Wetland Assessment for the Proposed Pure Source Sand Mining Operation

Free State Province, South Africa

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REFERENCE

Wetland Scoping Report V4

Prepared for:

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Report Name	**Wetland Assessment for the Proposed Pure Source MIne**
Reference	**Pure Source Wetland Scoping Report V4**
Submitted to	**Monte Cristo Commercial Park (Pty) Ltd**
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Date: 2018/07/13 *Location: 26°44'35.93"S; 27°36'24.54"E*

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DECLARATION

I, Ivan Baker declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Ivan Baker

Wetland Ecologist

The Biodiversity Company

20th July 2018

1 Introduction

The Biodiversity Company was commissioned by Monte Cristo Commercial Park (Pty) Ltd to conduct a wetland assessment to support the Mining Right Application and Environmental Authorisation process for the proposed Pure Source Sand Mining Operation.

The proposed project will involve the development of an open pit mine, a processing plant and associated infrastructure. Commodities to be mined will include sand (silica), gravel and diamonds (alluvial).

This report aims to provide a desktop scoping level assessment of the wetland systems which may be potentially affected through the proposed mining operation. In addition, this report aims to provide delineated buffer zones for the delineated systems. Furthermore, this report aims to identify potential fatal flaws for the proposed project and the methods which were utilised in the field assessments. The overall aim of the wetland study was to complete the following objectives:

- The delineation and assessment of wetland areas within 500 m of the project area;
- Determining the ecological status, functioning and importance of wetland systems;
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.

2 Study Area

The proposed project is located approximately 23 km west of Sasolburg in the Free State Province. The project area is situated within the Vaal Water Management Area in the C23B quaternary catchment. The catchment of the project area drains into the C23B-01731 Sub Quaternary Reach (SQR) of the Vaal River system. The C23B-01731 SQR is 27.52 km in length and is within the Highveld Ecoregion. The specific reach of the SQR is located downstream of the Vaal River Barrage and upstream of the Goosebay gauging weir near to the town of Vaal Oewer (**Error! Reference source not found.**).

The catchment draining the project area consists of typical undulating, hygrophilous vegetation. Frost, fire and grazing maintain the dominance of grasslands in the region with the considered catchment being accurately defined by this broad description.

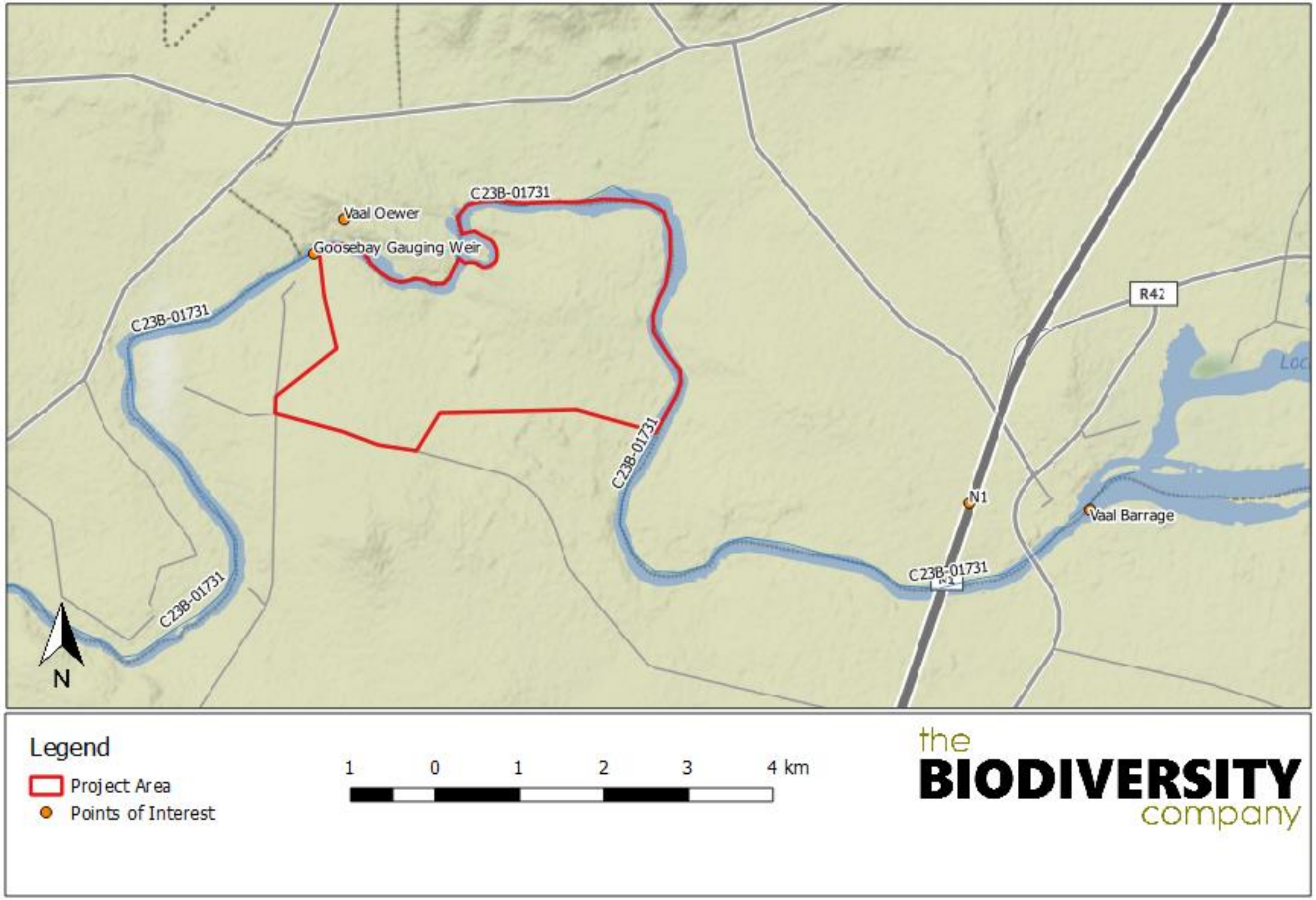

Figure 1: Locality map of the proposed project

2.1 Vegetation Types

The project area falls within the Soweto Highveld Grassland (GM 8) type according to Mucina and Rutherford (2006).

The distribution of the GM 8 vegetation type is restricted to Gauteng and Mpumalanga with small portions of this vegetation type occurring in the North-West and Free State provinces. This vegetation type is delineated by the Vaal River, Perdekop in the south-east and the N17 between Johannesburg and Ermelo. The GM 8 vegetation type extends further westward as far as Randfontein and includes parts of Soweto. The GM 8 vegetation type surround parts to the south as well, including Vanderbijlpark, Vereeniging and Sasolburg, which is located in the northern most parts of the Free State, Mucina and Rutherford (2006).

The vegetation within the GM 8 region is dominated by short to medium-high (<1m), dense, tufted grassland which includes *Themeda triandra* within gently to moderately undulating landscapes on the Highveld plateau. Other grass species which occur to a lesser extent include *Eragrostis recemosa*, *Elionurus muticus*, *Tristachya leucothrix* and *Heteropogon contortus*, Mucina and Rutherford (2006).

The conservation status of this vegetation type is endangered with a target percentage of 24. Half of the area which is covered in this vegetation type has been transformed into agriculture, mining and urban land uses.

2.2 Climate

The mean annual precipitation for this region reaches approximately 662mm and is characterised by summer rainfall, Mucina and Rutherford (2006). This area is characterised by high and low extreme temperatures during the summer and winter periods respectively and has frequent frost during the winters, see Figure 2.

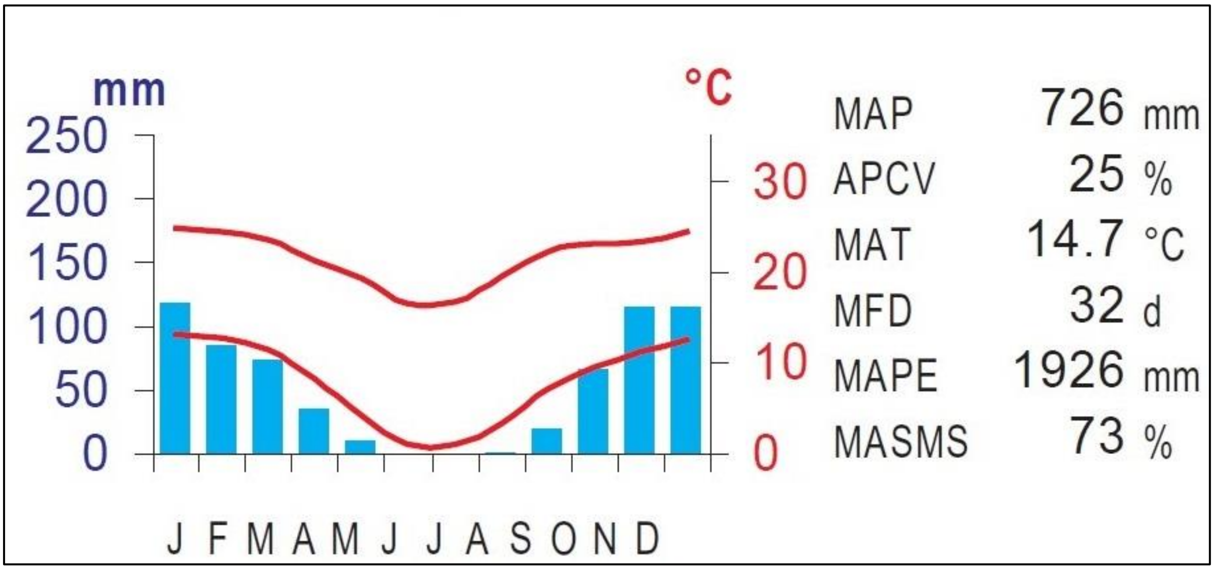

Figure 2: Climate diagram for the project area, Mucina & Rutherford (2006).

2.3 Soils and Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the project area falls within the Bc36 land type. This land type is characterised by plinthic catena. Upland duplex with margalitic soils are rare within this land type. Eutrophic red soils are known to be wide spread across this area.

The geology of this area is characterised by the Madzaringwe Formation shale, mudstone and sandstone from the Karoo Supergroup or the Karoo Suite dolerites which feature prominently in this area. To the west, the rocks of Ventersdorp, old Transvaal and Witwatersrand Supergroups are significant with the south being characterised by the Volksrust Formation from the Karoo Supergroup. Deep soils occur in this area and is typically labelled by Ea, Ba and Bb land types.

3 Methodology

3.1 Desktop assessment

- Aerial imagery (Google Earth Pro);
- Vegetation and climate information (Mucina & Rutherford, 2006);
- Land Type Data (Land Type Survey Staff, 1972 - 2006);
- The National Freshwater Ecosystem Priority Areas (Nel et al., 2011); and
- Contour data (5m).

3.2 Wetland Identification and Mapping

The wetland areas are delineated in accordance with the DWAF (2005) guidelines, a cross section is presented in Figure 3. 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.

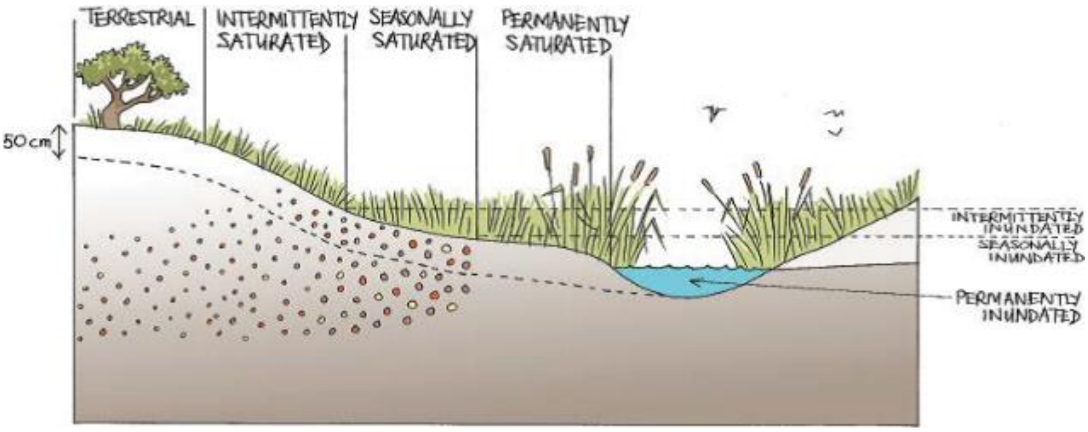

Figure 3: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change (Ollis et al. 2013)

3.3 Wetland Delineation

The wetland indicators described in "3.2" 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.

3.4 Wetland 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 serve 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. 2009). 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 1).

Table 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

3.5 Determining the Present Ecological Status (PES) of wetlands

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.

Table 2: The Present Ecological Status categories (Macfarlane, et al., 2009)

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**

3.6 Determining the Ecological Importance and Sensitivity of Wetlands

The method used for the EIS determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in Table 3, (Rountree et al., 2012).

Table 3: Description of Ecological Importance and Sensitivity categories

EIS 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**

3.7 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).

3.8 Determining Buffer Requirements

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

4 Results and Discussion

4.1 Desktop Results

4.1.1 NFEPA Wetlands

No NFEPA wetlands have been identified within the 500m project boundaries.

4.1.2 Topographical River Lines (Quarter Degree Square "2627")

As illustrated in Figure 4, the topographical river line data for quarter degree square "2627" indicates six major river lines flowing from inland towards the Vaal River. These river lines have been investigated and either labelled as likely wetland areas or drainage lines given the suitable topography.

Topographical river lines have been used to identify possible wetland areas. This information has resulted in the classification of various wetlands and dry drainage channels. The river lines labelled "A", "B", "E" and "F" have all been identified as likely wetland areas, whereas those labelled "C" and "D" have been identified to be likely dry drainage lines, see section "**Error! Reference source not found.**" and Figure 4.

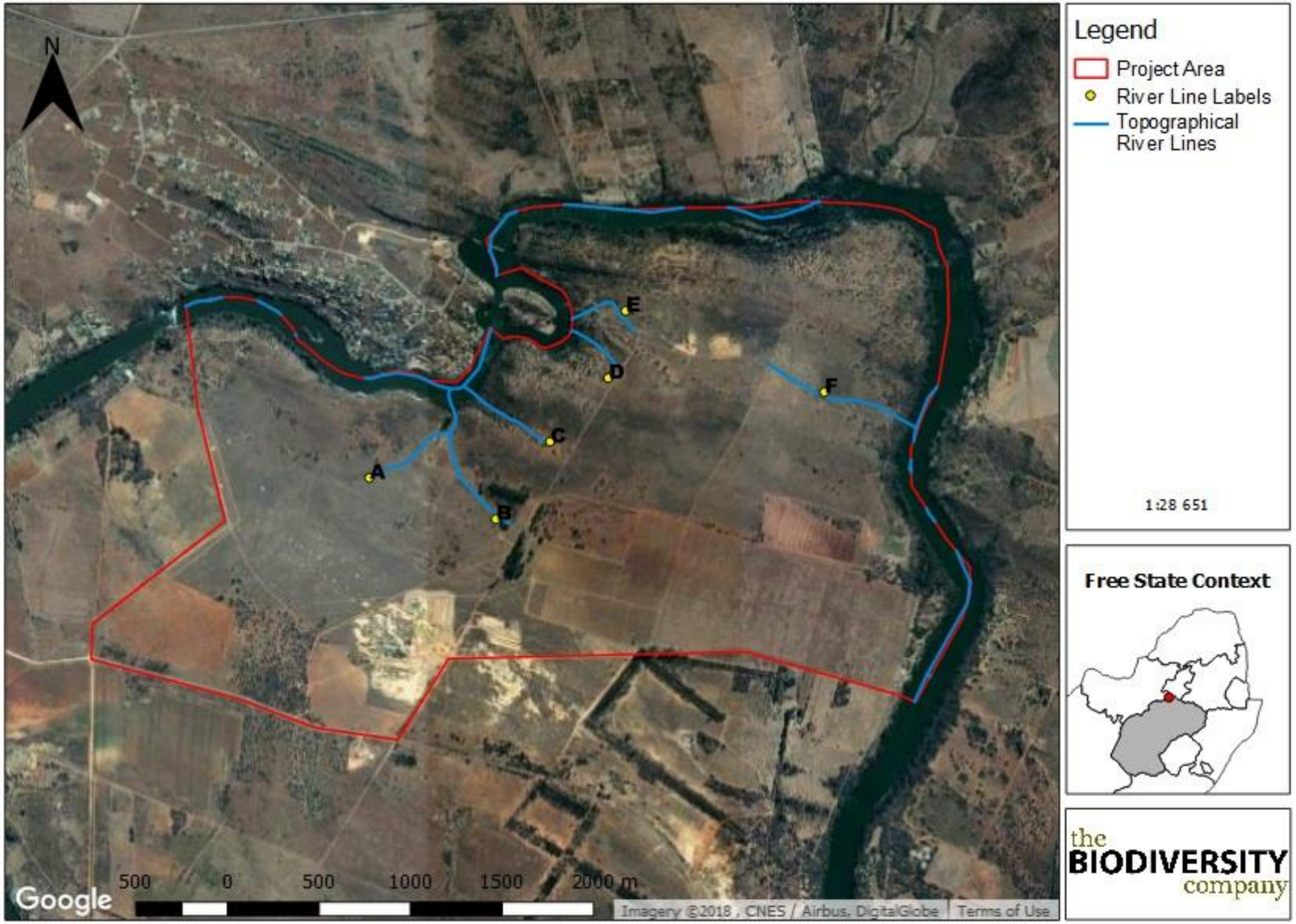

Figure 4: Topographical River Lines

5 Potential Impacts arising from the Proposed Project

The construction and operation of the proposed infrastructure (excluding the water supply line) is not expected to pose any significant threats towards the delineated wetland areas, given that the closest expected wetland area is in excess of 750 m. The water supply line however, is expected to pose threats towards the delineated wetlands to the west given its proximity to the wetlands and the recommended buffer of 102 m.

As for the open cast mining of aggregate, sand and alluvial diamonds, various direct and indirect impacts are expected. An increase in sedimentation, loss of vegetation within the catchment, the alteration of sub-surface hydropedological flow paths and the direct loss of wetlands are some of the impacts expected for the proposed activity. Considerable risks indicated by means of the impact assessment illustrated in Table 4 include the “construction of associated infrastructure” in regard to direct loss of wetland systems and loss of sub-surface flows. The loss of sub-surface flows is likely seeing that these flows are so close to the surface. All excavations and construction will completely drain these flows and compact these areas to such an extent that sub-surface flows will be altered.

During the operational phase, the following activities are expected to pose threats which are not expected to be minimised to a “Low” risk score by means of mitigation measures; The operation of the supporting infrastructure regarding reduced catchment water yield and the loss of sub-surface flows. These impacts are expected to have “Medium” and “High” risk scores after the application of recommended mitigation measures.

Lastly, the activities associated with the closure and decommissioning phase are all expected to have low risks given that these activities take place and that the suggested mitigation measures be successfully applied.

The level of disturbance emphasises the need to recommend relevant mitigation measures (including adhering to the recommended buffer zone) to limit the impact significance rating to such an extent that final recommendations can be made to inform and guide the environmental impact practitioner and regulatory authorities.

A detailed risk and impact matrix must be completed to fully determine the significance and likelihood of all associated impacts. Recommendations will be made to avoid impacts where possible, and mitigation measures will then be prescribed where feasible in order to reduce the significance of unavoidable impacts. These mitigation measures may also be considered to reduce the extent of the initial buffer width of 102 m.

Table 4:Impact significance summary pre- and post-mitigation

Activity	Impact Description	SIGNIFICANCE Pre- Mitigation	Mitigation measures / Recommendations	SIGNIFICANCE Post-Mitigation
Construction Phase				
The removal of vegetation, ground compaction and infrastructure placement.	Destruction of wetland systems	Medium	Minimise footprint area of infrastructure. Avoid wetland areas and adhere to recommended buffer areas.	Low
Placement of infrastructure within the catchment area	Loss / reduced catchment water yield	Medium	Minimise infrastructure footprint area. Incorporate soft / green engineering where feasible. Separate clean and dirty water. Implement best practice storm water management. Avoid wetland areas and adhere to recommended buffer areas.	Low
Vegetation removal and altered surface flow dynamics	Increase in suspended solid concentrations	Low	Implement phased vegetation clearing to minimise the extent of bare areas. Concurrent rehabilitation. Separate clean and dirty water. Implement best practice storm water management. Stay clear of the recommended buffer zones.	Low
Onsite mixing, fuelling and use of machines and vehicles. Erosion of the cleared footprint areas.	Contamination of surface water resources	Medium	Separate clean and dirty water. Implement best practice storm water management. No cleaning of vehicles, machines and equipment in water resources. Servicing of machines, vehicles and equipment in designated areas. Storage of potential contaminants in bunded areas. All contractors must have spill kits available and be trained in the correct use thereof.	Low
Disturbances caused by noise, traffic, machines and human movement	Loss of species diversity	Medium	Minimise footprint area of infrastructure. Make use of existing access routes. Avoid wetland areas and adhere to buffer areas. Minimise noise disturbance. Implement dust suppression. Implement waste management.	Low
Introduction of "pests" and weeds into the area.	Change in species abundances	Low	Minimise footprint area of infrastructure. Make use of existing access routes. Avoid wetland areas and adhere to buffer areas. Minimise noise disturbance. Implement dust suppression. Implement waste management.	Low
Preparation of mining area	Loss of wetland systems	Medium	Stay well clear of such areas (if present) and ensure that the layout of components that directly impact upon the surface stay clear of the recommended buffer zones.	Low
Construction of associated infrastructure	Loss of wetland systems	High	Avoid wetland areas and adhere to recommended buffer areas.	Low
Construction of associated infrastructure	Loss of sub-surface flows	High	The loss of sub-surface flows is imminent. A hydropedology study is recommended to further improve mitigation and recommendations.	Medium
Operation Phase				
Operation of mine	Destruction. of wetland systems	High	The operation of the mine is unlikely to have a direct impact on wetlands. Avoid wetland areas and adhere to recommended buffer areas.	Low
Operation of the supporting infrastructure	Reduced catchment water yield	High	Minimise the footprint area of supporting infrastructure. Any loss of water to the catchment must be quantified, and mitigation options to re-introduce water in a safe and environmentally friendly way must be assessed.	Medium
Operation of the supporting infrastructure	Los of sub-surface flows	High	The loss of sub-surface flows is imminent. A hydropedology study is recommended to further improve mitigation and recommendations.	Medium

Operation of the supporting infrastructure	Increased in suspended solid concentrations	Medium	Separate clean and dirty water. Implement best practice storm water management.	Low
Operation of mine	Mine water discharge from dewatering	Medium	Contain waste water in a PCD. Contaminated water must not be discharged into the watercourses. Clean and dirty water must be separated. This water could be looked at for treatment and then re-introduced to mitigate losses to the catchment water hydro-dynamics.	Low
Decomissioning and Closure				
Backfill of voids, removal of infrastructure	Restored catchment water yield	Low	All voids must be backfilled, and surface infrastructure must be removed from the site. Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography. Trees (or vegetation stands) removed must be replaced. No grazing must be permitted to allow for the recovery of the area. Attenuation ponds may be created in channels to retain water in the catchment.	Low
Backfill of voids	Rehabilitated topography and surface flow dynamics (including subsidence)	Low	All voids must be backfilled, and surface infrastructure must be removed from the site. Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography.	Low
Backfill of void, and shaping of catchment area	Increased in suspended solid concentrations	Low	Decommission cut-off berms and drains last. Debris must be placed in preferential flow paths. Compacted areas must be ripped (perpendicularly) to a depth of 300mm. A seed mix must be applied to rehabilitated and bare areas. Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography.	Low
Backfill of voids	Restoration of shallow recharge	Low	Mitigation is not possible.	Low
Degradation of soil resources by means of vehicle transportation causing leaks and compaction	Contamination of surface water resources	Medium	Ensure vehicles and machines are maintained and serviced off-site. Implement concurrent rehabilitation, applying a proven seed mix to rehabilitated and bare areas. Debris must be placed in preferential flow paths.	Low
Ripping of compacted areas	Improving soil quality	Low	Monitor the footprint area to make note of compacted areas. These areas shuld be ripped, ameliorated and revegetated.	Low

6 Conclusion

The outcomes of this scoping assessment have identified the potential loss of wetland areas as a potential fatal flaw for the proposed project. However, further investigation will be made during the Environmental Impact Assessment process.

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