wetland system it is important to note where they are and to preserve them.

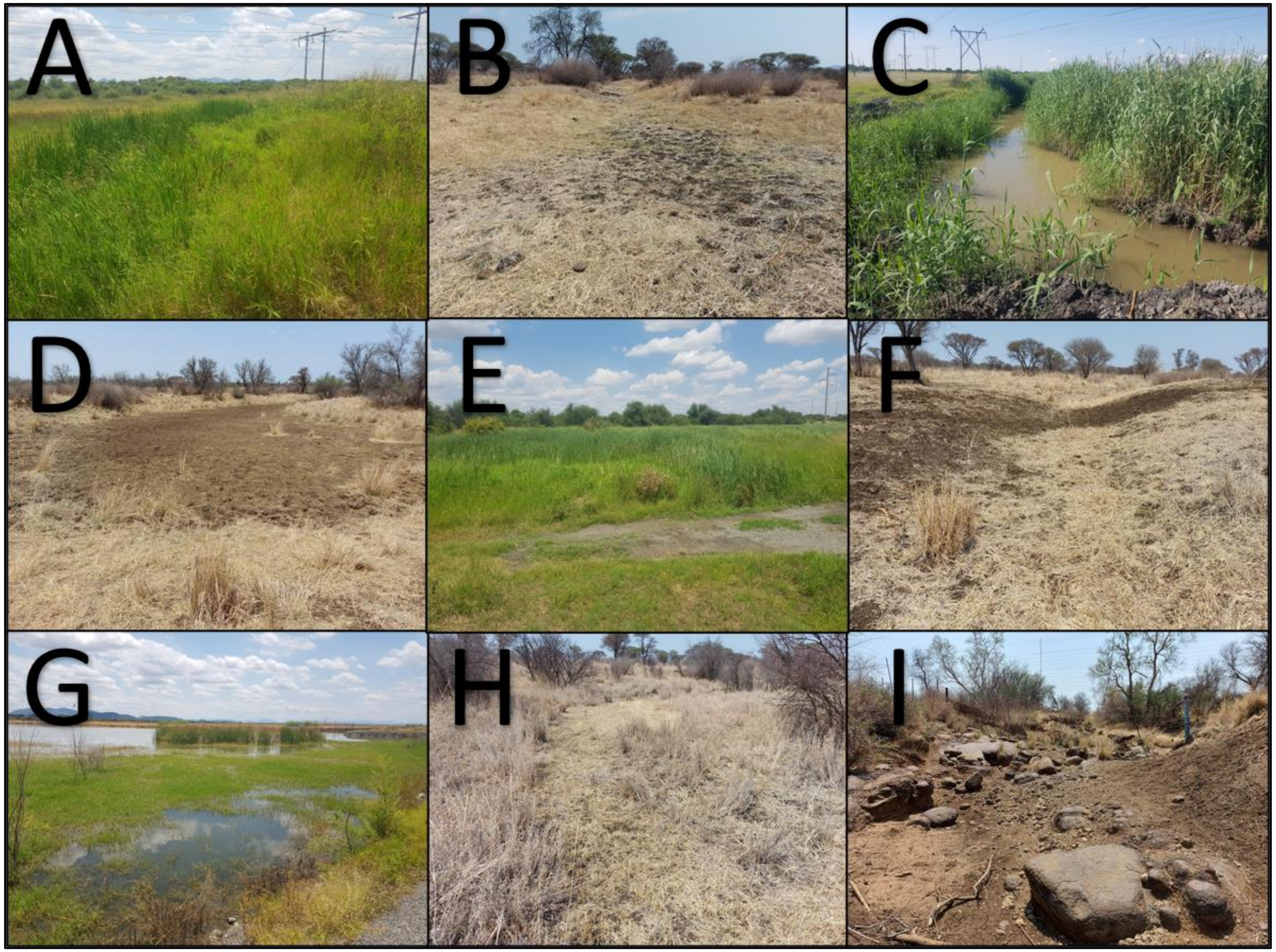

Figure 3-7 Photographical evidence of the different wet areas found within the 500 m regulated area, A - F) unchannelled valley bottom wetlands, G) Dam, and I) Drainage feature

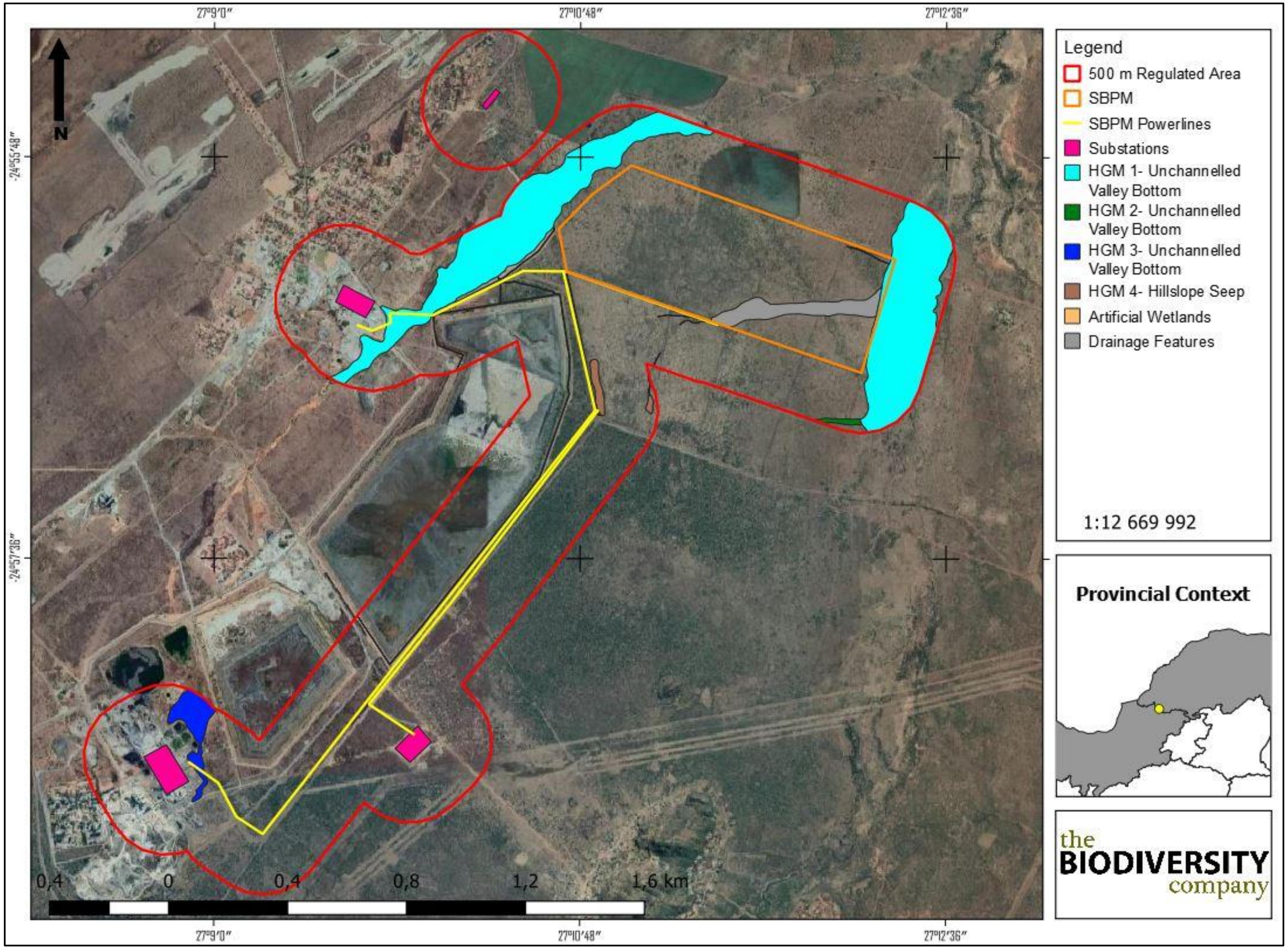

Figure 3-8 ***Delineation and location of the different HGM units identified within the 500 m regulated area***

3.2.2 Unit Setting

Unchanneled valley bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows. Figure 3-9 presents a diagram of the relevant HGM unit, showing the dominant movement of water into, through and out of the system.

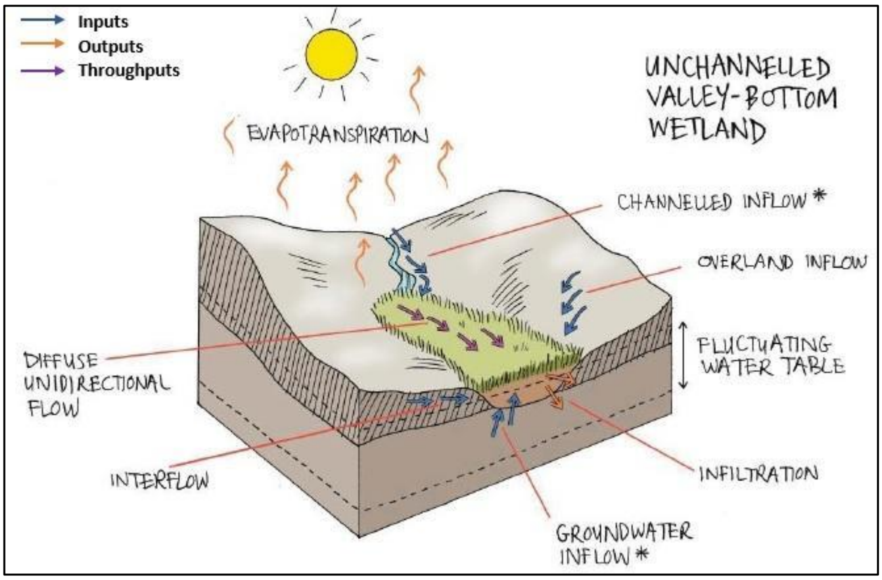

Figure 3-9 Amalgamated diagram of a typical unchanneled valley bottom, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

The hillslope seeps are located within slopes. Isolated hillslope seeps are characterised by colluvial movement of material. These systems are fed by very diffuse sub-surface flows which seep out at very slow rates, ultimately ensuring that no direct surface water connects this wetland with other water courses within the valleys. Figure 3-10 illustrates a diagram of the hillslope seeps, showing the dominant movement of water into, through and out of the system.

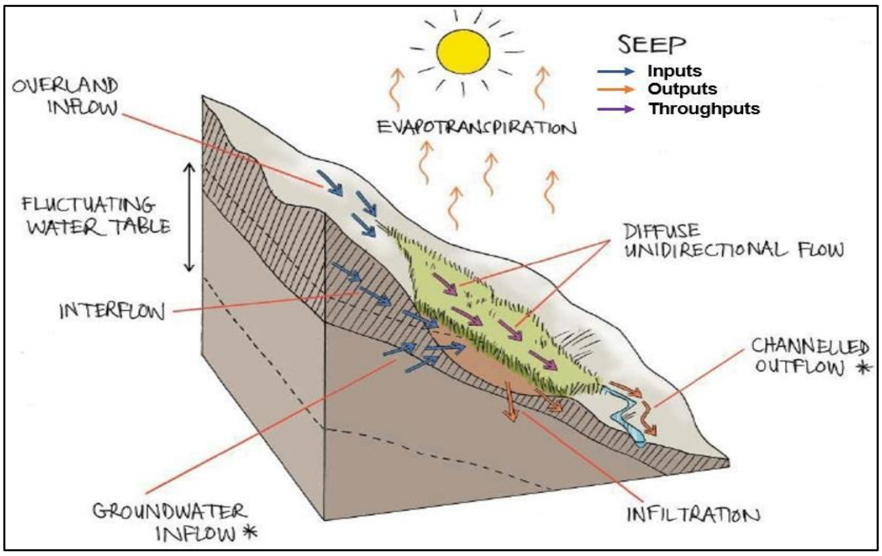

Figure 3-10 Amalgamated diagram of a typical hillslope seep, highlighting the dominant water inputs, throughputs and outputs, SANBI guidelines (Ollis et al. 2013)

3.2.3 Indicators

3.2.3.1 Hydromorphic Soils

According to (DWAF, 2005), soils are the most important characteristic of wetlands in order to accurately identify and delineate wetland areas. Two dominant soil forms were identified within the identified wetland, namely the Rensburg and Arcadia soil forms (see Figure 3-11) (Soil Classification Working Group, 2018).

The Rensburg soil form consists of a vertic topsoil on top of a gley horizon. The soil family group identified for the Rensburg soil form on-site has been classified as the "1000" soil family due to the non-calcareous nature of the gley horizon.

The Arcadia soil form consists of a vertic topsoil on top of a lithic horizon. The soil family group identified for the Arcadia soil form on-site has been classified as the "1100" soil family given dark topsoil colours, the lack of lime and the geolithic properties of the lithic horizon.

Vertic topsoil have high clay content with smectic clay particles being dominant (Soil Classification Working Group, 2018). The smectic clays have swell and shrink properties during wet and dry periods respectively. Peds will be shiny, well-developed with a highly plastic consistency during wet periods as a result of the dominance of smectic clays. During shrinking periods, cracks form on the surface and rarely occurs in shallow vertic clays.

Gley horizons that are well developed and have homogenous dark to light grey colours with smooth transitions. Stagnant and reduced water over long periods is the main factor responsible for the formation of a gley horizon and could be characterised by green or blue tinges due to the presence of a mineral called Fougerite which includes sulphate and carbonate complexes. Even though grey colours are dominant, yellow and/or red striations can be noticed throughout a gley horizon. The structure of a gley horizon mostly is characterised as strong pedal, with low hydraulic conductivities and a clay texture, although sandy gley horizons are known to occur. The gley soil form commonly occurs at the toe of hillslopes (or benches) where lateral water inputs (sub-surface) are dominant and the underlaying geology is characterised by a low hydraulic conductivity. The gley horizon usually is second in diagnostic sequence in shallow profiles yet is known to be lower down in sequence and at greater depths (Soil Classification Working Group, 2018).

For the Lithocutanic horizon, *in situ* weathering of rock underneath a topsoil resulting in a well-mixed soil-rock layer. The colour, structure and consistency of this material must be directly related to the parent material of the weathered rock. The Lithocutanic horizon is usually followed by a massive rock layer at shallow depths. Hard rock, permeable rock and horizontally layered shale usually is not associated with the weathering processes involved with the formation of this diagnostic horizon.

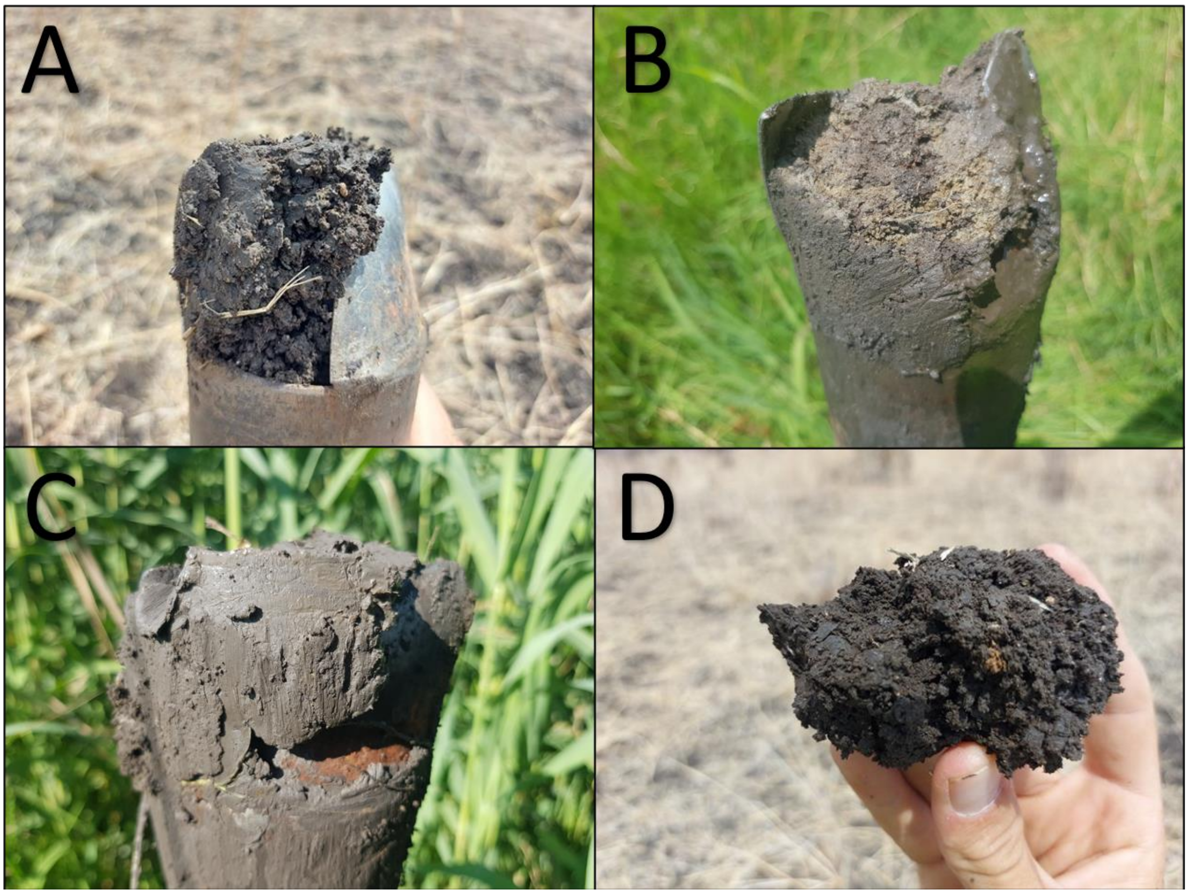

Figure 3-11 Different soil forms found inside the wetlands, A) Vertic topsoil of the Rensburg soil form. B) Gleyic horizon with signs of wetness. C) Gley horizon of the Rensburg soil form. D) Vertic topsoil with some mottling

3.2.3.2 Hydrophytes

Vegetation plays a considerable role in identifying, classifying and accurately delineating wetlands (DWAF, 2005). During the site visit, various hydrophytic species were identified (including facultative species). Examples include *Phragmites australis, Typha capensis, Schoenoplectus spp.* and *Imperata cylindrica.* (See Figure 3-12).

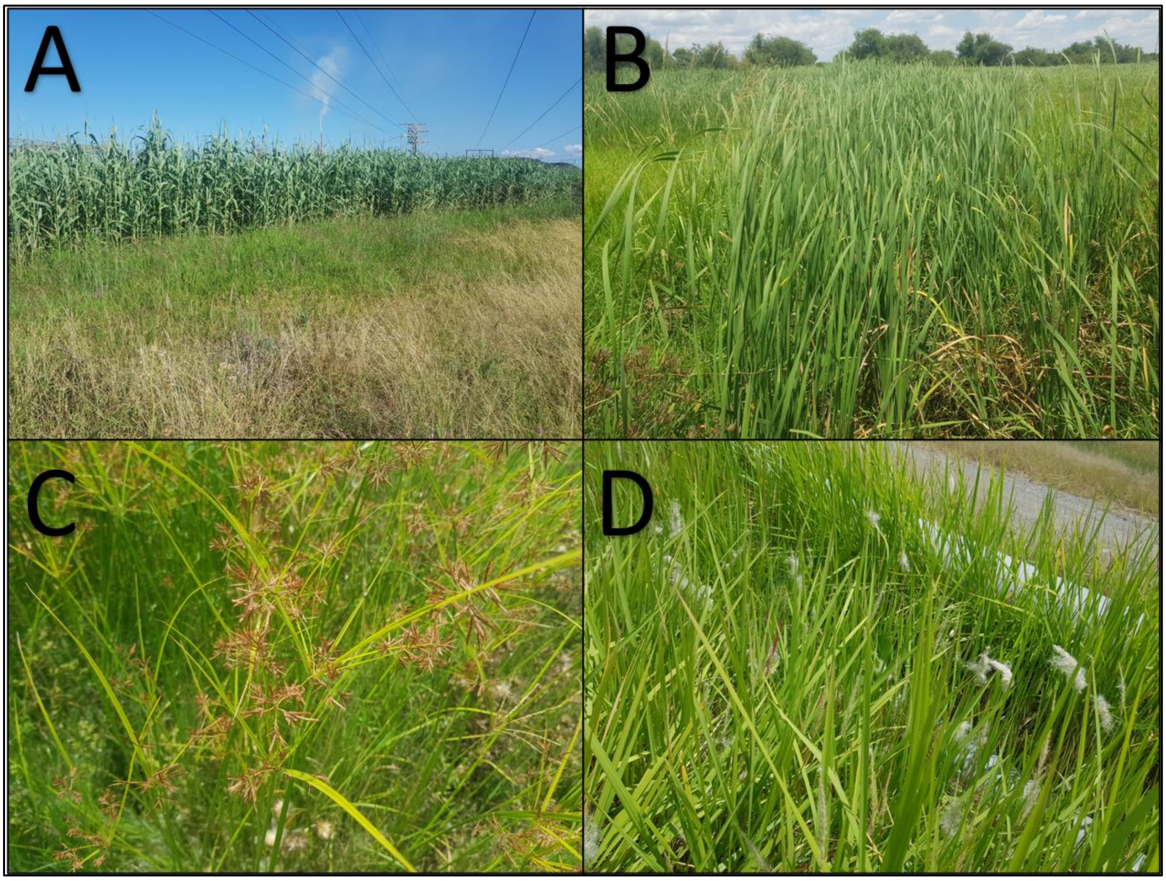

Figure 3-12 Hydrophytic vegetation identified within delineated watercourses. A) Phragmites australis. B) Typha capensis. C) Schoenoplectus spp. D) Imperata cylindrica

3.2.4 General Functional Description

Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration (Kotze *et al.,* 2009).

Hillslope seeps are well documented by Kotze *et al*., 2009 to be associated with sub-surface ground water flows. These systems tend to contribute to flood attenuation given their diffuse nature. This attenuation only occurs while the soil within the wetland is not yet fully saturated. The accumulation of organic material and sediment contributes to prolonged levels of saturation due to this deposition slowing down the sub-surface movement of water. Water typically accumulates in the upper slope (above the seep). The accumulation of organic matter additionally is essential in the denitrification process involved with nitrate assimilation. Seeps generally also improve the quality of water by removing excess nutrient and inorganic pollutants originating from agriculture, industrial or mine activities. The diffuse nature of flows ensures the assimilation of nitrates, toxicants and phosphates as well provides erosion control. These Eco Services are not provided by the wetland given the nature of the typical seep's position on slopes.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique and therefore, the ecosystem services rated high for these systems on site might differ slightly to those expectations.

3.2.5 Ecological Functional Assessment

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al.,* 2008). HGM units 1,2 & 4 scored "Intermediate" ecosystem service scores with HGM 3 scoring "Moderately High". The average ecosystem service scores for the delineated systems are illustrated in Table 3-2 and Figure 3-13.

Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation, erosion control, biodiversity maintenance and tourism and recreation.

Table 3-2 Average ecosystem service scores for delineated wetlands

Moderately High	Intermediate
HGM 3	HGM 1
	HGM 2
	HGM 4

HGM 3 scored a higher ecosystem services score than the rest of the wetlands due to the pollution from the active mine running into the system. This together with the higher volumes of hydrophyte vegetation increased the assimilation potential of the HGM unit. HGM 3 is also classified as being an unchannelled valley bottom which is known for their flood attenuation, streamflow and sediment trapping that is important to ensure the structural and geomorphological integrity of the watercourse/s downstream.

The vegetation cover plays an important role to ensure that the flood attenuation, streamflow and sediment trapping within the wetlands remain intact. Hydrophyte vegetation help to diffuse the flow of water and thus prevents sediments from flowing downstream helping to keep downstream areas clean.

Biodiversity maintenance is directly associated with the amounts and types of habitats identified within a wetland (i.e., grassland, stream networks, marsh etc). The integrity of densely vegetated areas is important to the conservation of fauna and flora species, but also ensures a natural buffer zone which shields the wetland from aeolian forces.

During the site visit it was observed that HGM 1, 2 & 4 have less vegetation cover compared to that of HGM 4 which affects the wetlands ecosystem services scores. The wetlands are also located in more natural areas where less pollution occurs. Theses HGM units do not receive high volumes of water through runoff from active mining practise and thus plays a smaller role in nutrient assimilation and water quality enhancement.

These HGM units however still play an important role in the ecosystems due to their ability to regulate streamflow and help with flood attenuation during the rainy seasons. The wetland will also play a role in biodiversity maintenance by providing important habitats for charismatic species as well as provide resources for human use.

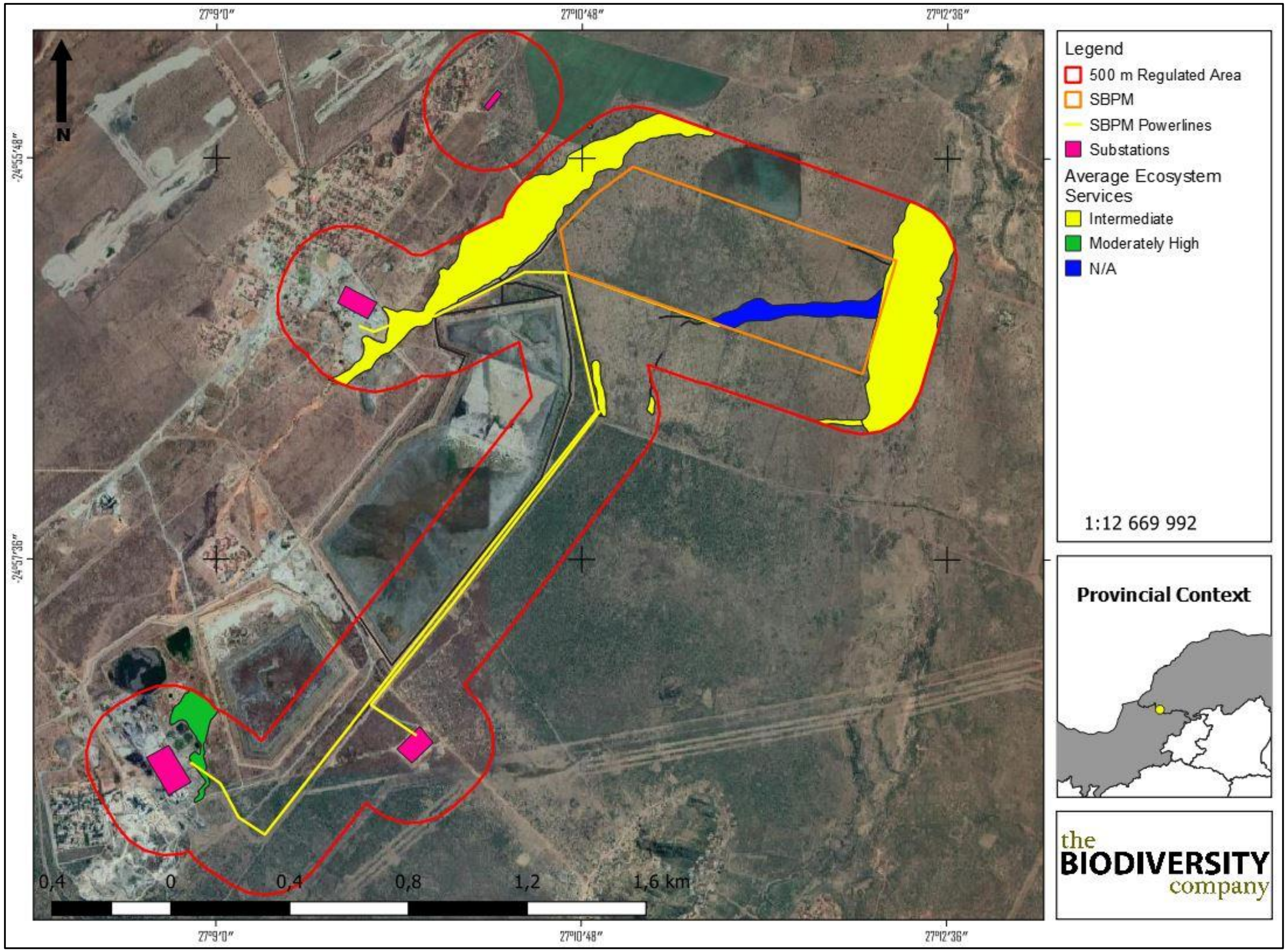

Figure 3-13 Average ecosystem service scores for the delineated wetland systems

3.2.6 The Ecological Health Assessment

The PES for the assessed HGM units is presented in Table 3-3 and Figure 3-14. The delineated wetland systems have scored overall PES ratings ranging between “Largely Modified” (class D) to “Seriously Modified” (class E).

The wetlands that were rated as “Largely Modified” are located in the more natural areas of the project area within the game farm. Although the wetlands are located within more natural areas, multiple anthropogenic impacts still occur on the systems. These systems are characterised by overgrazing and trampling by game as well as the building of fences and roads through the wetlands. There is mining going on within the catchment of the wetlands which will also alter the ecological state of the wetlands.

The wetlands that were rated as being “Seriously Modified” are located close to development with some development taking place within the wetland boundary. During the site visit evidence was seen of excavating taking place within the wetland as well as trucks driving through the wetlands. These will remove the hydrophyte vegetations as well as compress the soils inside the wetland altering its ecological state.

Table 3-3 Average present ecological state of the wetlands

Largely Modified	Seriously Modified
HGM 1	HGM 2
	HGM 3
	HGM 4

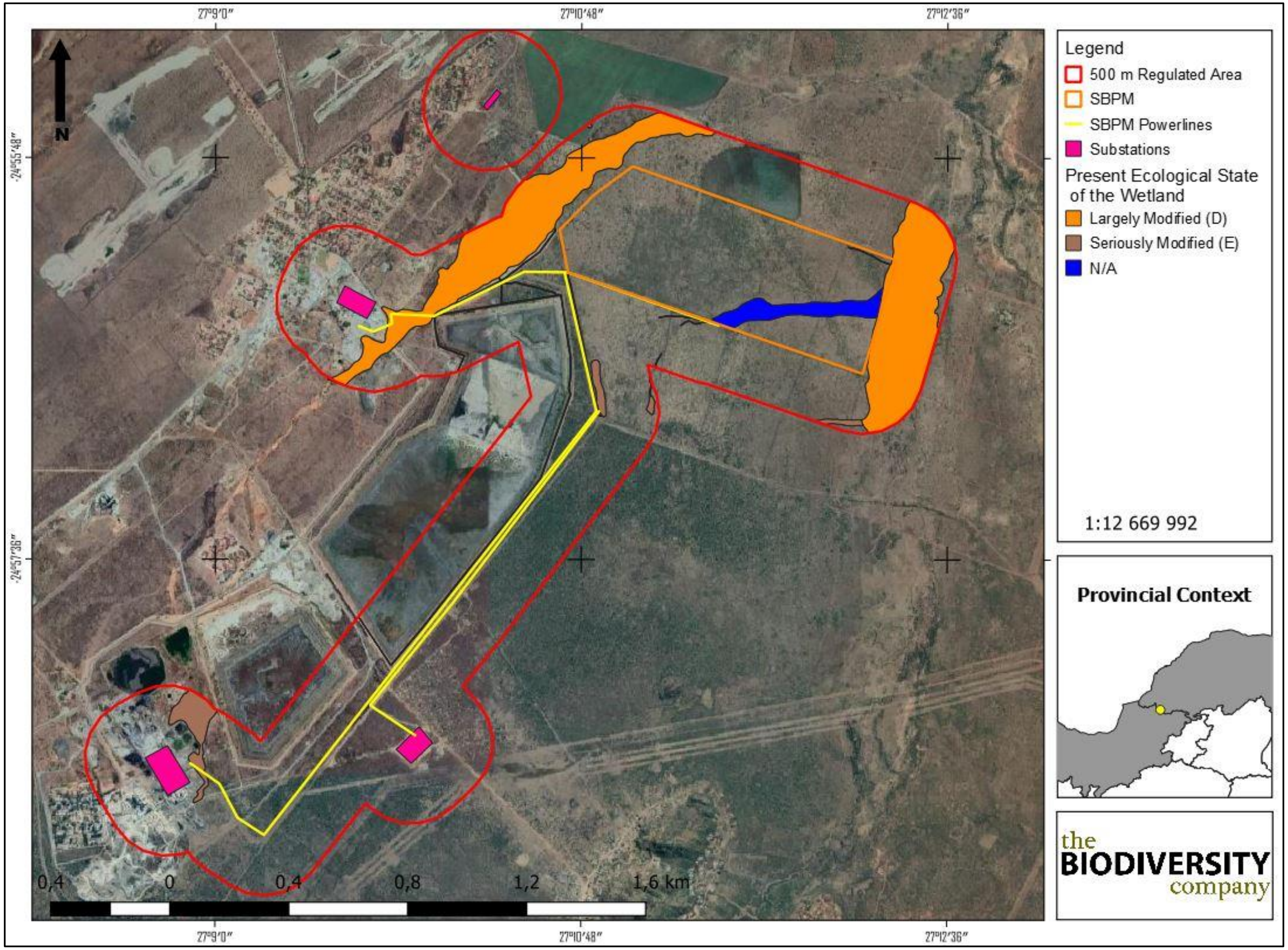

Figure 3-14 Overall present ecological state of delineated wetlands

3.2.7 The Importance & Sensitivity Assessment

The results of the ecological IS assessment are shown in Table 3-4. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection status and the protection status of the wetland itself considering the NBA wetland data set. The IS for all the unchannelled valley bottom HGM units have been calculated to be “Moderate”, which combines the moderate protection status of the wet veg type and the low protection status of the wetland itself. The IS of the hillslope seep HGM unit have been calculated to be “Low” due to the low protection for both the wet veg and the wetland itself.

Table 3-4 The IS results for the delineated HGM unit

HGM Type	Wet Veg			NBA Wetlands			SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
HGM 1 - 3	Central Bushveld Group 2	Vulnerable	Moderately Protected	D/E/F Seriously Modified	Critical	Not Protected	N	**Moderate**
HGM 5	Central Bushveld Group 2	Least Threatened	Poorly Protected	D/E/F Seriously Modified	Critical	Not Protected	N	**Low**

3.2.8 Buffer Requirements

The scientific buffer calculation (Macfarlane *et al*., 2014) was used to determine the size of the buffer zones relevant to the proposed development of the PV and substations as well as for the proposed powerlines. The buffer size for both the development and the powerlines were determined to be 15 m post mitigation (see Table 3-5 and Figure 3-15).

Table 3-5 Pre- and post-mitigation buffer requirements

Aspect	Pre-Mitigation Buffer Size (m)	Post Mitigation Buffer Size (m)
PV and Substation	36	15
Powerlines	30	15

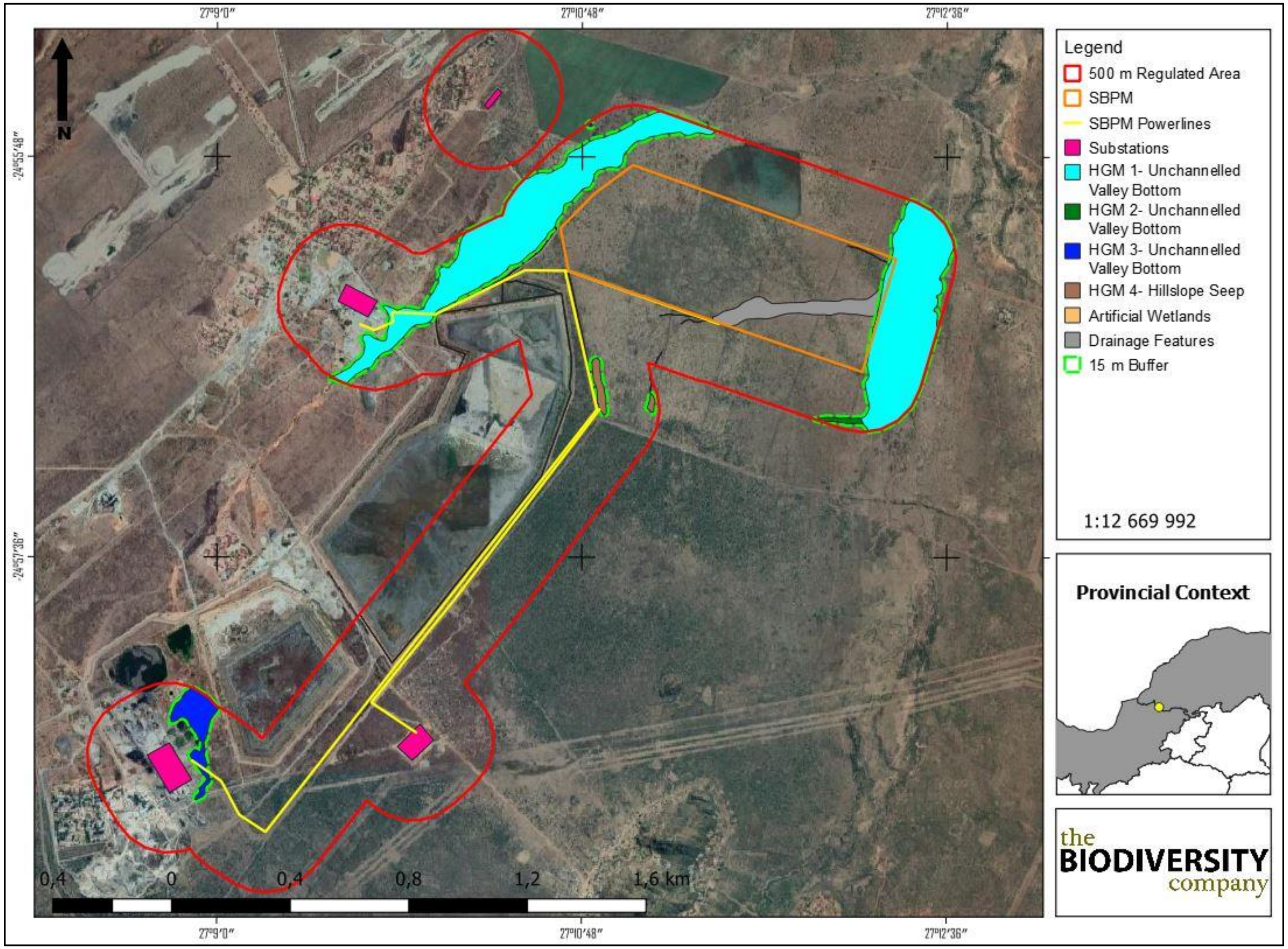

Figure 3-15 Recommended 15 m buffer zone for the delineated wetlands

4 Risk Assessment

4.1 Potential Impacts

The impact assessment considered both direct and indirect impacts, if any, to the wetland system. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) will be considered for this component of the study (Figure 4-1). In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and phasing to avoid impacts. Figure 4-2 below indicates that avoidance will be possible.

Three levels of risk have been identified and considered for the overall risk assessment, these include high, medium and low risks. The high risks refer to the wetlands directly impacted by die PV solar panels themselves these risks can be avoided by placing the PVs outside the wetland buffer. Medium risk refers to wetland areas that are either directly affected or on the periphery of the infrastructure and at an indirect risk. These risks are associated with powerlines crossing over wetlands as well as the PV located over drainage features identified within the 500 m regulated area. Low risks are wetland systems beyond the project area that would be avoided, or wetland areas that could be avoided if feasible. The medium risks were the priority for the risk assessment, focussing on the expected potential for these indirect risks. The significance of all post-mitigation risks was determined to be low.

For this project we will focus on using the first step in the hierarchy which is the avoidance of the impacts on the wetland. Due to the fact that direct and indirect impacts will degrade delineated wetland systems, a risk assessment has been compiled to determine the potential risk towards sensitive receptors.

Table 6-1 illustrates various aspects that are expected to impact upon the delineated wetlands during the construction and operational phase.

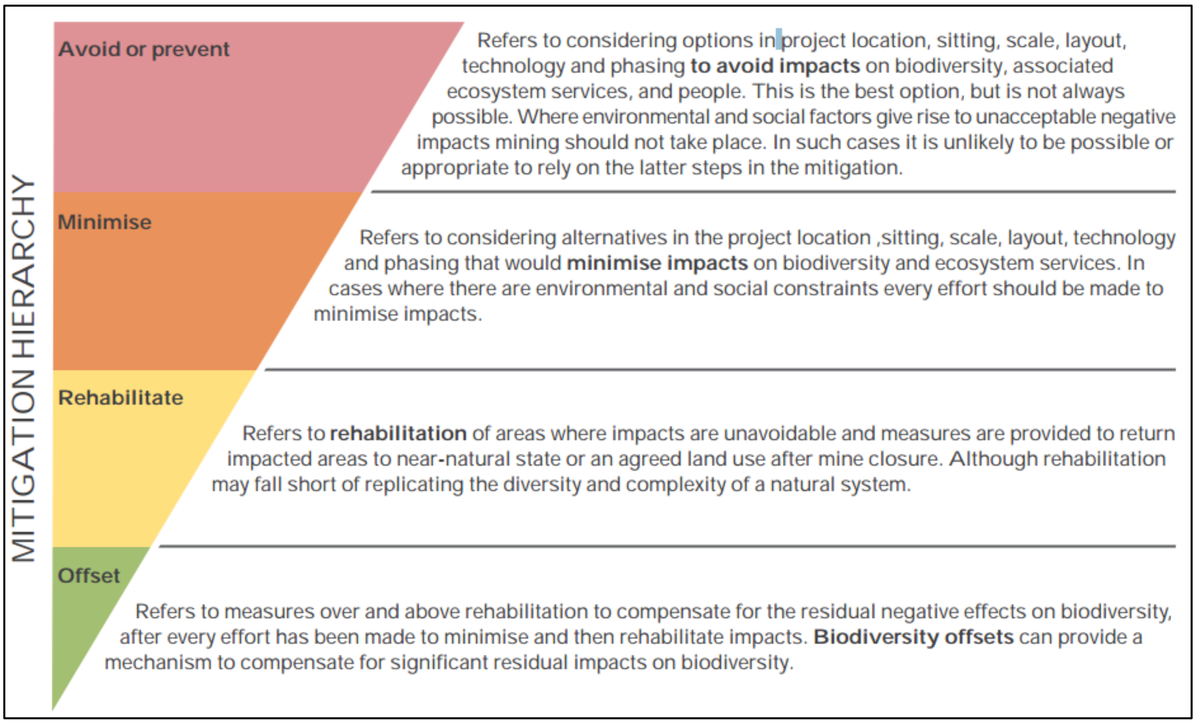

Figure 4-1 The mitigation hierarchy as described by the DEA (2013)

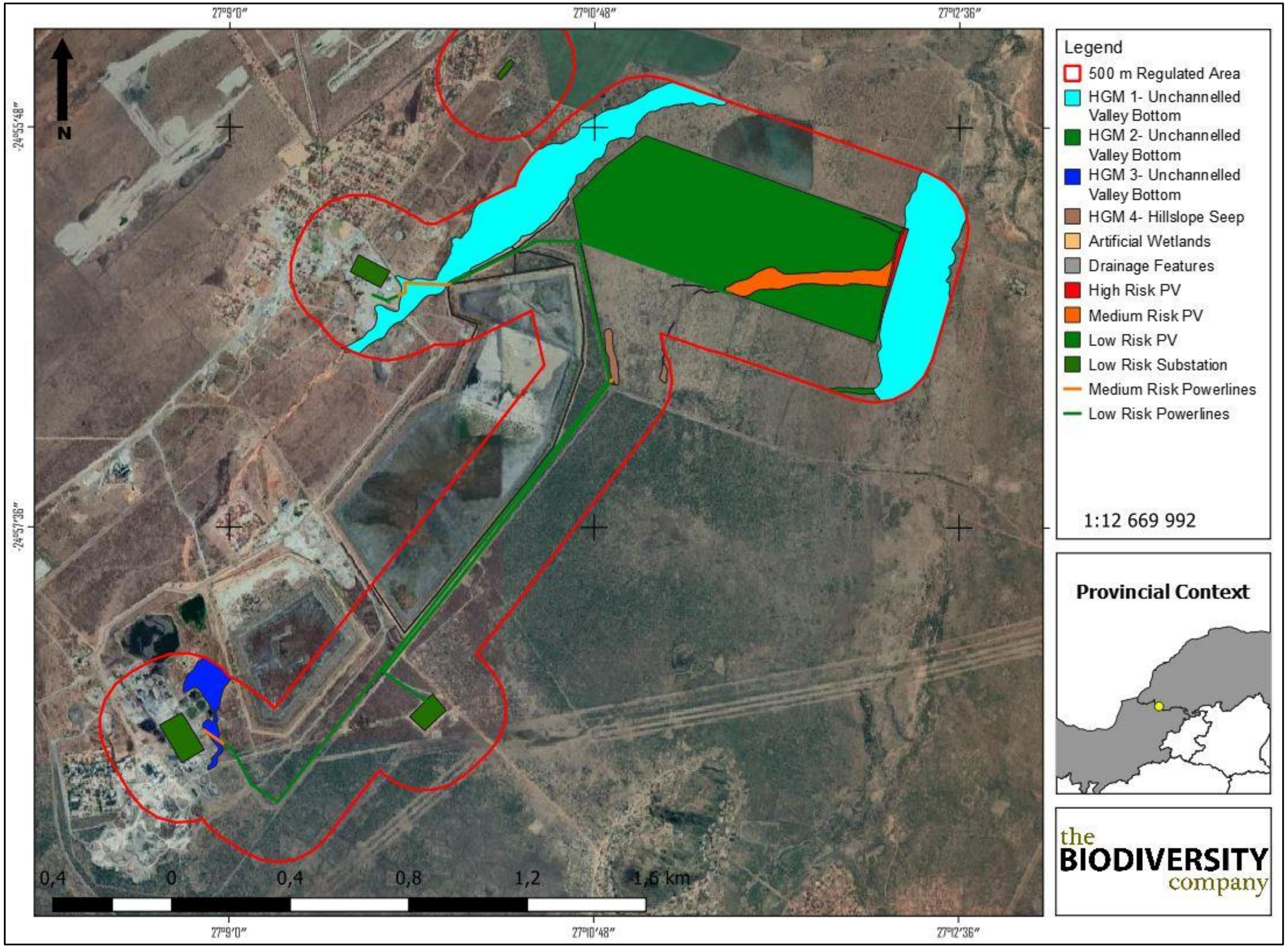

Figure 4-2 The identified risk areas

Table 4-1 Impacts assessed for the proposed project

Activity	Aspect	Impact
Construction Phase	Clearing of vegetation	• Altered surface flow dynamics; • Erosion; • Alteration of sub-surface flow dynamics; • Sedimentation of the water resource; • Direct and indirect loss of wetland areas; • Water quality impairment; • Compaction; • Decrease in vegetation; • Change of drainage patterns; • Altering hydromorphic properties; and • Indirect loss of wetland areas.
	Stripping and stockpiling of topsoil	
	Establish working area	
	Digging of sump (lining)	
	Drilling of hole	
	Water use for drilling	
	Vehicle access	
	Leaks and spillages from machinery, equipment & vehicles	
	Solid waste disposal	
	Human sanitation& ablutions	
	Re-fuelling of machinery and vehicles	
	Laying of core samples	
	Backfill of material	
Operational Phase	Traffic	
	Drilling Activities	
	Waste Disposal	
Decommissioning Phase	Removal of structures, machinery and equipment	
	Sealing borehole with cement	
	Rehabilitation of site to agreed land use	

Table 4-2 DWS Risk Impact Matrix for the proposed project

Aspect	Flow Regime	Water Quality	Habitat	Biota	Severity	Spatial scale	Duration	Consequence
Construction Phase (PV site, Substations and Pipeline)								
Clearing of vegetation	5	5	5	5	5	3	2	10
Stripping and stockpiling of topsoil	5	5	5	5	5	2	2	9
Establish working area	5	5	5	5	5	1	1	7
Digging of sump (lining)	5	5	5	5	5	2	1	8
Drilling of hole	5	5	5	5	5	2	1	8
Water use for drilling	5	5	5	5	5	2	1	8
Vehicle access	5	5	5	5	5	2	1	8
Leaks and spillages from machinery, equipment & vehicles	5	5	5	5	5	2	1	8
Solid waste disposal	5	5	5	5	5	2	1	8
Human sanitation& ablutions	5	5	5	5	5	2	1	8
Re-fuelling of machinery and vehicles	5	5	5	5	5	1	1	7
Laying of core samples	5	5	5	5	5	1	1	7
Backfill of material	5	5	5	5	5	2	2	9
Operational Phase (PV site, Substations and Pipeline)								
Traffic	1	2	1	3	1,75	2	5	8,75
Drilling Activities	1	2	2	2	1,75	1	4	6,75
Waste Disposal	1	2	2	2	1,75	1	4	6,75
Decommissioning Phase (PV site, Substations and Pipeline)								
Removal of structures, machinery and equipment	1	2	1	2	1,5	2	1	4,5
Rehabilitation of site to agreed land use	1	2	1	2	1,5	2	1	4,5

Table 4-3 DWS Risk Impact Matrix for the proposed project continued

Aspect	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Sig.	Without Mitigation	With Mitigation
Construction Phase								
Clearing of vegetation	1	2	5	1	9	90	Moderate	Low
Stripping and stockpiling of topsoil	3	3	1	3	10	90	Moderate	Low
Establish working area	1	2	1	2	6	42	Low	Low
Digging of sump (lining)	1	2	1	2	6	48	Low	Low
Drilling of hole	3	2	1	4	10	80	Moderate	Low
Water use for drilling	1	2	1	1	5	40	Low	Low
Vehicle access	2	2	1	2	7	56	Moderate	Low
Leaks and spillages from machinery, equipment & vehicles	2	2	1	3	8	64	Moderate	Low
Solid waste disposal	2	2	1	2	7	56	Moderate	Low
Human sanitation& ablutions	2	2	1	2	7	56	Moderate	Low
Re-fuelling of machinery and vehicles	2	2	1	2	7	49	Low	Low
Laying of core samples	2	2	1	2	7	49	Low	Low
Backfill of material	1	2	1	2	6	54	Low	Low
Operational Phase								
Traffic	2	1	1	1	5	43,75	Low	Low
Drilling Activities	5	1	1	1	8	54	Low	Low
Waste Disposal	3	1	1	1	6	40,5	Low	Low
Decommissioning Phase								
Removal of structures, machinery and equipment	2	2	1	3	8	36	Low	Low
Rehabilitation of site to agreed land use	2	2	1	3	8	36	Low	Low

4.1.1 Mitigation Measures

The following general mitigation measures are provided in view of the expected Low levels of residual risk posed to the wetland areas:

- The wetland and buffer areas must be avoided;
- A stormwater management plan must be compiled and implemented for the project, facilitating the diversion of clean water to the delineated resources;
- The construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- Laydown yards, camps and storage areas must be within project area;
- The contractors used for the project should have spill kits available to ensure that any fuel or oil spills are clean-up and discarded correctly;
- It is preferable that construction takes place during the dry season to reduce the erosion potential of the exposed surfaces;
- All chemicals and toxicants to be used for the construction must be stored within the drilling site and in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”;
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- No dumping of material on-site may take place; and
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported.

5 Conclusion and Recommendation

5.1 Baseline Ecology

During the site assessment, four HGM units were identified and assessed within the 500 m regulated area namely three unchannelled valley bottoms and a hillslope seep wetland. One of the HGM unit scored overall PES scores of D – “Largely Modified” due to the modification to the hydrology and vegetation of the wetland through anthropogenic activities. The remaining three HGM units scored overall PES scores of E – “Seriously Modified”. The unchannelled valley bottom wetlands scored “Medium” importance and sensitivity scores due to the moderate protection level of both the wet veg and wetland units. The hillslope seep wetland scored a “Low” importance and sensitivity score due to the low protection level of the wet veg as well as the wetland itself. The average ecosystem service score ranges between “Intermediate” and “Moderately High”. A 15 m post mitigation buffer was assigned to the wetland systems.

5.2 Specialist Recommendation

Based on the results and conclusions presented in this report, it is expected that the proposed activities will have low residual impacts on the wetlands and thus no fatal flaws were identified for the project. A General Authorisation (GN 509 of 2016) is required for the water use authorisation.

The following Zones of Regulation (ZoR) are applicable to the drainage line identified within the assessment area:

- A 32 m Zone of Regulation in accordance with the National Environmental Management Act, 1998 (Act No. 107 of 1998) should be assigned to the drainage lines; and
- A 100 m ZoR in accordance with the National Water Act, 1998 (Act No. 36 of 1998) should be assigned to the drainage lines.

6 References

Department of Water Affairs and Forestry (DWAF). 2005a. A Practical Field Procedure for Identification and Delineation of Wetlands and Riparian Areas.

Department of Water and Sanitation (DWS). 2005b. River Ecoclassification: Manual for Ecostatus Determination. First Draft for Training Purposes. Department of Water Affairs and Forestry.

Department of Water and Sanitation (DWS). 2020. A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa. Draft. Compiled by RQS-RDM.

Kotze, D.C., Marneweck, G.C., Batchelor, A.L., Lindley, D.C., and Collins, N.B. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands, Mondi Wetland Project.

Macfarlane, D.M., Bredin, I.P., Adams, J.B., Zungu, M.M., Bate, G.C. and Dickens, C.W.S. 2014. Preliminary guideline for the determination of buffer zones for rivers, wetlands and estuaries. Final Consolidated Report. WRC Report No TT 610/14, Water Research Commission, Pretoria.

Macfarlane, D.M., Kotze, D.C., Ellery, W.N., Walters, D., Koopman, V., Goodman, P. and Goge, C. 2007. A technique for rapidly assessing wetland health: WET-Health. WRC Report TT 340/08.

Mucina, L. and Rutherford, M.C., 2010. The vegetation of South Africa, Lesotho and Swaziland.

Nel J.L. and Driver A. 2012. South African National Biodiversity Assessment 2011: Technical Report. Volume 2: Freshwater Component. CSIR Report Number CSIR/NRE/ECO/IR/2012/0022/A, Council for Scientific and Industrial Research, Stellenbosch.

Nel JL, Murray KM, Maherry AM, Petersen CP, Roux DJ, Driver A, Hill L, Van Deventer H, Funke N, Swartz ER, Smith-Adao LB, Mbona N, Downsborough L and Nienaber S. 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis DJ, Snaddon CD, Job NM, and Mbona N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria.

SANBI. 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).