8.2 Impact Assessment Report

Tate Environmental
Specialist Services

Transkei Quarries – Mthatha Quarry

Impact Assessment Report

Aquatic Biodiversity Theme

Eastern Cape, South Africa

October 2025

TATE ENVIRONMENTAL SPECIALIST SERVICES

Hydrology Biodiversity Ecology

Document Reference	Tate, R. 2025. Transkei Quarries – Mthatha Quarry. Impact Assessment Report. Aquatic Biodiversity Theme. Eastern Cape, South Africa. October 2025. V1.	
Submitted to	Umhlaba Environmental Consulting	
1st Submission	22/10/2025	
Author	Russell Tate (Pr. Sci. Nat. 400089/15)	
Contact	Russell@HCVAfrica.com +27824549019	

Declaration

I, Russell Tate, declare that:

- I act as the independent specialist in this study;
- I will perform the work relating to the study 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 science relevant to this study, including knowledge of the Act, regulations and any guidelines that have relevance to the study;
- 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 study;
- 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.
- Please refer to appendix A for the specialist CV.

Russell Tate

Water Resource Specialist

Russell@HCVAfrica.com

Pr. Sci. Nat – Aquatic Science (Pr. Sci. Nat. 400089/15)

TESS

October 2025

Executive Summary

Tate Environmental Specialist Services (TESS) was appointed by Umhlaba Environmental Consulting to undertake a freshwater biodiversity impact assessment specialist study for the proposed expansion of the existing Transkei Quarries – Mthatha Quarry. The quarry is in the city of Mthatha in the Eastern Cape Province, South Africa.

The aim of this study was to derive the extent and condition of the watercourses associated with the project and investigate the nature of the anticipated impacts of the activities.

The hydrological setting of the project was within the T20D quaternary catchment. The nearest Sub Quaternary Reach (SQR) associated with the project includes the T20D-06388 of the Corana River. An unclassified tributary of the Corana River known as the Kangisa River was also associated with the AoI.

The outcome of this assessment delineated 13 watercourse HGM units within the AoI. Of these, 7 were considered for further assessment. The summarised information relating to the Present Ecological Status and Ecological Importance and Sensitivity is presented in the table below. A scientific buffer was calculated for the watercourses, where a 50m buffer was utilised to protect these sensitive environments.

Table 0-1: PES and EIS Summaries

Watercourse Unit	PES	EIS	Buffer
HGM1	Class C	High	50m
HGM2	Class D	High	50m
HGM3	Class C	High	50m
HGM5	Class C	High	50m
HGM7	Class D	High	50m
HGM10	Class C	High	50m
HGM13	Class D	High	50m

The outcomes of the risk assessment indicate significant residual direct impacts to wetlands. A total of 3.18 hectares of direct impact by mining activities are expected to occur in wetlands (HGM3) should mining take place. It is recommended that wetland habitats are avoided should resource development allow. Where wetland habitat is to be mined, a wetland offset study is recommended to be completed.

Additional recommendations include the completion of a floodline. This can be completed during the Water Use License Application phase.

In the view of the proposed activities, should the proposed mitigation and offset actions be implemented, no fatal flaw was identified and the project should be favourably considered. In line with the recommendations, avoidance and an offset must be implemented.

Table of Contents

Tables

Figures

1 Introduction

Tate Environmental Specialist Services (TESS) was appointed by Umhlaba Environmental Consulting to undertake a freshwater biodiversity impact assessment specialist study for the proposed expansion of the existing Transkei Quarries – Mthatha Quarry. The quarry is in the city of Mthatha in the Eastern Cape Province, South Africa.

The aim of this report was to provide the findings of the results of a baseline ecological survey which took place on the 16th of October 2025 and present the results of an impact assessment for the proposed activities. The objective of the study was to comply with the requirements of the Department of Forestry, Fisheries and the Environment (DFFE). In line with the aims of the study, the following Scope of Work (SoW) was established:

1. Comply with Section 2 of the Aquatic Biodiversity Protocol (Government Notice (GN) 320) and Animal and Plant Species Protocol (GN 1150, as amended in GN 3717)
2. Comply with GN No. 320, published in Government Gazette No. 43110 on the 20th of March 2020.
3. Adhere to the SANBI Species Environmental Assessment Guideline (SANBI 2020).

This report presents the findings of the aquatic biodiversity theme specialist study. According to the Species Environmental Assessment Guideline (SANBI 2020), an Area of Influence (AoI) is defined according to the important ecosystem processes and functions that may be plausibly affected by a proposed development and its associated activities.

Specialists are required in terms of the guidelines to evaluate an appropriate AoI based on the identification of taxon-specific impact receptors (SANBI, 2020). The surveys conducted as part of this specialist study included an AoI of 500 m around Proposed Development Area (PDA).

1.1 Definitions

According to the National Water Act (NWA) Act Number 36 of 1998 the definition of wetland and riparian areas are provided as:

- **Wetland**: 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.
- **Riparian:** The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency

sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas.

Further definitions provided in the NWA defines a watercourse as:

- 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
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse.
- The watercourse includes, where relevant its bed and banks.

The definition of the extent of a watercourse is defined in the amendment of the General Authorisation for section 21 (c) and (i) water uses (RSA Government, 2016). The extent of the watercourse is defined as:

- The outer edge of the 1 in 100 year flood line and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; and
- Wetlands and pans: the delineated boundary (outer temporary zone) of any wetland or pan.

The definition of wetland areas is further defined by the Department of Water and Forestry (DWAF) 2008 guidelines (DWAF, 2008) where the following is considered pertinent to their classification:

- The presence, either permanently, seasonally or temporarily, of water at or near the surface
- Distinctive redoximorphic features in the soils, and
- Vegetation which is adapted to or tolerant of saturated soils.

2 Description of the Study Area

The study area was located in the city of Mthatha in the Eastern Cape Province, South Africa. The Mean Annual Precipitation (MAP) for the derived Area of Interest (AoI) over the periods 2009-2024 was 745 mm, peaking in 2022 at 896 mm, with the lowest value recorded in 2024 at 572 mm. The temporal distribution of rainfall in the AoI consisted of a unimodal flood regime where peak flows are observed in the summer between November and March.

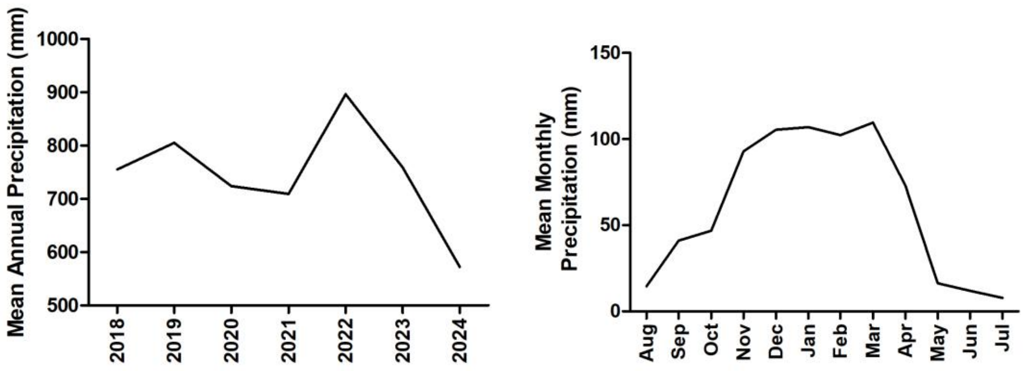

Figure 2-1: Annual (left) and mean monthly (right) precipitation in the Area of Interest between 2018 and 2024 (WaPOR, 2025)

The hydrological setting of the project was within the T20D quaternary catchment. The nearest Sub Quaternary Reach (SQR) associated with the project includes the T20D-06388 of the Corana River. An unclassified tributary of the Corana River known as the Kangisa River was also associated with the AoI. Watersheds sizes are provided as:

- Corana River: 98 km^2
- Kangisa River: 9.9 km^2

The National Freshwater Ecosystem Priority Area (NFEPA) and National Biodiversity Assessment (2018) maps indicated that there are Channelled Valley Bottom (CVB) and Unchanneled Valley Bottom watercourses within the AoI (Figure 2-3 and Figure 2-4).

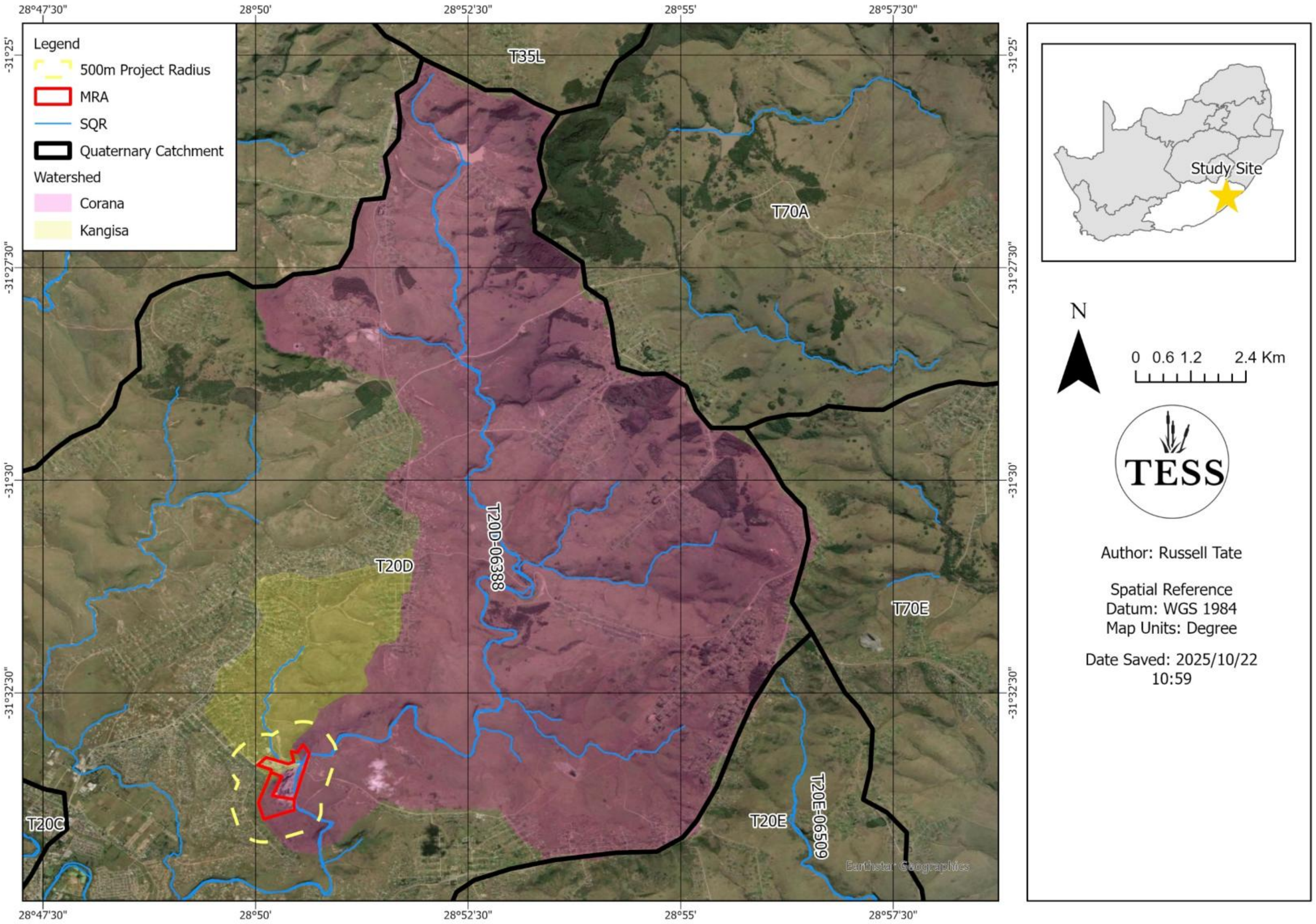

Figure 2-2: Hydrological and Local Setting of the Study Area

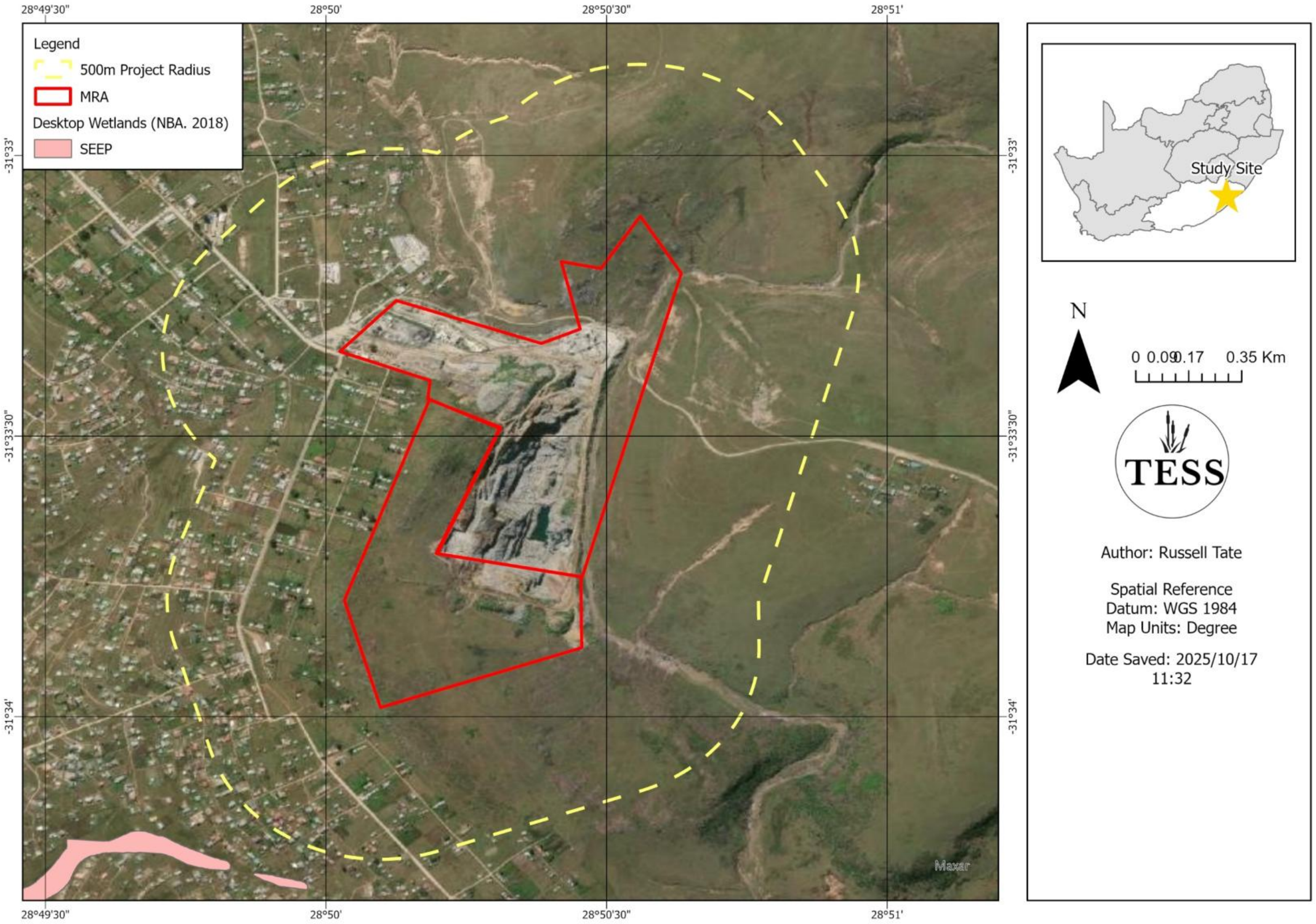

Figure 2-3: Desktop Wetlands (NBA, 2018)

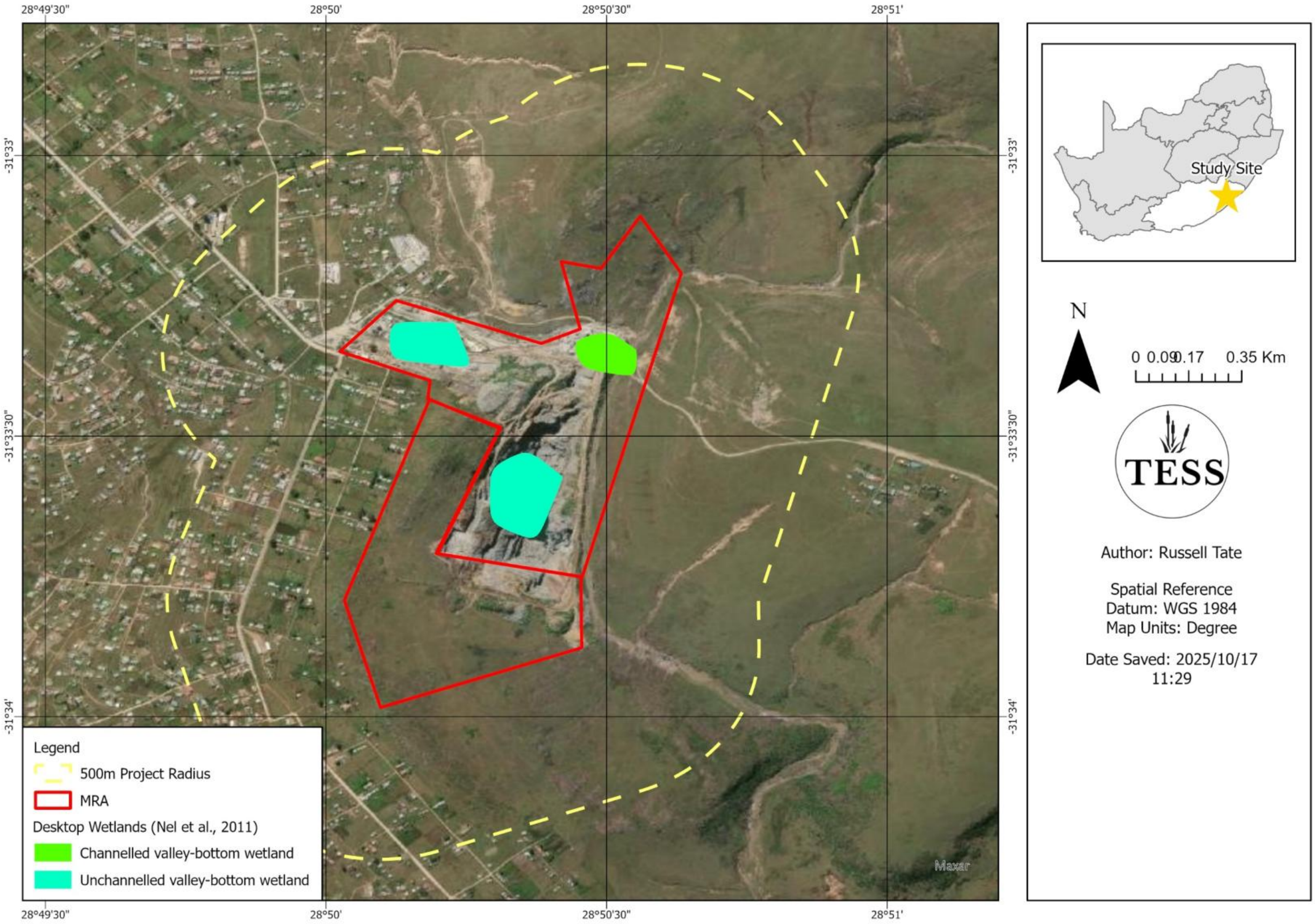

Figure 2-4: Desktop Wetlands (NFEPA (Nel et al., 2011))

3 Methods

3.1 Literature Survey

The literature and spatial databases utilised to inform this study are presented below:

- Wetland Map 5 (NBA, 2018)
- National Freshwater Ecosystem Priority Areas (NFEPA, Nel et al., 2011)
- Eastern Cape Critical Biodiversity Area's Spatial Dataset.
- International Union for the Conservation of Nature (IUCN) spatial datasets.
- Global Biodiversity Information Facility (GBIF) Datasets.
- Aerial Imagery (Google Earth™).

3.2 Survey and Sampling Points

A survey was completed by an aquatic biodiversity specialist on the 17th of October 2025. The location of the sampling points and relevant specialist tracks are provided in Figure 3-1 and Table 3-1. Images of the sampling points are provided in Table 3-2.

Table 3-1: Location of Aquatic Sampling Points

Site	Longitude	Latitude
C1	28.84238	-31.5558
C2	28.84179	-31.5642
T1	28.84102	-31.555

Table 3-2: Photographs of Aquatic Sampling Points (October 2025)

Site	Upstream	Downstream
C1		
C2		

Site	Upstream	Downstream
T1		

3.3 Wetland Ecology

Following the desktop assessment, the wetland areas were delineated in accordance with the procedures stipulated in DWS (2008) guidelines, where a cross section of a typical wetland profile is presented in Figure 3-2.

The identification of the wetland areas was completed by considering the following specific indicators:

- The terrain unit Indicator was used to identify areas in the landscape where wetlands are likely to occur;
- The soil form indicator, utilised the soil classifications where focus was drawn to soils that are associated with saturation;
  - Soils were assessed using a 75mm open bucket soil auger where notes on soil condition were made up to a depth of 50cm.
- The soil wetness indicator was utilised to study the morphological signatures of the soil profiles;
  - The following characteristics were used:
    - Permanent – Prominent Grey Matrix, Few to no high chroma mottles, sulphuric odour
    - Seasonal – grey matrix >10%, many low chroma mottles
    - Temporary – Minimal grey matrix <10%, few high chroma mottles
- The vegetation indicator was then used to confirm and identify hydrophilic vegetation associated with saturated soils according to the lists provided in DWAF (2008).

The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) was used to classify the wetland hydrogeomorphic (HGM) types for this study (Ollis et al., 2013). This system uses a hierarchical classification where defining a wetland is based on the principles of the HGM approach which includes the assessment of the structural features of the wetland (Ollis et al., 2013).

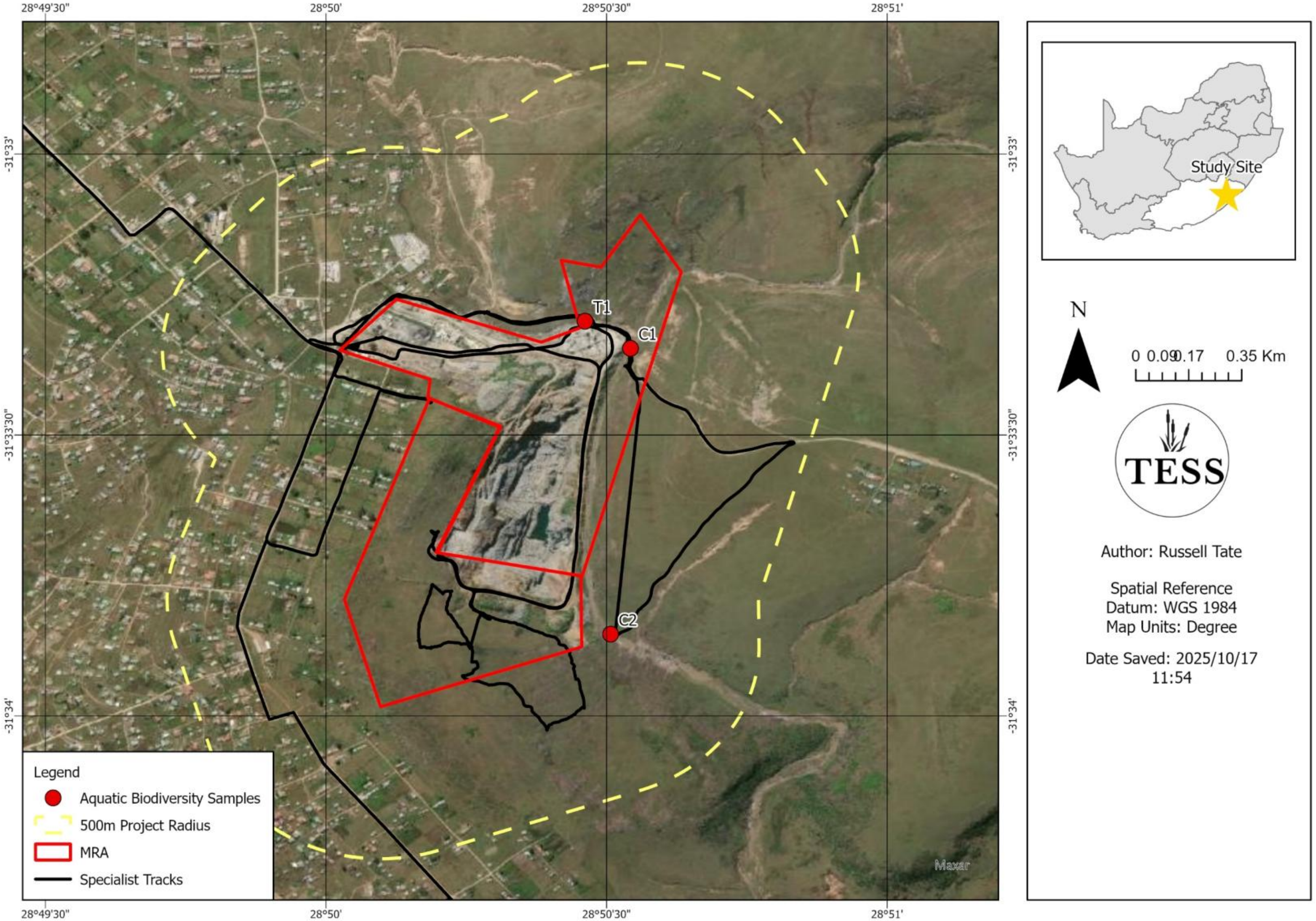

Figure 3-1: Watercourse specialist tracks and Sample Points (October 2025)

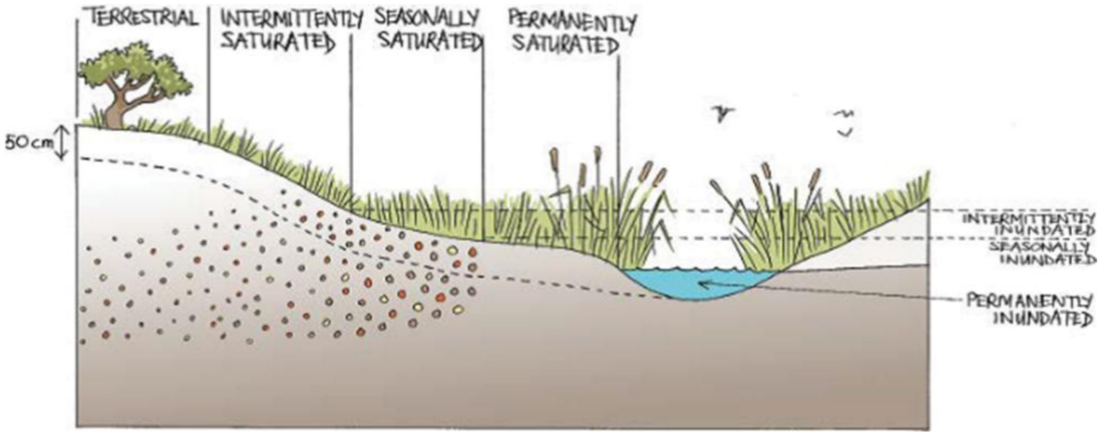

Figure 3-2: Cross section through a wetland (Ollis et al., 2013)

3.3.1 Wetland Present Ecological Status

The overall approach used in the PES method followed the established guidelines presented in Macfarlane et al. 2020. A level 1 assessment was completed. The method relies on the assessment of land cover types within an established watershed, within incoming stream and wetland buffers, as well as within homogenous disturbance units established in the delineated wetland.

The PES method relies on the comparison of the subject wetland to an expected reference condition. The method makes use of 4 primary metrics including:

- Hydrology
- Geomorphology
- Water quality
- Vegetation

Through the assessment of land cover and the nature of impacts within disturbance units, the wetland can be classified into a PES category as provided. The PES field techniques included the assessment of the 4 metrics within the homogenous disturbance units.

Table 3-3: The Present Ecological Status categories, (Macfarlane et al., 2020)

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**

Impact Category	Description	Impact Score Range	PES
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**

3.3.2 Eco-Services and Functional Assessment

Wetland areas and watercourses are known to provide numerous and important ecosystem services to local communities. It is therefore of importance to study the ecological services of a wetland system in order to provide data which supports effective water resource management.

The assessment of the ecosystem services supplied by the identified wetland was conducted as per the guidelines as described in the WET-EcoServices manual (Kotze et al., 2020). A desktop assessment was completed prior to the survey where the following aspects related to domestic, agricultural, subsistence, commercial and recreational activities were noted:

- Downstream water users
- Within wetland water users
- Within wetland and downstream effected communities

The wetlands under consideration were then rated based on the findings from a field survey and further informed by aerial imagery. Following the rating of criteria the eco-services were classified into categories as provided in Table 3-4.

Table 3-4: 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

3.3.1 Ecological Importance and Sensitivity

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWS (1999). The method takes into consideration PES scores obtained for WET-Health as well as function and service provision of the systems to enable determination of the representative EIS category for the wetland feature. 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 3-5, (Rountree et al., 2013).

Table 3-5: 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**

3.4 Riverine Ecology

3.4.1 Water Quality

In situ water quality was obtained the single sampling site using a calibrated Extech DO-600 Multimeter. The following constituents included conductivity (µS/m), temperature (°C), pH and dissolved oxygen (mg/l).

3.4.2 Intermediate Habitat Integrity Assessment

The Intermediate Habitat Assessment Index (IHIA) as described by Kleynhans (1996) was used to define the ecological condition of the riparian habitat of the considered river reach. The IHIA was informed by the results of the land cover assessments and direct observations of changes to the river system. The IHIA considers both the riparian and instream habitat condition. The method relies on the study of reference condition or natural watercourses within a similar setting. The spatial framework for the assessment of the perennial rivers was derived based on the extent of the AoI. The integrity categories of the method are provided in Table 3-6.

Table 3-6: Intermediate habitat integrity categories (Kleynhans, 1996)

Category	Description	Score
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

3.4.3 Aquatic Invertebrates

Macroinvertebrate assemblages are indicators of localised conditions because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life. They are particularly well-suited for assessing site-specific impacts (upstream and downstream studies) (Barbour et al., 1999). Benthic macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and pollution tolerances, thus providing strong information for interpreting cumulative effects (Barbour et al., 1999). The assessment and monitoring of benthic macroinvertebrate communities forms an integral part of the monitoring of the health of an aquatic ecosystem.

3.4.3.1 South African Scoring System

The South African Scoring System version 5 (SASS5) is the current index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Chironomidae) to highly sensitive families (e.g. Perlidae). SASS results are expressed both as an index score (SASS score) and the Average Score Per recorded Taxon (ASPT value).

Sampled invertebrates were identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms were made to family level (Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores were then compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the South Eastern Uplands lower ecoregion (Figure 3-3).

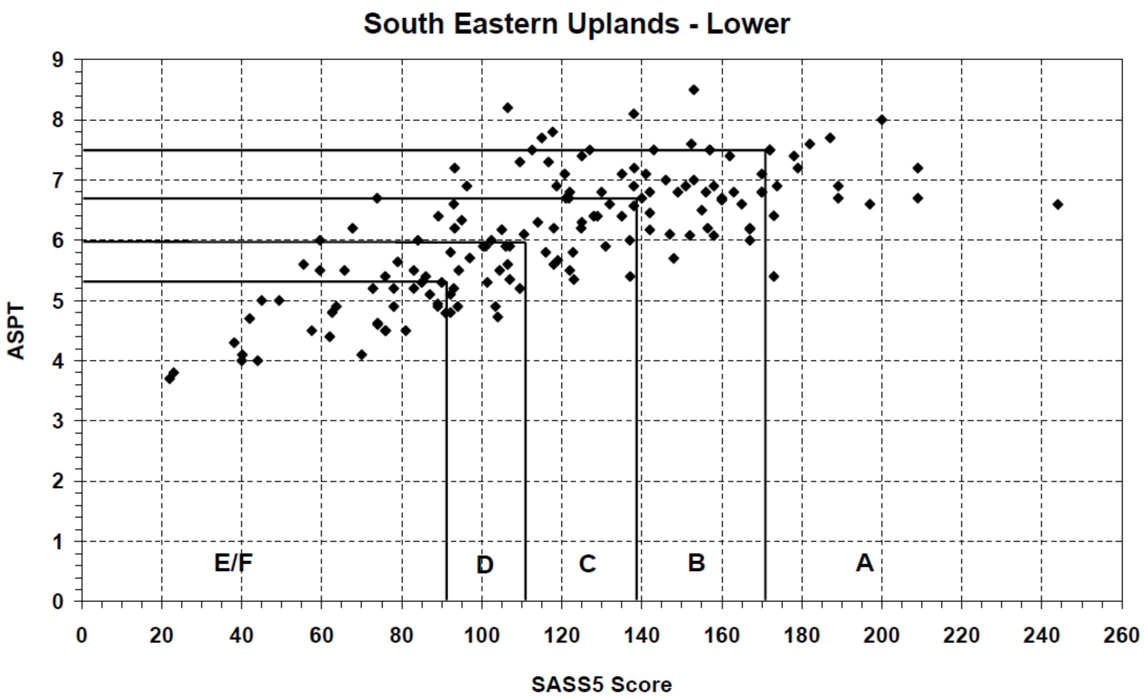

Figure 3-3: South Eastern Uplands Ecoregion (Dallas, 2007)

3.4.3.2 Macroinvertebrate Assessment Index

To complete the PES assessment, the Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat and water quality-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the relevant ecoregion (Thirion 2007; Thirion et al., 1995). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and
- Energy inputs from the watershed riparian and terrestrial vegetation.

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the PES. The spatial framework for the MIRAI was the sites C1 and C2.

3.4.4 Fish Community

Fish were sampled at the two sampling points using a Haltech electrofisher. Approximately 10 minutes of active sampling took place at the C1 and C2 sampling points.

3.4.5 Overall Present Ecological Status

The overall PES of the associated aquatic ecosystems was determined using the River Eco-status Monitoring Programme (REMP) Ecological Classification manual (Kleynhans and Louw, 2007). The PES was calculated based on the results of the various abovementioned biological indexes.

3.5 Limitations and Assumptions

The following limitations and assumptions form part of this study:

- The results of this study were derived from rapid ecological assessments.
- No floodline delineation was completed for this assessment.
- Watercourses are defined by dynamic processes. Temporal variation of the extent and condition of the watercourses is a naturally occurring process. Therefore, the spatial extent of the watercourses provided in this study should be reconsidered within at least 5-10 years from the publishing of this study.
- No hydrological assessment was completed for this assessment.
- The delineations of the project were restricted within the accessible farm portions.

4 Results

4.1 Screening Tool Results

The results of the DFFE screening tool assessment are provided in Figure 4-1. The summary of results of the screening tool assessment are provided in Table 4-1

Table 4-1: Screening tool summary

Screening Theme	Sensitivity	Rationale
Aquatic biodiversity	Very High and Low	There are Ecological Support Areas and Rivers associated with the project.

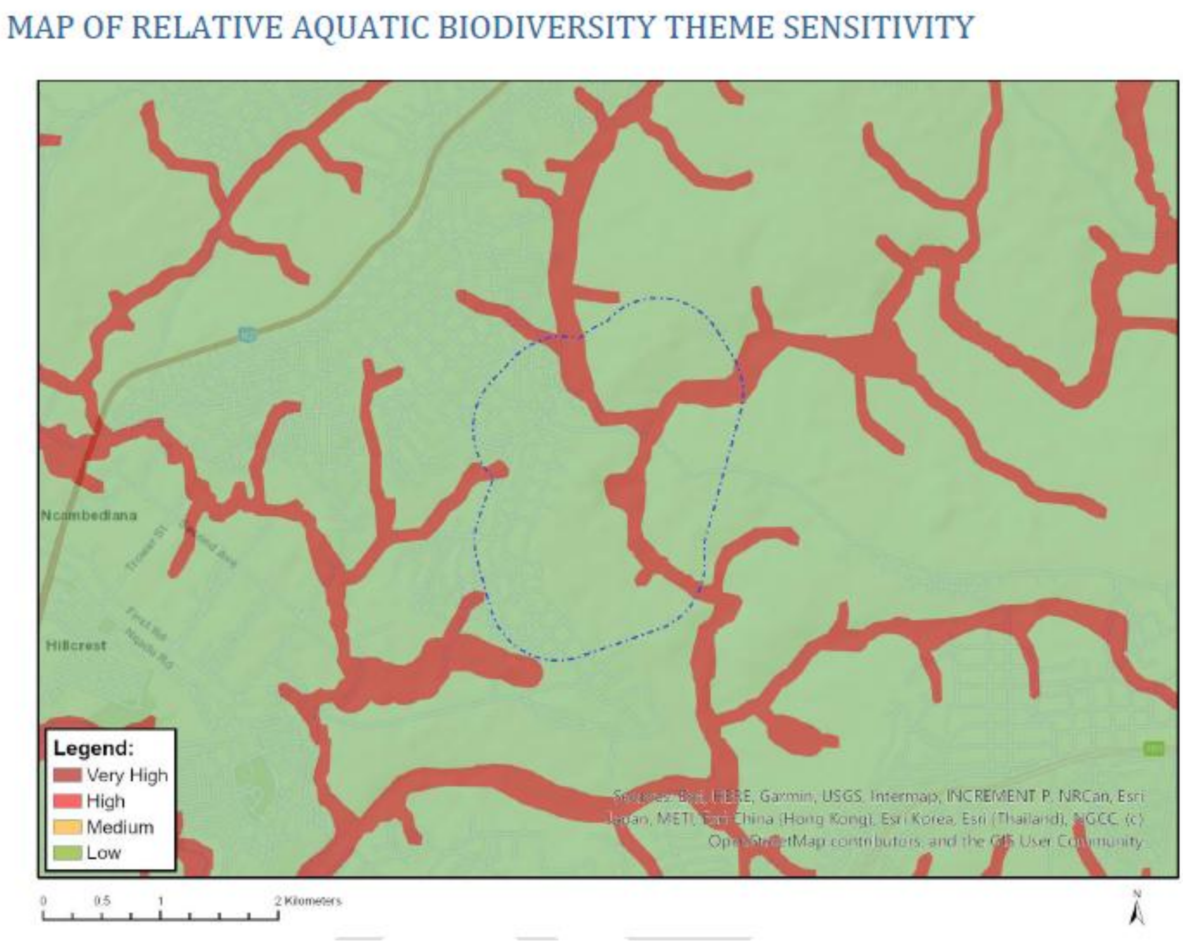

Figure 4-1: DFFE Screening Tool extract for the 500m project radius

4.2 Site Sensitivity Verification Summary

The specialist tracks for the survey are presented in Figure 3-1. The outcomes of the Site Sensitivity Verification (SSV) study have confirmed and provided evidence which supports the results of the screening tool results. The following recommendations were provided:

- Aquatic biodiversity:
    - Impact assessment recommended.

A summary of the site sensitivity findings is provided in Table 4-2.

Table 4-2: Site sensitivity summary

Aquatic Biodiversity Theme	
Study Completed By	Russell Tate
Professional Registration	South African Council for Natural Scientific Professions. Professional Natural Scientist (Pr. Sci. Nat.) 400089/15 – Aquatic Health
Specialist Affiliation	Independent Consultant - Tate Environmental Specialist Services
Date of Survey	16 October 2025.
Recommendation	High sensitivity – Impact Assessment Recommended

4.3 Watercourse Type and Classification

Three HGM types were observed during the survey within the 500m screening area. These HGM types consisted of riverine, Channelled Valley Bottom (CVB), and Seep wetland features (Figure 4-2, Figure 4-3). The wetland areas could be separated into 13 distinct HGM units as detailed in Table 4-3. The wetland delineations are provided in Figure 4-4, while the wetland's considered further in the analysis are provided in Figure 4-5. Only watercourses which are directly associated with the existing and proposed area of expansion were included for further analysis.

Table 4-3: Wetland classification within 500m screening zone

HGM Name	Hectares	System	DWS Ecoregion	NFEPA Wet Veg Group/s	Landscape Unit	HGM Type
HGM1	12.5	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Valley Bottom	River
HGM2	6.9	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Valley Bottom	River
HGM3	4.3	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM4	18.6	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM5	15.0	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM6	6.0	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM7	0.4	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM8	1.0	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM9	8.1	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM10	0.1	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM11	0.6	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep
HGM12	0.9	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Valley Bottom	CVB
HGM13	0.2	Inland	South Eastern Uplands	Sub-Escarpment Grassland	Slope	Seep

Figure 4-2: A riverine geomorphic unit at HGM1 (October 2025)

Figure 4-3: A seep geomorphic unit at HGM3 in the lower reach of the Mgwalana River (October 2025)

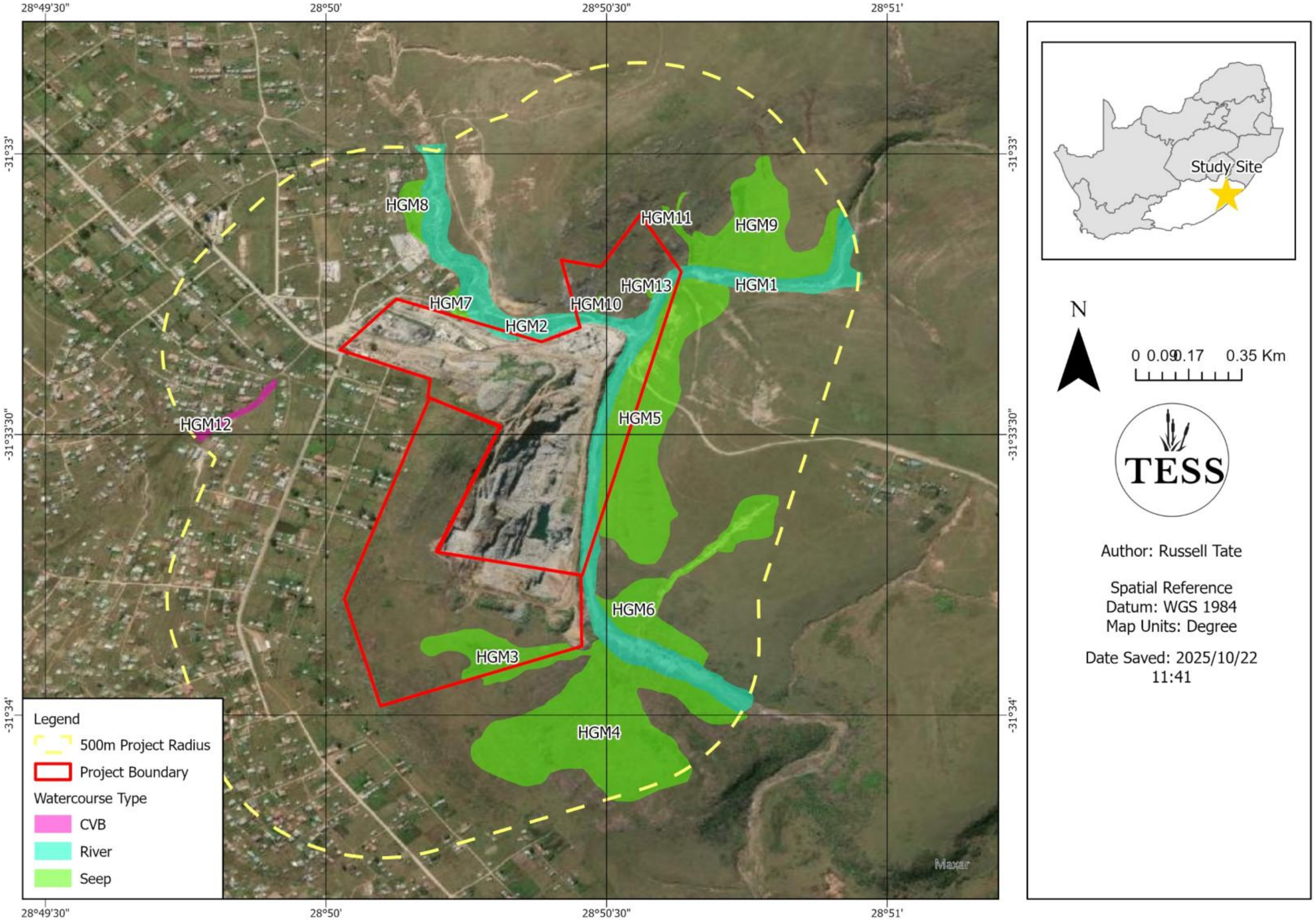

Figure 4-4: Delineation of the watercourse types in the project area

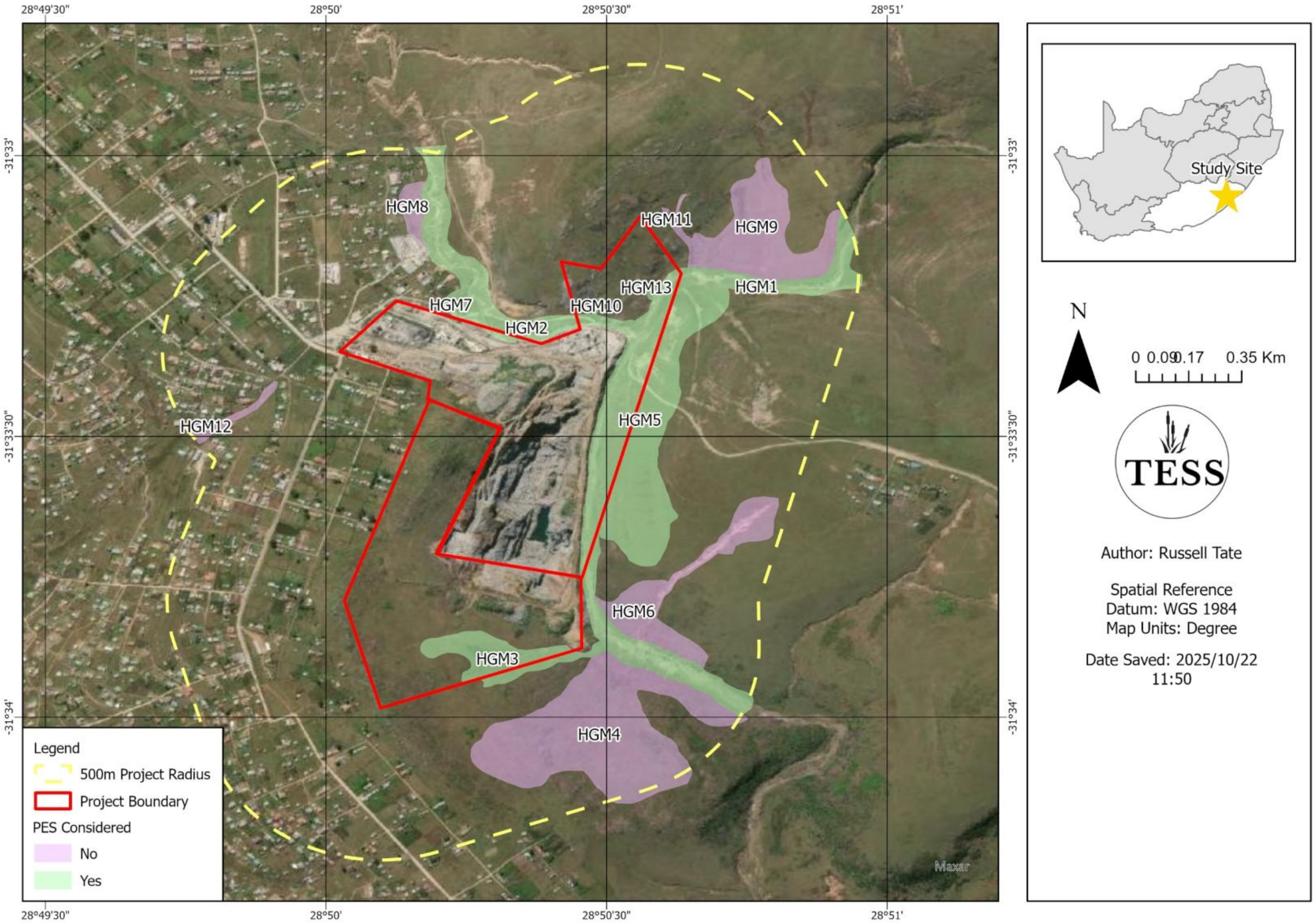

Figure 4-5: Watercourses considered for further analysis

4.4 Watercourse Present Ecological Status

4.4.1 Riverine Condition

4.4.2 Riparian and Instream Habitat Condition

The results of the watershed-based land cover analysis are provided in Table 4-4. The landcover of the watersheds are presented in Figure 4-14. The results of the IHIA for the riverine systems are presented in Table 4-5 and Table 4-6.

Table 4-4: Land Cover characteristics of the considered rivers (SANLC, 2022)

Landcover/Watershed	**Corana (% coverage)**	**Kangisa (% coverage)**
Barren Land	0.2	1.2
Built-up	16.4	44.4
Cultivated	26.5	18.5
Forested land	11.1	0.8
Grassland	42.8	33.3
Mines & Quarries	0.5	1.5
Waterbodies	0.2	0.0
Wetlands	2.2	0.2

Table 4-5: IHIA for Instream Habitat

Criterion	**Water loss**	**Flow mod**	**Bed mod**	**Channel mod**	**Water quality**	**Inundation**	**Exotic veg**	**Exotic fauna**	**Solid waste disposal**	**Condition**
HGM1	5	12	16	18	8	8	0	0	5	**64**
HGM2	10	20	20	20	10	10	0	0	16	**49**

Table 4-6: IHIA for Riparian Habitat

Criterion	**Indigenous vegetation removal**	**Exotic vegetation encroachment**	**Bank erosion**	**Channel mod**	**Water loss**	**Inundation**	**Flow mod**	**Water quality**	**Condition**
HGM1	12	5	10	18	5	8	12	8	**61**
HGM2	16	5	16	20	10	10	20	10	**46**

The landcover assessments indicate that 26% of the watershed has been cultivated in the Corana River system, while 44% of the Kangisa has been urbanised.

The results of the IHIA assessment confirm that the land cover changes have had an impact on the condition of the watercourses. The high degree of development in the Kangisa River watershed has resulted in significant impacts to instream and riparian condition, resulting in a largely modified classification (class D). The Corana River system still contains a large proportion of natural areas including 42% grassland (Figure 4-6) and 11% forested lands. Based on observations made in the field and the analysis of landcover information the watercourse was classified as moderately modified (class C). The primary impacts observed within the watersheds could be summarised as follows:

- Significant landcover alteration in the Kangiso River watershed has resulted in changes in hydrological processes resulting in increased peak flow volumes and frequencies. This has had an impact on channel morphology (Figure 4-7).
- Direct and indirect impacts from the mining and processing activities were evident in the river systems, where encroachment into riparian habitat had occurred in the form of berms and infilling (Figure 4-8).
- Informal quarrying activities were noted to also have an impact on riparian conditions through direct mining and infilling of the Kangiso River.

Figure 4-6: General land cover in the AoI representing grassland cover (October 2025)

Figure 4-7: General land cover in the HGM2 watershed showing cover representing built up (October 2025)

Figure 4-8: A berm in the riparian habitat of the Corana River (October 2025)

Figure 4-9: Informal quarrying activities adjacent to HGM2 (October 2025)

4.4.2.1 Water Quality

The results of the water quality analysis are presented in Table 4-7.

Table 4-7: *In situ* water quality analysis results (October 2025)

Site	pH	Conductivity (mS/m)	DO (mg/l)	Temperature (°C)
RQO/TWQR	**6.5-9.5****	**-**	**>5.00****	**5-30**
C1	7.8	33	6.2	22
C2	7.7	33	6.3	22
T1	8.5	136	4.1	26
**Target Water Quality Guidelines (DWAF, 1996) Red shading indicates values exceeding thresholds				

The results of the water quality analysis indicate the presence of basic pH values, and low levels of electrical conductivity in the Corana River. Adequate dissolved oxygen was also present in the Corana River sampling points. Based on the results, no increases in dissolved solid concentrations occur between up and downstream of the mining activities.

The water quality in the Kangisa River has been impaired as indicated by the high concentrations of dissolved solids, and low dissolved oxygen concentrations. It is clear that runoff from adjacent berms compounded by the urbanised upstream watershed has had an impact on water quality.

4.4.2.2 Aquatic Macroinvertebrates

The results of the biotope assessment are provided in Table 4-8. Invertebrate assessments were completed to provide further evidence to support the established ecological condition as well as the ecological importance and sensitivity.

Table 4-8: Invertebrate Biotope Assessment Results (October 2025)

Site	C1	C2
Hydraulic Biotope	**Pool/Run**	**Pool/Run**
Stones in current	3	2
Stones out of current	3	2
Bedrock	2	2
Aquatic Vegetation	0	0
Marginal Vegetation In Current	1	2
Marginal Vegetation Out Of Current	3	3
Gravel	2	2
Sand	3	2
Mud	2	3
Biotope Score	19	18
Weighted Biotope Score (%)	43	37
Biotope Category (Tate and Husted, 2015)	Class D	Class E

The results of the biotope analysis indicate diverse habitat in the sites considered. This included the important stones and vegetation biotopes. The sampling point C2 contained slightly reduced habitat diversity in comparison to the upstream site. However, based on the results, invertebrate habitat diversity would not be considered a limiting factor for invertebrate species diversity.

The results of the SASS5 assessment are presented in Table 4-9.

Table 4-9: South African Scoring System Results (October 2025)

Site	SASS Score	No. of Taxa	ASPT	Ecological Class (Dallas, 2007)
C1	186	32	5.8	A
C2	198	33	6.0	A

The results of the invertebrate assessment indicated the presence of a highly diverse assemblage representing between 32 and 33 families. The sensitivity of the invertebrate assemblages were such that high values of Average Score Per Taxon (ASPT) were obtained. The overall SASS5 classification of the invertebrate assemblage was natural (Class A). The results of the MIRAI are presented in Table 4-10. The results of the more sensitive index MIRAI indicated a largely natural (class B) invertebrate assemblage. Expected taxa such as Perlidae, high diversity of Ephemeroptera, Odonata and Hemiptera were observed during the survey. This result indicates that water quality impacts in the watershed are limited, while instream habitats are remain intact.

Table 4-10: Macroinvertebrate Assessment Index results for the Corana River (October 2025)

Invertebrate Metric Group	Weighting	Score Calculated
Flow Modification	70	77
Habitat	80	90
Water Quality	100	81
Ecological Score		82
Invertebrate Category		**Class B**

4.4.2.3 Fish Species

According to the available data an expected fish species community was derived as presented in Table 4-11. A total of four species are expected with a high degree of confidence. Despite sampling, none of the species indicated were observed. Anecdotal information from interviews with the mining employees indicates the presence of small bodied fish likely representing *Enteromius mandelai,* and that large catfish *Clarias gariepinus* are regularly encountered during flooding.

The absence of fish species during the survey can likely be attributed to seasonality and the cryptic nature of the species expected, it is expected that the species listed are expected to occur with a high degree of confidence.

Table 4-11: Expected fish species in the AoI

Species	IUCN Status (IUCN, 2025)	Likelihood of Occurrence
*Clarias gariepinus**	Least Concern	High
Enteromius mandelai	Not Assessed	High
Anguilla marmorata	Least Concern	High
Anguilla mossambica	Least Concern	High
*Non-native distribution		

4.4.2.4 Riverine Present Ecological Status

The results of the PES assessment for the October 2025 survey are presented in Table 4-12. The overall PES of the Corana River (HGM1) within the stipulated spatial framework was derived to be moderately modified (class C). Riverine unit HGM2 representing the Kangisa River was derived to be largely modified (class D).

Table 4-12: Present Ecological Status for the Corana River (October 2025)

Aspect Assessed	Score	Ecological Classification
Instream Ecological Category	64	**Class C**
Riparian Ecological Category	61	**Class C**

Aspect Assessed	Score	Ecological Classification
Aquatic Invertebrate Ecological Category	82	Class B
PES	Class C	

4.4.3 Wetland Condition

The results of the wetland condition assessments are presented in Table 4-13, Table 4-14, Table 4-15, Table 4-16 and Table 4-17. Landcover of the considered areas are presented Figure 4-14. The wetlands within the AoI were found to range from moderately (class C) to largely modified (class D). The wetland systems were primarily impacted by cumulative activities including urbanisation, quarrying activities and livestock agriculture.

Typical impacts observed in the wetlands consisted of the following:

- Direct impacts from urbanised areas resulting in infilling of wetland areas by infrastructure and the deposition of solid waste (Figure 4-10).
- Livestock agricultural activities occur on the steep mountain slopes, often forming gullies in seep wetlands (Figure 4-11 and Figure 4-12). General impacts from livestock activities were also noted, reducing vegetation diversity and cover.
- Direct impacts from informal and formal mining activities in the form of direct excavation (Figure 4-9) as well as infilling (Figure 4-13).

Figure 4-10: Solid waste dumping in a wetland in the AoI (October 2025)

Figure 4-11: Livestock activities in a wetland in the AoI (October 2025)

Figure 4-12: Gully formation and erosion in a wetland in the AoI (October 2025)

Figure 4-13: Infilling of a seep wetland (October 2025)

Table 4-13: Present Ecological Status of HGM3 (October 2025)

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.6	2.9	3.9	4.7
PES Score (%)	64%	71%	61%	53%
Ecological Category	C	C	C	D
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	3.7			
Combined PES Score (%)	63%			
Combined Ecological Category	C			
Hectare Equivalents	2.7 Ha			

Table 4-14: Present Ecological Status of HGM5 (October 2025)

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.5	3.5	3.9	5.0
PES Score (%)	65%	65%	61%	50%
Ecological Category	C	C	C	D
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	3.9			
Combined PES Score (%)	61%			
Combined Ecological Category	C			
Hectare Equivalents	9.1 Ha			

Table 4-15: Present Ecological Status of HGM7 (October 2025)

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	6.2	6.5	3.9	6.5
PES Score (%)	38%	35%	61%	35%
Ecological Category	E	E	C	E
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	5.9			
Combined PES Score (%)	41%			
Combined Ecological Category	D			
Hectare Equivalents	0.2 Ha			

Table 4-16: Present Ecological Status of HGM10 (October 2025)

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.3	2.3	3.9	2.5
PES Score (%)	67%	77%	61%	75%
Ecological Category	**C**	**C**	**C**	**C**
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	3.0			
Combined PES Score (%)	70%			
Combined Ecological Category	**C**			
Hectare Equivalents	0.1 Ha			

Table 4-17: Present Ecological Status of HGM13 (October 2025)

Final (adjusted) Scores				
PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	5.0	5.0	3.9	6.0
PES Score (%)	50%	50%	61%	40%
Ecological Category	**D**	**D**	**C**	**E**
Trajectory of change	→	→	→	→
Confidence (revised results)	Low	Low	Low	Low
Combined Impact Score	5.0			
Combined PES Score (%)	50%			
Combined Ecological Category	**D**			
Hectare Equivalents	0.1 Ha			

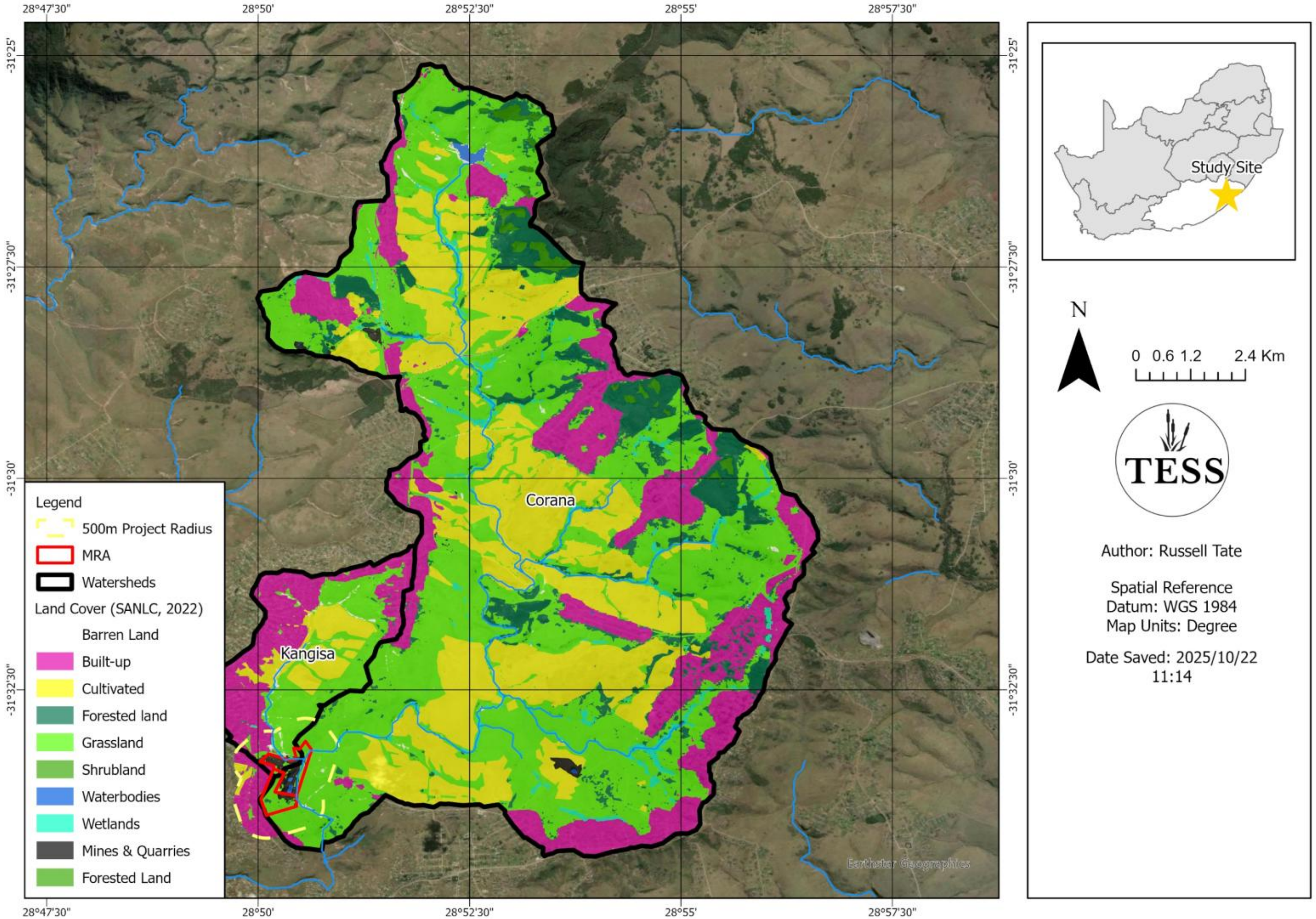

Figure 4-14: Landcover of the Project Area and Watersheds

4.5 Ecosystem Services, Sensitivity and Importance

The results of the ecoservices assessment are presented in Table 4-18. The results of the ecoservices assessment show that the following ecosystem services are important (moderate and above) within the HGM units:

- Very High Importance:
  - Water for human use
  - Cultural and Spiritual
- Moderate Importance:
  - Harvestable Resources
  - Food for livestock
  - Tourism and Recreation
  - Sediment Trapping
  - Phosphate and toxicant assimilation

The watercourses were found to provide very high importance ecosystem services for downstream and in project area users. During the assessment this was effectively illustrated through direct observations of cultural practices and domestic activities.

Based on the layout and shapefiles provided in the Eastern Cape conservation plan, the watercourses under consideration fall within an Ecological Support Area (ESA). When considering the NFEPA watershed data the project is not associated with an upstream management area (Nel et al., 2011). The watercourses are not associated with any strategic water use areas.

The Ecological Importance and Sensitivity of the watercourses were derived to be high as presented in Table 4-19 and Table 4-20.

Table 4-18: Ecological Function Assessment Results (October 2025)

ECOSYSTEM SERVICE		River	Seep
REGULATING AND SUPPORTING SERVICES	Flood attenuation	Very Low	Very Low
	Stream flow regulation	-	Very Low
	Sediment trapping	Very Low	Moderately Low
	Erosion control	Low	Very Low
	Phosphate assimilation	Very Low	Moderately Low
	Nitrate assimilation	Very Low	Low
	Toxicant assimilation	Very Low	Moderately Low
	Carbon storage	Low	Low
	Biodiversity maintenance	Very Low	Very Low
PROVISIONING SERVICES	Water for human use	Very High	High
	Harvestable resources	Moderate	Very Low
	Food for livestock	Moderately Low	Low
	Cultivated foods	Very Low	Very Low

ECOSYSTEM SERVICE		River	Seep
CULTURAL SERVICES	Tourism and Recreation	Moderately Low	Low
	Education and Research	Very Low	Very Low
	Cultural and Spiritual	Very High	Moderately High

Table 4-19: Ecological Importance and Sensitivity – Seep Wetlands

Wetland Importance and Sensitivity	Seep
Ecological Importance and Sensitivity	2.3
Hydrological/functional importance	1.6
Direct human benefits	2.0
Highest Value	**2.3**
EIS Category	**High**

Table 4-20: Ecological Importance and Sensitivity - Rivers

Biological determinants		
Determinant	**Rating**	**Interpretation**
Rare and endangered biota	2	Moderate
Unique biota	1	Low
Intolerant biota	4	High
Species richness	1	Low
Habitat determinants		
Diversity of aquatic habitat	3	High
Refuge value of habitat types	1	Low
Sensitivity of habitat to flow modification	3	High
Sensitivity to flow related water quality changes	3	High
Migration route corridor for instream and riparian biota	3	High
National parks and wilderness areas	3	High
Mean	2.4	-
EIS class	High	Delineations that are considered to be unique on a national or even international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.

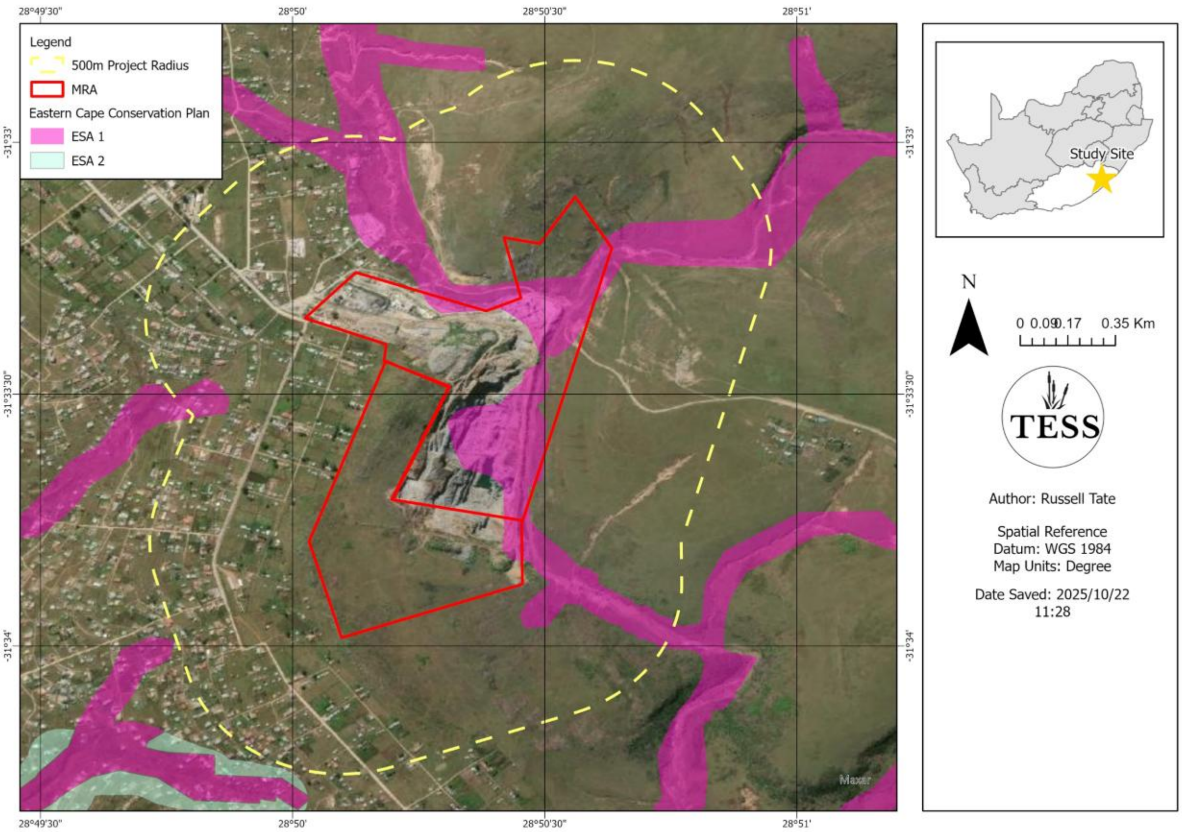

Figure 4-15: Eastern Cape Conservation Plan

4.6 Buffers and Regulated Areas

It is important to note that the proposed project falls within the legislated 500m regulated area as per the following definition:

Regulated area of a watercourse for Section 21 (c) or (i) of the Act water uses in terms of the Notice means:

- (c) A 500m radius from the delineated boundary (extent) of any wetland or pan.

According to the National Environmental Management Act (Act no. 107 of 1998), Amendment of the Environmental Impact Assessment Regulations listing notice 1 of 2014, should no existing setback be defined, an area of 32 metres from the edge of the watercourse must not be developed (buffered).

Wetland buffer zones were defined according to Macfarlane et al. (2009). It is noted that the proposed project is to take place within the regulated areas within 500m from the delineated wetland areas. The proposed project will be for the expansion of an existing quarry, and the continued processing of weathered quartzite to produce aggregate and sand products.

The threat assessment for the proposed project is indicated in Table 4-21. The results of the buffer analysis are presented in Table 4-22 and Table 4-23 whilst this is mapped in Figure 4-16. The buffer analysis recommended a 50m buffer requirement for delineated watercourses.

It should be noted that the quarry and mining processing facilities are currently active and the project would be for the expansion of the quarry site only.

Table 4-21: The pre-and post- mitigation threat analysis defined for the project

Phase	Threat	Before Mitigation	After mitigation
Construction Phase	1. Alteration to flow volumes	VL	VL
	2. Alteration of patterns of flows (increased flood peaks)	L	L
	3. Increase in sediment inputs & turbidity	VH	VH
	4. Increased nutrient inputs	VL	VL
	5. Inputs of toxic organic contaminants	VL	VL
	6. Inputs of toxic heavy metal contaminants	L	L
	7. Alteration of acidity (pH)	VL	VL
	8. Increased inputs of salts (salinization)	VL	VL
	9. Change (elevation) of water temperature	VL	VL
	10. Pathogen inputs (i.e. disease-causing organisms)	VL	VL
Operational Phase	1. Alteration to flow volumes	L	L
	2. Alteration of patterns of flows (increased flood peaks)	VL	VL
	3. Increase in sediment inputs & turbidity	VH	VH
	4. Increased nutrient inputs	L	L
	5. Inputs of toxic organic contaminants	L	L
	6. Inputs of toxic heavy metal contaminants	L	L
	7. Alteration of acidity (pH)	L	L
	8. Increased inputs of salts (salinization)	L	L
	9. Change (elevation) of water temperature	L	L
	10. Pathogen inputs (i.e. disease-causing organisms)	VL	VL

Table 4-22: Buffer requirements before and after mitigation in the Seeps

Phase	Before mitigation	After mitigation	Recommended Buffer
Construction	110	35	50
Operation	110	35	50

Table 4-23: Buffer requirements before and after mitigation in the Riverine

Phase	Before mitigation	After mitigation	Recommended Buffer
Construction	110	39	50
Operation	110	39	50

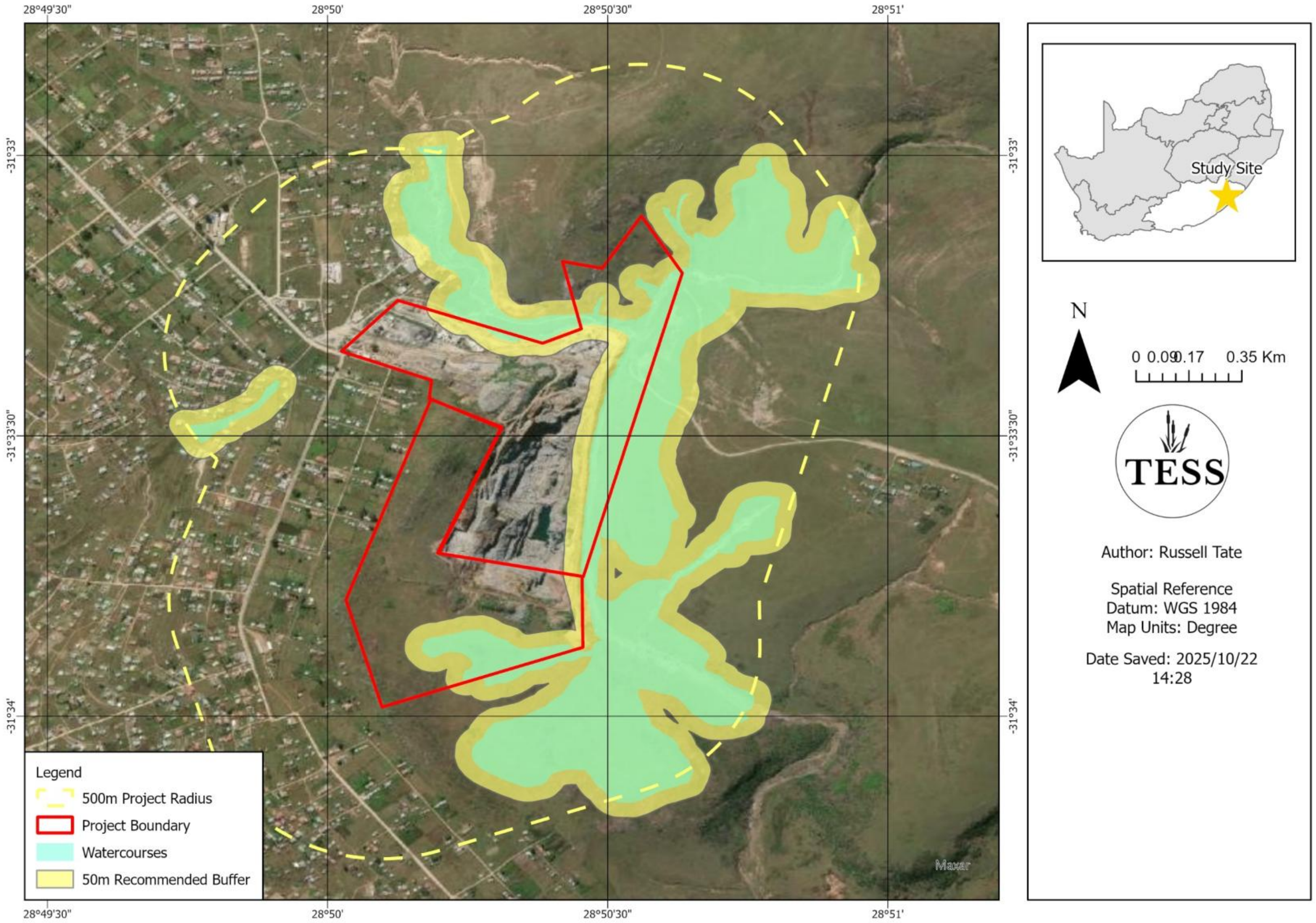

Figure 4-16: Buffer zones recommended for the watercourses in the project area

5 Anticipated Impacts

5.1 Risk Assessment Methodology

Two risk assessment approaches were utilised in this assessment, the first was to address the minimum requirements of the DWS, whilst the second risk assessment was applicable to the National Environmental Management Act (NEMA) standards. And aligns with standard approaches to determine impact in a similar manner to other ecological standards. The DWS risk assessment was conducted in accordance with the requirements of the DWS General Authorisation (GA) legislation in terms of Section 39 of the NWA for water uses as defined in Section 21(c) or Section 21(i) (GN 49833 of 2023) as well as GN 4167 of 2023.

Table 5-1: Risk Assessment Matrix Interpretation

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	**(L) Low Risk OR (+) Positive (+ +) Highly positive**	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
30 – 60	**(M) Moderate Risk**	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
61 – 100	**(H) High Risk**	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

Once a potential impact has been determined it is necessary to identify which project activity will cause the impact, the probability of occurrence of the impact, and its magnitude and extent (spatial and temporal). This information is important for evaluating the significance of the impact, and for defining mitigation and monitoring strategies. Direct and indirect impacts of the impacts identified during the specialist investigations were assessed in terms of five standard rating scales to determine their significance.

The rating system used for assessing impacts (or when specific impacts cannot be identified, the broader term issue should apply) is based on six criteria, namely:

- Status of impacts (**Table 5-2**) – determines whether the potential impact is positive (positive gain to the environment), negative (negative impact on the environment), or neutral (i.e. no perceived cost or benefit to the environment). Take note that a positive impact will have a low score value as the impact is considered favourable to the environment;
- Spatial extent of impacts (**Table 5-3**) – determines the spatial scale of the impact on a scale of localised to global effect. Many impacts are significant only within the immediate vicinity of the site or within the surrounding

community, whilst others may be significant at a local or regional level. Potential impact is expressed numerically on a scale of 1 (site-specific) to 5 (global);

- Duration of impacts (**Table 5-4**) – refers to the length of time that the aspect may cause a change either positively or negatively on the environment. Potential impact is expressed numerically on a scale of 1 (project duration) to 5 (permanent);
- Frequency of the activity (**Table 5-5**)– The frequency of the activity refers to how regularly the activity takes place. The more frequent an activity, the more potential there is for a related impact to occur.
- Severity of impacts (**Table 5-6**) – quantifies the impact in terms of the magnitude of the effect on the baseline environment, and includes consideration of the following factors:
    - The reversibility of the impact;
    - The sensitivity of the receptor to the stressor;
    - The impact duration, its permanency and whether it increases or decreases with time;
    - Whether the aspect is controversial or would set a precedent;
    - The threat to environmental and health standards and objectives;
- Probability of impacts (**Table 5-7**) –quantifies the impact in terms of the likelihood of the impact occurring on a percentage scale of <5% (improbable) to >95% (definite).
- Confidence – The degree of confidence in predictions based on available information and specialist knowledge:
    - Low;
    - Medium; or
    - High.

In addition, each impact needs to be assessed in terms of reversibility and irreplaceability as indicated below:

- Reversibility of the Impacts - the extent to which the impacts/risks are reversible assuming that the project has reached the end of its life cycle (decommissioning phase):
    - High reversibility of impacts (impact is highly reversible at end of project life i.e. this is the most favourable assessment for the environment);
    - Moderate reversibility of impacts;
    - Low reversibility of impacts; or
    - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment).
- Irreplaceability of Receiving Environment/Resource Loss caused by impacts/risks – the degree to which the impact causes irreplaceable loss of resources assuming that the project has reached the end of its life cycle (decommissioning phase):

- High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment);
- Moderate irreplaceability of resources;
- Low irreplaceability of resources; or
- Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Table 5-2: Status of Impacts

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment (positive impact)	+
Neutral	No determined cost or benefit to the receiving environment	N
Negative	At cost to the receiving environment (negative impact)	-

Table 5-3: Extent of Impacts

Rating	Description	Quantitative Rating
Very Low	**Site Specific** – impacts confined within the project site boundary	1
Low	**Proximal** – impacts extend to within 1 km of the project site boundary	2
Medium	**Local** – impacts extend beyond to within 5 km of the project site boundary	3
High	**Regional** – impacts extend beyond the site boundary and have a widespread effect - i.e. > 5 km from project site boundary	4
Very High	**Global** – impacts extend beyond the site boundary and have a national or global effect	5

Table 5-4: Duration of Impacts

Rating	Description	Quantitative Rating
Very Low	**Project duration** – impacts expected for the duration of the project or not greater than 1 year	1
Low	**Short term** – impacts expected on a duration timescale of 1 to 2 years	2
Medium	**Medium term** – impacts expected on a duration timescale of 2-5 years	3
High	**Long term** – impacts expected on a duration timescale of 5-15 years	4
Very High	**Permanent** – impacts expected on a duration timescale exceeding 15 years	5

Table 5-5: Frequency of impacts

Rating	Frequency	Quantitative Rating
Very Low	Annually or less	1
Low	6 monthly	2
Medium	Monthly	3
High	Weekly	4
Very High	Daily / Permanent	5

Table 5-6: Severity of Impacts

Rating	Description	Quantitative Rating
Very Low	Negligible – zero or very low impact	1
Low	Small / potentially harmful	2
Medium	Significant / slightly harmful	3
High	Great / harmful	4
Very High	Disastrous / extremely harmful	5

Table 5-7: Probability of Impacts

Rating	Description	Quantitative Rating
Highly Improbable	Likelihood of the impact arising is estimated to be negligible; <5%.	1

Rating	Description	Quantitative Rating
Improbable	Likelihood of the impact arising is estimated to be 5-35%.	2
Possible	Likelihood of the impact arising is estimated to be 35-65%	3
Probable	Likelihood of the impact arising is estimated to be 65-95%.	4
Highly Probable	Likelihood of the impact arising is estimated to be > 95%.	5

5.2 Determination of Impact Significance

The information presented above in terms of identifying and describing the aspects and impacts is summarised in below in Table 5-8 and significance is assigned with supporting rationale.

The environmental significance rating is an attempt to evaluate the importance of a particular impact, the consequence and likelihood of which is assessed by the relevant specialist. The description and assessment of the aspects and impacts is presented in a consolidated table with the significance of the impact assigned using the process and matrix detailed below.

The sum of the first three criteria (spatial scope, duration and severity) provides a collective score for the consequence of each impact. The sum of the last two criteria (frequency of activity and frequency of impact) determines the likelihood of the impact occurring. The product of consequence and likelihood leads to the assessment of the significance of the impact (Significance = Consequence X Likelihood), shown in the significance matrix below in **Table 5-9**.

Table 5-8: Consolidated Table of Aspects and Impacts Scoring

Spatial Scale	**Rating**	**Duration**	**Rating**	**Severity**	**Rating**
Activity specific	1	One day to one month	1	Insignificant/non-harmful	1
Area specific	2	One month to one year	2	Small/potentially harmful	2
Whole site/plant/mine	3	One year to ten years	3	Significant/slightly harmful	3
Regional/neighbouring areas	4	Life of operation	4	Great/harmful	4
National	5	Post closure	5	Disastrous/extremely harmful	5

Frequency of Activity	Rating	Probability of Impact	Rating
Annually / Once-off	1	Almost never/almost impossible (<5%)	1
6 monthly	2	Very seldom/highly unlikely (5-35%)	2
Monthly	3	Infrequent/unlikely/seldom (35-65%)	3
Weekly	4	Often/regularly/likely/possible (65-95%)	4
Daily / Regularly	5	Daily/highly likely/definitely (> 95%)	5

Significance Rating of Impacts	Timing
Very Low (1-25) Low (26-50) Low – Medium (51-75) Medium – High (76-100) High (101-125) Very High (126-150)	Pre-construction Construction Operation Decommissioning

Table 5-9: Significance Assessment Matrix

	Consequence (Severity + Spatial Scope + Duration)														
Likelihood (Frequency of Activity + Probability of Impact)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	08	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

Table 5-10: Positive and Negative Impact Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very High	126-150	Avoidance – consider alternatives	Optimal contribution from Project
	High	101-125	Avoidance as far as possible; implement strict mitigation measures to account for residual impacts	Positive contribution from Project with scope to improve
	Medium-High	76-100	Where avoidance is not possible, consider strict mitigation measures	Moderate contribution from Project with scope to improve
	Low-Medium	51-75	Mitigation measures to lower impacts and manage the project impacts appropriately	Improve on mitigation measures
	Low	26-50	Appropriate mitigation measures to manage the project impacts	Improve on mitigation measures; consider alternatives to improve on
	Very Low	1-25	Ensure impacts remain very low	Consider alternatives to improve on

The model outcome is then assessed in terms of impact certainty and consideration of available information. Where a particular variable rationally requires weighting or an additional variable requires consideration the model outcome is adjusted accordingly.

5.3 Risk Assessment Results

5.3.1 Existing Activities – No Go Situation

Existing activities within the project area include active mining activities, processing, livestock and cultivation agriculture, urban activities and road infrastructure.

The historical activities have had a moderate to large impact on the condition of the watercourses. The no-go situation is therefore identified as the continuation of the deterioration of the assessed watercourses.

5.3.2 Project Description

The existing mining activities are proposed to be expanded into an undeveloped land portion as illustrated in Figure 5-1.

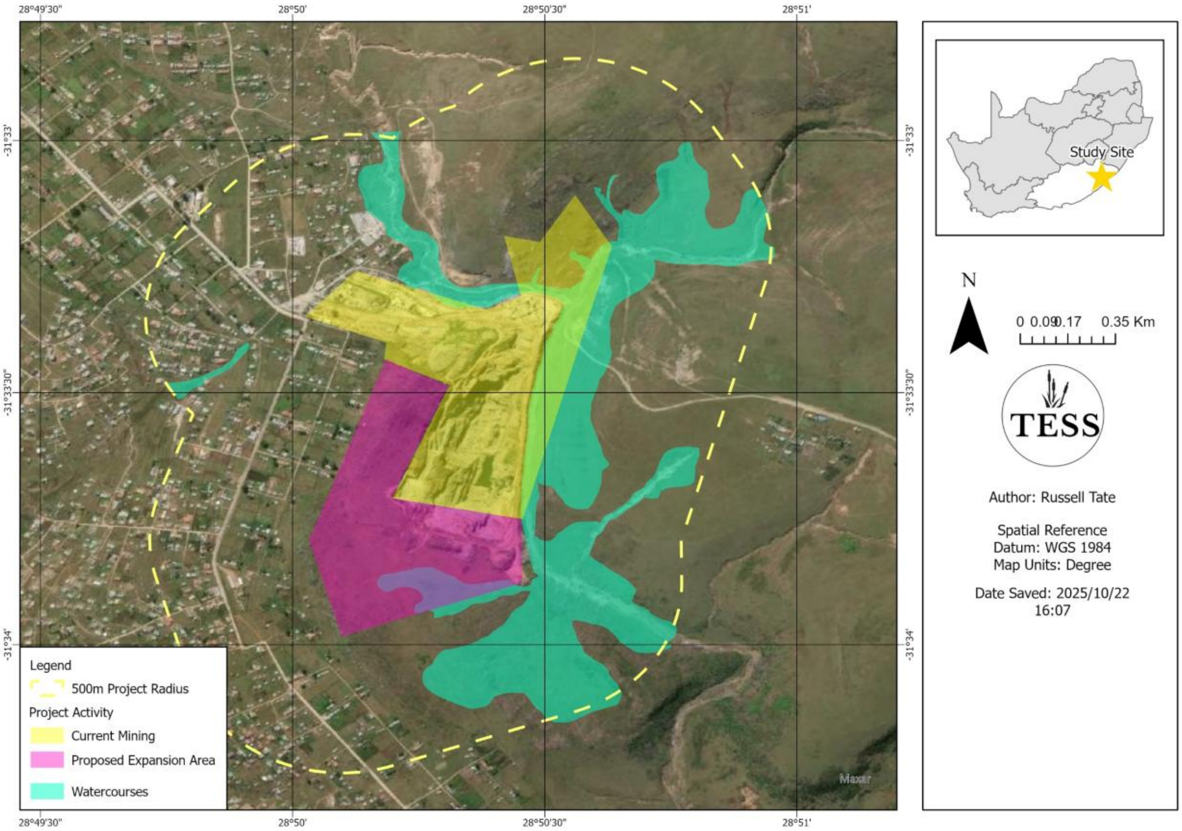

Figure 5-1: Proposed Project Activities

The current and proposed mining operations include expanding the existing pit through opencast methods, and the processing of weathered quartzite to make aggregate and sand products. Proposed activities will include:

- Site clearance/preparation.
- Placement of mobile equipment.
- Construction of stormwater controls.
- Clearing of vegetation and topsoil ahead of the excavation areas.
- Loosening of quartzite material through mechanical and blasting means.
- Haulage of material.
- Processing will occur via crushing and screening (existing).
- Supporting services which are to take place include the use of an existing workshop and admin buildings (existing).
- Water for the project will be sourced from collected pit water (existing).
- Decommissioning activities will include the sloping of benches to a suitable angle as well as the control of invasive vegetation and establishment of native flora.

No existing and ongoing activities are included in this risk assessment. The activities included are related to the expansion of mining activities, thus no processing activities are considered.

5.3.3 Linear Infrastructure

The existing road infrastructure on the site will be utilised for all ongoing and proposed activities. Newly developed portions will however be accessed by an expanded road network.

5.3.3.1 Avoidance

It is noted that the watercourses delineated in this study must be avoided by linear infrastructure. No further infilling of riparian habitats must occur.

5.3.3.2 Construction Phase

The construction phase of linear infrastructure will involve the active clearing of vegetation, alteration of slope as well as general catchment drainage modification. Only indirect impacts are anticipated from this infrastructure type should avoidance be implemented.

5.3.3.2.1 Mitigation Actions

Mitigation actions and infrastructure design must ensure compliance in the implementation of the standards and measures stipulated in General Notice (GN) 4167 published in Government Gazette 49833 of 8 December 2023 (GN 4167) as provided below, the developer must ensure that the activities are:

- Structurally stable.
- Do not induce sedimentation, erosion or flooding.
- Do not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse.
- Do not cause a detrimental change in the quality of water in the watercourse.
- Do not cause detrimental change in the stability or geomorphological structure of the watercourse.
- Do not create a nuisance condition, or health or safety hazards.
- Impeding or diverting the flow/ and or altering the bed, banks, course or characteristics of a watercourse do not detrimentally affect the on-site and surrounding environment or other up-stream and down-stream water users, property, health and safety of the general public or resource quality.
- The existing hydraulic, hydrological, geomorphic and ecological functions of the watercourse in the vicinity of the structure is maintained or improved upon.
- Ensure that all construction and maintenance activities take place outside the 1 in 100-year flood line or riparian habitat.
- The construction activities must ensure that a maximum impact footprint around the works is established, clearly demarcated, that no vegetation is cleared or damaged beyond this demarcation, and that equipment and machinery is only operated within the delineated impact footprint.

The following general mitigation measures are recommended:

- Storm-water generated from roadways must be captured and buffered, where flow velocities are to be significantly reduced before discharge into the environment.
- All contractors and staff are to be familiarised with the method statement and have undergone an induction / training on the location of sensitive No-Go areas and basic environmental awareness using the mitigation provided in this report.
- Areas where construction is to take place must be clearly demarcated. Any areas not demarcated must be avoided.
- Storm-water verges as well as other denuded areas must be grassed (re-vegetated) with local indigenous grasses to protect against erosion.
- Any materials excavated must not be deposited in the wetlands or areas where it is prone to being washed downstream or impeding natural flow.
- Stockpiling or storage of materials and/or waste must be placed beyond the defined buffers in this report for each respective activity.
- No vehicles shall enter watercourse buffer zones outside of construction footprints.
- Hydrocarbons for refuelling purposes must be stored in a suitable storage device on an impermeable surface outside of the delineated wetland buffer zone.
- Disturbed areas must be re-vegetated after completion of the phase:
  - A six-month timeframe for the initiation of this action.
  - Ripping of the soils should occur in two directions.
  - Removed vegetation and topsoil can be harvested and applied here.
- Drainage channels constructed for the access roads must be constructed so as not to result in erosion.
- An alien vegetation removal and management plan must be implemented along the verges of the roads and the existing wetland crossing point.
- General storm-water management practices should be included in the design phase and implemented during the construction phase of this project.
- Following the completion of the phase, all construction materials and debris should be removed and disposed of in a suitable area. An inspection should be completed within a 8 week period after the phase is completed.

5.3.3.3 Operation Phase

Drainage off the hardened surfaces created by the roadways structures are anticipated to be silt laden and of a higher runoff velocity during rainfall events. This can result in the erosion and sedimentation of downslope watercourses. The subsequent effect of this would be water and habitat quality deterioration in downslope waterbodies leading to a decreased ecological status of associated watercourses.

5.3.3.3.1 Mitigation Actions

The following mitigation is recommended for the operational phase

- The implementation of mitigation actions indicated in the construction phase.
- The implementation of a suitable storm-water management plan for the disturbance footprint must be in place and implemented by this phase.
- An annual audit of the road areas for signs of environmental disturbance outside and within the footprint area must be conducted.
- Alien invasive management programmes should continue throughout the duration of the activity.
- Watercourse monitoring should take place at least every three years as part of the environmental management plan.

5.3.3.4 Decommissioning Phase

The impacts expected to be taking place during the decommissioning phase would likely be similar to that of the construction phase where disturbed areas are likely to generate sediment which may impact downslope waterbodies.

5.3.3.4.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- An alien invasive management plan should be developed.
- Areas where decommissioning is to take place must be clearly demarcated. Any areas not demarcated must be avoided.

5.3.4 Mining Activities

5.3.4.1 Direct Impact

A total of 3.18 hectares of direct impact by mining activities are expected to occur in wetlands (HGM3) should mining take place. Should this be proposed, an offset requirement for the wetland unit is required (Macfarlane et al., 2014). In order to implement this requirement, an offset study is required. This is recommended based on:

- Significant impacts on water resources that cannot be fully mitigated.
- Residual negative impacts which remain after mitigation.
- Indirect impacts to an Ecological Support Area and impacts to an area within 32m of a watercourse.

Based on the current proposed developmental footprint area and its proximity to the identified watercourses, construction and operation of the development the following impacts can be expected:

- Increased Sedimentation and Erosion:

  - Soil disturbance, vegetation clearing, and poor stockpile management can lead to sediment runoff into water bodies, smothering aquatic habitats and degrading water quality.
- Alteration of Natural Hydrology:
  - Excavations, roads, stormwater development disrupt natural drainage patterns, impacting hydrological processes including groundwater recharge, and surface streamflow dynamics.
- Water Pollution
  - Use and storage of fuels, oils, and chemicals can result in spills and leaks, contaminating surface and groundwater and harming aquatic biodiversity.

5.3.4.2 Avoidance

Should resource planning allow, the mining activities should aim to avoid the established buffer zones and therefore no direct impacts to watercourses are expected from the mining activities.

5.3.4.3 Construction Phase

The direct mining of a wetland will have an impact to the following hydrological processes:

- Altered runoff pattern/volume/velocity.
- Altered Peak Flow Volume.
- Altered Peak Frequency.
- Increased sediment load.

The alteration of the hydrological processes will have a direct effect on the downslope watercourse condition.

Indirect impacts are expected to take place from the excavations, where water balance changes are expected to occur. The management of stormwater as well as pit water is important as this can present a risk to water quality of downslope waterbodies.

5.3.4.3.1 Mitigation Actions

Mitigation actions and infrastructure design must ensure compliance in the implementation of the standards and measures stipulated in General Notice (GN) 4167 published in Government Gazette 49833 of 8 December 2023 (GN 4167) as provided below, the developer must ensure that the activities are:

- Structurally stable.
- Do not induce sedimentation, erosion or flooding.
- Do not cause a detrimental change in the quantity, velocity, pattern, timing, water level and assurance of flow in a watercourse.
- Do not cause a detrimental change in the quality of water in the watercourse.

- Do not cause detrimental change in the stability or geomorphological structure of the watercourse.
- Do not create a nuisance condition, or health or safety hazards.
- Impeding or diverting the flow/ and or altering the bed, banks, course or characteristics of a watercourse do not detrimentally affect the on-site and surrounding environment or other up-stream and down-stream water users, property, health and safety of the general public or resource quality.
- The existing hydraulic, hydrological, geomorphic and ecological functions of the watercourse in the vicinity of the structure is maintained or improved upon.
- Ensure that all construction and maintenance activities take place outside the 1 in 100-year flood line or riparian habitat.
- The construction activities must ensure that a maximum impact footprint around the works is established, clearly demarcated, that no vegetation is cleared or damaged beyond this demarcation, and that equipment and machinery is only operated within the delineated impact footprint.

The following general mitigation measures are recommended:

- The implementation of the buffer zone stipulated in this report.
- Clean and dirty surface water separation and a storm-water management plan must be put into place via standard best practice methods.
- An effective storm-water management plan for developed areas must be implemented.
- The revegetation of disturbed non-active cleared areas must take place within the first growing season between following completion of the activity.
- The above must be audited within 3 months of completing the phase.
- No discharge of domestic water must occur if possible. Domestic water must be reused for dust suppression.
- All stockpiles and hazardous waste storage areas must be bunded by either a cut-off trench or berm directed to a Pollution Control Dam or alternative storage facility inline with best practice surface water management guidelines.

5.3.4.4 Operational Phase

The operation of the structures will include the continual expansion of the open pit and therefore similar impacts to the construction phase can be expected.

5.3.4.4.1 Mitigation Actions

- The implementation of mitigations actions provided in the construction phase.
- The implementation of the buffer zones provided in this report.
- Clean and dirty surface water separation and storm-water management plan must be put into place via standard best practice methods.
- An effective storm-water management plan for the project must be implemented.

- The revegetation of disturbed non-active cleared areas must take place within 6 month of completing the construction phase.
- The above must be audited within 3 months of completing the phase.
- No discharge of domestic water must occur if possible. Domestic water must be reused for dust suppression. Should domestic water be required to be discharge, the management of nitrogen concentrations is imperative.

5.3.4.5 Decommissioning Phase

Similar impacts as indicating in the construction phase are expected during the decommissioning phase of the open pit. Runoff from the open pit would likely contain elevated dissolved solids and suspended materials which could reduce the condition of the downslope waterbodies.

5.3.4.5.1 Mitigation Actions

- An overarching rehabilitation plan should be developed, implemented and adapted throughout the life of the project.
- The revegetation of disturbed non-active cleared areas must take place within the first growing season between following completion of the activity.
- The above must be audited within 3 months of completing the phase.
- An alien invasive flora management plan should be developed.

5.3.5 Risk Assessment Tables

Table 5-11: Summary Results of the standardised DWS Risk Assessment

Phase	Activity	Impact	Risk Rating After Mitigation (HGM3)	Risk Interpretation
Construction phase	Site access and clearing of vegetation in working areas	• Increased sedimentation in nearby water bodies due to soil disturbance. • Loss of wetland and riparian vegetation. • Reduction in habitat complexity. • Disturbance to aquatic and semi-aquatic biodiversity through increased human activity and noise. • Enhanced erosion potential, especially on slopes or during heavy rainfall events.	Low	Low
	Establishment of laydown yards/construction camps	• Risk of contamination from improper waste disposal (sewage, solid waste, grey water). • Potential for oil and fuel leaks from machinery and vehicles, leading to surface or groundwater pollution. • Compaction of soil, reducing infiltration and increasing surface runoff into aquatic systems. • Introduction of invasive species via construction materials or vehicles. • Increased risk of accidental spills and poor stormwater management near camps.	Low	Low
	Excavations and earthworks	• Increased sediment runoff into rivers and wetlands, impacting aquatic fauna and flora. • Direct impacts to wetlands resulting in hydrological process alteration. • Disruption of natural flow paths and hydrological connectivity. • Disturbance of aquatic habitats. • Altered infiltration, runoff and groundwater recharge dynamics.	High	High
	Stockpiling/movement of soils	• Dust and particulate runoff into water bodies, degrading water quality. • Erosion from uncovered or poorly managed stockpiles, increasing sediment loads. • Soil compaction and alteration of natural runoff patterns.	Low	Low
	Storage and use of chemicals, fuels and oils.	• Risk of spills and leaks leading to contamination of surface and groundwater. • Toxic impacts on aquatic life, including fish kills and disruption of invertebrate communities. • Long-term accumulation of pollutants in sediments and aquatic food webs. • Volatilization or runoff of hazardous substances during rainfall. • Secondary contamination through improper disposal of containers or waste.	Low	Low
	Alteration of surface drainage and hydrological processes	• Disrupted drainage patterns. • Erosion and sedimentation of wetlands, stream banks and channels from altered flow velocities. • Reduced groundwater recharge.	Low	Low
Operation phase	Storage and use of chemicals, fuels and oils.	• Risk of spills and leaks leading to contamination of surface and groundwater. • Toxic impacts on aquatic life, including fish kills and disruption of invertebrate communities. • Long-term accumulation of pollutants in sediments and aquatic food webs. • Volatilization or runoff of hazardous substances during rainfall. • Secondary contamination through improper disposal of containers or waste.	Low	Low
	Alteration of surface drainage and hydrological processes	• Disrupted drainage patterns. • Direct impacts to wetlands resulting in hydrological process alteration. • Erosion and sedimentation of wetlands, stream banks and channels from altered flow velocities. • Reduced groundwater recharge.	High	High

Table 5-12: NEMA Risk Assessment Results – Before Mitigation

Phase	**Construction/Decommissioning**						**Operation**					
Activity	Site access and clearing of vegetation in working areas	Establishment of laydown yards/construction camps	Excavations and earthworks	Stockpiling/movement of soils	Storage and use of chemicals, fuels and oils.	Alteration of surface drainage and hydrological processes	Site access and clearing of vegetation in working areas	Establishment of laydown yards/construction camps	Excavations and earthworks	Stockpiling/movement of soils	Storage and use of chemicals, fuels and oils.	Alteration of surface drainage and hydrological processes
Spatial Scale	1	1	3	1	1	3	1	1	3	1	1	3
Duration	4	4	5	4	4	5	4	4	5	4	4	5
Severity	2	2	5	2	2	5	2	2	5	2	2	5
Frequency	2	2	5	1	1	5	2	1	5	1	1	5
Probability	3	3	5	2	1	5	3	3	5	2	1	5
Significance Rating	35	35	130	21	14	130	35	28	130	21	14	130
Significance interpretation	Low	Low	Very High	Low	Low	Very High	Low	Low	Very High	Low	Low	Very High

Table 5-13: NEMA Risk Assessment Results – After Mitigation

Phase	**Construction/Decommissioning**						**Operation**					
Activity	Site access and clearing of vegetation in working areas	Establishment of laydown yards/construction camps	Excavations and earthworks	Stockpiling/movement of soils	Storage and use of chemicals, fuels and oils.	Alteration of surface drainage and hydrological processes	Site access and clearing of vegetation in working areas	Establishment of laydown yards/construction camps	Excavations and earthworks	Stockpiling/movement of soils	Storage and use of chemicals, fuels and oils.	Alteration of surface drainage and hydrological processes
Spatial Scale	1	1	3	1	1	3	1	1	3	1	1	3
Duration	4	4	5	4	4	5	4	4	5	4	4	5
Severity	2	2	5	2	2	5	2	2	5	2	2	5
Frequency	2	2	5	1	1	5	2	1	5	1	1	5
Probability	2	2	5	1	1	5	2	2	5	1	1	5
Significance Rating	28	28	130	14	14	130	28	21	130	14	14	130
Significance interpretation	Low	Low	Very High	Low	Low	Very High	Low	Low	Very High	Low	Low	Very High

Table 5-14: NEMA Impact Assessment –Cumulative – Water and Habitat impacts Pre-Mitigation

Phase	Construction Phase	Operational Phase
Activity	Alteration of surface drainage and hydrological processes	Alteration of surface drainage and hydrological processes
Spatial Scale	3	3
Duration	5	5
Severity	5	5
Frequency	5	5
Probability	5	5
Significance Rating	130	130
Significance interpretation	Very High	Very High
Consequence	13	13
Likelihood	10	10

Table 5-15: NEMA Impact Assessment –Cumulative – Water and Habitat impacts Post Mitigation

Phase	Construction Phase	Operational Phase
Activity	Alteration of surface drainage and hydrological processes	Alteration of surface drainage and hydrological processes
Spatial Scale	3	3
Duration	5	5
Severity	5	5
Frequency	5	5
Probability	5	5
Significance Rating	130	130
Significance interpretation	Very High	Very High
Consequence	13	13
Likelihood	10	10

5.4 Unplanned Events

The planned activities of the development will have known impacts which were discussed; however, there is potential for unanticipated impacts on a watercourse which result from accidents or equipment failure. As a result, these risks are undefined as the size, volume, toxicity etc. are unknown making assessing the risk unfeasible; however, their potential for modification of a system should still be noted. Due to the unanticipated nature of these risks, capturing them all is impossible. Hydrocarbon spillages into riverine habitat has the potential to contaminate both sediments and water resources. As a result, spill kits must be always available on site with all incidents reported to the onsite Environmental Control Officer (ECO). During construction, unplanned erosion may occur from, for example bank collapse during construction which will result in the sedimentation of the watercourse downstream. Erosion control measures must therefore be considered.

Table 5-16 is a summary of the findings from a riverine ecology perspective. Please note not all potential unplanned events may be captured herein and this must therefore be managed throughout all phases.

Table 5-16: Unplanned Events and their Management Measures

Unplanned Event	Potential Impact	Mitigation
Hydrocarbon spill	Contamination of sediments and water resources associated with the spillage.	A spill response kit must be always available. The incident must be reported on and if necessary a wetland specialist must investigate the extent of the impact and provide rehabilitation recommendations.
Uncontrolled erosion	Sedimentation of downstream river reach.	Erosion control measures must be put in place. Monitoring and active engagement with local land users is recommended to monitor for erosion in the long term.

5.5 Cumulative Impact Assessment

The results of the cumulative impact assessment are provided above Table 5-14 and Table 5-15.

5.5.1 Cumulative Impact Statement

The expected cumulative impacts for the proposed project on aquatic biodiversity are rated as significant due to the residual impact to watercourses. A wetland offset study is recommended to take place.

5.6 Irreplaceable Loss

Should the mitigation and avoidance actions as recommended in this study be implemented, no irreplaceable loss of aquatic biodiversity can be expected. However, should mining of the wetland unit HGM5 occur, the permanent loss of wetland habitat is expected.

6 Aquatic Ecology Minimum Requirements Statements

The National Environmental Management Act (NEMA) has established minimum criteria that must be considered in aquatic biodiversity studies (RSA Government, 2020). Although these aspects were largely covered in this report, specific aspects relating to the anticipated impacts remain. The following table was compiled to directly address the remaining aspects not already covered by the impact and risk assessment (Table 6-1).

Table 6-1: Additional aspects required by the minimum report requirement notice

Condition	Response
2.5.1: Is the proposed development consistent with maintaining the priority aquatic ecosystems in its current state and according to the stated goal.	No NFEPA areas to be affected.
2.5.2: Is the proposed development consistent with maintaining the resource quality objectives.	No applicable Resource Quality Objectives anticipated to be impacted.
2.5.3a: How will the project impact on the hydrological functioning at a landscape level.	The project will directly impact water balance of the downslope watercourses. Furthermore, the open pit will likely reduce infiltration rates and increase the catchment hardness.
2.5.3a: Will the proposed development change the sediment regime of the aquatic ecosystem.	An increase in sediment yields can be expected from the project.
2.5.3c: What will the extent of the modification in relation to the overall aquatic ecosystem be.	Should avoidance be implemented limited impacts to watercourse extents can be expected. Should mining of wetland occur, a direct modification of 3.18 hectares is expected.
2.5.3d: To what extent will the risks associated with water uses and related activities change.	There will be a minimal impact to water users associated with the project.
2.5.4a: How will the proposed development effect base flows.	Some impact to local baseflow is expected. This will not be significant in relation to the size of the Corana Watershed.
2.5.4b: How will the proposed development effect the quantity of water.	It is expected that an increase peak flow will occur in the associated watercourses.
2.5.4b: How will the proposed development effect the hydrogeomorphic characteristics of the watercourse.	A seep wetland of 3.18 hectares is expected to be lost.
2.5.4b: How will the proposed development effect the quality of water.	Some impact to water quality is expected due to runoff from stockpiles and stormwater management structures.
2.5.4b: How will the proposed development effect habitat fragmentation.	There is unlikely to be habitat fragmentation in the watercourses considered.
2.5.4f: How will the proposed development effect unique or important aquatic features.	The seep wetland is rated as High importance, the proposed development will directly impact this wetland.
2.5.5a: How will the proposed development impact on flood attenuation.	An increase in peak flow is expected and therefore a reduction in flood attenuation.
2.5.5b: How will the proposed development impact on streamflow regulation.	Limited significant impacts to streamflow are anticipated. However some minor change is expected.
2.5.5c: How will the proposed development impact on sediment trapping.	Sediment trapping of natural vegetation will be reduced by the project. The project will have a limited impact on sediment trapping.
2.5.5d: How will the proposed development impact on phosphate assimilation.	Phosphate assimilation is expected to be reduced in the watershed.
2.5.5e: How will the proposed development impact on nitrate assimilation.	Nitrate assimilation is expected to be reduced in the watershed.
2.5.5f: How will the proposed development impact on toxicant assimilation.	Toxicant assimilation is expected to be reduced in the watershed.

Condition	Response
2.5.5g: How will the proposed development impact on erosion control.	The proposed project will implement erosion/surface water controls and will therefore minimise erosion risk.
2.5.5h: How will the proposed development impact on carbon storage	Carbon storage in watercourses is unlikely to be impacted.
2.5.6: How will the proposed development impact on freshwater ecology with regards to the community composition	Aside for the direct loss of wetland habitat, indirect impacts are not expected to have a significant impact to downstream ecology.

7 Recommendations and Monitoring

The following monitoring plan is provided Table 7-1.

Table 7-1: Monitoring plan for the project

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored	Specifics
Current sites used in this study.	Overall ecological status	Once every three years	Methods applied in this study with the inclusion of statistical analysis	Sensitivity scores in the rivers must not deviate more than 30% from the means of the established scores.
				ASPT in the rivers must not deviate more than 30%
Current sites used in this study. Additional sites must be selected downstream to obtain a statistically relevant number of sites.	Determine if surface water quality deterioration is occurring.	Once every three years	Invertebrate communities must not differ significantly from baseline conditions	Statistical analysis must compare mean values of downstream sample points and ensure no significant differences occur ($p<0.05$)
Sites used in this study and any future surface water assessments.	Determine if surface water quality deterioration is occurring.	Once every three years	Standard water quality monitoring, as per the recommended in the surface water study which must accompany the overall application.	A full spectrum of water quality analysis must take place whereafter elements of concern must be monitored
Habitat Monitoring	The quantification of freshwater habitats within the project area	Once every three years	Standard wetland and riverine assessment with land cover analysis	The monitoring of the freshwater habitat changes will be important to interpret with changes in watercourse condition

The following are recommendations made in support of this study:

- It is recommended that floodlines are determined on the riverine habitats associated with the project. The floodline delineation will provide inputs into the suitable design
- A wetland offset study is recommended (Macfarlane et al., 2014).
- A water use license is recommended.

8 Conclusion

The outcome of this assessment delineated 13 watercourse HGM units within the AoI. Of these, 7 were considered for further assessment. The summarised information relating to the Present Ecological Status and Ecological Importance and Sensitivity is presented in Table 8-1. A scientific buffer was calculated for the watercourses, where a 50m buffer was utilised to protect these sensitive environments.

Table 8-1: PES and EIS Summaries

Watercourse Unit	PES	EIS	Buffer
HGM1	Class C	High	50m
HGM2	Class D	High	50m
HGM3	Class C	High	50m
HGM5	Class C	High	50m
HGM7	Class D	High	50m
HGM10	Class C	High	50m
HGM13	Class D	High	50m

8.1 Impact Statement

The outcomes of the risk assessment indicate significant residual direct impacts to wetlands. A total of 3.18 hectares of direct impact by mining activities are expected to occur in wetlands (HGM3) should mining take place. It is recommended that wetland habitats are avoided should resource development allow. Where wetland habitat is to be mined, a wetland offset study is recommended to be completed.

In the view of the proposed activities, should the proposed mitigation and offset actions be implemented, no fatal flaw was identified and the project should be favourably considered. In line with the recommendations, avoidance and an offset must be implemented.

9 References

Barbour MT Gerritsen J, White JS. 1996. Development of a stream condition index (SCI) for Florida. Prepared for Florida Department of Environmental Protection: Tallahassee, Florida.

Dallas HF. 2007. River Health Programme: South African Scoring System (SASS) Data Interpretation Guidelines. Report produced for the Department of Water Affairs and Forestry (Resource Quality Services) and the Institute of Natural Resources.

Department of Water and Sanitation (DWS). 2008. A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria, Republic of South Africa.

Dickens CWS, Graham PM. 2002. The South African Scoring System (SASS) Version 5: Rapid bioassessment method for rivers. African Journal of Aquatic Science. 27 (1): 1 -10.

Gerber A, Gabriel, MJM. 2002. Aquatic Invertebrates of South African Rivers Field Guide. Institute for Water Quality Studies. Department of Water Affairs and Forestry. 150pp

Kleynhans CJ, Louw MD. 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Resource Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 329/08.

Kleynhans CJ. 1996. A qualitative procedure for the assessment of the habitat integrity status of the Luvuvhu River (Limpopo System, South Africa) Journal of Aquatic Ecosystem Health 5:41-54.

Kleynhans CJ. 1999. Assessment of Ecological Importance and Sensitivity. Institute for Water Quality Studies, Department of Water Affairs and Forestry.

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

Kotze DC, Marneweck GC, Batchelor AL, Lindley DC, Collins NB. 2009. A Technique for rapidly assessing ecosystem services supplied by wetlands. Mondi Wetland Project.

Macfarlane DM, Dickens J, Von Hase F. 2009. Development of a methodology to determine the appropriate buffer zone width and type for developments associated with wetlands, watercourses and estuaries.

Macfarlane DM, Kotze DC, Ellery WN, Walters D, Koopman V, Goodman P, Coge C. 2008. WET-Health, a technique for rapidly assessing wetland health. WRC Report TT 340/08. Water Research Commission.

Macfarlane DM, Holness S, von Hase A, Brownli S, Kilian M. 2014. Wetland Offsets: A Best Practice Guideline for South Africa.

South African National Biodiversity Institute (SANBI) and Department of Water Affairs (DWA), Pretoria. WRC Report No. TT 618/14.

Macfarlane DM, Ollis DJ, Kotze DC. 2020. WET-Health (Version 2.0). A Refined Suite of Tools for Assessing the Present Ecological State of Wetland Ecosystems. Technical Guide. Water Research Commission. TT 820/20.

National Biodiversity Assessment (NBA). 2018. National Wetland Map 5 dataset. South African National Biodiversity Institute (SANBI).

Nel JL. 2011. ATLAS of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources, Pretoria: Water Research Commission.

Ollis DJ, Snaddon CD, Job NM, 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.

RSA Government. 2016. General Authorisation in Terms of Section 39 of the National Water Act, 1998 (Act no. 36 of 1998) For Water Uses as Defined in Section 21 (c) or Section 21 (i). Department of Water and Sanitation. Notice 509 of 2016.

South African National Biodiversity Institute (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).

Thirion A, Mocke A, Woest, R. 1995. Biological monitoring of streams and rivers using SASS4. A User's Manual. Internal Report No. N 000/00REQ/1195. Institute for Water Quality Studies. Department of Water Affairs and Forestry. 46.

Thirion CA. 2007. Module E: Macroinvertebrate Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. Pretoria, South Africa: Department of Water Affairs and Forestry.

WaPOR. 2025. https://wapor.apps.fao.org/home/WAPOR_2/1. Accessed 25/10/2025