Appendix C2_Freshwater Assessment

SCIENTIFIC AQUATIC SERVICES

Freshwater Assessment

AS PART OF THE ENVIRONMENTAL AND WATER USE AUTHORISATION PROCESSES FOR THE PROPOSED ADDITIONAL AREAS ASSOCIATED WITH THE UNDERGROUND MINING ACTIVITIES AT THE KWEZI SHAFT, LOCATED IN RUSTENBURG, NORTH WEST PROVINCE.

Prepared for:	Alta Van Dyk Environmental Consultants
Report author:	K. Coertze (Cand.Sci.Nat)
Report reviewer:	S. van Staden (Pri.Sci.Nat)
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Part of the SAS Environmental Group of Companies

Website: http://www.sasenvironmental.co.za

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed additional areas associated with the undermining of freshwater ecosystems (hereafter referred to as the 'proposed underground mining operation') at the existing Kwezi shaft in Rustenburg, North-West Province.

SAS previously undertook a freshwater and aquatic assessment for the reach of the Dorpspruit stream associated with the Kwezi Mining Right Area (MRA) in 2022. Subsequently, two (2) additional areas along the south western boundary of the MRA was included for undermining (the two additional areas will hereafter be referred to as the 'study area') and as such amendments to and/or new EA and WUA processes must updated and/or applied for.

The freshwater assessment for the study area (Blocks A and B) was undertaken in July 2024. No natural occurring freshwater ecosystems, as per the NWA (Act no. 36 of 1998), as amended was noted within the study area. A Channelled Valley Bottom (CVB) wetland was however identified within the north eastern portion of the investigation area. Due to the significant invasion of alien vegetation and modification of the hydraulic regimes, the CVB wetlands was assessed to be in a seriously modified (Category E) ecological condition and of low/marginal ecological importance and sensitivity.

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed undermining of the south eastern CVB wetland. Provided that all mitigation measures outlined in this report are adhered to throughout the life of the proposed underground mining operation, the perceived impact significance is "Low" provided that the mitigation measures as outlined in this report are strictly adhered to. Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against potential subsidence must be implemented and strictly adhered to. If any other rock engineer technical reports have been compiled since 2021, specifically for the undermining of the north eastern CVB wetland, then the recommendations and mitigation measures stipulated in those reports must also be adhered to. The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the potential formation of a pollution plume and possible decant of contaminated water from the mine into the receiving environment. It is also recommended that the pillar safety factor under the north eastern CVB wetland be increased to ensure that no subsidence of the watercourse takes place.

Thus, it is the opinion of the specialist that the proposed undermining of the north eastern CVB wetland associated with the expansion portions (Block A and B) of the Kwezi MRA is considered acceptable and can be authorised by means of a Water Use Authorisation process in terms of Government Notice (GN) 4167 as it relates to the National Water Act (NWA) and is acceptable for Environmental Authorisation (EA).

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed additional areas associated with the undermining of freshwater ecosystems (hereafter referred to as the 'proposed underground mining operation') at the existing Kwezi shaft in Rustenburg, North-West Province.

SAS previously undertook a freshwater and aquatic assessment for the reach of the Dorpspruit stream associated with the Kwezi Mining Right Area (MRA) in 2022. Subsequently, two (2) additional areas along the south western boundary of the MRA was included for undermining (the two additional areas will hereafter be referred to as the 'study area') and as such amendments to and/or new EA and WUA processes must updated and/or applied for.

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the proposed underground mining operation and the associated investigation area (defined as a 500 m radius around the study area), in line with Government Notice (GN) 4167 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended, in terms of freshwater characteristics, including mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS) and defining the Present Ecological State (PES) of the freshwater ecosystems associated with the proposed underground mining operation. The report also aims to define the socio-cultural and ecological service provision of the freshwater ecosystems and additionally outlines the Recommended Ecological Category (REC), Recommended Management Objective (RMO) and Best Attainable State (BAS) for the freshwater ecosystems.

The assessment took the following approach:

- A desktop study was conducted, in which possible freshwater ecosystems were identified for on-site investigation, and relevant national and provincial databases were consulted;
- The field assessment was undertaken on the 5th of July 2024 to ground truth the freshwater ecosystems associated with the study area. No natural occurring freshwater ecosystems were identified to be associated with the study area. However, a Channelled Valley Bottom (CVB) wetland was identified in the north eastern portion of the investigation area; and
- The characteristics of the wetland was defined including the PES, EIS, REC, RMO and BAS

The results of the field assessment are presented in Section 4 of this report, and are summarised in table A below:

Table A: Summary of results of the field assessment as discussed in Section 4.

Freshwater ecosystems	PES	Ecoservices importance	EIS	REC / RMO / BAS
Channelled Valley Bottom wetland.	E	Very low to low	Moderate	D/ Improve/D
Extent of modification anticipated.	**Low** Based on the PES and EIS of the south eastern CVB wetland and the findings of the DWS Risk Assessment Matrix, the activities associated with the proposed undermining of the north eastern CVB wetland will pose a "Low" risk to the ongoing functionality of the wetland. Key mitigation measures include: ➢ Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence and dewatering, formation of a pollution plume and decant respectively, must be implemented; ➢ The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the formation of a cone of depression and pollution plume, from the mine into the receiving environment; and ➢ It is advised that the pillar safety factor under the CVB wetland be increased to further ensure no subsidence takes place.			

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed undermining of the south eastern CVB wetland. Provided that all mitigation measures outlined in this report are adhered to throughout the life of the proposed underground mining operation, the perceived impact significance is “Low” provided that the mitigation measures as outlined in this report are strictly adhered to. Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against potential subsidence must be implemented and strictly adhered to. If any other rock engineer technical reports have been compiled since 2021, specifically for the undermining of the north eastern CVB wetland, then the recommendations and mitigation measures stipulated in those reports must also be adhered to. The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the potential formation of a pollution plume and possible decant of contaminated water from the mine into the receiving environment. It is also recommended that the pillar safety factor under the north eastern CVB wetland be increased to ensure that no subsidence of the watercourse takes place.

A summary of the DWS Risk Assessment is provided in Table B below.

Table B: Summary of DWS Risk Assessment applied to the north eastern CVB wetland associated within the proposed underground mining operation.

Phase	No.	Activity	Impact	Risk Rating
Operational	1	Operation of the underground mining area related to the undermining of the north eastern CVB wetland.	• Mining of PGM ore and associated interburden.	L
			• Potential destabilisation of the surrounding environment through the extraction of ore and subsequent potential subsidence of the land.	L
Closure/ Post Closure	2	Post-closure management activities.	• Decant of contaminated water from the rehabilitated mine area into the receiving environment, subject to confirmation by a suitably qualified geohydrologist.	L

Thus, it is the opinion of the specialist that the proposed undermining of the north eastern CVB wetland associated with the expansion portions (Block A and B) of the Kwezi MRA is considered acceptable and can be authorised by means of a Water Use Authorisation process in terms of Government Notice (GN) 4167 as it relates to the National Water Act (NWA) and is acceptable for Environmental Authorisation (EA).

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on aquatic biodiversity in terms of Government Notice 320 as promulgated in Government Gazette 43110 of 20 March 2020 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Appendix H
2.2	Description of the preferred development site, including the following aspects-	Section 1.1.1
2.2.1	a. Aquatic ecosystem type b. Presence of aquatic species and composition of aquatic species communities, their habitat, distribution and movement patterns	Section 4.4
2.2.2	Threat status, according to the national web based environmental screening tool of the species and ecosystems, including listed ecosystems as well as locally important habitat types identified	Section 3.1
2.2.3	National and Provincial priority status of the aquatic ecosystem (i.e. is this a wetland or river Freshwater Ecosystem Priority Area (FEPA), a FEPA sub- catchment, a Strategic Water Source Area (SWSA), a priority estuary, whether or not they are free-flowing rivers, wetland clusters, etc., a CBA or an ESA; including for all a description of the criteria for their given status	Section 3.1
2.2.4	A description of the Ecological Importance and Sensitivity of the aquatic ecosystem including: a. The description (spatially, if possible) of the ecosystem processes that operate in relation to the aquatic ecosystems on and immediately adjacent to the site (e.g. movement of surface and subsurface water, recharge, discharge, sediment transport, etc.); b. The historic ecological condition (reference) as well as Present Ecological State (PES) of rivers (in-stream, riparian and floodplain habitat), wetlands and/or estuaries in terms of possible changes to the channel, flow regime (surface and groundwater)	Section 4.4
2.3	Identify any alternative development footprints within the preferred development site which would be of a “low” sensitivity as identified by the national web based environmental screening tool and verified through the Initial Site Sensitivity Verification	Section 5
2.4	Assessment of impacts – a detailed assessment of the potential impact(s) of the proposed development on the following very high sensitivity areas/ features:	Section 6
2.4.1	Is the development consistent with maintaining the priority aquatic ecosystem in its current state and according to the stated goal?	Section 4.4 and Section 6
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 4.4
2.4.3	How will the development impact on fixed and dynamic ecological processes that operate within or across the site, including: a. Impacts on hydrological functioning at a landscape level and across the site which can arise from changes to flood regimes (e.g. suppression of floods, loss of flood attenuation capacity, unseasonal flooding or destruction of floodplain processes); b. Change in the sediment regime (e.g. sand movement, meandering river mouth/estuary, changing flooding or sedimentation patterns) of the aquatic ecosystem and its sub-catchment; c. The extent of the modification in relation to the overall aquatic ecosystem (i.e. at the source, upstream or downstream portion, in the temporary / seasonal / permanent zone of a wetland, in the riparian zone or within the channel of a watercourse, etc.). d. Assessment of the risks associated with water use/s and related activities.	Section 4.4
2.4.4	How will the development impact on the functionality of the aquatic feature including: a. Base flows (e.g. too little/too much water in terms of characteristics and requirements of system);	Section 4.4 and Section 6

	b. Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river); c. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland); d. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); and e. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal).	
2.4.5	How will the development impact on the functionality of the aquatic feature including: a. water including change in the hydrological regime or hydroperiod of the aquatic ecosystem (e.g. seasonal to temporary or permanent; impact of over-abstraction or instream or off-stream impoundment of a wetland or river) b. Change in the hydrogeomorphic typing of the aquatic ecosystem (e.g. change from an unchannelled valley-bottom wetland to a channelled valley-bottom wetland). c. Quality of water (e.g. due to increased sediment load, contamination by chemical and/or organic effluent, and/or eutrophication); d. Fragmentation (e.g. road or pipeline crossing a wetland) and loss of ecological connectivity (lateral and longitudinal); e. The loss or degradation of all or part of any unique or important features (e.g. waterfalls, springs, oxbow lakes, meandering or braided channels, peat soil, etc.) associated with or within the aquatic ecosystem.	Section 4.4 and Section 6
2.4.6	How will the development impact on key ecosystem regulating and supporting services especially Flood attenuation; Streamflow regulation; Sediment trapping; Phosphate assimilation; Nitrate assimilation; Toxicant assimilation; Erosion control; and Carbon storage.	Section 4.4 and Section 6
2.4.7	How will the development impact community composition (numbers and density of species) and integrity (condition, viability, predator-prey ratios, dispersal rates, etc.) of the faunal and vegetation communities inhabiting the site?	Section 4.4
2.4.9	A motivation must be provided if there were development footprints identified as per paragraph 2.3 above that were identified as having a “low” biodiversity sensitivity and were not considered appropriate.	Section 7
3.	The report must contain as a minimum the following information:	
3.1	Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise and their curriculum vitae;	Appendix A and H
3.2	A signed statement of independence by the specialist;	Appendix A
3.3	The duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2 and 4.4
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Appendix C - E
3.5	A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations;	Section 1.3
3.6	Areas not suitable for development, to be avoided during construction and operation (where relevant);	Section 5
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts;	Section 6.4
3.8	A suitable construction and operational buffer for the aquatic ecosystem, using the accepted protocol;	Section 5
3.9	Impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 6
3.10	A motivation where the development footprint identified as per 2.3 were not considered stating reasons why these were not being considered; and	Section 7
3.11	A reasoned opinion, based on the finding of the specialist assessment, regarding the acceptability or not, of the development and if the development should receive approval, and any conditions to which the statement is subjected.	Section 7

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GLOSSARY OF TERMS

Alien vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Facultative species:	Species usually found in wetlands (76%-99% of occurrences) but occasionally found in non-wetland areas
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Groundwater:	Subsurface water in the saturated zone below the water table.
Hydromorphic soil:	A soil that in its undrained condition is saturated or flooded long enough to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soil).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soil with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
Wetland Vegetation (WetVeg) type:	Broad groupings of wetland vegetation, reflecting differences in regional context, such as geology, climate, and soil, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celcius
AIP	Alien and Invasive Plant
CVB	Channelled Valley Bottom
CR	Critically Endangered
BAS	Best Attainable State
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
EI	Ecological Importance
EIS	Ecological Importance and Sensitivity
EPL	Ecosystem Protection Level
ES	Ecological Sensitivity
ESA	Ecological Support Area
ETS	Ecosystem Threat Status
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
ha	Hectare
HGM	Hydrogeomorphic
km	Kilometre
LOM	Life of Mining
m	Meter
mm	Millimetre
m.a.m.s.l	Metres above mean sea level
MAP	Mean Annual Precipitation
MRA	Mining Right Area
mS/m	Millisiemens/meter
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NP	Not Protected
NWA	National Water Act
PES	Present Ecological State
RAM	Risk Assessment Matrix
REC	Recommended Ecological Category
RMO	Resource Management Objective
RWQO	Resource Water Quality Objectives
SACNASP	South African Council for Natural Scientific Professions
SAS	Scientific Aquatic Services
SWSA	Strategic Water Source Area
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WUA	Water Use Authorisation
ZoR	Zone of Regulation

1 INTRODUCTION

1.1 *Background*

Scientific Aquatic Services (SAS) (Pty) Ltd was appointed to conduct a freshwater assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed additional areas associated with the undermining of freshwater ecosystems (hereafter referred to as the 'proposed underground mining operation') at the existing Kwezi shaft in Rustenburg, North-West Province.

SAS previously undertook a freshwater and aquatic assessment for the reach of the Dorpspruit stream associated with the Kwezi Mining Right Area (MRA) in 2022 (Figure 1). Subsequently, two (2) additional areas (Figures 2 and 3) along the south western boundary of the MRA was included for undermining (the two additional areas will hereafter be referred to as the 'study area') and as such amendments to and/or new EA and WUA processes must updated and/or applied for.

The site visit for the freshwater assessment was undertaken on the 5th of July 2024 to establish baseline ecological conditions and the risk significance posed by the proposed activities, to guide the activities in relation to any potential freshwater ecosystems that may be affected directly or indirectly by the proposed underground mining operation. In order to identify all possible freshwater ecosystems that may potentially be impacted by the proposed underground mining operation, a 500 m "zone of investigation" around the study area, in accordance with Government Notice (GN) 4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), as amended was used as a guide in which to assess possible sensitivities of the receiving environment. This area – i.e. the 500 m zone of investigation around the study area – will henceforth be referred to as the "investigation area".

1.1.1 *Project Description*

The study area is located in the Rustenburg Local Municipality and is part of the Bonjanala Platinum District. The two additional areas are referred to as Block A (northern area) and Block B (southern area) (Figures 2 and 3). Block A is approximately 11.8 hectares (ha) in extent and is characterised as a vacant open veld area with an artificial channel bisecting the area. Block B is an industrial area approximately 21.7 ha in extent.

The Kwezi shaft is situated approximately 0.86 kilometres (km) east of the study area. Ore is mined at the Kwezi shaft via a decline shaft. Mining is undertaken via board and pillar methods to target the Upper Group 2 reef. The Kwezi shaft does not process any ore at the shaft and ore is transported via a conveyor system to an ore storage silo prior to transportation via railway to the Kroondal processing plants. No new surface infrastructure is proposed as existing surface infrastructure will be utilised to service the proposed underground mining operation.

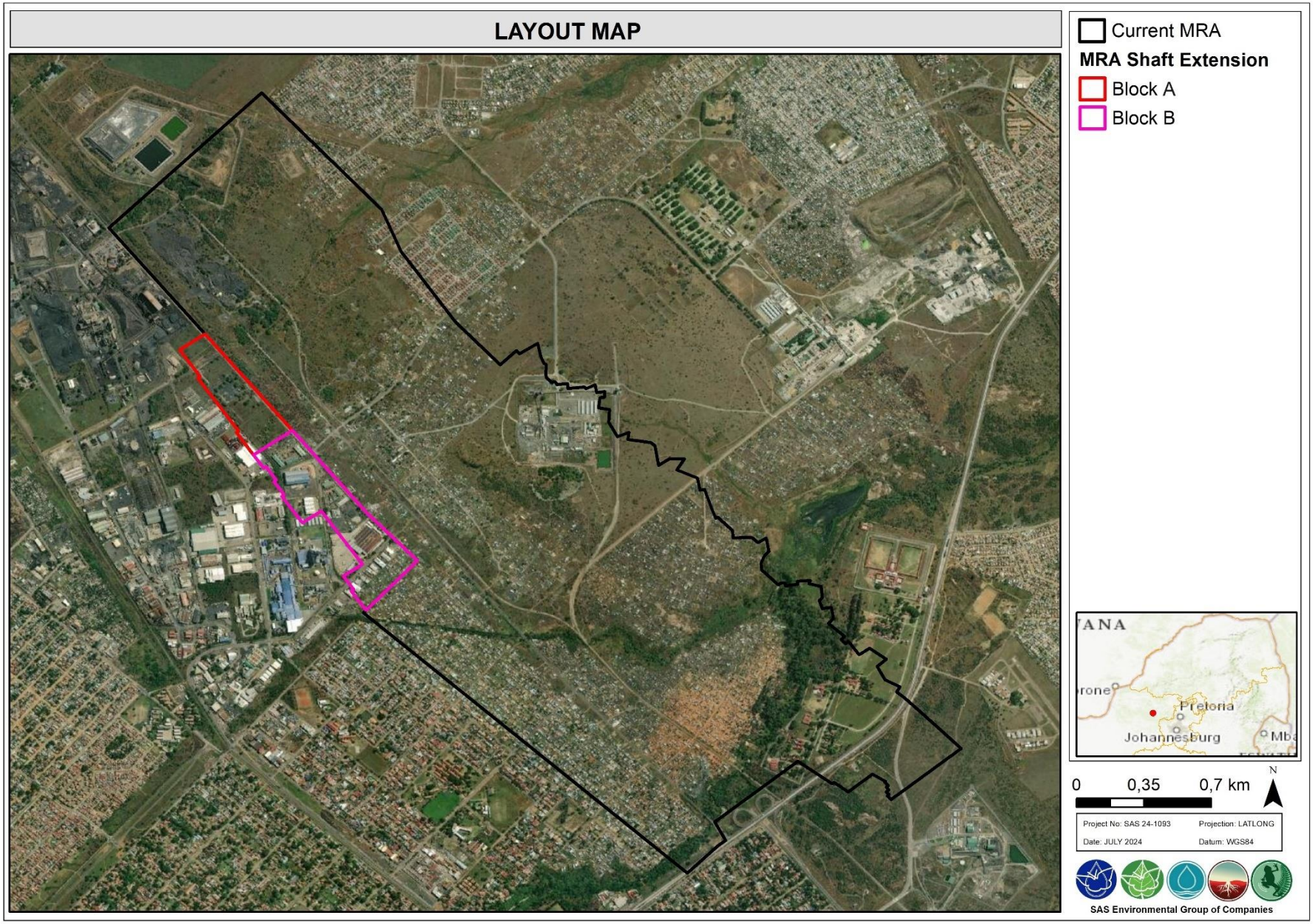


Figure 1: A digital satellite image depicting the location of the study area (Block A and B) in relation to the Kwezi Mining Right Area.

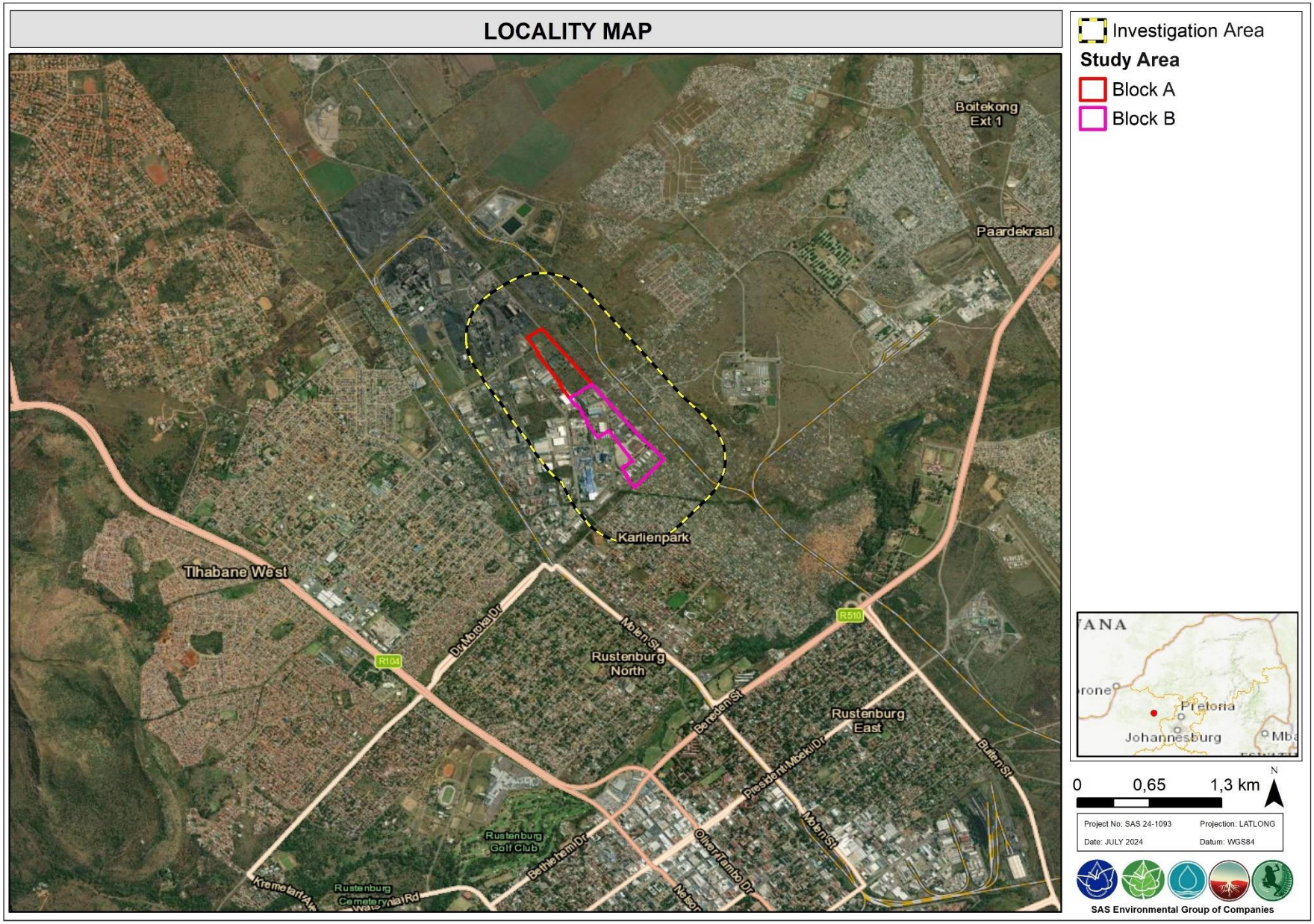


Figure 2: The study and associated investigation area depicted in relation to the surrounding area.

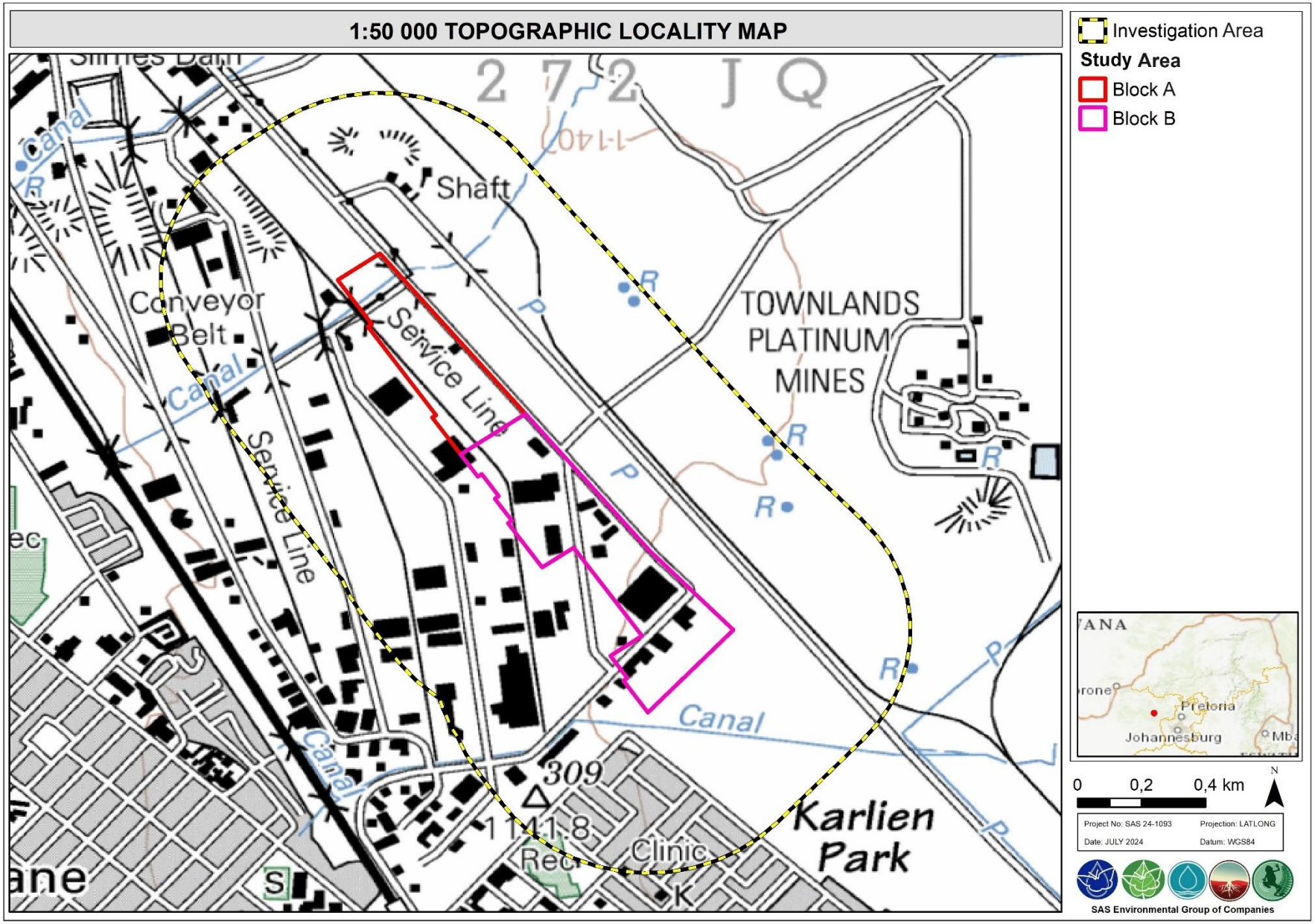


Figure 3: The study and associated investigation area depicted on a 1:50 000 topographic map.

1.2 *Scope of Work*

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database; the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], (2014) database, National Biodiversity Assessment (NBA) 2018 database, and the North West Biodiversity Sector Plan (NWBSP, 2015), were undertaken to aid in defining the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the freshwater ecosystems;
- Freshwater ecosystems were field verified according to the "Department of Water Affairs and Forestry (DWAF, 2008[1]): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil, morphological characteristics, vegetation types and wetness were used to verify the freshwater ecosystems;
- The classification of the freshwater ecosystems was undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa: User Manual: Inland systems (Ollis *et al*., 2013);
- The PES of the freshwater ecosystems were determined according to the WET Health tool (Macfarlane *et al.,* 2008);
- The EIS of the freshwater ecosystems were determined according to the method described by Rountree and Kotze*,* (2013);
- The Ecoservices of the freshwater ecosystems were assessed according to "A technique for rapidly assessing ecosystem services supplied by wetlands" (Kotze *et al.,* 2020) (Version 2);
- Allocation of a suitable Recommended Management Objective (RMO), Recommended Ecological Category (REC) and Best Attainable State (BAS) to the freshwater ecosystems based on the results obtained from the PES and EIS assessment's;
- The freshwater ecosystem boundaries, and legislated zones of regulation were depicted for the freshwater ecosystems, where applicable;
- The EAP-provided impact assessment method and the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was applied to identify potential impacts that may affect the freshwater ecosystems within the investigation area as a

[1] Even though an updated manual is available since 2008 (Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas), this is still considered a draft document currently under review.

result of the proposed underground mining operation, and to aim to quantify the significance thereof; and

- To present management and mitigation measures which should be implemented during the proposed underground mining operation to assist in minimising the impact of the proposed activities on the receiving environment.

1.3 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this report:

- The determination of the freshwater ecosystem boundaries and the assessment thereof, is confined to the reaches of the freshwater ecosystems that traverse the study area and associated investigation area;
- The study and investigation areas and their immediate surrounds have undergone historical transformation including agriculture, urbanisation and current and historic mining activities. As a result, various areas within the study and associated investigation area displayed transformed topography, soil profiles and runoff patterns within the landscape. As such, these disturbances have likely resulted in alterations to the hydroperiod of the identified freshwater ecosystems;
- The data presented in this report is based on two (2) site visits undertaken in February 2022 and July 2024 (only for the additional areas i.e. Block A and B, the remaining MRA area was not re-assessed in the July 2024 assessment). The effects of natural seasonal and long-term variation in the freshwater ecosystem conditions in the system/s are, therefore, unknown;
- It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the actual site characteristics within the study area at the scale required to inform the EA process. However, this information is considered to be useful as background information to the study;
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required, the freshwater ecosystems will need to be surveyed and pegged according to surveying principles and with surveying equipment;
- Wetland, riparian and terrestrial zones create transitional areas where an ecotone is formed as vegetation species change from terrestrial to obligate/facultative species. Within this transition zone, some variation of opinion on the freshwater ecosystem boundaries may occur. However, if the DWAF (2008) method is followed, all assessors should get largely similar results; and

- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the freshwater ecosystems that may be affected by the proposed underground mining operation have been accurately assessed and considered, based on the site observations undertaken in terms of freshwater ecosystem ecology.

2 ASSESSMENT APPROACH

2.1 *Freshwater Ecosystem Definition*

For the purposes of this investigation, the definitions of a watercourse, riparian and wetland habitat were taken as per that in the National Water Act, 1998 (Act No. 36 of 1998) as amended. The definitions are as follows:

A **watercourse** means:
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare a watercourse.
*****and a reference to a watercourse includes where relevant, its bed and banks.

The National Water Act, 1998 (Act No. 36 of 1998) further provides definitions of wetland and riparian habitats as follows:

Wetland habitat is "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 habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized 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.

Thus, for the purposes of this investigation, the definition of a freshwater ecosystem is synonymous with the definition of a watercourse as per the National Water Act, 1998 (Act No. 36 of 1998), as amended and the terms may be used interchangeably in this report.

2.2 *Freshwater Ecosystem Field Verification*

A site verification and assessment was undertaken on the 5th of July 2024 (North West winter dry period) during which the presence of any freshwater ecosystem characteristics as defined by Department of Water Affairs and Forestry (DWAF, 2008) and the National Water Act, 1998 (Act No. 36 of 1998), as amended were noted (please refer to Section 4 of this report). A detailed explanation of the methods of assessment undertaken is provided in **Appendix C** of this report.

The freshwater ecosystem delineation took place, as far as possible, according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method, is based on the fact that freshwater ecosystems have several distinguishing factors including the following:

- Landscape position;
- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils; and
- Vegetation adapted to saturated soils.

3 RESULTS OF THE DESKTOP ANALYSIS

3.1 *Analyses of Relevant Databases*

The following section contains data accessed as part of the desktop assessment and are presented as a "dashboard" report below (Table 1). The dashboard report aims to present concise summaries of the data on as few pages as possible to allow for integration of results by the reader to take place. Where required, further discussion and interpretation is provided, and information that was considered of importance was emboldened.

It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases used do not always provide an entirely accurate indication of the "proposed development's" actual site characteristics at the scale required to inform the EA/WUA processes. Nevertheless, this information is considered useful as background information to the study, is important in legislative contextualisation of risk and impact, and was used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance. It must, however, be noted that site assessment of key areas may potentially contradict the information contained in the relevant databases, in which case the site verified information must carry more weight in the decision-

making process. The information contained in the dashboard report below is intended to provide background to the landscape of the study and associated investigation area. Actual site conditions at the time of the assessment may differ to the background information provided by various datasets. Please refer to Section 4 for details pertaining to the site investigation.

Table 1: Desktop data relating to the characteristics of the freshwater ecosystems associated with the study and associated investigation area [Quarter Degree Squares (QDS) 2527CA and 2527CB].

Aquatic ecoregion and sub-regions in which the study area is located	
Ecoregion	Bushveld Basin
Catchment	Limpopo
Quaternary Catchment	A22H
WMA	Crocodile (West) and Marico
subWMA	Elands
Dominant characteristics of the Bushveld Basin (Kleynhans *et al.*, 2007)	
Level II	8.05
Primary terrain morphology	Plains; low relief
Dominant primary vegetation types	Mixed Bushveld
Altitude (m a.m.s.l)	900 to 1500
MAP (mm)	400 to 700
Coefficient of Variation (% of MAP)	25 to 29
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	16 to 20
Winter temperature (July)	2 to 22
Summer temperature (Feb)	14 to 32
Annual simulated runoff (mm)	20 to 40 (limited); 40 to 100
Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)	
Sub-quaternary reach	A22J – 00878 (Hex River)
Proximity to study area	3.76 km east of the study area.
Assessed by expert?	Yes
PES Category Median	Seriously modified (Class E)
Mean EI Class	Moderate
Mean ES Class	Moderate
Stream Order	2
Default Ecological Class	Moderate (Class C)
Detail of the area in terms of the Land Type Data (Job *et al.*, 2019)	
The entire study area and associated investigation area are indicated to be within the Ea3 land type grouping. These Land Types accommodate high base status, dark coloured and/or red structured soils, usually of clay texture, associated with basis igneous rocks. More than half of the land surface is covered by vertic, melanic or red structured diagnostic horizons. Duplex soils or exposed rock may cover significant portions of the land surface, but vertic, melanic or red structured horizons are dominant.	

Details of the Study area in terms of the (NFEPA) (2011) database	
FEPA CODE	The study and investigation area fall within a sub quaternary catchment currently not considered important in terms of fish conservation or freshwater ecology.
NFEPA Rivers & Wetlands	No rivers or natural wetland features are indicated by the database to be within the study area or associated investigation area.
Wetland Vegetation (WetVeg) Type	The entire study and associated investigation area are situated within the Central Bushveld Group 2 WetVeg group, indicated as "Vulnerable" according to the threat status provided by Mbona *et al.* (2015).
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (National Wetland Map 5 is included in the NBA) (Figure 4)	
According to the NBA 2018: SAIIAE database, two (2) seep wetlands are indicated in the south eastern (directly outside the investigation area) and north eastern portions of the associated investigation area. The south eastern seep is indicated to be impacted by roads and railways. These two seep wetlands correspond to the features identified by the North-West Biodiversity Sector Plan (2015) database as Ecological Support Areas (ESA). The north eastern seep wetland is indicated to be in a natural or near-natural (WETCON A/B) ecological condition while the south eastern wetland is indicated to be in a Largely to Critically Modified (WETCON D/E/F) ecological condition. The Ecosystem Protection Level (EPL) of the wetlands is indicated as Not Protected **(NP)** and the Ecosystem Threat Status (ETS) is Critically Endangered **(CR).**	
National web based environmental screening tool (2020; Accessed July 2024) (Figure 5)	
The screening tool is intended for pre-screening of sensitivities in the landscape to be assessed within the EIA process. This assists with implementing the migration hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.	
The study area is indicated to be of **low** aquatic biodiversity sensitivity. The sections associated with the seep wetlands in the south eastern and north eastern portions of the investigation area are indicated to be of **very high** aquatic biodiversity sensitivity. These areas are also considered of very high aquatic biodiversity sensitivity as the wetlands fall within an ESA.	
Details according to the Strategic Water Source Areas (2017 & 2021) Database	
Surface water SWSAs are defined as areas of land that supply a disproportionate (i.e., relatively large) quantity of mean annual surface water runoff in relation to their size. The 2021 SWSA was checked for surface water while the 2017 database was used for underground SWSAs.	
The study area and associated investigation area are not associated with a surface water Strategic Water Source Areas (SWSA) according to the 2021 database. The entire study area and associated investigation area are indicated to be within the Kroondal and Marikana underground SWSA by the 2017 database.	
Detail of the study and investigation areas in terms of the North West Biodiversity Sector Plan (2015) (Figure 6)	
The areas indicated as seep wetlands in the south east and south west of the investigation area (NBA; 2018) are indicated as Category 1 Ecological Support Area (ESA) areas. ESAs are terrestrial and aquatic areas that are not essential for meeting biodiversity representation targets (thresholds), but which nevertheless play an important role	

	in supporting the ecological functioning of Critical Biodiversity Areas (CBAs) and/or in delivering ecosystem services that support socio-economic development, such as water provision, flood mitigation or carbon sequestration.
Importance of the study area according to the Mining and Biodiversity Guidelines (2012) (Figure 7)	
Highest Biodiversity Importance (B)	Scattered sections of the study area in Block A and majority of the investigation area are considered to be of Highest Biodiversity Importance from a mine planning perspective. **Risk for mining**: Highest risk to mining. **Implications for mining**: EIAs and associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licences, and environmental authorisations. If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being.
Moderate Biodiversity Importance (D)	The majority of Block A and the entire Block B occurs in an area considered to be of Moderate Biodiversity Importance from a mine planning perspective. **Risk for mining**: Moderate risk to mining. **Implications for mining**: EIAs and associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g., threatened species) not included in the existing datasets, and on providing site-specific information to guide the application of the mitigation hierarchy. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.

CBA = Critical Biodiversity Area; DWS = Department of Water and Sanitation; EI = Ecological Importance; ES = Ecological Sensitivity; ESA = Ecological Support Area; m.a.m.s.l = Metres Above Mean Sea Level; MAP = Mean Annual Precipitation; NBA = National Biodiversity Assessment; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State; SAIIAE = South African Inventory of Inland Aquatic Ecosystems; WMA = Water Management Area

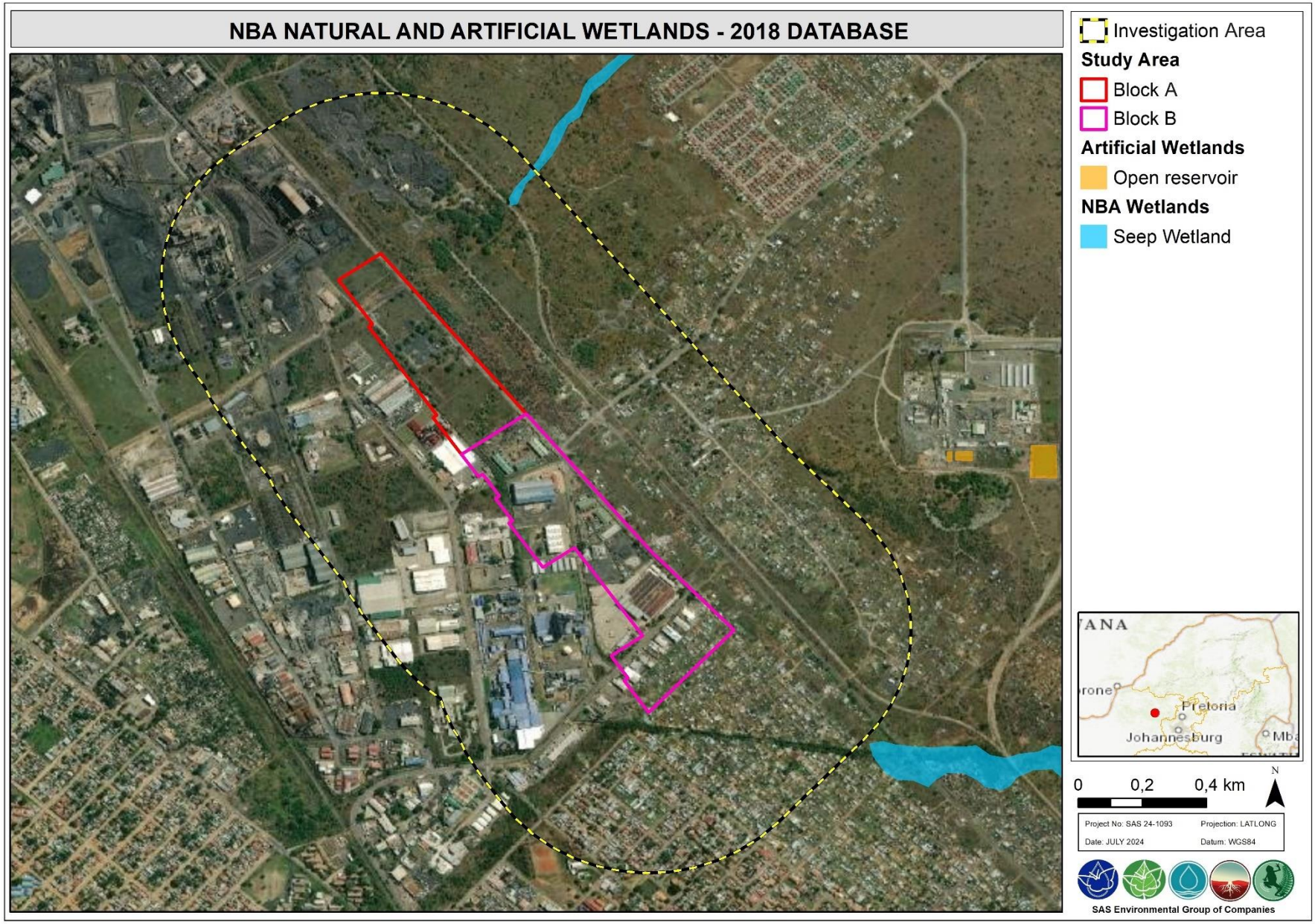


Figure 4: Wetlands associated with the study and investigation areas according to the National Biodiversity Assessment (2018) database.

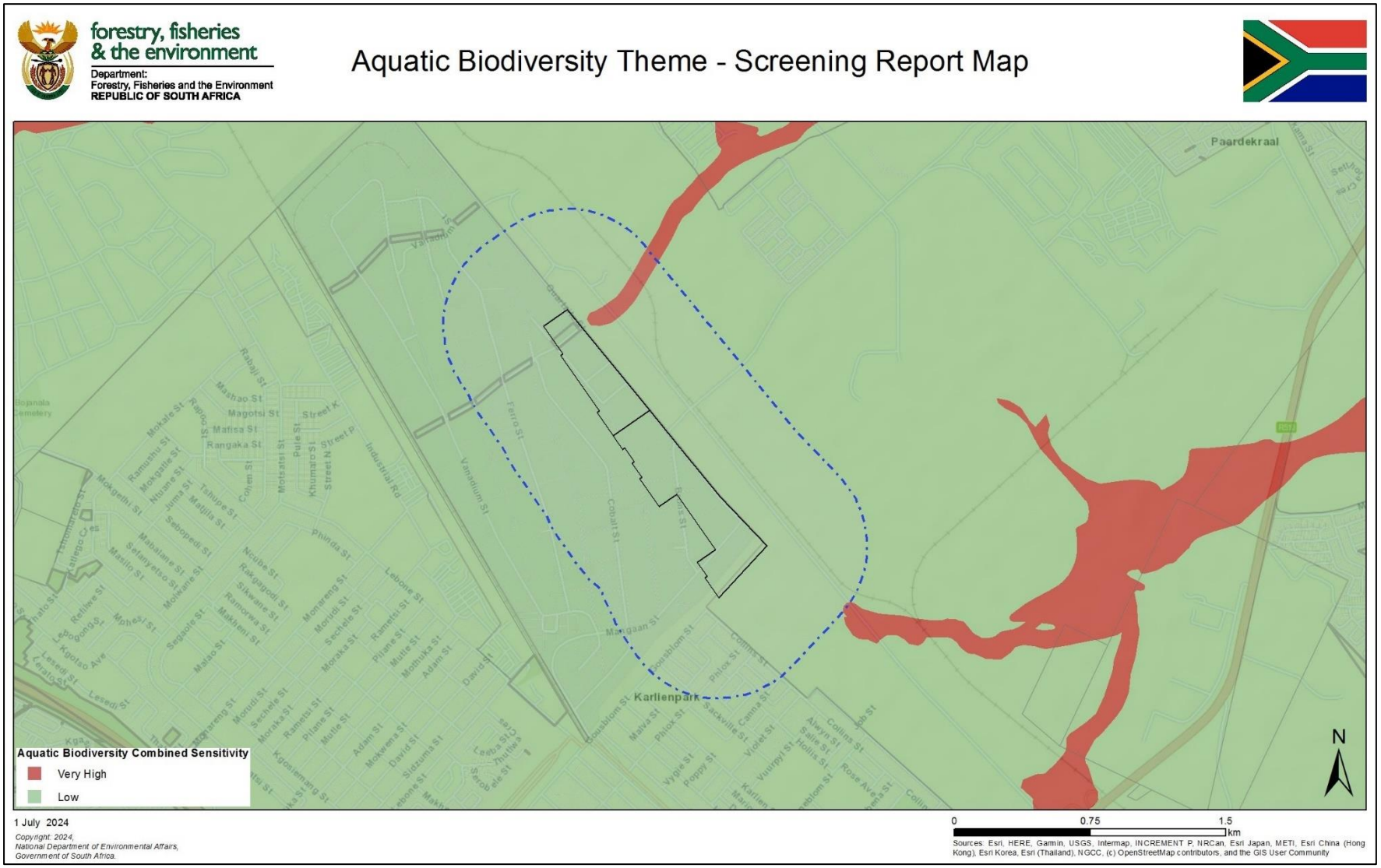


Figure 5: Aquatic Biodiversity Theme Sensitivity for the study and associated investigation area according to the Screening Tool (Accessed July 2024).

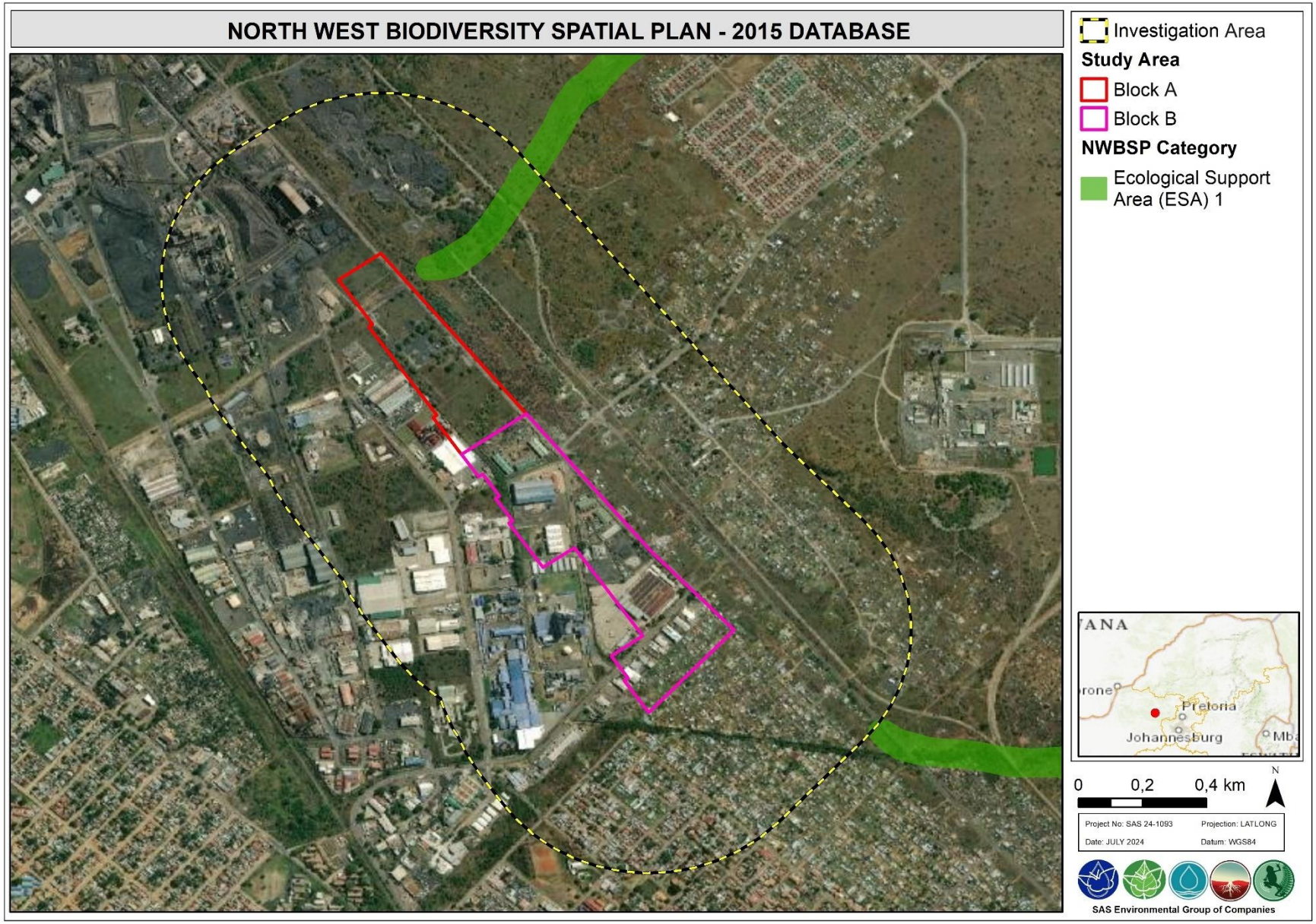


Figure 6: Ecological Support Areas (ESA) associated with the study and investigation areas, according to the North-West Biodiversity Sector Plan (2015) database.

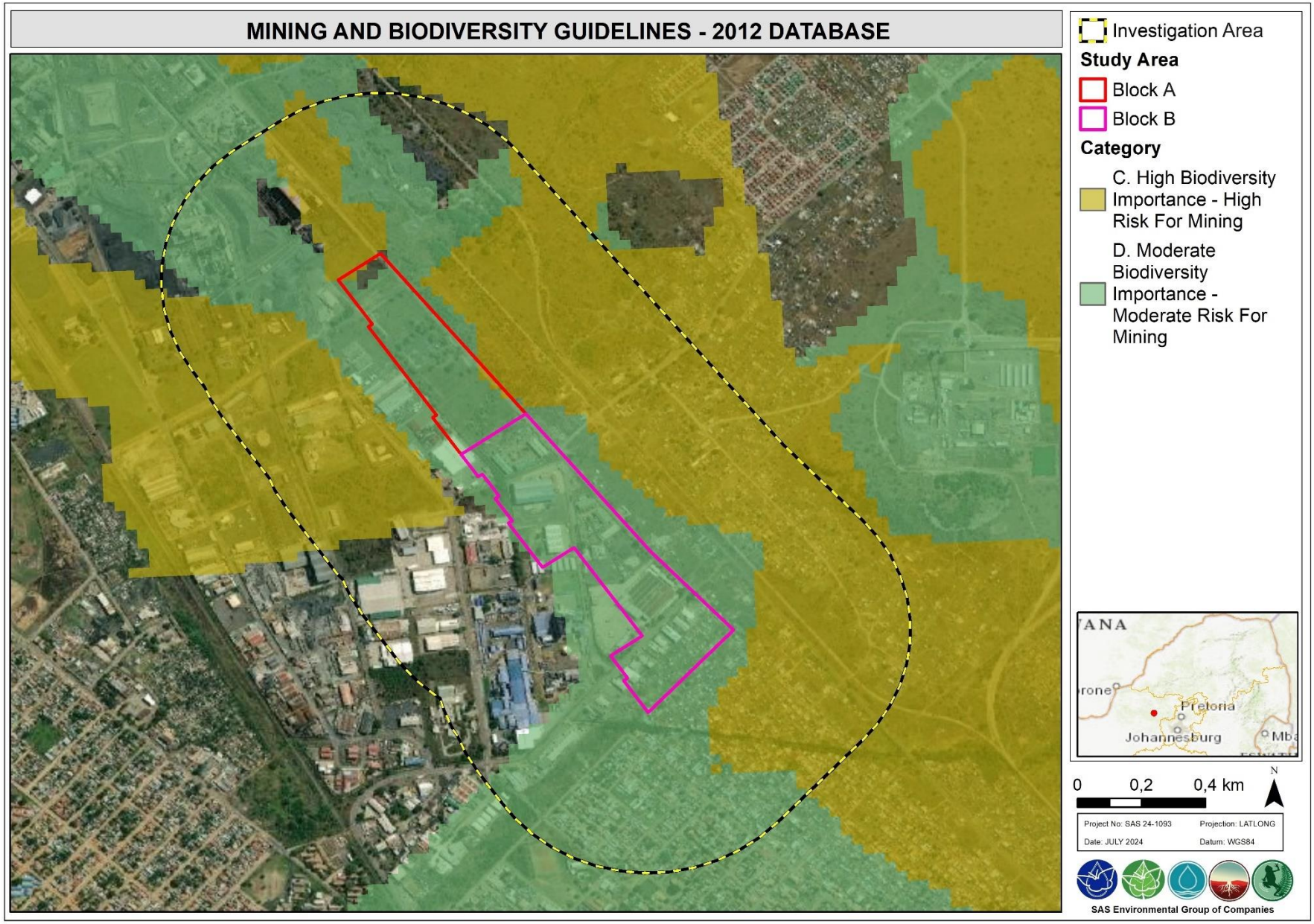


Figure 7: Importance of the study and associated investigation area according to the Mining and Biodiversity Guidelines (2012) database.

4 RESULTS: FRESHWATER ECOSYSTEM ASSESSMENT

4.1 *Freshwater Ecosystem Characterisation*

No natural occurring freshwater ecosystems, as per the NWA (Act no. 36 of 1998), as amended was noted within the study area. A Channelled Valley Bottom (CVB) wetland was however identified within the north eastern portion of the investigation area.

The CVB wetland within the north eastern portion of the investigation area was classified according to the Classification System (Ollis *et al.*, 2013) as an Inland System within the Central Bushveld Group 2 WetVeg (wetland vegetation) group, classified by Mbona *et al*. (2015) as "Vulnerable". At Levels 3 (Landscape Unit) and 4 (Hydrogeomorphic (HGM) Type) of the Classification System, the CVB wetland was classified as per the summary in the table below.

Table 2: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al*., 2013) of the CVB wetland associated with investigation area.

Freshwater Ecosystem	Level 3: Landscape unit	Level 4: HGM Type
Channelled Valley Bottom wetland	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes.	**Channelled valley bottom:** A valley bottom wetland with a river channel running through it.

4.2 *Anthropogenically derived artificial features*

Four (4) artificial features were identified within the study and associated investigation areas.

According to Ollis *et al*., (2013) an artificially created system is defined as a feature that is "produced by humans, not naturally occurring". Ollis *et al*., (2013) further elaborates "artificial features are aquatic ecosystems where hydric soil features have developed, or where wetland plants have colonised, in historically non-wetland areas due to human activities". In addition to the identified freshwater ecosystems, anthropogenically derived features in which water ponds, were also noted within the study area and associated investigation area. The artificial feature (artificial channel) identified within Block A drains into the CVB wetland identified within the north eastern portion of the investigation area. Another artificial feature (artificial channel) was identified within the southern portion of the investigation area which also drains into a CVB wetland (also known as the Dorpspruit Stream), further east.

These features have formed due to land-use changes prompting increased runoff and ponding, as well as historic excavation activities which have altered the natural topography,

thus allowing water to collect. As these features are of an artificial origin and anthropogenically derived they were not further assessed, however these were included for mapping purposes to indicate locality within the landscape. Figure 8 below presents photographs of the artificial features in relation to the natural CVB wetland.

Figure 8: Representative photographs of the artificial feature (top) which drain into the north eastern CVB wetland (bottom). The artificial feature has been channelised by means of concrete embankments.

4.3 *Freshwater Ecosystem Delineation*

As noted in Section 1.2, the freshwater ecosystem assessment was limited to the study area and associated investigation area as provided by the proponent. It was confirmed during the site assessment that various land transformation had occurred within the study area and immediate surrounds over time with the most significant impact from the expansion of the urban area. As a result, changes to the topography, soil and vegetation profiles were evident. Thus, where necessary, delineations were refined and augmented with the use of digital satellite imagery, historical aerial imagery and 5 meter (m) contours to improve the accuracy of the delineations, where necessary. The delineations as presented in this report are, nevertheless, deemed the best estimate of the temporary zone boundaries of the freshwater

ecosystems based on site conditions present at the time of the assessment, and are considered adequate to allow for informed decision-making.

During the site assessments (February 2022 & July 2024), the following indicators were used to verify the boundaries of the freshwater ecosystems:

- Terrain units were used as the primary indicator. Despite transformation of the landscape associated with the investigation area, the terrain provided an indication of low-lying areas where water is likely to collect and/or move through the landscape;
- Vegetation was utilised in conjunction with the soil indicators associated with the freshwater ecosystems, where feasible. The distinction between obligate, facultative, and terrestrial vegetation was relatively discernible;
- Soil wetness indicator, duration and frequency of saturation in the soil profile is a diagnostic indicator since it influences the colour change in the soil. Low chroma (grey and muted colours) as well as mottles are more prominent in soil which have higher saturation frequency. Moist soil also indicates an increased hydroperiod and thus the potential presence of hydromorphic characteristics. This was utilised with the vegetation as the secondary indicator; and
- Soil morphological characteristics typically associated with freshwater ecosystem conditions, such as gleying or mottling were utilised in conjunction with saturation as the secondary indicator.

The delineated CVB wetland and artificial features are conceptually depicted in Figure 9 overleaf.

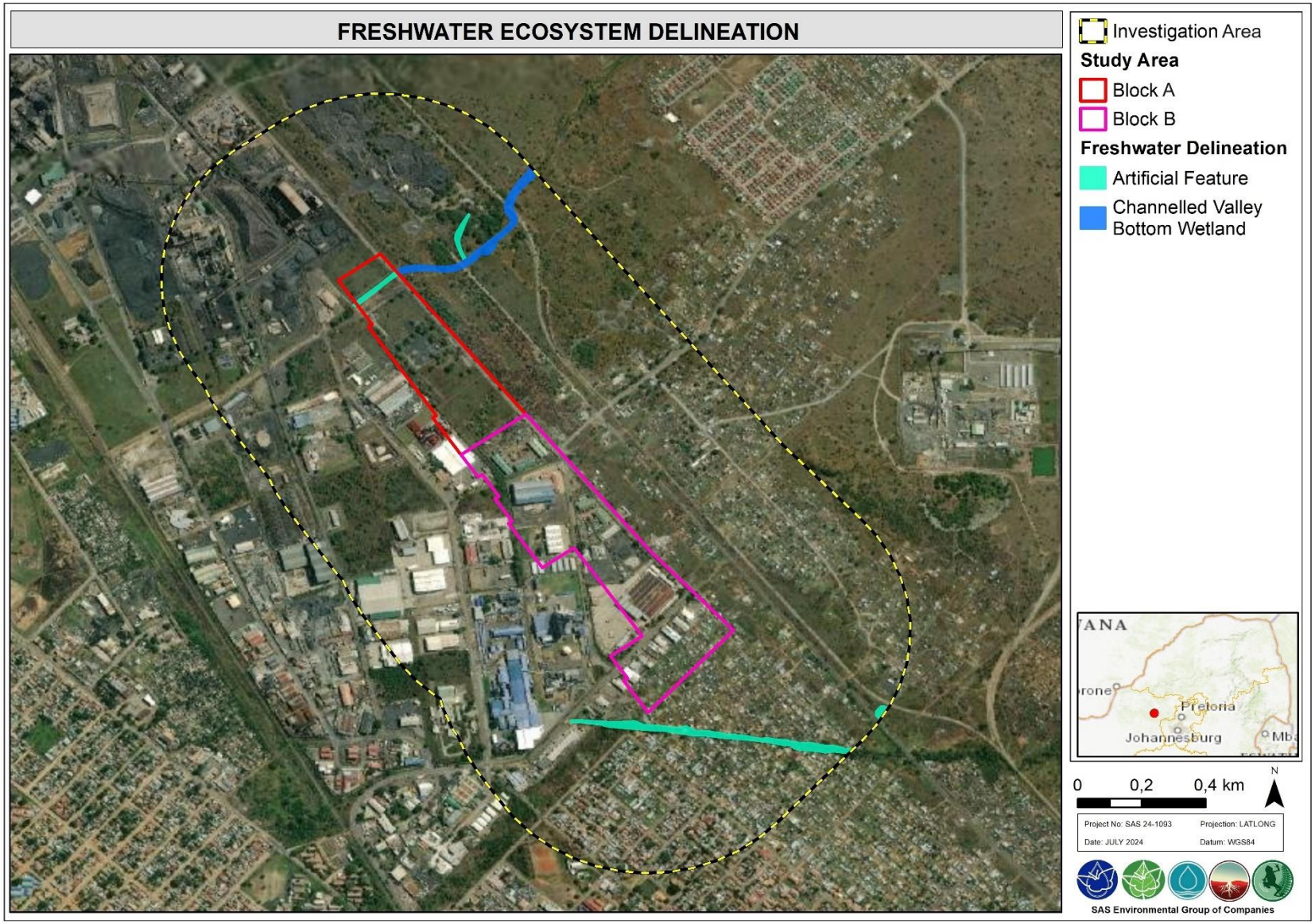


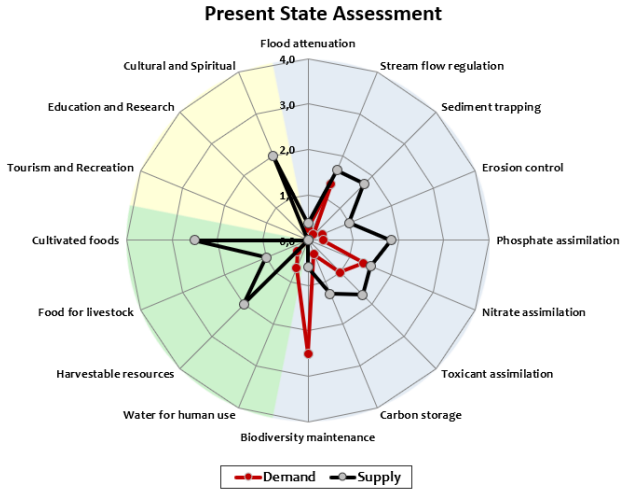
Figure 9: Map depicting the delineated CVB wetland and artificial features associated with the study and investigation areas.

4.4 *Freshwater Ecosystem: Site Verification Results*

Both of these natural occurring CVB wetlands (within the investigation area and further east of the investigation area) were previously assessed by SAS (2022) as part of the freshwater and aquatic assessment undertaken for the larger MRA area. As the previous freshwater assessment was only undertaken two (2) years ago, using the latest best practice methodology, it wat determined that the ecological assessment of the CVB wetlands are still accurate and the need for an update of these assessments (PES, EIS and Eco Ecoservice provisioning) was not deemed necessary at this time.

The results of the 2022 freshwater assessment was included in this report for ease of reference and completeness sake. Further, for the purposes of presenting a concise discussion, the assessment results for the CVB wetlands are discussed collectively as all results were largely similar. The results of the assessments are discussed in the dashboard style report which follow and the details thereof are presented in **Appendix F**.

Table 3: Summary of the assessment of the Channelled Valley Bottom (CVB) wetlands in the north eastern portion of the investigation area and further east of the investigation area (as assessed in the SAS 2022 freshwater assessment).

<table>
<tr><td colspan="2">Ecological & socio-cultural service provision graph:
 
</td><td colspan="2"> 
Representative photographs of the CVB wetlands and the various impacts affecting the ecological condition of the wetlands including indiscriminate waste disposal, embankment erosion and Alien and Invasive Plant (AIP) encroachment.</td></tr>
<tr><td>PES Discussion</td><td>PES Category: E (Seriously modified)
The seriously modified ecological condition of the CVB wetlands were ascribed to numerous changes to the hydraulic regimes, geomorphological processes and vegetation composition which have occurred within the wetlands as well as the catchments thereof. Impacts such as road crossings, channel straightening, prison dam, hardened surfaces, urban development, historical and current mining activities and dense alien vegetation have altered the ecological condition of the CVB wetlands.</td><td>Ecoservice provision</td><td>Ecoservices importance category: Very Low to Low
The most important regulating and supporting services that the CVB wetlands provide include: stream flow regulation, sediment trapping, phosphate, nitrate and toxicant assimilation. The importance for streamflow regulation is due to the CVB wetlands which confluence with the Hex River approximately 3.76 km east of the greater MRA. The importance of sediment trapping, phosphate, nitrate and toxicant assimilation is due to increased hardened surface and stormwater inputs into the CVB wetlands from the surrounding catchment, and urbanised areas. Due to the location of the CVB wetlands within an urbanised and mining area, and impacts from various culvert crossings which may act as a barrier to faunal migration, the wetland provides limited biodiversity maintenance. The high demand for biodiversity maintenance and potential supply of harvestable resources, cultivated foods and cultural and spiritual activities are ascribed to the close proximity of informal urbanised areas to the wetlands. The limited ecological service provisioning across all components was primarily attributed to the degraded ecological integrity of the wetlands.</td></tr>
<tr><td>EIS discussion</td><td>EIS Category: Low/Marginal
The CVB wetlands are considered to be of Low/Marginal ecologically important and sensitive. This is mainly due to the seriously modified ecological condition of the Dorpspruit stream due to numerous activities such as alien vegetation encroachment, alterations to the natural flow path as a result of channel straightening, road crossings and the prison dam, as well as anthropogenic disturbances.</td><td>REC, RMO & BAS Category</td><td>REC: D / BAS: D/ RMO: Improve
The Recommended Management Objective (RMO) of the CVB wetlands are to maintain the PES, seriously modified ecological conditions (Category E). However, since a PES Category E/F is considered ecologically unacceptable (Malan and Day, 2012), the recommended Ecological Category (REC) is Category D and therefore, efforts should be made to improve the Ecostatus of the wetlands accordingly. It is acknowledged however that this would require a catchment-wide approach by all stakeholders, and ecological restoration of the wetlands is not the sole responsibility of a single stakeholder. Please refer to the discussion below pertaining to impacts and mitigation measures.</td></tr>
</table>

Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):	
Alterations to the natural hydraulic regime and geomorphological processes of the CVB wetlands have occurred. These impacts include channel straightening, road crossings, prison dam and hardened surfaces due to catchment wide urbanisation and mining activities. Channel straightening has occurred mostly where the CVB wetlands are located within urban areas. The road crossings cause head cut erosion on lateral inflows due to the flow being concentrated and has exacerbated gully erosion within the wetlands, especially the southern CVB wetland. Channel straightening and road crossings alters the natural flow path and velocity of flow within the CVB wetlands which can negatively impact habitat and ecoservice provision of the wetlands. Increased hardened surfaces reduce infiltration rates and increase inputs of sediment laden runoff to the wetlands. The surrounding urbanised areas (and associated hardened surfaces and stormwater discharge) increases the volume and velocity of water within the wetland. However, small scale abstraction, road crossings and AIP encroachment within both wetlands has likely resulted in a decrease in the natural flood peaks of the wetlands. Basic water quality parameters were taken, during the February 2022 assessment, upstream and downstream of the CVB wetland associated with the southern artificial channel, and the water quality was noted to be poor. Temperature was between 31.90 ºC- 34.15 ºC, whilst Electrical Conductivity (EC) was 59.7 mS/m - 106.1 mS/m, which is within the unacceptable (>85 mS/m) to tolerable (≤ 85 mS/m) range limit and pH of 7.52 - 7.74 which is within the ideal range limit (≥ 6.5 mS/m - ≤ 8.0 mS/m) according to the Research Water Quality objectives (RWQO) of South Africa (DWA, 2011). Although no onsite specific water quality testing was undertaken for the CVB wetland assoicated with the northern artificial channel, water quality is likely to be similar to that of the southern CVB wetland as these two wetland features occur in close proximity to one another and are influenced by similar impacts. High levels of urbanisation and mining activities were noted within the surrounding area, which have had a significant impact on the habitat provisioning of the CVB wetlands due to the limited existing buffer zone around the wetlands. The wetlands provide very limited habitat to biota with the primary vegetation cover comprising alien invasive shrubs and trees such as *Acacia mearnsii, Tithonia rotundifolia, Flaveria bidentis, Tagetes minuta* and *Bidens pilosa.* Overall, the wetlands are considered likely to provide some roosting, breeding and feeding habitat for less sensitive avifauna, small mammals, amphibians, reptiles and invertebrates, although the extent of anthropogenic activity surrounding the wetlands will largely deter faunal activity.	
Extent of modification anticipated	The proposed undermining of the north eastern CVB wetland has the potential to alter the functioning of the wetland to an overall low degree. The extraction of ore can potentially lead to destabilisation of the surrounding environment and to subsequent potential subsidence of the land and creation of a cone of depression. Water entering the underground mining area as a result of ingress into underground mine workings may necessitate dewatering of the underground mining area, which may result in the discharge of dirty water into the wetland environment. Possible decant from the underground mining also poses a low threat to the north eastern CVB wetland as contaminated water may alter water quality, flow regimes and lead to a subsequent loss of biodiversity of the CVB wetland. Thus, well designed and strict implementation of the recommended mitigation measures will need to occur to prevent direct impacts and edge-effects from occurring.
Risk Assessment Outcome & Business Case:	
The DWS Risk Assessment (2023) only considers activities within the delineated extent of freshwater ecosystems and/or within the regulated zone (GN 4167 500m ZoR). As such, only the north eastern CVB wetland was considered in this assessment as this wetland is the only natural watercourse associated with the investigation area.	
Low	Based on the PES and EIS of the south eastern CVB wetland and the findings of the DWS Risk Assessment Matrix, the activities associated with the proposed undermining of the north eastern CVB wetland will pose a "Low" risk to the ongoing functionality of the wetland. Key mitigation measures include: ➢ Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence and dewatering, formation of a pollution plume and decant respectively, must be implemented; ➢ The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the formation of a cone of depression and pollution plume, from the mine into the receiving environment; and ➢ It is advised that the pillar safety factor under the CVB wetland be increased to further ensure no subsidence takes place.

5 LEGISLATIVE REQUIREMENTS AND APPLICATION OF BUFFER ZONES.

The following legislative requirements and relevant provincial guidelines were taken into consideration during the assessment. A detailed description of these legislative requirements is presented in **Appendix B**:

- Constitution of the Republic of South Africa, 1996[2];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA) as amended;
- Government Notice 4167 (GN 4167) as published in the Government Gazette 49833 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) as amended; and
- Government Notice 704 (GN 704)as published in the Government Gazette 20119 of 1999.

The definition and motivation for a regulated zone of activity for the protection of the assessed freshwater ecosystems can be summarised as follows:

Table 4: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
Water Use License Application for water uses as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998).	Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the National Water Act (NWA), 1998 (Act No.36 of 1998) as amended. In accordance with GN 4167, a regulated area of a watercourse in terms of water uses as listed in Section 21(c) and 21(i) is defined as: • the outer edge of the 1 in 100-year flood line 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 • in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench. • **In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.**
	Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources. These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the National Water Act, 1998 (Act No. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:*

[2] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

Regulatory authorisation required	Zone of applicability
	(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood line ***or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked****;* According to the above, the activity footprint must fall outside of the 1:100 year flood line of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.

These zones of regulations (ZoR) must be taken into consideration during the proposed underground mining operation, in line with the mitigation hierarchy as advocated by the Department of Environmental Affairs *et. al*, (2013). The delineated wetlands and their applicable zones of regulation in terms of the National Water Act, 1998 (Act No. 36 of 1998) (GN 4167), (GN 704) and the National Environmental Management Act, 1998 (Act No. 107 of 1998) are conceptually depicted in the figure overleaf.

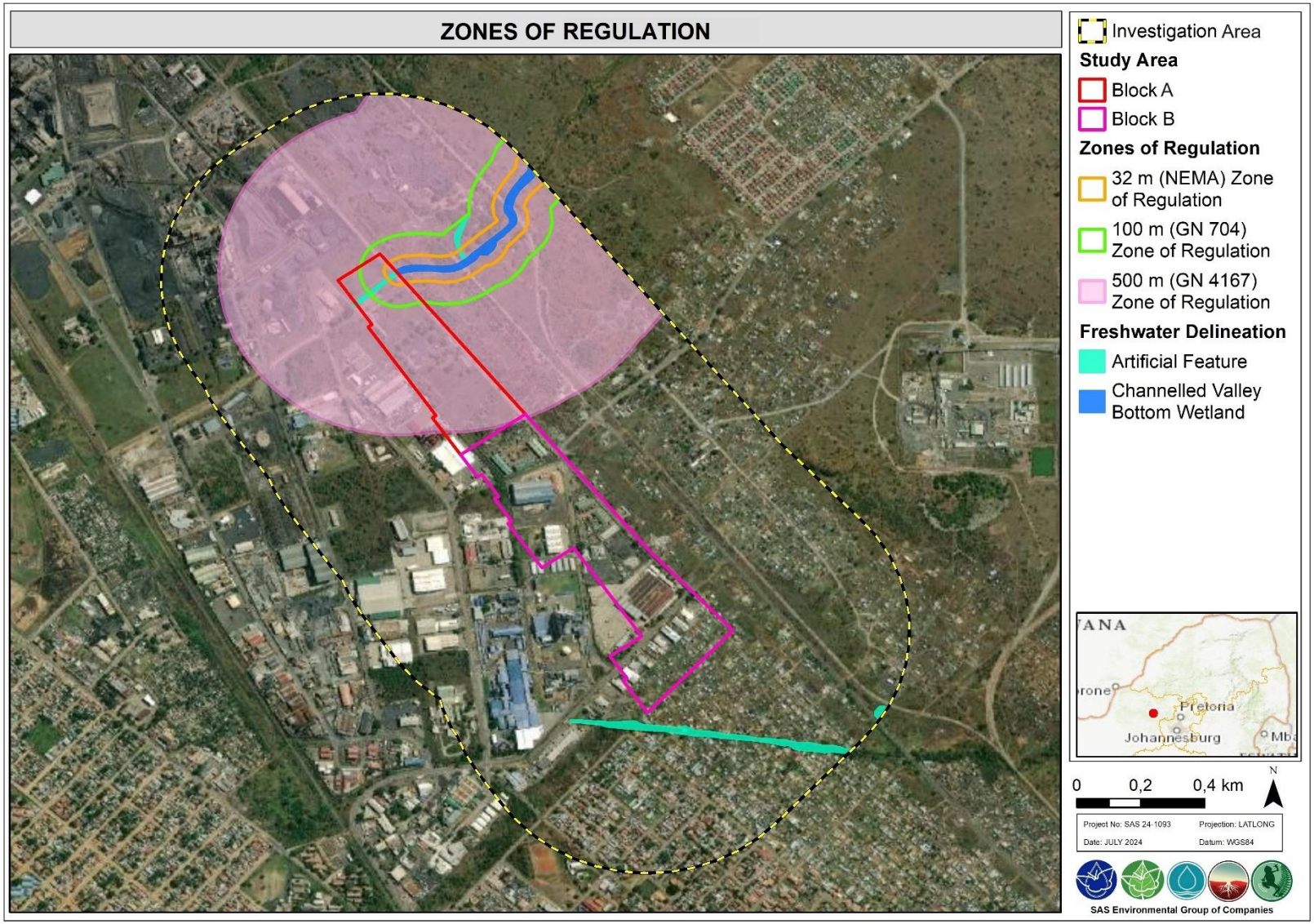


Figure 10: Conceptual presentation of the Zones of Regulation in terms of NEMA, GN 4167 and GN 704 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) for the of the study area.

6 RISK AND IMPACT ASSESSMENTS

This section presents the significance of potential impacts on the freshwater ecology of the north eastern CVB wetland located within the investigation area associated with Blocks A and B. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed underground mining operation and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures and assuming that they are fully implemented.

The results of the Impact Assessment for the proposed undermining activities as presented here (Section 6.3) will be utilised in the EA process, whilst the results of the DWS Risk Assessment Matrix will be utilised in the WUA process which will be undertaken separately to the EA process, in consultation with the relevant competent authorities. Thus, although the two methods may present different scores for the same activity, this is due to differences in their methodologies (please refer to **Appendix D and Appendix E**) and not due to inconsistencies in their application, and each must be judged individually for their specified purpose as discussed above.

6.1 *Consideration taken with the application of the Risk and Impact Assessment*

The points below summarise the considerations undertaken as part of the risk assessment:

- The DWS Risk Assessment Matrix (RAM) was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report presents the perceived impact significance ***post-mitigation****;*
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al.* (2013) (**Figure D1; Appendix D**) would be followed, i.e. the impacts would be avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The risk assessment only considers activities within the delineated extent of freshwater ecosystems and/or within the regulated zone (GN 4167 500m ZoR). As such, only the north eastern CVB wetland was considered in this assessment as this wetland is the only natural watercourse associated with the investigation area;
- It must however be noted that the undermining of the south western CVB wetland (Dorpspruit stream) was previously assessed by SAS (2022). As this wetland does not

fall within the current investigation area associated with Blocks A and B (study area) it was not included as part of the assessment;

- It was assumed that no new surface infrastructure will be required as part of the underground mining activities (including no new Waste Rock Dumps) and thus surface infrastructure was not assessed;
- At the time of undertaking this assessment, no new information pertaining to the undermining related to Blocks A and B were provided. As such, the information contained in the Rock Engineering Technical Report (Sibanye Stillwater, 2021), was used to guide the application of the RAM and it was assumed that a similar mining approach would be followed for the undermining of the north eastern CVB wetland as the Dorpspruit stream (southern CVB wetland). The following aspects were noted:
    - Undermining is only planned up to the top boundary pillar, but water seepage through geological discontinuities, surface exploration boreholes and camara boreholes is expected;
    - Mining will not extend beyond a limit of 50 m below surface, as weathering extends from 25 m to 45 m below surface; and
    - To avoid potential surface subsidence, pillars will be designed with a minimum factor of safety.
- Based on the above extracts from the Rock Engineering Technical Report (Sibanye Stillwater, 2021), the following approach was undertaken:
    - Due to the presence of a weathered rock layer between 25 m and 45 m, the proposed undermining activities may result in subsidence; and
    - Water influx into the undermining cavity may potentially result in decant, with a higher risk expected during the rainy season (although the risk is not quantified);
- The DWS RAM (2023) takes into consideration the PES and Overall Watercourse Importance, with the latter carrying the most weight during the calculations. As such the PES and EIS as determined in Section 4.4 was included in the application of the RAM; and
- The considered control measures are easily practicable.

6.2 *Risk Assessment discussion of anticipated ecological impacts*

There are four key ecological impacts on the north eastern CVB wetland that are anticipated to occur namely:

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and ecological service provision;
- Impacts on the hydrology and sediment balance of the wetlands; and
- Impacts on water quality.

Various activities and development aspects may lead to these impacts, however, provided that the mitigation hierarchy is followed, some impacts can be avoided or adequately minimised where avoidance is not feasible. The mitigation measures provided in this report have been developed with the mitigation hierarchy in mind, and the implementation and strict adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the DWS Risk Assessment Matrix applied to the proposed underground mining operation, is provided in the table below, whilst a comprehensive outcome of the risk assessment is presented in **Appendix G**.

Table 5: Summary of the results of the DWS Risk Assessment matrix applied to the north eastern CVB wetland within the investigation area.

Phase	No.	Activity	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Mitigation Measures to be implemented
Operational	1	Operation of the underground mining area related to the undermining of the north eastern CVB wetland.	Potential creation of a cone of depression, which may drain water from the CVB wetland, thus resulting in desiccation of the wetland.	10	20	40%	8	L	• Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence and dewatering, formation of a pollution plume and decant respectively, must be implemented; • The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the formation of a cone of depression and pollution plume, from the mine into the receiving environment; and • Water levels need to be strictly managed to ensure they are kept below any decant level while ensuring that a significant cone of depression impact does not take place.
	2		Potential destabilisation of surrounding environment through the extraction of ore and subsequent potential subsidence of the land	8	13	20%	5,2	L	• Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence must be implemented; • As per the Rock Engineering Technical report (Sibanye Stillwater, 2021) to avoid potential surface subsidence, pillars will be designed with a minimum factor of safety to ensure subsidence is avoided; and • It is advised that the pillar safety factor under the CVB wetland be increased to further ensure no subsidence takes place.
Closure/ Post closure	3	Post-closure management activities (Decant of contaminated water from the rehabilitated mine area into the receiving environment subject to confirmation by a suitably qualified geohydrologist).	• Contamination of water within the receiving environment, and subsequent reduction in water quality (increase in salts and specific contaminants of concern and reduced pH); • Subsequent negative impacts on biota and vegetation; • Altered flow regimes (increased hydroperiod); and • Habitat degradation.	8	16	40%	6,4	L	• The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from decant of contaminated water from the mine into the receiving environment; • If feasible, the volume of decant can be managed via passive water management systems before release into the environment; and • Any area where decant points may be determined needs to be very carefully managed throughout the Life Of Mining (LOM).

As noted from the risk assessment above, the assessed activities and aspects are expected to pose an overall “Low” risk to the northern astern CVB wetland, provided that the mitigation measures as outlined in this report are strictly adhered to. Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against potential subsidence must be implemented and strictly adhered to. If any other rock engineer technical reports have been compiled since 2021, specifically for the undermining of the north eastern CVB wetland, then the recommendations and mitigation measures stipulated in those reports must also be adhered to. The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from dewatering, potential formation of a pollution plume. It is also recommended that the pillar safety factor under the north eastern CVB wetland be increased to ensure that no subsidence of the watercourse takes place.

6.3 *Impact Assessment*

The results of the DWS specified Risk Assessment Matrix (as promulgated in GN4167 of 2023 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)), as amended are translated into the impact assessment methodology provided by the Environmental Assessment Practitioner (EAP).

Table 6: Summary of the impact assessment for the proposed underground mining activities associated with the north eastern CVB wetland.

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION						
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTAL	SP
Operation Phase																				
Potential creation of a cone of depression, which may drain water from the CVB wetland, thus resulting in desiccation of the wetland.	Operation of the underground mining area related to the undermining of the north eastern CVB wetland.	8	4	1	4	3	4	80	**MH**	Moderate	Negative	*•Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence and dewatering, formation of a pollution plume and decant respectively, must be implemented;* *•The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the formation of a cone of depression and pollution plume, from the mine into the receiving environment; and* *•Water levels need to be strictly managed to ensure they are kept below any decant level while ensuring that a significant cone of depression impact does not take place.*	4	3	1	2	2	3	36	**L**
Potential destabilisation of the surrounding environment through the extraction of ore and subsequent potential subsidence of the land.		8	4	1	4	3	2	40	**M**	Moderate	Negative	*•Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence must be implemented;* *•As per the Rock Engineering Technical report (Sibanye Stillwater, 2021) to avoid potential surface subsidence, pillars will be designed with a minimum factor of safety to ensure subsidence is avoided; and* *•It is advised that the pillar safety factor under the CVB wetland be increased to further ensure no subsidence takes place.*	4	3	1	2	2	3	36	**L**
CLOSURE/POST CLOSURE PHASE																				
•Contamination of water within the receiving environment, and subsequent reduction in water quality (increase in salts and specific contaminants of concern and reduced pH);	Post-closure management activities.	8	5	2	3	3	4	84	**MH**	Moderate	Negative	*•The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from decant of contaminated water from the mine into the receiving environment;*	4	3	1	2	2	3	36	**L**

POTENTIAL ENVIRONMENTAL IMPACT	ACTIVITY	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		M	D	S	I	R	P	TOTAL	SP				M	D	S	I	R	P	TOTAL	SP
•Subsequent negative impacts on biota and vegetation; •Altered flow regimes (increased hydroperiod); and •Habitat degradation.												*•If feasible, the volume of decant can be managed via passive water management systems before release into the environment; and* *•Any area where decant points may be determined needs to be very carefully managed throughout the LOM.*								

6.4 *Cumulative Impact Assessment*

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified in Section 6.2 & 6.3, above. Freshwater ecosystems within the region are under continued threat largely due to growing mining intensification and urbanisation. These cumulative impacts lead to increasing impacts on the functioning and service provision by wetlands and rivers.

As the CVB wetland is a tributary of the greater Hex River, it is imperative that impacts on the CVB wetland be reduced through implementation of the mitigation measures provided in this report to reduce the cumulative risk and impacts on the Hex River which is affected by several mining and urbanisation impacts which affect water quality, as well as instream and aquatic biota.

As the expansion of the Kwezi MRA will include the expansion of the Waste Rock Dumps (at the Kwezi shaft and not assessed as part of this assessment), the potential for eutrophication of the receiving environment. The potential for decant of contaminated water also increases which can lead to impaired water quality and changes to the hydrological processes of the CVB wetland as well as the Dorpspruit stream.

Mining and urban activities in the area have resulted in the reduction of functional freshwater habitats in the landscape and continued mining and urban activities will contribute to the degradation of water quality, and loss of indigenous vegetation, especially if potential impacts are not managed accordingly in line with the mitigation hierarchy and best practice protocols.

7 CONCLUSION

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecosystem assessment as part of the Environmental Authorisation (EA) and Water Use Authorisation (WUA) processes for the proposed additional areas associated with the undermining of freshwater ecosystems (hereafter referred to as the ‘proposed underground mining operation’) at the existing Kwezi shaft in Rustenburg, North-West Province.

No natural occurring freshwater ecosystems, as per the NWA (Act no. 36 of 1998), as amended was noted within the study area. A Channelled Valley Bottom (CVB) wetland was

however identified within the north eastern portion of the investigation area. The results of the assessment are summarised in the table below:

Table 7: Summary of results of the field assessment as discussed in Section 4.

Freshwater ecosystems	PES	Ecoservices importance	EIS	REC / RMO / BAS
North eastern Channelled Valley Bottom wetland	E	Very low to low	Moderate	D/ Improve/D
Extent of modification anticipated.	**Low** Based on the PES and EIS of the south eastern CVB wetland and the findings of the DWS Risk Assessment Matrix, the activities associated with the proposed undermining of the north eastern CVB wetland will pose a "Low" risk to the ongoing functionality of the wetland. Key mitigation measures include: ➢ Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against subsidence and dewatering, formation of a pollution plume and decant respectively, must be implemented; ➢ The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the formation of a cone of depression and pollution plume, from the mine into the receiving environment; and ➢ It is advised that the pillar safety factor under the CVB wetland be increased to further ensure no subsidence takes place.			

Following the freshwater ecosystem assessment, the Department of Water and Sanitation (DWS) Risk Assessment Matrix (2023) was applied to determine the significance of impacts of the proposed undermining of the south eastern CVB wetland. Provided that all mitigation measures outlined in this report are adhered to throughout the life of the proposed underground mining operation, the perceived impact significance is "Low" provided that the mitigation measures as outlined in this report are strictly adhered to. Mitigation measures as stipulated in the Rock Engineer Technical report (Sibanye Stillwater, 2021) to mitigate against potential subsidence must be implemented and strictly adhered to. If any other rock engineer technical reports have been compiled since 2021, specifically for the undermining of the north eastern CVB wetland, then the recommendations and mitigation measures stipulated in those reports must also be adhered to. The management and mitigation measures recommended by a suitably qualified geohydrologist must be implemented to mitigate the potential impacts arising from the potential formation of a pollution plume and possible decant of contaminated water from the mine into the receiving environment. It is also recommended that the pillar safety factor under the north eastern CVB wetland be increased to ensure that no subsidence of the watercourse takes place.

Thus, it is the opinion of the specialist that the proposed undermining of the north eastern CVB wetland associated with the expansion portions (Block A and B) of the Kwezi MRA is considered acceptable and can be authorised by means of a Water Use Authorisation process in terms of Government Notice (GN) 4167 as it relates to the National Water Act (NWA) and is acceptable for Environmental Authorisation (EA).

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APPENDIX A – Terms of Use and Indemnity

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS (Pty) Ltd and its staff reserve the right, at their sole discretion, to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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APPENDIX B – Legislative Considerations

The Constitution of the Republic of South Africa, 1996	The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.
National Environmental Management Act (Act No. 107 of 1998) (NEMA)	The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact. Provincial regulations must also be considered.
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	**Ecosystems that are threatened or in need of protection** (1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection. *(b)* An MEC for environmental affairs in a province may, by notice in *the Gazette,* publish a provincial list of ecosystems in the province that are threatened and in need of protection. (2) The following categories of ecosystems may be listed in terms of subsection (1): *(a)* critically endangered ecosystems, being ecosystems that have undergone severe degradation of ecological structure, function or composition as a result of human intervention and are subject to an extremely high risk of irreversible transformation; *(b)* endangered ecosystems, being ecosystems that have undergone degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems; (c) vulnerable ecosystems, being ecosystems that have a high risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although they are not critically endangered ecosystems or endangered ecosystems; and *(d)* protected ecosystems, being ecosystems that are of high conservation value or of high national or provincial importance, although they are not listed in terms of paragraphs *(a), (b)* or (c).
The National Water Act 1998 (Act No. 36 of 1998) (NWA)	The National Water Act (NWA) (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DWS in terms of Section 21 (c) & (i).
Government Notice 4167 as published in the Government Gazette 49833 of 08 December 2023 as it relates to the NWA (Act 36 of 1998) as amended	GN 4167 outlines the parameters and process of a General Authorisation (GA), which replaces the need to apply for a licence in terms of Section 40 of the NWA, provided that the water use is within the limits and conditions of the GA. The notice replaces GN 509 of 2016. The GA sets out the need to determine the regulated area of a watercourse, as well as the degree of risk posed by an activity/ies related to a particular water use. In accordance with GN 4167 of December 2023, the regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as: a) the outer edge of the 1 in 100-year flood line 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; b) in the absence of a determined 1 in 100-year flood line or riparian area the area within 100 m distance from the edge of a watercourse where the edge of the watercourse (excluding flood plains) is the first identifiable annual bank fill flood bench; or c) In respect of a wetland, a 500 m radius around the delineated boundary (extent) of any wetland, including pans.

	The GA only applies to the use of water in terms of Section 21(c) and (i) of the NWA where the risk class is LOW as determined through the application of the Risk Matrix as prescribed in the Notice. The GA also does not apply where other Section 21 water uses are triggered, does not apply for most sewage infrastructure and pipelines carrying hazardous materials, water uses associated with hazardous materials, water uses associated with water and wastewater treatment works, and for most mining-related water uses. The GA may be exercised as follows: i) Section 21(c) or (i) water use activities that are determined to pose a LOW Risk as determined through the application of the Risk Matrix as prescribed in the Notice can be undertaken subject to the general conditions of the GA; ii) Section 21(c) or (i) water use activities set out in Appendix D1 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA. Such water use activities in Appendix D1 include inter alia emergency river crossings, fence erection, solar renewable infrastructure that has no direct impact on watercourses and mini-scale hydropower developments; iii) Prescribed water use activities undertaken by certain State Owned Entities as detailed in Appendix D2 of the Notice can be undertaken without being subject to the requirement of a risk assessment and subject to the general conditions of the GA; iv) Maintenance work associated an existing lawful water use in terms of section 21(c) or (i) of the Act that has a LOW risk class as determined through the Risk Matrix can be undertaken ; v) River and stormwater management activities including maintenance of infrastructure as contained in a river management plan or similar management plan, may be conducted subject to the approval of such a plan by the relevant DWS regional office or catchment management agency; vi) Rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix can be conducted; and vii) Emergency work arising from an emergency situation and or incident associated with the persons' existing lawful water use entitlement can be undertaken, provided that all work is executed and reported in the manner prescribed in the Emergency protocol contained in Appendix C of the GA. A General Authorisation (GA) issued as per this notice will require the proponent to adhere with specific conditions, rehabilitation criteria and monitoring and reporting programme. Furthermore, the water user must ensure that there is a sufficient budget to complete, rehabilitate and maintain the water use as set out in this GA. Upon completion of the registration, the responsible authority will provide a certificate of registration to the water user within 30 working days of the submission. On written receipt of a registration certificate from the Department, the person will be regarded as a registered water user and can commence within the water use as contemplated in the GA.
Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act 36 of 1998)	Regarding the use of water for mining and related activities aimed at the protection of water resources. These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the National Water Act, 1998 (Act No. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on waterlogged ground, or on ground likely to become waterlogged, undermined, unstable or cracked;* According to the above, the activity footprint must fall outside of the 1:100 year flood line of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest.

APPENDIX C – Method of Assessment

1. Desktop Study

Prior to the commencement of the field assessment, a background study, including a literature review, was conducted in order to determine the ecoregion and ecostatus of the larger aquatic system within which the freshwater features present or in close proximity of the proposed study area are located. Aspects considered as part of the literature review are discussed in the sections that follow.

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

The NFEPA project is a multi-partner project between the Council of Scientific and Industrial Research (CSIR), Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), DWA, South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). The project responds to the reported degradation of freshwater ecosystem condition and associated biodiversity, both globally and in South Africa. It uses systematic conservation planning to provide strategic spatial priorities of conserving South Africa's freshwater biodiversity, within the context of equitable social and economic development.

The NFEPA project aims to identify a national network of freshwater conservation areas and to explore institutional mechanisms for their implementation. Freshwater ecosystems provide a valuable, natural resource with economic, aesthetic, spiritual, cultural and recreational value. However, the integrity of freshwater ecosystems in South Africa is declining at an alarming rate, largely as a consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity between freshwater ecosystems), socio-economic (competition between stakeholders for utilisation) and institutional (building appropriate governance and co-management mechanisms).

The NFEPA database was searched for information in terms of conservation status of rivers, wetland habitat and wetland features present in the vicinity of or within the proposed study area.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa

The freshwater features encountered within the proposed study area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System". A summary of Levels 1 to 4 of the classification system are presented in Table C1 and C2, below.

Table C1: Proposed classification structure for Inland Systems, up to Level 3.

WETLAND / AQUATIC ECOSYSTEM CONTEXT		
LEVEL 1: SYSTEM	LEVEL 2: REGIONAL SETTING	LEVEL 3: LANDSCAPE UNIT
Inland Systems	DWA Level 1 Ecoregions OR NFEPA WetVeg Groups OR Other special framework	Valley Floor
		Slope
		Plain
		Bench (Hilltop / Saddle / Shelf)

Table C2: Hydrogeomorphic (HGM) Unit for the Inland System, showing the primary HGM Types at Level 4A and the subcategories at Level 4B to 4C.

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	**B**	**C**
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
	Rejuvenated bedrock fall	Active channel
		Riparian zone
	Rejuvenated foothills	Active channel
		Riparian zone
	Upland floodplain	Active channel
		Riparian zone
Channelled valley-bottom wetland	(not applicable)	(not applicable)
Unchannelled valley-bottom wetland	(not applicable)	(not applicable)
Floodplain wetland	Floodplain depression	(not applicable)
	Floodplain flat	(not applicable)
Depression	Exorheic	With channelled inflow
		Without channelled inflow
	Endorheic	With channelled inflow
		Without channelled inflow
	Dammed	With channelled inflow
		Without channelled inflow
Seep	With channelled outflow	(not applicable)
	Without channelled outflow	(not applicable)
Wetland flat	(not applicable)	(not applicable)

Level 1: Inland systems

From the Classification System, Inland Systems are defined as aquatic ecosystems that have no existing connection to the ocean[3] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but which are inundated or saturated with water, either permanently or periodically. It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.,* 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have

[3] Most rivers are indirectly connected to the ocean via an estuary at the downstream end, but where marine exchange (i.e. the presence of seawater) or tidal fluctuations are detectable in a river channel that is permanently or periodically connected to the ocean, it is defined as part of the estuary.

most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

The Vegetation Map of South Africa, Swaziland and Lesotho (Mucina & Rutherford, 2006) group's vegetation types across the country according to Biomes, which are then divided into Bioregions. To categorise the regional setting for the wetland component of the National Freshwater Ecosystem Priority Areas (NFEPA) project, wetland vegetation groups (referred to as WetVeg Groups) were derived by further splitting bioregions into smaller groups through expert input (Nel *et al*., 2011). There are currently 133 NFEPA WetVeg Groups. It is envisaged that these groups could be used as a special framework for the classification of wetlands in national- and regional-scale conservation planning and wetland management initiatives.

Level 3: Landscape Setting

At Level 3 of the Classification System, for Inland Systems, a distinction is made between four Landscape Units (Table C1) on the basis of the landscape setting (i.e. topographical position) within which an HGM Unit is situated, as follows (Ollis *et al.,* 2013):

- **Slope:** an included stretch of ground that is not part of a valley floor, which is typically located on the side of a mountain, hill or valley;
- **Valley floor:** The base of a valley, situated between two distinct valley side-slopes;
- **Plain:** an extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land; and
- **Bench (hilltop/saddle/shelf):** an area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops/crests (areas at the top of a mountain or hill flanked by down-slopes in all directions), saddles (relatively high-lying areas flanked by down-slopes on two sides in one direction and up-slopes on two sides in an approximately perpendicular direction), and shelves/terraces/ledges (relatively high-lying, localised flat areas along a slope, representing a break in slope with an up-slope one side and a down-slope on the other side in the same direction).

Level 4: Hydrogeomorphic Units

Seven primary HGM Types are recognised for Inland Systems at Level 4A of the Classification System (Table C2), on the basis of hydrology and geomorphology (Ollis *et al*., 2013), namely:

- **River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water;
- **Channelled valley-bottom wetland:** a valley-bottom wetland with a river channel running through it;
- **Unchannelled valley-bottom wetland:** a valley-bottom wetland without a river channel running through it;
- **Floodplain wetland:** the mostly flat or gently sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by over-topping of the channel bank;
- **Depression:** a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates.
- **Wetland Flat:** a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat; and
- **Seep:** a wetland area located on (gently to steeply) sloping land, which is dominated by the colluvial (i.e. gravity-driven), unidirectional movement of material down-slope. Seeps are often located on the side-slopes of a valley but they do not, typically, extend into a valley floor.

The above terms have been used for the primary HGM Units in the classification system to try and ensure consistency with the wetland classification terms currently in common usage in South Africa. Similar terminology (but excluding categories for "channel", "flat" and "valleyhead seep") is used, for example, in the recently developed tools produced as part of the Wetland Management Series including WET-Health (Macfarlane *et al*., 2008), WET-IHI (DWAF, 2007) and WET-EcoServices (Kotze *et al*., 2009).

3. WET-Health

Healthy wetlands are known to provide important habitats for wildlife and to deliver a range of important goods and services to society. Management of these systems is therefore essential if these attributes are to be retained within an ever-changing landscape. The primary purpose of this assessment is to evaluate the eco-physical health of wetlands, and in so doing to promote their conservation and wise management.

Level of Evaluation
Two levels of assessment are provided by WET-Health:

- Level 1: Desktop evaluation, with limited field verification. This is generally applicable to situations where a large number of wetlands need to be assessed at a very low resolution; or
- Level 2: On-site evaluation. This involves structured sampling and data collection in a single wetland and its surrounding catchment.

Framework for the Assessment
A set of three modules has been synthesised from the set of processes, interactions and interventions that take place in wetland systems and their catchments: hydrology (water inputs, distribution and retention, and outputs), geomorphology (sediment inputs, retention and outputs) and vegetation (transformation and presence of introduced alien species).

Units of Assessment
Central to WET-Health is the characterisation of HGM Units, which have been defined based on geomorphic setting (e.g. hillslope or valley-bottom; whether drainage is open or closed), water source (surface water dominated or sub-surface water dominated) and pattern of water flow through the wetland unit (diffusely or channelled) as described under the Classification System for Wetlands and other Aquatic Ecosystems above.

Quantification of Present State of a wetland
The overall approach is to quantify the impacts of human activity or clearly visible impacts on wetland health, and then to convert the impact scores to a Present State score. This takes the form of assessing the spatial *extent* of the impact of individual activities and then separately assessing the *intensity* of the impact of each activity in the affected area. The extent and intensity are then combined to determine an overall *magnitude* of impact. The impact scores, and Present State categories are provided in the table below.

Table C3: Impact scores and categories of Present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place, but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great, but some remaining natural habitat features are still recognisable.	6-7.9	E
Critical	Modifications have reached a critical level and the ecosystem processes have been completely modified with an almost complete loss of natural habitat and biota.	8-10	F

Assessing the Anticipated Trajectory of Change
As is the case with the Present State, future threats to the state of the wetland may arise from activities in the catchment upstream of the unit or within the wetland itself or from processes downstream of the

wetland. In each of the individual sections for hydrology, geomorphology and vegetation, five potential situations exist depending upon the direction and likely extent of change (table below).

Table C4: Trajectory of Change classes and scores used to evaluate likely future changes to the present state of the wetland.

Change Class	Description	HGM change score	Symbol
Substantial improvement	State is likely to improve substantially over the next 5 years	2	↑↑
Slight improvement	State is likely to improve slightly over the next 5 years	1	↑
Remain stable	State is likely to remain stable over the next 5 years	0	→
Slight deterioration	State is likely to deteriorate slightly over the next 5 years	-1	↓
Substantial deterioration	State is expected to deteriorate substantially over the next 5 years	-2	↓↓

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

4. Watercourse Function Assessment

"The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class".[4] The assessment of the ecosystem services supplied by the identified freshwater features was conducted according to the guidelines as described by Kotze *et al.* (2020). An assessment was undertaken that examines and rates 16 different ecosystem services, selected for their specific relevance to the South African situation, as follows:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate assimilation;
- Nitrate assimilation;
- Toxicant assimilation;
- Erosion control;
- Carbon storage;
- Biodiversity maintenance;
- Provision of water for human use;
- Provision of harvestable resources;
- Food for livestock;
- Provision of cultivated foods;
- Cultural and spiritual experience;
- Tourism and recreation; and
- Education and research.

For each ecosystem service, indicator scores are combined automatically in an algorithm given in the spreadsheet that has been designed to reflect the relative importance and interactions of the attributes represented by the indicators to arrive at an overall supply score. In addition, the demand for the ecosystem service is assessed based on the wetland's catchment context (e.g. toxicant sources upstream), the number of beneficiaries and their level of dependency, which are also all rated on a five-

[4] Department of Water Affairs and Forestry, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999

point scale. Again, an algorithm automatically combines the indicator scores relevant to demand to generate a demand score.

*It is important to note that when assessing riparian zones associated with riverine habitats, the contribution of the riparian zone to streamflow regulation is omitted, owing to a lack of relevant studies (Kotze *et al*, 2020).

Table C5: Integrating scores for supply and demand to obtain and overall importance score

Integrating scores for supply & demand to obtain an overall importance score						
		Supply				
		Very Low	Low	Moderate	High	Very High
Demand		0	1	2	3	4
Very Low	0	0,0	0,0	0,5	1,5	2,5
Low	1	0,0	0,0	1,0	2,0	3,0
Moderate	2	0,0	0,5	1,5	2,5	3,5
High	3	0,0	1,0	2,0	3,0	4,0
Very High	4	0,5	1,5	2,5	3,5	4,0

A single overall importance score is generated for each ecosystem service by combining the supply and demand scores. This aggregation therefore places somewhat more emphasis on supply than demand, with the supply score acting as the starting score for a “moderate” demand scenario. The importance score is, however, adjusted by up to one class up where demand is “very high” and by up to one class down where demand is “very low”. The overall importance score can then be used to derive an importance category for reporting purposes.

Table C6: Classes for determining the likely extent to which a benefit is being supplied.

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

5. Ecological Importance and Sensitivity (EIS) (Rountree and Kotze, 2013)

The purpose of assessing importance and sensitivity of water resources is to be able to identify those systems that provide higher than average ecosystem services, biodiversity support functions or are especially sensitive to impacts. Water resources with higher ecological importance may require managing such water resources in a better condition than the present to ensure the continued provision of ecosystem benefits in the long term (Rountree & Kotze, 2013).

In order to align the outputs of the Ecoservices assessment (i.e. ecological and socio-cultural service provision) with methods used by the DWA (now the DWS) used to assess the EIS of other watercourse types, a tool was developed using criteria from both WET-Ecoservices (Kotze, *et, al,* 2009) and earlier DWA EIA assessment tools. Thus, three proposed suites of important criteria for assessing the Importance and Sensitivity for wetlands were proposed, namely:

- Ecological Importance and Sensitivity, incorporating the traditionally examined criteria used in EIS assessments of other water resources by DWA and thus enabling consistent assessment approaches across water resource types;
- Hydro-functional importance, taking into consideration water quality, flood attenuation and sediment trapping ecosystem services that the wetland may provide; and
- Importance in terms of socio-cultural benefits, including the subsistence and cultural benefits provided by the wetland system.

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C7) of the wetland system being assessed.

Table C7: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

EIS Category	Range of Mean	Recommended Ecological Management Class
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

6. Recommended Management Objective (RMO) and Recommended Ecological Category (REC) Determination

“A high management class relates to the flow that will ensure a high degree of sustainability and a low risk of ecosystem failure. A low management class will ensure marginal maintenance of sustainability but carries a higher risk of ecosystem failure” (DWA, 1999).

The RMO (table below) was determined based on the results obtained from the PES, reference conditions and EIS of the freshwater resource (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C8: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
PES	A	Pristine	A Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, an REC class D is allocated by default, as the minimum acceptable PES category.**

A freshwater resource may receive the same class for the REC as the PES if the freshwater resource is deemed in good condition, and therefore must stay in good condition. Otherwise, an appropriate REC should be assigned in order to prevent any further degradation as well as enhance the PES of the watercourse.

Table C9: Description of Recommended Ecological Category (REC) classes.

Class	Description
A	Unmodified, natural
B	Largely natural with few modifications
C	Moderately modified
D	Largely modified

APPENDIX D – DWS Risk Assessment Methodology

For the proponent to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that are possessed by an organisation;
- **Environmental impacts** are the consequences of these impacts on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is;
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems;
- **Resources** include components of the biophysical environment;
- **Intensity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards;
- **Spatial scale** refers to the geographical scale of the impact; and
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria (refer to the table below). The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The intensity, spatial scale and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 75. The likelihood of the impact occurring is determined by assigning a likelihood score of between 20% and 100%. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[5].

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act, 1998 (Act No. 107 of 1998) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances, where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

[5] Some risks/impacts that have low significance will however still require mitigation

"RISK ASSESSMENT KEY" (Based on DWS 2023 publication: Section 21 c and i water use Risk Assessment Protocol) GN4167 of December 2023 published in Government Gazette 49833 of 8 December 2023) (p208).

Table D1: Intensity (What is the intensity of the impact on the resource quality - hydrology, water quality, geomorphology, biota?)

Negative impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection status	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

*PES of affected watercourses must be considered when scoring Impact Intensity

Table D2: Spatial Scale (How big is the area that the activity is impacting on, relative to the size of the impacted watercourses?)

Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5

Table D3: Duration (How long does the aspect impact on the resource quality?)

Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5

Table D4: Likelihood of impact (What is the probability that the activity will impact on the resource quality?)

Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

Table D5: Rating Classes.

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 29	(L) Low Risk	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
56 – 169	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.
170 – 300	(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.

NOTE: A Low Risk class must be obtained for all activities to be considered for a GA

Table D6: Calculations.

Intensity = Maximum Intensity Score (negative value for positive impact)	MAX = 5
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 15 (MIN = -15 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 75
Significance\Risk = (Consequence X Likelihood) X (100/75)	MAX = 100

Control Measure Development

The following points presents the key concepts considered in the development of mitigation measures for the proposed construction:

- Mitigation and performance improvement measures and actions that address the risks and impacts[6] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

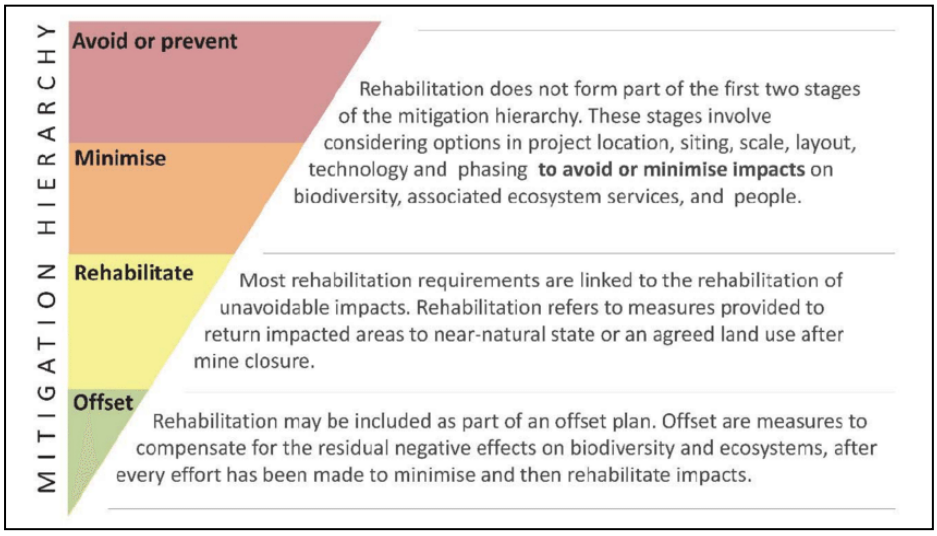


Figure D1: Impact Minimisation hierarchy as advocated by the DEA *et al.*, (2013)

[6] Mitigation measures should address both positive and negative impacts.

APPENDIX E – EAP Provided Impact Assessment Methodology

Evaluation Component	Rating	Scale	Description / criteria
(M) = MAGNITUDE of negative impact (at the indicated spatial scale)	**10**	**Very high**	Bio-physical and/or social functions and/or processes might be *severely* altered.
	8	**High**	Bio-physical and/or social functions and/or processes might be *considerably* altered.
	6	**Medium**	Bio-physical and/or social functions and/or processes might be *notably* altered.
	4	**Low**	Bio-physical and/or social functions and/or processes might be *slightly* altered.
	2	**Very low**	Bio-physical and/or social functions and/or processes might be *negligibly* altered.
	0	**Zero**	Bio-physical and/or social functions and/or processes will remain *unaltered.*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10**	**Very high**	Positive: Bio-physical and/or social functions and/or processes might be *substantially* enhanced.
	8	**High**	**Positive**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced.
	6	**Medium**	**Positive**: Bio-physical and/or social functions and/or processes might be *notably* enhanced.
	4	**Low**	**Positive**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced.
	2	**Very low**	**Positive**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced.
	0	**Zero**	**Positive**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
(D) = DURATION	**5**	**Permanent**	**Impact in perpetuity. –**
	4	**Long term**	Impact ceases after operational phase/life of the activity > 60 years.
	3	**Medium term**	Impact might occur during the operational phase/life of the activity – 60 years.
	2	**Short term**	Impact might occur during the construction phase - < 3 years.
	1	**Immediate**	**Instant impact.**
(E) = EXTENT (or spatial scale/influence of impact)	**5**	**International**	**Beyond the National boundaries.**
	4	**National**	Beyond provincial boundaries, but within National boundaries.
	3	**Regional**	Beyond 5 km of the mine area and within the provincial boundaries.
	2	**Local**	Within a 5 km radius of the mine area.
	1	**Site-specific**	**On site or within 100 meters of the site boundaries.**
	0	**None**	**Zero extent.**
(I) = IRREPLACEABLE loss of resources	**5**	**Definite**	**Definite** loss of irreplaceable resources.
	4	**High potential**	**High** potential for loss of irreplaceable resources.
	3	**Moderate potential**	**Moderate** potential for loss of irreplaceable resources.
	2	**Low potential**	**Low** potential for loss of irreplaceable resources.
	1	**Very low potential**	**Very low** potential for loss of irreplaceable resources.
	0	**None**	**Zero potential.**
(R)= REVERSIBILITY of impact	**5**	**Irreversible**	Impact **cannot** be reversed.
	4	**Low irreversibility**	**Low** potential that impact might be reversed.
	3	**Moderate reversibility**	**Moderate** potential that impact might be reversed.
	2	**High reversibility**	**High** potential that impact might be reversed.
	1	**Reversible**	Impact **will be** reversible.
	0	**No impact**	No impact.
(P) = PROBABILITY (of occurrence)	**5**	**Definite**	>95% chance of the potential impact occurring.
	4	**High probability**	75% - 95% chance of the potential impact occurring.
	3	**Medium probability**	25% - 75% chance of the potential impact occurring
	2	**Low probability**	5% - 25% chance of the potential impact occurring.
	1	**Improbable**	<5% chance of the potential impact occurring.
	0	**No probability**	**Zero probability.**
Evaluation Component	**Rating scale and description / criteria**		

CUMULATIVE IMPACTS	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Medium**:* The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Low**:* The activity is localised and might have a negligible cumulative impact. ***None**:* No cumulative impact on the environment.

Significance Score	Environmental Significance	Description / criteria
125 – 150	Very high (VH)	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	High (H)	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	Medium-high (MH)	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked at.
40 – 74	Medium (M)	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	Low (L)	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	Positive impact (+)	A positive impact is likely to result in a positive consequence/effect and is likely to contribute to positive decisions about whether or not to proceed with the project.

APPENDIX F - Results of the Field Investigation

PRESENT ECOLOGICAL STATE (PES) AND ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS) RESULTS

Table F1: Presentation of the results of the WET-Health PES assessment applied to the wetlands within the investigation area and surrounding area.

Wetlands	Hydrology		Geomorphology		Vegetation		Overall PES Score
	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	
CVB wetlands in the northern and southern portions.	6.5	-2	4.4	-2	7.5	-2	6.18 (E)

Table F2: Presentation of the results of the Ecoservices assessment applied to the CVB wetlands located in the investigation area and surrounding area.

CONDENSED SUMMARY SHEET

		Present State				Future State			
	ECOSYSTEM SERVICE	Supply	Demand	Importance Score	Importance	Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0,4	0,3	0,0	Very Low	0,4	0,3	0,0	Very Low
	Stream flow regulation	1,7	1,3	0,8	Low	1,7	1,3	0,8	Low
	Sediment trapping	1,8	0,2	0,3	Very Low	1,8	0,2	0,3	Very Low
	Erosion control	1,0	0,4	0,0	Very Low	1,0	0,4	0,0	Very Low
	Phosphate assimilation	1,8	0,3	0,5	Very Low	1,8	0,3	0,5	Very Low
	Nitrate assimilation	1,5	1,3	0,7	Very Low	1,5	1,3	0,7	Very Low
	Toxicant assimilation	1,7	1,0	0,7	Very Low	1,7	1,0	0,7	Very Low
	Carbon storage	1,3	0,3	0,0	Very Low	1,3	0,3	0,0	Very Low
	Biodiversity maintenance	0,6	2,5	0,4	Very Low	0,6	2,5	0,4	Very Low
PROVISIONING SERVICES	Water for human use	0,0	2,7	0,0	Very Low	0,0	2,7	0,0	Very Low
	Harvestable resources	2,0	0,3	0,7	Very Low	2,0	0,3	0,7	Very Low
	Food for livestock	1,0	0,0	0,0	Very Low	1,0	0,0	0,0	Very Low
	Cultivated foods	2,5	0,0	1,0	Low	2,5	0,0	1,0	Low
CULTURAL SERVICES	Tourism and Recreation	0,0	0,0	0,0	Very Low	0,0	0,0	0,0	Very Low
	Education and Research	0,0	0,0	0,0	Very Low	0,0	0,0	0,0	Very Low
	Cultural and Spiritual	2,0	0,0	0,5	Very Low	2,0	0,0	0,5	Very Low

Table F3: Presentation of the results of the EIS assessment applied to the CVB wetlands associated with the investigation area and surrounding area.

Ecological Importance and Sensitivity			CVB wetlands
			Score (0-4)
Biodiversity support			A (average)
			0,67
Presence of Red Data species			0
Populations of unique species			0
Migration/breeding/feeding sites			2
Landscape scale			B (average)
			1,00
Protection status of the wetland			1
Protection status of the vegetation type			2
Regional context of the ecological integrity			0
Size and rarity of the wetland type/s present			1
Diversity of habitat types			1
Sensitivity of the wetland			C (average)
			1,00
Sensitivity to changes in floods			1
Sensitivity to changes in low flows/dry season			1
Sensitivity to changes in water quality			1
Hydro-Functional Importance			Score (0-4)
			3,00
Regulating & supporting benefits	**Flood attenuation**		2
	Streamflow regulation		3
	Water Quality Enhancement	***Sediment trapping***	2
		Phosphate assimilation	3
		Nitrate assimilation	3
		Toxicant assimilation	3
		Erosion control	2
	Carbon storage		2
Direct Human Benefits			Score (0-4)
			0,67
Subsistence benefits	***Water for human use***		1
	Harvestable resources		2
	Cultivated foods		1
Cultural benefits	***Cultural heritage***		0
	Tourism and recreation		0
	Education and research		0

APPENDIX G – Risk Assessment Outcome

Table G1: Summary of the scorings of the DWS risk assessment matrix (2023) applied to the CVB wetland located within the north eastern portion of the investigation area.

Phase	Activity	Impact	CVB wetland		Intensity of Impact on Resource Quality					Overall Intensity	Spatial scale	Duration	Severity	Importance rating	Consequence	Likelihood	Significance	Risk Rating	Confidence level
					Abiotic Habitat (Drivers)			Biota (Responses)											
			PES	EIS	Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
Operational	Operation of the underground mining area related to the undermining of the north eastern CVB wetland.	•Potential creation of a cone of depression, which may drain water from the CVB wetland, thus resulting in desiccation of the wetland.	E	Low / Very low	1	2	1	1	1	**4**	2	4	**10**	**2**	**20**	40%	**8**	L	High
		Potential destabilisation of the surrounding environment through the extraction of ore and subsequent potential subsidence of the land	E	Low / Very low	2	3	2	2	1	**6**	2	3	**11**	**2**	**22**	60%	**13,2**	L	High
CLOSURE/POST CLOSRE	Post-closure management activities. (Decant of contaminated water from the rehabilitated mine area into the receiving environment subject to confirmation by a suitably qualified geohydrologist)	•Contamination of water within the receiving environment, and subsequent reduction in water quality (increase in salts and specific contaminants of concern and reduced pH); •Subsequent negative impacts on biota and vegetation; •Altered flow regimes (increased hydroperiod); and •Habitat degradation.	E	Low / Very low	2	2	2	2	2	**4**	2	2	**8**	**2**	**16**	40%	**6,4**	L	Medium

APPENDIX H – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Kristen Coertze MSc (Botany) (University of the Free State)
Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

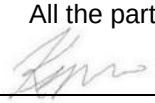
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview, 2007		
Postal code:	1401	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Natural Professional Scientist at South African Council for Natural Scientific Professions (SACNASP) Accredited River Health Practitioner by the South African River Health Program (RHP) Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Kristen Coertze, declare that -

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



Signature of the Specialist

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

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

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Group CEO, Water Resource Discipline Lead, Managing Member, Ecologist, Aquatic Ecologist
Joined SAS Environmental Group of Companies	2003 (year of establishment)

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health Practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2003
BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)	2001
BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)	2000

Short Courses

Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017
Tools for Wetland Assessment (Rhodes University)	2017
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2018
Wetland Management: Introduction and Delineation (WLID1502S) (University of the Free State)	2018
Hydropedology and Wetland Functioning (TerraSoil Science and Water Business Academy)	2018

AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

DEVELOPMENT SECTORS OF EXPERIENCE

1. Mining: Coal, chrome, Platinum Group Metals (PGMs), mineral sands, gold, phosphate, river sand, clay,
2. Linear developments (energy transmission, telecommunication, pipelines, roads)
3. Minerals beneficiation
4. Renewable energy (Hydro, wind and solar)
5. Commercial development
6. Residential development
7. Agriculture
8. Industrial/chemical

KEY SPECIALIST DISCIPLINES

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

Freshwater Assessments

- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant Species and Landscape Plans
- Freshwater Offset Plans
- Hydropedological Assessment
- Pit Closure Analysis

Aquatic Ecological Assessment and Water Quality Studies

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Biodiversity Offset Plan

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF KRISTEN COERTZE

PERSONAL DETAILS

Position in Company	Junior Freshwater Ecologist
Joined SAS Environmental Group of Companies	2021

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Candidate Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Member of the Gauteng Wetland Forum
Member of the Grassland Society of Southern Africa

EDUCATION

Qualifications

MSc Botany (University of the Free State)	2023
BSc (Hons) Environmental Science (University of the Free State)	2019
BSc Geography and Environmental Science (University of the Free State)	2018

AREAS OF WORK EXPERIENCE

South Africa – Free State, Western Cape, Gauteng, Mpumalanga, Limpopo Provinces.

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Freshwater Offset Plan
- Maintenance and Management Plans
- Plant Species and Landscape Plans

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use License Applications / General Authorisations)