SCIENTIFIC AQUATIC SERVICES

Freshwater Assessment

FOR THE PROPOSED PART OF THE ENVIRONMENTAL MANAGEMENT PLAN AMENDMENT FOR THE MINING ACTIVITIES AT THE GOEDGEVONDEN COMPLEX NEAR OGIES, MPUMALANGA PROVINCE.

Prepared for:	Jacana Environmentals CC
Report author:	A. Mileson
Report reviewers:	S. van Staden (Pr.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) was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the proposed Goedgevonden Complex Environmental Management Plan (EMP) Amendment process, located near the town of Ogies, Mpumalanga Province, with a specific focus on freshwater ecosystems associated with the proposed Ogiesfontein (OFT) Eastern and Southern Underground Blocks and the proposed Goedgevonden (GGV) Eastern Underground Block, and Incline 2.

Three wetland hydrogeomorphic (HGM) units were identified and assessed in the north-eastern portion of the MRA: two hillslope seep HGM units and one channelled valley bottom HGM unit. The hillslope seep HGM unit associated with the proposed OFT Eastern Underground Block was found to be largely to seriously modified (PES Category D/E) and of moderate ecological importance and sensitivity, whilst the hillslope seep and channelled valley bottom HGM units associated with the proposed OFT Southern Underground Block, GGV Eastern Underground Block and Incline 2 were found to be moderately modified (PES Category C) and of high ecological importance and sensitivity. The wetland associated with the proposed Incline 4 is located within an existing opencast mining area and was therefore not assessed in detail; however based on the assessment undertaken by Wetland Consulting Services (WCS) (2013) and analysis of digital satellite imagery, it is likely that the wetland is largely to severely modified (PES Category D/E) since a portion of the wetland has been lost as a result of opencast mining.

Although the baseline study was undertaken considering prevailing conditions at the time of the site assessment (predominantly grassland and farmland, except in the area of Incline 4) at the time of assessment in December 2020, it is acknowledged that the future mine plan involves an approved opencast mining approach, which will include the areas in which a total of four inclines are located. The risk assessment was therefore undertaken based on the chronological order of the proposed mine plan, i.e. that the opencast mining will occur prior to the development of the inclines.

Should the existing approved mine plan for opencast mining be followed, namely, to develop the incline shafts into the high wall of the opencast pits, the development of the proposed shafts and underground mining areas will have a negligible additional impact on the receiving freshwater environment, provided that sufficient pillar safety factors are employed to prevent subsidence in the undermined landscape. On this basis, the outcome of the risk assessment indicated that the risk is deemed to be of 'low' significance, since the majority of the wetlands associated with the proposed Inclines 2 and 4 and the associated underground mining will be completely lost assuming that opencast mining proceeds as per the mine plan.

However, in the event that opencast mining does not proceed, it will be necessary to revise the risk assessment accordingly to adequately consider the impact of the proposed development, and to ensure that appropriate mitigation measures are implemented to ensure that the significance of potential impacts are minimised as much as possible. In that scenario, it is the specialist's opinion that the proposed underground mining activities may be considered for authorisation, with the proviso that appropriate mitigation measures are implemented and strictly adhered to for the life of mine.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the proposed Goedgevonden Complex Environmental Management Plan (EMP) Amendment process, located near the town of Ogies, Mpumalanga Province.

The Goedgevonden (GGV) Mining Right Area (MRA), and specifically the proposed new amendment footprint (hereafter the "focus area") is located within the Emalaheni Local Municipality which is an administrative area of the Nkangala District Municipality, approximately 4 km south of the N12 National Route, and approximately 29 km southwest of Witbank and 38 km east of the town of Delmas. The focus area is located in a largely rural community setting, situated west of the Nkangala District with the town of Ogies situated directly north thereof.

The purpose of this report is to define the ecology of the freshwater ecosystems associated with the proposed underground mining, specifically the proposed Ogiesfontein (OFT) Eastern and Southern Underground Blocks, the proposed Goedgevonden (GGV) Eastern Underground Block and Incline 2, and the proposed Incline 4, associated with the GGV Southern Underground Block, as well as ancillary infrastructure and their associated investigation areas (defined as a 500 m radius around these areas, in line with GN 509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) in terms of freshwater characteristics, including mapping of the freshwater ecosystems, defining areas of increased Ecological Importance and Sensitivity (EIS) and the Present Ecological State (PES) of the freshwater ecosystems associated with the proposed OFT and GGV East underground blocks. 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 took place in November 2020 prior to the commencement of a significance rainfall period to ground-truth the freshwater ecosystems. Four wetland hydrogeomorphic (HGM) units were identified and classified according to the Ollis *et al.* (2013) classification system as three hillslope seeps and a channelled valley bottom;
- The wetland associated with the proposed Incline 4 was not assessed as it is within an existing opencast mining area however the Ecostatus of that system was inferred based on previous assessments and analysis of digital satellite imagery;
- The characteristics of the freshwater ecosystems were 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 the table below:

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

Wetland	PES	Ecoservices	EIS	REC / RMO / BAS
Hillslope seep HGM unit 1 (OFT Eastern Underground Block)	D/E	Moderate to moderately low	Moderate	D / D / Improve
Hillslope seep HGM unit 2 (OFT Southern Underground Block and Incline 2)	C	Moderate	High	C / B / Improve or Maintain
Channelled valley bottom HGM unit (GGV East Underground Block and Incline 2)	C	Moderate	High	C / C / Maintain
Hillslope seep (Incline 4)*	D/E	Moderate to moderately low	Low	D / D / Improve

*** Not assessed as part of this study; results inferred from WCS (2013) and analysis of digital satellite imagery.**

Following the freshwater ecological assessment, the Glencore Risk Assessment Matrix was applied to ascertain the potential risk significance of the proposed activities on the receiving freshwater environment.

Although the baseline study was undertaken considering the prevailing conditions (Grassland, farmland and freshwater ecosystems) at the time of the assessment in November 2020, it is acknowledged that authorization has previously been granted for opencast mining within the assessed areas. At the time of preparing this report, the mine plan entails undertaking opencast mining prior to the proposed underground mining, and as a result the proposed incline shafts will be developed into the high walls of the opencast areas. The risk assessment was therefore undertaken based on the chronological order of the proposed mine plan, i.e. that the opencast mining will occur prior to the development of the inclines. Should the mine plan change, the risk assessment will need to be revised accordingly to adequately consider the impact of the proposed development.

Should the existing approved mine plan for opencast mining be followed, namely, to develop the incline shafts into the high wall of the opencast pits, the development of the proposed shafts and underground mining areas will have a negligible additional impact on the receiving freshwater environment, provided that sufficient pillar safety factors are employed to prevent subsidence in the undermined landscape. On this basis, the outcome of the risk assessment indicated that the risk is deemed to be of 'low' significance, since the majority of the wetlands associated with the proposed Inclines 2 and 4 and the associated underground mining will be completely lost assuming that opencast mining proceeds as per the mine plan.

However, in the event that opencast mining does not proceed, it will be necessary to revise the risk assessment accordingly to adequately consider the impact of the proposed development, and to ensure that appropriate mitigation measures are implemented to ensure that the significance of potential impacts are minimised as much as possible. In that scenario, it is the specialist's opinion that the proposed underground mining activities may be considered for authorisation, with the proviso that appropriate mitigation measures are implemented and strictly adhered to for the life of mine.

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
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 4.3
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 4.3
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 7
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 4.3 and Section 6
2.4.2	Is the development consistent with maintaining the Resource Quality Objectives for the aquatic ecosystems present?	Section 4.3
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 4.3
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); 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);	Section 4.3

	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 4.3
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 4.3
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 4.3
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 1 and 4.3
3.4	The methodology used to undertake the impact assessment and site inspection, including equipment and modelling used, where relevant;	Appendix C
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 6
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
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
Fluvial:	Resulting from water movement.
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.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
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.
Obligate species:	Species almost always found in wetlands (>99% of occurrences).
Perched water table:	The upper limit of a zone of saturation that is perched on an unsaturated zone by an impermeable layer, hence separating it from the main body of groundwater
Perennial:	Flows all year round.
RAMSAR:	The Ramsar Convention (The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilisation of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.
RDL (Red Data listed) species:	Organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status according to the International Union for Conservation of Nature (IUCN) Classification.
Seasonal zone of wetness:	The zone of a wetland that lies between the Temporary and Permanent zones and is characterised by saturation from three to ten months of the year, within 50cm of the surface
Temporary zone of wetness:	the outer zone of a wetland characterised by saturation within 50cm of the surface for less than three months of the year
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

BAR	Basic Assessment Report
BAS	Best Attainable State
BGIS	Biodiversity Geographic Information Systems
CSIR	Council of Scientific and Industrial Research
UCVB	Unchannelled Valley Bottom
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EPL	Ecosystem Protection Level
ES	Ecological Sensitivity
ESA	Ecological Support Area
ETS	Ecosystem Threat Status
EWR	Ecological Water Requirements
FEPA	Freshwater Ecosystem Priority Areas
GA	General Authorisation
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
IAIA	International Association of Impact Assessors
IUCN	International Union for Conservation of Nature
IWUL	Integrated Water Use License
mm	Millimetre
m.a.m.s.l	Metres above mean sea level
MAP	Mean Annual Precipitation
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RHP	River Health Program
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South Africa Institute of Aquatic Biodiversity
SAIIAE	South Africa Inventory of Inland Aquatic Ecosystems
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SASSO	South African Soil Surveyors Association
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application

1 INTRODUCTION

1.1 *Background*

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the Environmental Impact Assessment (EIA) and Environmental Authorisation (EA) process for the proposed Goedgevonden Complex Environmental Management Plan (EMP) Amendment process, located near the town of Ogies, Mpumalanga Province.

The Goedgevonden (GGV) Mining Right Area (MRA), and specifically the proposed new amendment footprint (hereafter the "focus area") is located within the Emalaheni Local Municipality which is an administrative area of the Nkangala District Municipality, approximately 4 km south of the N12 National Route, and approximately 29 km southwest of Witbank and 38 km east of the town of Delmas. The focus area is located in a largely rural community setting, situated west of the Nkangala District with the town of Ogies situated directly north thereof. The location and extent of the focus area is indicated in Figures 1 and 2.

To identify all freshwater ecosystems (defined as watercourses by the National Water Act, 1998 (Act No. 36 of 1998)) that may potentially be impacted by the proposed mining activities, a 500 m "zone of investigation" around the focus area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was used as a guide in which to assess possible sensitivities of the receiving environment. This 500 m "zone of investigation" will henceforth be referred to as the 'investigation area'.

Various studies pertaining to the freshwater ecology of the study area were historically undertaken by Wetland Consulting Services (WCS) (2004, 2005, 2009, 2012, and 2013). The purpose of the historical studies was to identify, delineate and define the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of freshwater ecosystems within the focus area. The purpose of this report is to provide a "wetland status quo" assessment in which the PES and EIS, as well as the socio-cultural and ecological service provision of the previously assessed freshwater ecosystems are defined utilising current industry "best practice" assessment methods, to ascertain what, if any, impact the proposed mining activities will have on the receiving freshwater environment.

All results will be used to inform a detailed risk assessment, which will be undertaken according to a pre-defined risk assessment methodology as provided by the proponent. In addition, mitigatory measures were developed, which aim to minimise the perceived impacts associated with the proposed mining activities, followed by an assessment of the significance of the impacts post-mitigation. This report, after consideration and a description of the ecological integrity of the focus area, must guide the Environmental Assessment Practitioner (EAP) and relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the activities from the perspective of freshwater ecosystem management.

1.2 *Project Description*

The proposed layouts (illustrating previously authorised infrastructure and mining activities as well as the proposed new amendment layout) is provided in Figures 1 and 2.

The GGV authorised layout consists of the following:

- Access roads;
- Internal roads;
- Rail loop;
- River diversions;
- Coal processing plant complex;
- Mine residue facility;
- Open cast mining areas;
- Pollution control dam;
- Run of Mine (RoM) trip;
- Road diversion; and
- Underground mining areas.

The proposed new amendment consists of mining activities across the MRA. The new amendment consists of the following:

- GGV Central underground Block;
- GGV East underground Block
- GGV Northern underground Block
- GGV Southern underground Block
- Four Inclines (namely inclines 1 to 4);
- A new road alignment;
- OFT Eastern Underground Block; and
- OFT Southern Underground Block.

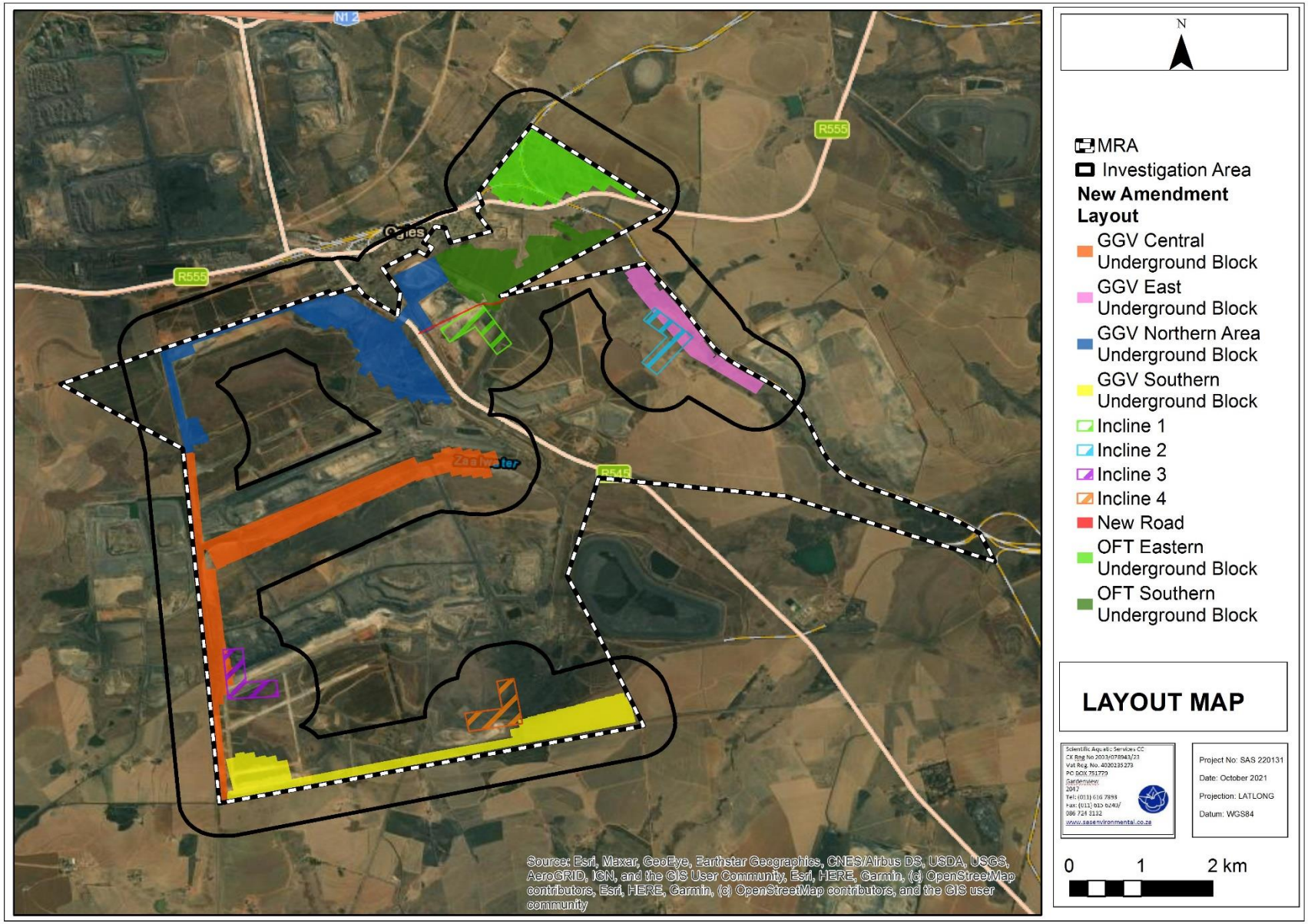


Figure 1: A digital satellite image depicting the location of the new amendment layout and investigation area in relation to the surrounds.

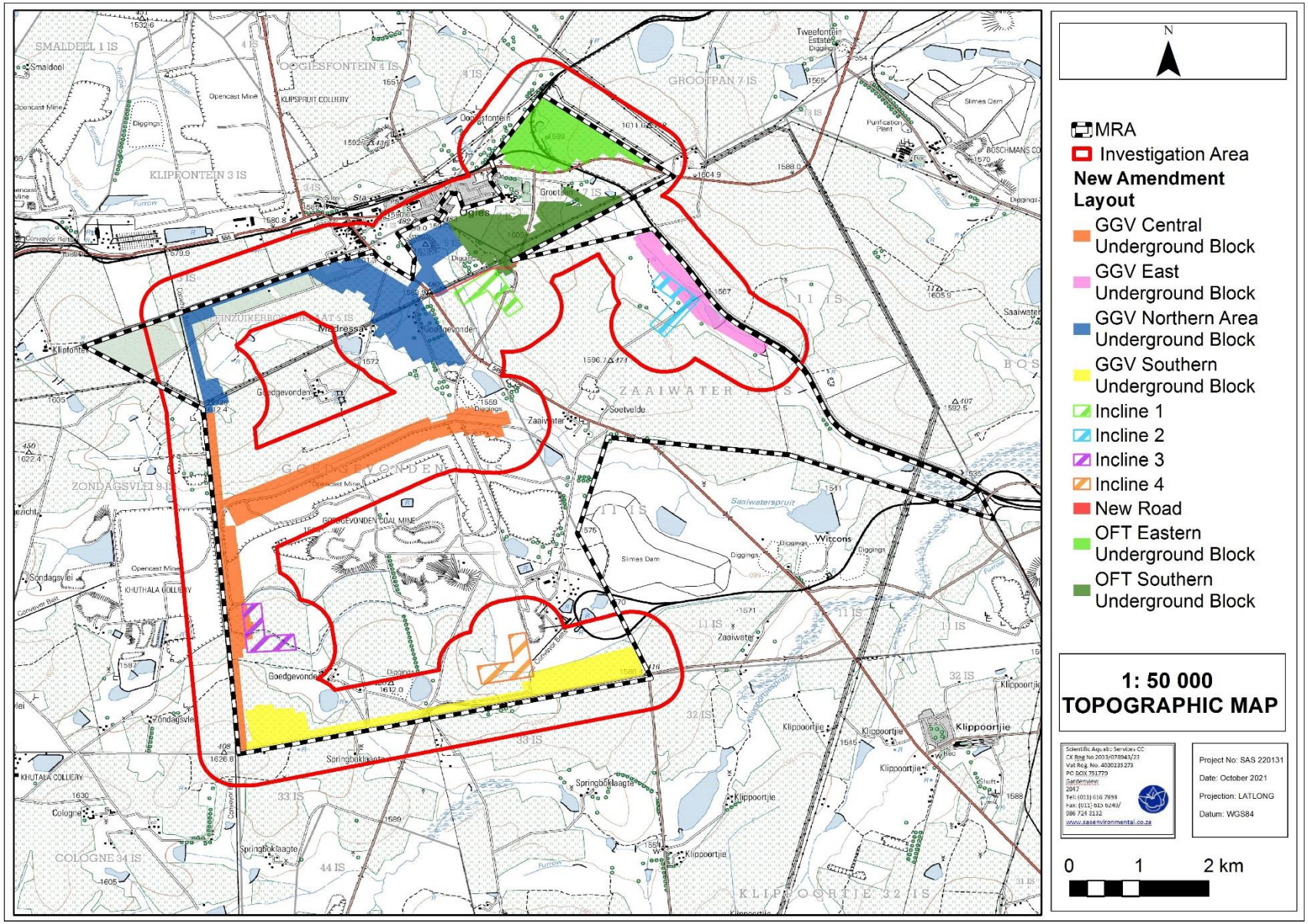


Figure 2: The focus and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.3 *Scope of Work*

Specific outcomes in terms of this report are outlined below. It must be noted that the scope of work described below is only applicable to the freshwater ecosystems associated with the proposed new amendment layout, and was not applied to freshwater ecosystems situated within the previously approved opencast mining areas.

- 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), and the Mpumalanga Biodiversity Spatial Planning (MBSP, 2019), were undertaken to aid in defining the PES and EIS of the freshwater ecosystems;
- The freshwater ecosystems within the investigation area were provided by the proponent, as undertaken by Wetland Consulting Services (WCS) and are depicted in this report in accordance with GN509 of 2016 as it relates to activities as stipulated in the National Water Act, 1998 (Act No. 36 of 1998);
- Delineations of applicable freshwater ecosystems as provided by the proponent and compiled by WCS were field verified where feasible by SAS according to "DWAF[1], 2008[2]: 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 when verifying the delineated 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 EIS of the freshwater ecosystems were determined according to the method described by Rountree and Kotze*,* (2013);
- The PES of the freshwater ecosystems was assessed according to the resource directed measures guideline as advocated by Macfarlane *et al.* (2008);
- The freshwater ecosystems were mapped in relation to the focus area. In addition to the freshwater ecosystem boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;

[1] The Department of Water Affairs and Forestry (DWAF) was formerly known as the Department of Water Affairs (DWA). At present, the Department is known as the Department of Water and Sanitation (DWS). For the purposes of referencing in this report, the name under which the Department was known during the time of publication of reference material, will be used.

[2] 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.

- 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 assessments;
- The pre-defined impact assessment as provided by the proponent was applied to identify potential impacts that may affect the freshwater ecosystems as a result of the proposed underground mining activities, and to aim to quantify the significance thereof; and
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact of the proposed underground mining activities on the receiving freshwater environment.

1.4 *Assumptions and Limitations*

The following assumptions and limitations are applicable to this report:

- The freshwater ecological assessment is confined to the freshwater ecosystems affected by specific areas of the proposed new amendment, comprising underground mining areas, the associated inclines and related surface infrastructure. Freshwater ecosystems situated within previously authorised (and existing) opencast mining areas are depicted in this report but were not assessed. Only the freshwater ecosystems associated with Incline 2 and the OFT Eastern and Southern Underground Blocks were assessed;
- The delineations undertaken by WCS were utilised, particularly for the purpose of indicating freshwater ecosystems located within 500 m of the proposed new amendment areas, in accordance with Regulation GN 509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998). Whilst some refinement of the delineations was undertaken by SAS where field verification was feasible (according to (DWAF) (2008)), SAS takes no responsibility for the accuracy of the delineations provided by the proponent. Although surrounding activities and general environs were taken into consideration during the assessment, the scope of work does not include identification, delineation or assessment of freshwater ecosystems located outside of the investigation area;
- Detailed assessments were confined to the proposed amendment layout areas (specifically the OFT Underground Blocks and the GGV East Underground Block) and did not include an assessment of the entire MRA as previous studies for the MRA have been completed which were used to inform this report where applicable. Specifically, the wetland associated with proposed Incline 4 was excluded from assessment as it is located within an existing opencast mining area. However, various sections within the

MRA were verified, rapidly, to confirm and/or update the findings of the previous assessments. The entire MRA, being associated with active surface mining, was not accessible across its entire extent due to both safety and access constraints within the active mining areas. The entire MRA and immediate surroundings were, however, included in the desktop analysis of which the results are presented in Section 3 of this report;

- The methods utilised by WCS (2013) to calculate the PES and EIS of the identified wetland systems have been greatly refined and improved subsequent to 2013. Thus, the methods utilised by WCS in 2013 do not provide directly comparable results as the assessment approaches and parameters have become more detailed and allow for the assessment of the hydraulic and geomorphological regimes and the wetland floral community separately;
- It is acknowledged that the future mine plan involves an approved opencast mining approach. This future opencast mining will include the areas in which the inclines are located (as depicted in Figures 1 and 2). As such, if future opencast mining is carried out, the quantum of risk posed to the receiving freshwater ecosystem habitat within the currently proposed underground mining areas will be minimal to negligible, since a complete loss of freshwater ecosystem habitat within the proposed underground and incline footprint areas will have already occurred as a result of the opencast activities;
- It is important to note that although all desktop 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 focus area at the scale required to inform the Environmental Authorisation 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 mining activities have been

accurately assessed and considered, based on the site observations undertaken in terms of the freshwater ecology.

1.5 *Legislative Requirements and Provincial Guidelines*

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[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 665 as published in the Government Gazette 36820 of 2013 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 August 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act No. 107 of 1998);
- Government Notice No. 864: Alien and Invasive Species Lists, 2016, in Government Gazette No. 40166 dated 29 July 2016;
- The Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA);
- The Mpumalanga Biodiversity Sector Plan Handbook (2014); and
- The Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998) (MNCA).

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". 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 not the acts amending it are allocated act numbers.

2 ASSESSMENT APPROACH

2.1 *Freshwater Ecosystem Site Verification*

Prior to the field survey, the previous assessments conducted by WCS (2004, 2005, 2009, 2012, and 2013) were studied, in addition to digital satellite imagery (current and historical) as well as historical aerial photographs of the area, to identify representative points of interest at which the current conditions of the freshwater ecosystems could be accurately assessed.

The site assessment was undertaken in November 2020, during which factors influencing the habitat integrity of the freshwater ecosystems were noted, and the functioning, environmental and socio-cultural services provided by the freshwater ecosystems were determined.

A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.2 *Sensitivity Mapping*

The delineations of the freshwater ecosystems associated with the focus area were verified with the use of a Global Positioning System (GPS). Geographic Information System (GIS) was used to project the freshwater ecosystem delineations onto digital satellite imagery and topographic maps. The sensitivity map presented in Section 5 presents the delineated freshwater ecosystems in relation to the focus area.

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 focus area’s actual site characteristics at the scale required to inform the

environmental authorisation 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 focus 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 focus area and investigation area.

Aquatic ecoregion and sub-regions in which the focus area is located.	
Ecoregion	Highveld
Catchment	Olifants-North
Quaternary Catchment (Figure)	B11F majority of the focus area, remaining northern portion within B20G
WMA	Olifants
subWMA	Upper Olifants
Dominant characteristics of the Highveld (11.02) Ecoregion Level 2 (Kleynhans *et al.*, 2007).	
Dominant primary terrain morphology	Plains: low relief. Plains: moderate relief; Moderately undulating plains and pans
Dominant primary vegetation types	Moist Sandy Highveld Grassland
Altitude (m a.m.s.l)	1300 to 1900
MAP (mm)	500 to 800
Coefficient of Variation (% of MAP)	20 to 29
Rainfall concentration index	55 to 64
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	12 to 18
Winter temperature (July)	0 to 20
Summer temperature (Feb)	10 to 26
Median annual simulated runoff (mm)	20 to 80; 80 to 100 (limited); 100 to 150; 150 to 200 (limited)
Mpumalanga Highveld Wetlands (MHW), (2014).	
The MHW identified eight natural wetland features associated with the focus area; namely a large floodplain wetland, two channelled valley bottom wetlands and five wetland seeps. According to the MHW Dataset these wetlands are classified as FEPA wetlands, which are currently in a largely modified (wetcon Class D) ecological condition. This corresponds with the depression wetlands identified by the NFEPA database (2011).	
Mining and Biodiversity Guidelines (2013) (Figure 8)	
Highest Biodiversity Importance	The majority of the focus area is situated within an area considered to be of Highest Biodiversity Importance. **Risk for mining:** Highest risk for mining. **Implications for mining:** Environmental screening, EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide a site-specific basis on which to apply the mitigation hierarchy to

Details of the focus area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database.	
FEPACODE	The focus area and investigation area fall within a sub quaternary catchment considered not important in terms of fish or watercourse conservation.
NFEPA Wetlands (Figure 4)	According to the NFEPA database, there are numerous natural and artificial wetlands located within the focus area and investigation area. The north eastern, south western and north western wetlands comprise several HGM units: the majority of HGM units are indicated as channelled valley bottom wetlands, wetland 'flats' and seeps, although one system in the north-west is indicated as comprising both channelled and unchanneled HGM units. There are also two depression features indicated in the south of the investigation area. According to the NFEPA Database the natural wetlands are classified as FEPA wetlands due to their importance for threatened waterbirds, although given the degree of anthropogenic influences it is unlikely that the wetlands are extensively utilised by sensitive avifauna. The natural wetlands are furthermore indicated to be in a moderately modified (Wetcon Class C) ecological condition according to the NFEPA Database, while the artificial wetlands are heavily to critically modified (Class Z3).
Wetland Vegetation Type	The new amendment layout and investigation area falls within the Mesic Highveld Grassland Group 4 Wetland Vegetation (WetVeg) group (not to be confused with the Mucina and Rutherford Mesic Highveld Grassland vegetation type). This vegetation group is considered least threatened according to Mbona *et al*. (2015).
NFEPA Rivers	The Tweefonteinspruit River is located approximately 1,72 km north east of the focus area. According to the NFEPA Database and PES 1999 Classification system the Tweefonteinspruit River is largely modified (Class D).
Mpumalanga Biodiversity Sector Plan (MBSP, 2019) (Figure 5)	
Ecological Support Area (ESA) Wetlands	According to the MBSP Aquatics database, there are several ESA wetlands which correlate with the wetlands identified by the NFEPA, NBA and Mpumalanga Highveld Wetlands Databases. As such, according to the MBSP (2013) all ESA wetlands are subject to a 100m setback buffer which potentially has regulatory implications for the client. These ESA wetlands are wetlands that although not considered FEPA wetlands, still maintain the hydrological functioning of rivers, water tables and freshwater biodiversity, as well as offer various ecosystem services.
Critical Biodiversity Area (CBA)	Several wetlands, primarily in the western portion of the investigation area are indicated by the MBSP as CBAs.
Other Natural Areas	Portions surrounding the ESA wetlands are indicated as "Other Natural Areas". These are areas that are not currently identified as priority areas, however most of the natural characteristics are retained and various biodiversity and ecological infrastructural functions are performed.
Heavily Modified	The majority of the focus area and investigation area are considered to be Heavily Modified, meaning these areas are currently modified to such an extent that any valuable biodiversity and ecological function has already been lost.
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 6)	

	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.	According to the NBA 2018: SAIIAE there are five natural channelled valley bottom wetlands (CVB), seven natural depression feature and three seep wetlands located within the greater MRA. The eastern CVB's are currently affected by artificial features, roads and mines therefore are considered heavily to critically modified (Class D/E/F) ecological condition. The western CVB is currently affected by an artificial feature; as such the CVB is considered moderately modified (Class C). The northern CVB is currently affected by artificial features, roads and railway lines and a degraded river system and is therefore considered heavily to critically modified (Class D/E/F). The CVBs are currently not protected (Ecosystem Protection Level (EPL)), and therefore critically endangered (Ecosystem Threat Status (ETS). The northern depression feature, two larger eastern depression features and the southern depression features are heavily to critically modified (Class D/E/F). The most southern depression feature is classified as natural to largely natural with few modifications (Class A/B). The two small eastern depression features are considered moderately modified (Class C). These depression features are classified as poorly protected (EPL) and of least concern (ETS). The northern and southern seep wetlands are currently affected by an artificial feature, roads and railway lines, thus the seep wetland is heavily to critically modified (Class D/E/F). However, the south western seep wetland is classified as moderately modified (Class C). These seep wetlands are classified as critically endangered (ETS) and poorly protected (EPL). There are several dams and open reservoirs located within the focus area and investigation area. According to the NBA Dataset the Tweefonteinspruit is largely modified (Class D), it is poorly protected (EPL) and therefore critically endangered (ETS).
Highest and Moderate Biodiversity Importance	The majority of the MRA and by association, the proposed new amendment layout, is indicated to be of Highest Biodiversity Importance. Small portions within the south of the MRA, associated with Incline 4 and the GGV southern underground block, are indicated to be of Moderate Biodiversity Importance whilst the remaining areas are currently not ranked. **Highest Biodiversity Importance:** **Risk for mining:** High risk to mining. **Implications for mining:** Highest Biodiversity Importance areas include areas where mining is not legally prohibited, but where there is a very high risk that due to their potential biodiversity significance and importance to ecosystem services (e.g. water flow regulation and water provisioning) that mining projects will be significantly constrained or may not receive necessary authorisations. **Moderate Biodiversity Importance:** **Risk for mining:** Moderate risk to mining. **Implications for mining:** These areas include Ecological Support Areas (ESA's), vulnerable ecosystems as well as areas for protected area expansion. 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.	National Web Based Environmental Screening Tool (2020). The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.

Ecological Status of the most proximal sub-quaternary reach (DWS, 2014) (Figure 7)			
Sub-quaternary reach	B11F – 01257 (Tweefonteinspruit)	B11F-01286 (Klippoortjiespruit)	The aquatic sensitivity for the study area has a very high sensitivity, due to the presence of the wetlands located within the focus area and investigation area. The majority of the focus area does however have a low sensitivity. The screening tool further indicates that the wetlands are classified as aquatic CBAs, however according to the MBSP (2019) Dataset the wetlands are classified as ESA CBAs.
Proximity to focus area	1,72 km north east of focus area	1,5 km south east of focus area	
Assessed by expert?	Yes	Yes	
PES Category Median	Seriously Modified (Class E)	Seriously Modified (Class E)	
Mean Ecological Importance (EI) Class	Low	Moderate	
Mean Ecological Sensitivity (ES) Class	Moderate	High	
Stream Order	1	1	
Default Ecological Class (based on median PES and highest EI or ES mean)	C (Moderate)	B (High)	

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

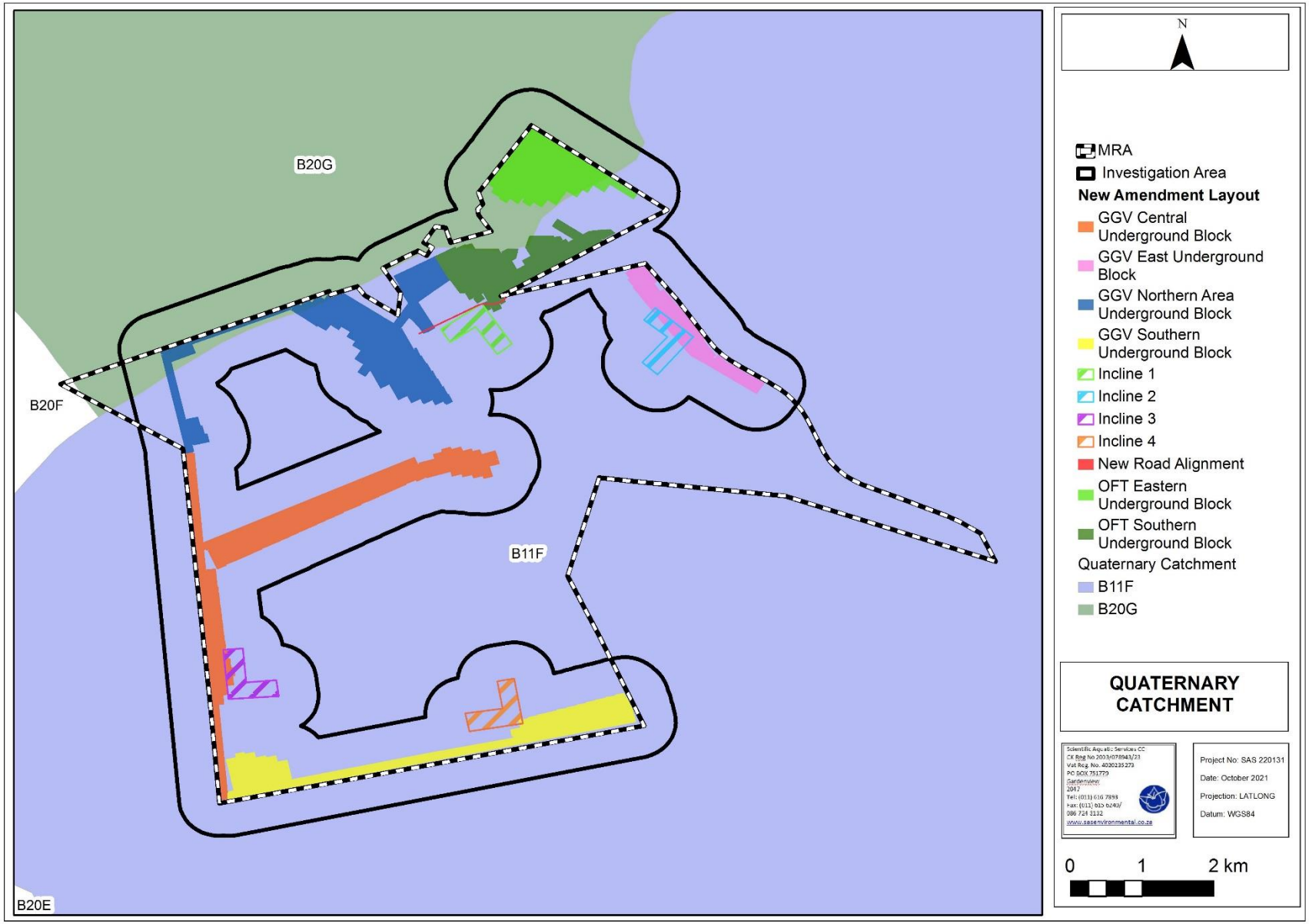


Figure 3: Aquatic ecoregion and quaternary catchment associated with the MRA, new amendment layout and associated investigation area.

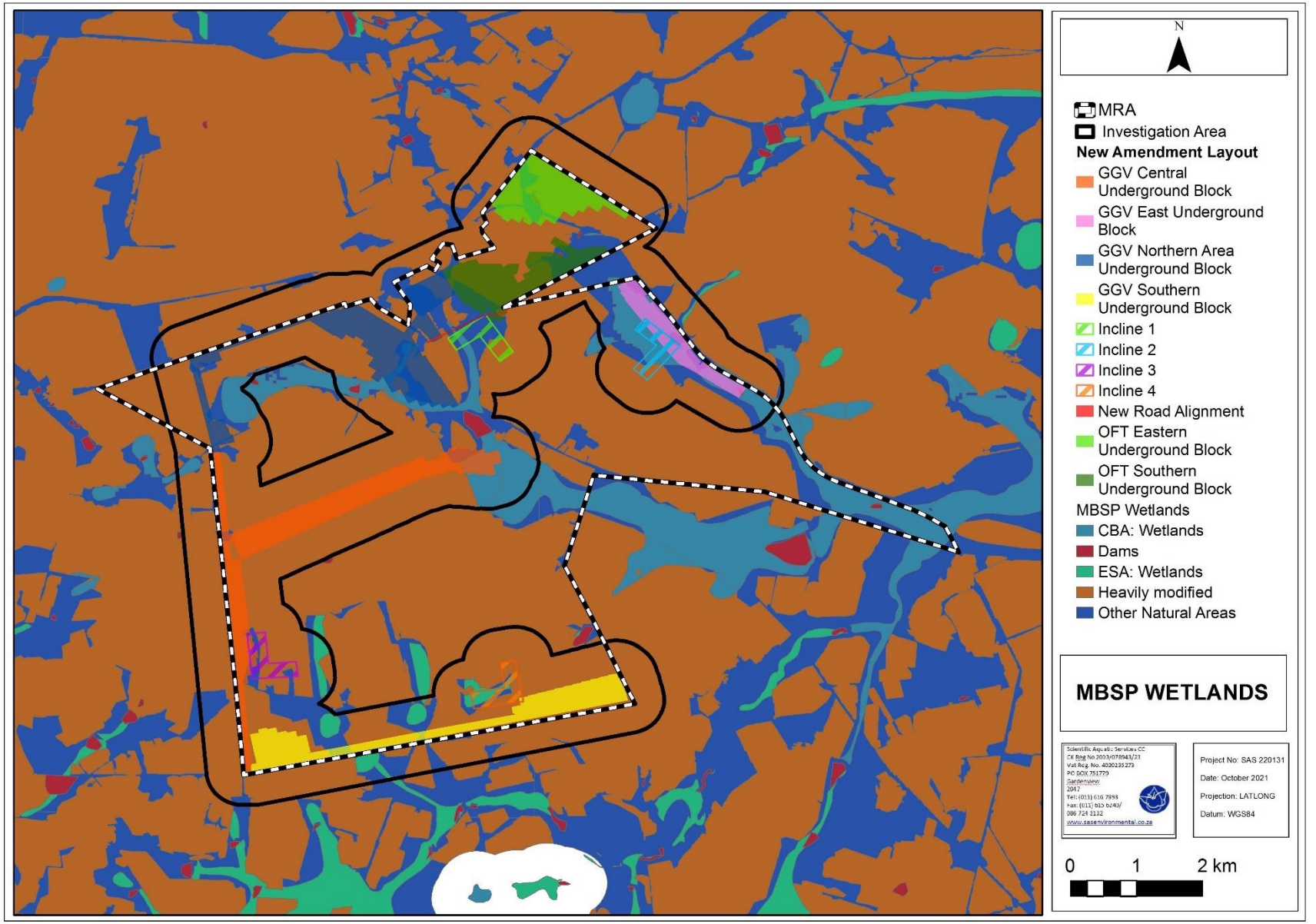


Figure 4: Wetlands associated with the associated with the MRA, new amendment layout and associated investigation area according to the Mpumalanga Spatial Biodiversity Plan (MBSP, 2014) database.

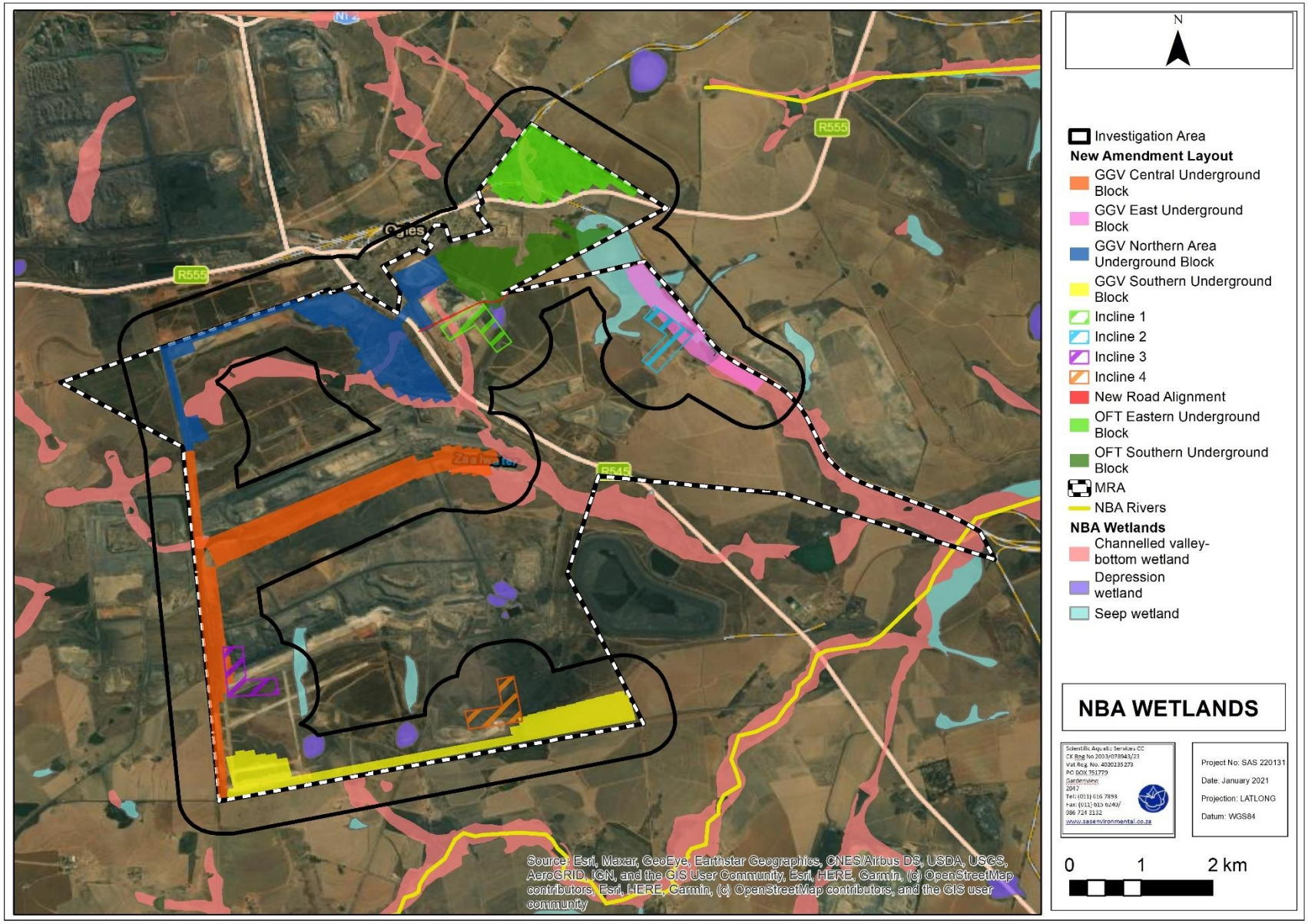


Figure 5: Wetlands and rivers associated with the associated with the MRA, new amendment layout and associated investigation area according to the National Biodiversity Assessment: South African Inventory of Inland Aquatic Ecosystems (NBA: SAIIAE, 2018).

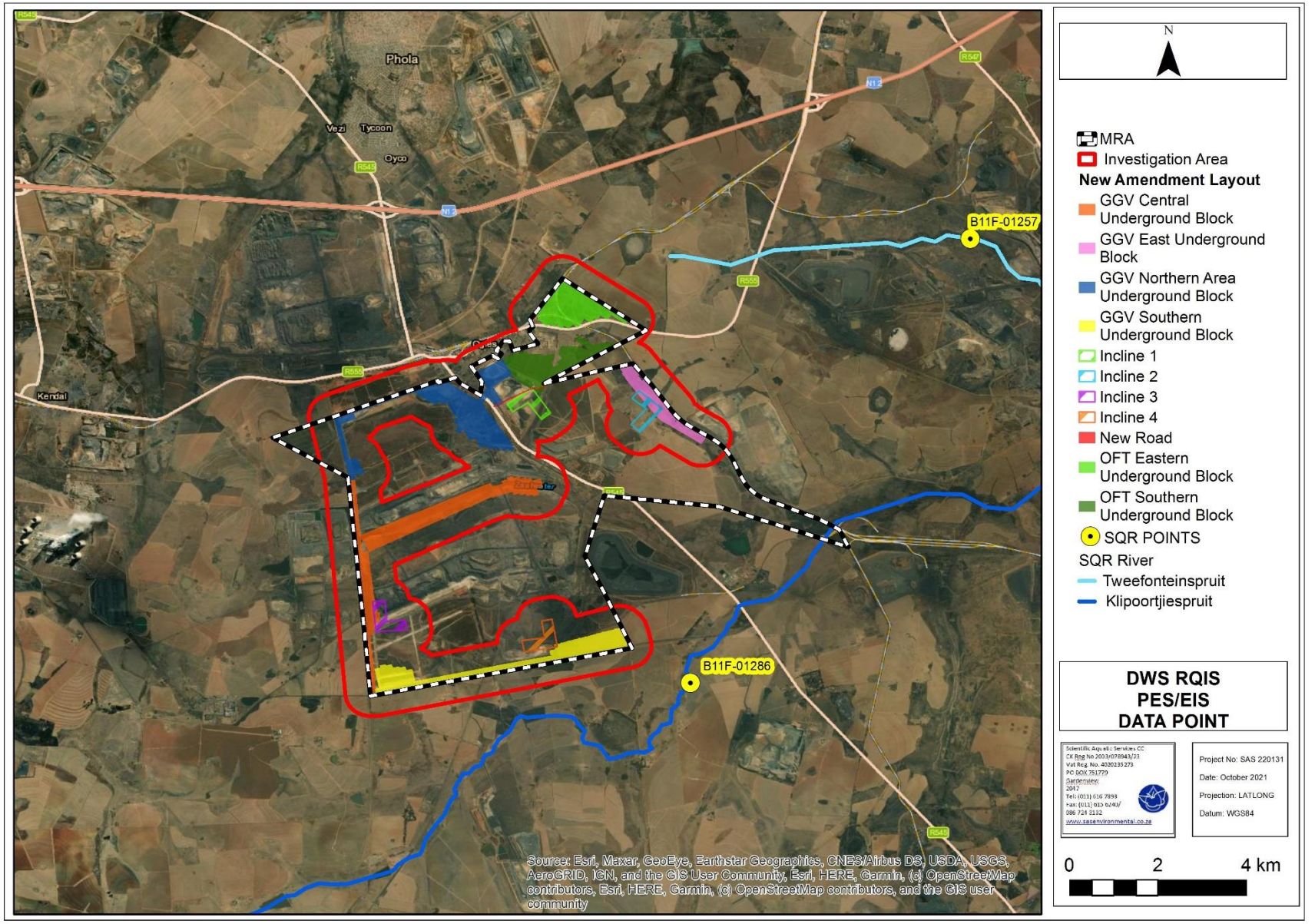


Figure 6: Relevant Sub-Quaternary Catchment Reach (SQR) associated with the associated with the MRA, new amendment layout and associated investigation area.

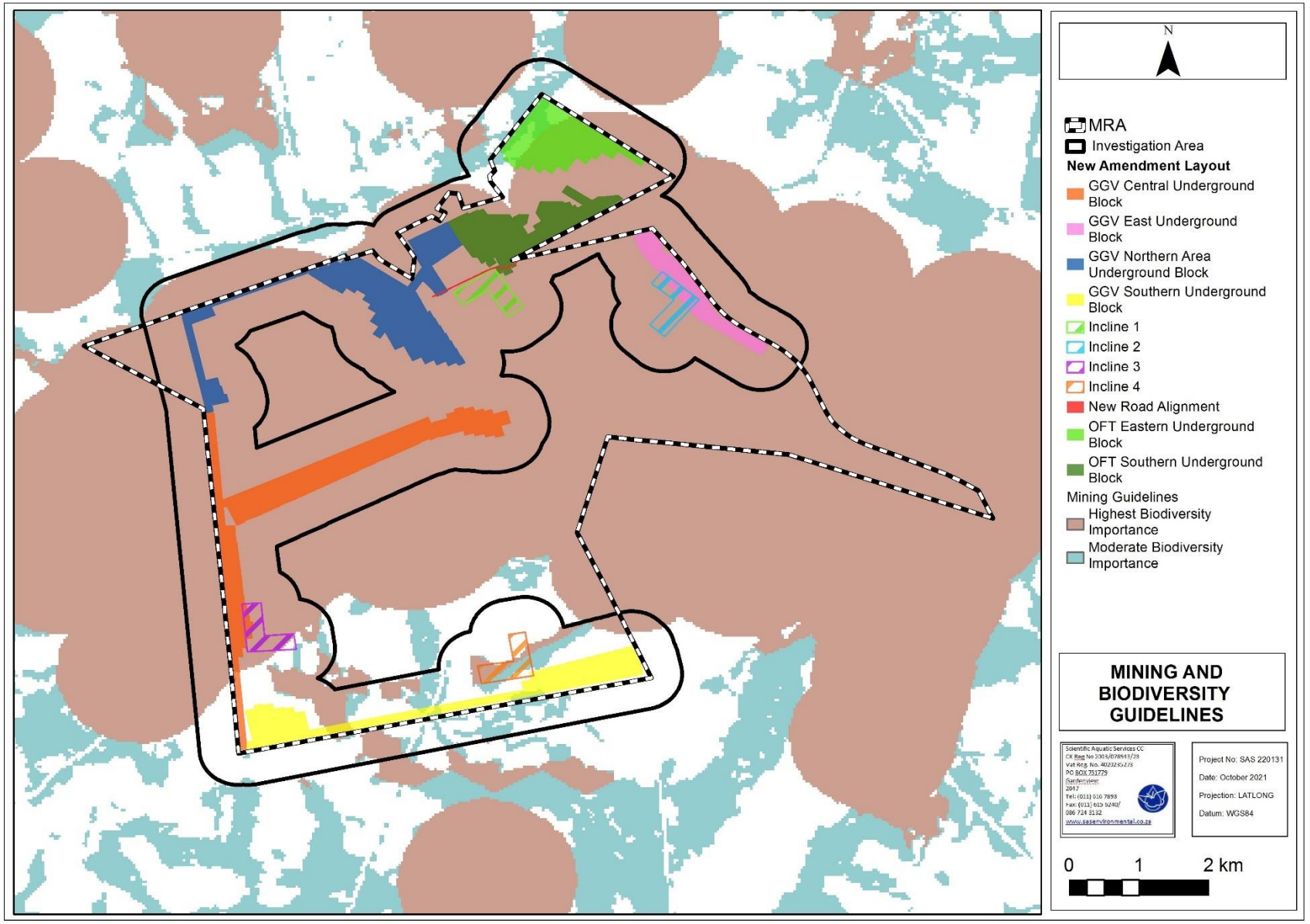


Figure 7:Biodiversity importance of the MRA, new amendment layout and associated investigation area according to the Mining and Biodiversity Guidelines (2013).

3.2 *Summary of Previous Studies Undertaken by Wetland Consulting Services*

Wetland Consulting Services undertook several studies of the various freshwater ecosystems (including valley bottom, hillslope seep and depression wetlands) within the study area between 2004 and 2013. It should be noted that not all of the freshwater systems identified by WCS are located within the focus area relevant to this investigation, as WCS (2013) was required to investigate a far larger extent of the study area than the area SAS was appointed to investigate. Excluded from this report therefore, except where it has relevance, are the valley bottom systems in the north-west of the study area, the Zaaiwaterspruit and the diversion thereof, the various depression wetlands identified and assessed by WCS (2013) and the various water quality sampling points. Of relevance to this study are the following systems previously delineated and assessed by WCS (2009 and 2013), conceptually depicted in Figure 8:

- One hillslope seep wetland associated with the OFT Eastern Underground Block (WCS 2009);
- A hillslope seep and channelled valley bottom wetland in the east, associated with the OFT Southern and GGV Eastern Underground Blocks and Incline 2 (WCS 2013); and
- A hillslope seep wetland in the south, associated with Incline 4 (WCS, 2013).

Furthermore, it is important to note that the methods of assessment utilised in 2009 and 2013 and currently, differ due to the ongoing development and refinement of industry accepted ‘best practice’ methods. Therefore, whilst the results of the previous assessments were taken into consideration as part of this study, direct comparisons cannot be drawn. However, where possible, comparisons between the condition of the freshwater ecosystems historically compared to current conditions is inferred based on the available information, including descriptions of the freshwater habitat contained in the historical studies. A summary of the historical results compared to those obtained during the course of this study is provided below.

When assessed by WCS in 2009, the hillslope seep associated with the OFT Eastern Underground Block was considered ‘seriously modified’ (PES Category E) and of moderate to low EIS (Category D). The hillslope seep and channelled valley bottom HGM units, assessed in 2013 by WCS, were at the time considered ‘moderately modified’ (PES Category C) and ‘largely modified’ (PES Category D) respectively. The loss of ecological integrity in turn influences the ability of wetlands to perform various ecological services, thus influencing the ecological integrity and sensitivity. WCS (2013) found that the assessed wetlands were of decreased EIS, with the hillslope seep wetland considered to be in an EIS Category C and the

degraded channelled valley bottom wetland in an EIS Category D. A summary of these results are presented in Table 2, whilst a comparison between the WCS (2009; 2013) results and those obtained during this study are presented in Table 4 (Section 4.3):

Table 2: Summary of the assessment results as provided by WCS, 2013.

Wetland Type	PES Category	EIS Category	Ecoservice provision
Hillslope seep (OFT Eastern Underground Block) assessed in 2009	E (seriously modified)	D (low/marginal)	Not assessed
Hillslope seeps (OFT Southern Underground Block) assessed in 2013	C (moderately modified)	C (moderate)	Intermediate
Channelled valley bottom (GGV Eastern Underground Block) assessed in 2013	D (largely modified)	D (low/marginal)	Intermediate
Hillslope seep (Incline 4) assessed in 2013	D (largely modified)	D (low/marginal)	Moderate to moderately low

For further information regarding the ecology of the various assessed ecosystems, please refer to Section 6 of WCS (2009 and 2013).

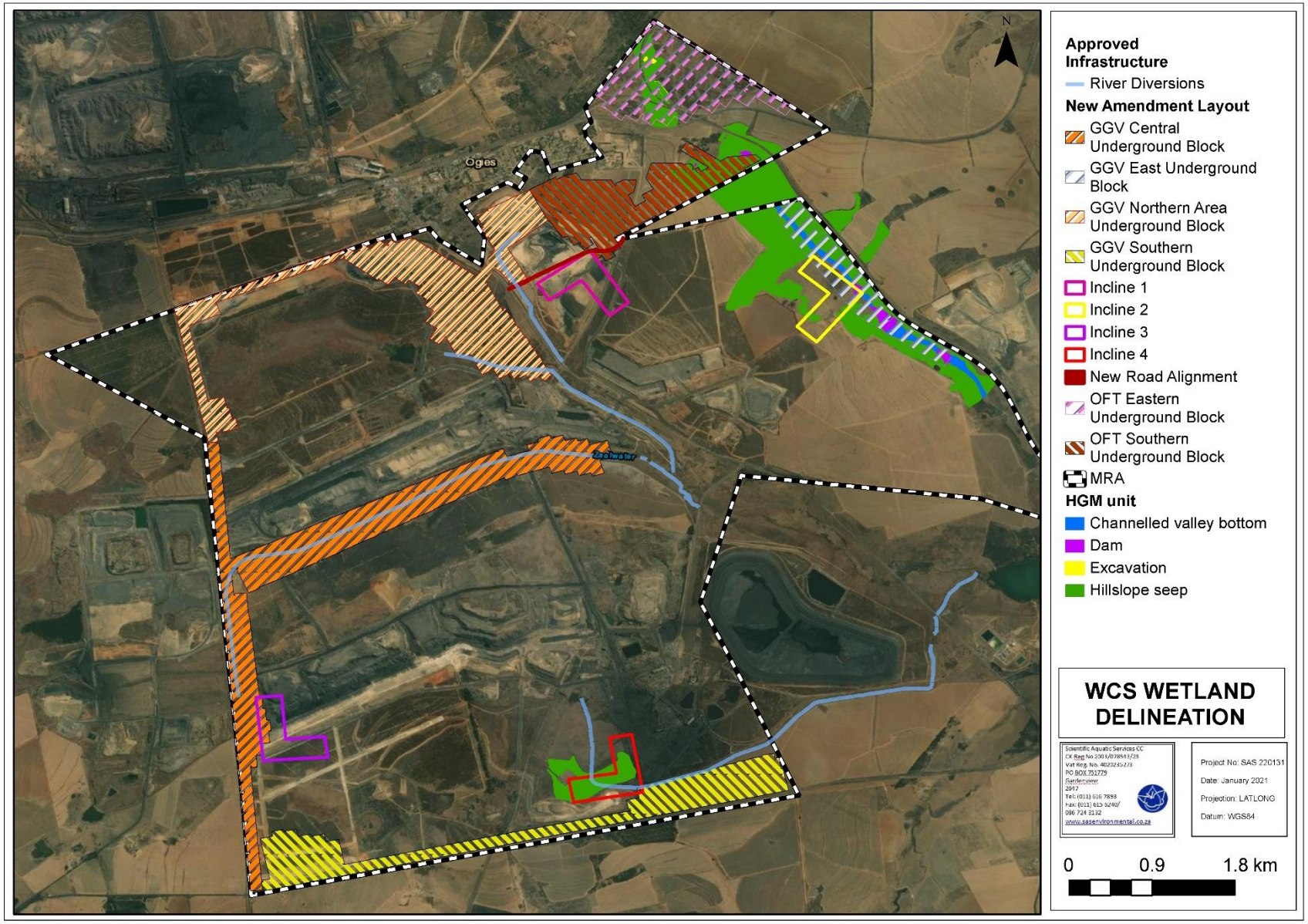


Figure 8: Conceptual depiction of the wetlands delineated and assessed by WCS (2009;2013) which are applicable to this investigation.

4 RESULTS: FRESHWATER ECOLOGICAL ASSESSMENT

4.1 *Freshwater Ecosystem Delineation*

The verification of the delineations undertaken by WCS (2005; 2013) was limited to the north-eastern portion of the MRA, and only limited verification thereof took place. It is important to note that due to changes in land use over the ensuing years, particularly the increased extent of open cast mining within the greater catchment, the characteristics, including the extent of wetlands, has been altered. In particular, changes to the movement patterns of water through the landscape through loss of wetland habitat are likely to have had an adverse effect on the hydroperiod of the wetlands, potentially causing a reduction in extent of wetland habitat. Therefore, where required, the field data gathered in November 2020 was supplemented with 5 m contours, digital satellite imagery and historical photographs to aid in refining the delineations. The delineations presented in this report (Figure 11 12) are nevertheless deemed the best estimate of the wetland temporary zone boundaries based on site conditions at the time of assessment and are considered sufficiently adequate to allow for informed decision making.

During the site assessment, the following indicators were used to verify the boundaries of the watercourses as previously delineated by WCS (2005; 2013):

- Terrain units were used as the primary indicator. Despite transformation of the landscape associated with the existing open cast mining and related activities, the terrain provided an indication of low-lying areas where water is likely to collect and/or move through the landscape;
- Soil morphological characteristics (Figure 9) typically associated with wetland conditions, such as gleying or mottling were utilised in conjunction with saturation as the secondary indicator. This indicator was especially prominent in verifying the boundary of the hillslope seeps associated with the channelled valley bottom wetlands that had been subjected to disturbances relating either to mining or agricultural activities;
- 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; and
- Vegetation (Figure 10) was utilised in conjunction with the soil indicators associated with the wetland systems, where feasible. The distinction between obligate, facultative, and terrestrial vegetation was relatively discernible, except in areas in which extensive

agricultural cropland has occurred and resulted in cleared vegetation communities along the wetland boundaries (e.g. in the far north-eastern corner of the focus area).

Figure 9: Soil samples obtained in a hillslope seep wetland illustrating mottling and gleying typically observed in wetlands.

Figure 10: Examples of obligate floral species identified within a hillslope seep wetland in the study area. Left: *Chironia purpurescens* and right: *Pycreus macranthus*.

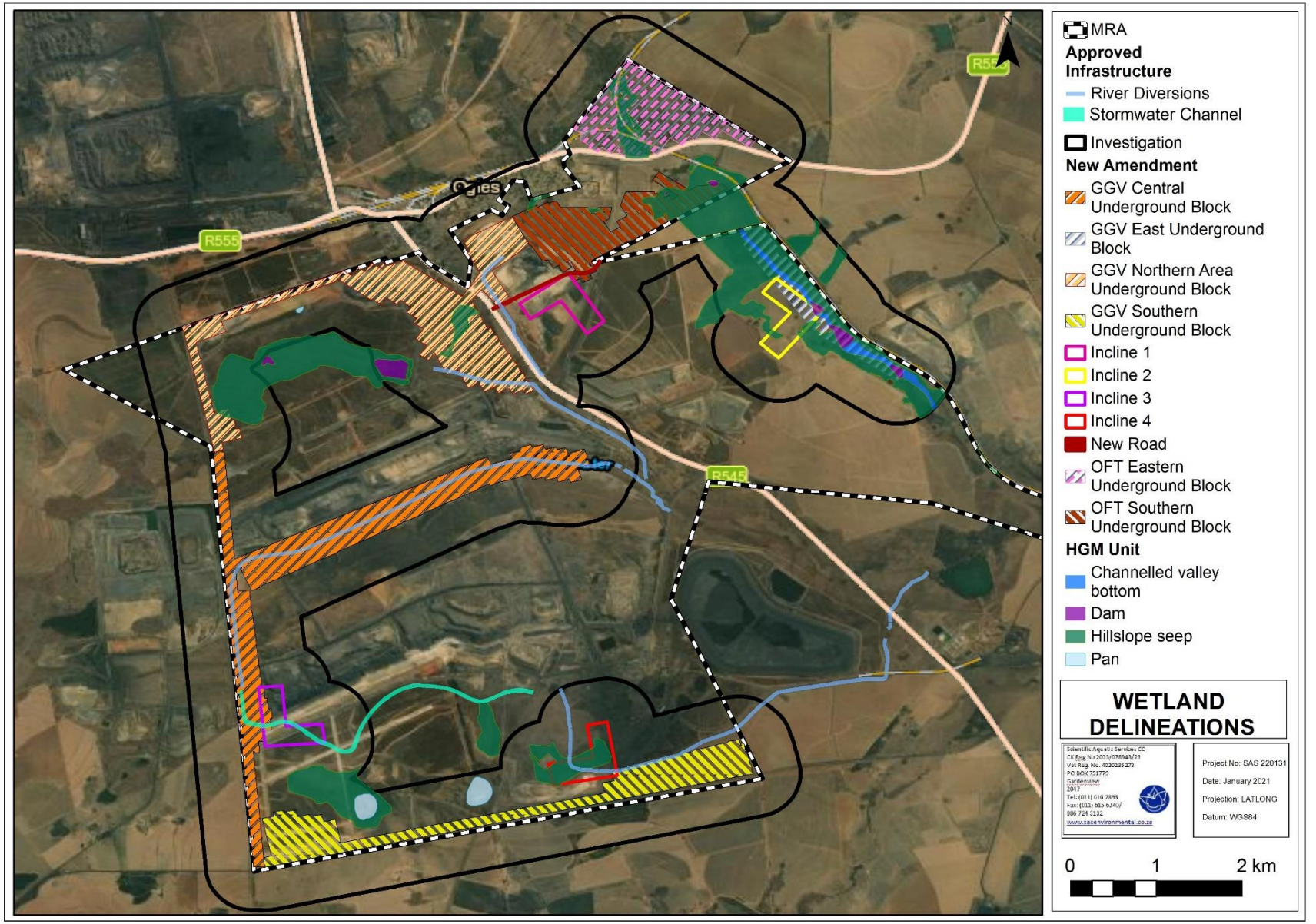


Figure 11: Location of the freshwater ecosystems associated with the new amendment layout and investigation area within the Goedgevonden MRA.

4.2 *Freshwater Ecosystem Characterisation*

Two freshwater ecosystems comprising three wetland HGM units were identified in association with the OFT Eastern and Southern Underground Blocks, and Incline 2, and one freshwater ecosystem associated with Incline 4. The ecosystem associated with the OFT Eastern Underground Block was characterised as a hillslope seep HGM unit, draining south to north to a larger wetland system which is not associated with the Goedgevonden Colliery. A second hillslope seep HGM unit and a channelled valley bottom HGM unit comprise the second freshwater ecosystem which is associated with the OFT Southern Underground Block and Incline 2, whilst Incline 4 is located within another hillslope seep wetland. The hillslope seep wetland associated with Incline 4 was not assessed as it is located within an area which has already received authorisation to be mined by means of opencast mining, however the Ecostatus of the wetland was inferred based on the assessment undertaken by WCS (2013) and visual analysis of digital satellite imagery.

For discussion purposes and ease of reference, the two hillslope seep HGM units that were assessed will hereafter be referred to as HS HGM 1 (in the north-east of the focus area, associated with the OFT Eastern Underground Block) and HS HGM 2 (along the eastern boundary of the focus area, associated with the OFT Southern Underground Block and with Incline 2).

The three wetland HGM units identified within the investigation area were classified according to the Classification System (Ollis *et al.*, 2013) as Inland Systems. The watercourses fall within the Highveld Aquatic Ecoregion and the Mesic Highveld Grassland Group 4 WetVeg (wetland vegetation) group, classified by Mbona *et al.* (2015) as “Least Threatened”. At Levels 3 (Landscape Unit) and 4 (HGM Type) of the Classification System, the systems were classified as per the summary in Table 3 below.

Table 3: Characterisation at Levels 3 and 4 of the Classification System (Ollis *et al*., 2013) of the watercourses associated with the proposed haul road options and investigation area.

Wetland system	Level 3: Landscape unit	Level 4: HGM Type
Freshwater ecosystem located within the eastern portion of the investigation area (associated with OFT Southern Underground Block, GGV East Underground Block and Incline 2).	**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.
	Slope: An inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	**Seep:** A wetland located on gently to steeply sloping land and dominated by colluvial (i.e gravity-driven) unidirectional movement of water and material down-slope.
Freshwater ecosystem located within the north-eastern portion of the investigation area (associated with OFT Eastern Underground Block).	**Slope:** An inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming	**Seep:** A wetland located on gently to steeply sloping land and dominated by colluvial (i.e gravity-

	part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.	driven) unidirectional movement of water and material down-slope.

4.3 *Site Verification Results*

Following the site verification, the various methods of assessment outlined in Section 1.3 were applied to the wetland HGM units. The results of these assessments are discussed in the dashboard style reports which follow and the details thereof are presented in Appendix E.

For ease of reference a summary of the results obtained by WCS (2013) compared to those obtained during this *status quo* assessment are presented below. These comparisons must be considered with caution, given the changes to the various industry standard assessment methods between the investigations.

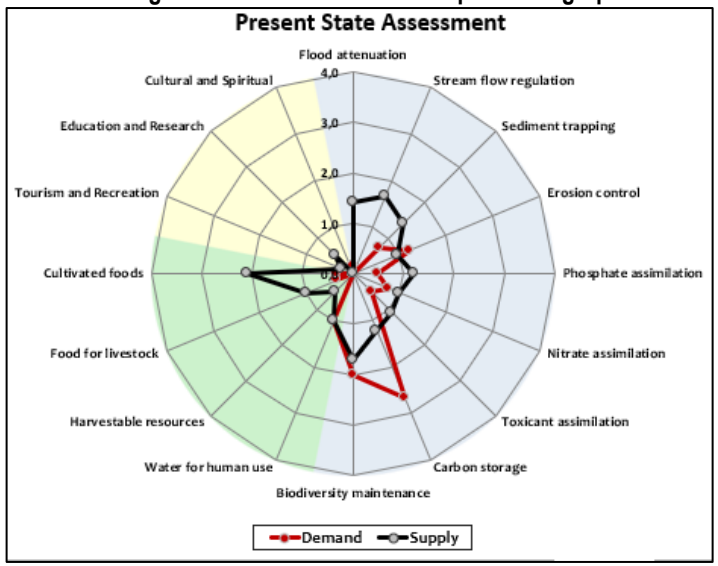
Table 4: Comparative summary of the results obtained by WCS (2009; 2013) and SAS (2022).

Wetland Type	PES (WCS 2009/2013)	PES (SAS, 2022)	EIS (WCS 2009/2013)	EIS (SAS, 2022)	Ecoservice provision (WCS 2009/2013)	Ecoservice provision (SAS, 2022)
Hillslope seep (OFT Eastern Underground Block)	E	D/E	D	Moderate	Not assessed	Moderate / moderately low
Hillslope seeps (OFT Southern Underground Block)	C	C	C	High	Intermediate	Moderate
Channelled valley bottom (GGV Eastern Underground Block)	D	C	D	High	Intermediate	Moderate
Hillslope seep (Incline 4)*	D	D/E	D	Low	Intermediate	Moderate / moderately low

*** Not assessed as part of this study; results inferred from WCS (2013) and analysis of digital satellite imagery.**

Table 5: Summary of the assessment applied to the hillslope seep HGM unit (HS HGM 1) associated with the OFT Eastern Underground Block.

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: D/E (5.9)** The hydraulic and geomorphological regimes have been seriously modified as a result of historical activities within the HGM unit including the construction of a railway line which greatly impedes flow to the downgradient portions of the larger wetland system and has affected water retention patterns within the HGM unit. In addition, three impoundments and several artificial trenches have contributed to altered hydrology and movement of sediment. The vegetation component, whilst largely comprising indigenous species has been affected by these modifiers, as well as by the encroachment of commercial crops which has led to loss of vegetation as well as exposure of soil in turn contributing to the altered sediment balance within the HGM unit.
Ecoservice provision	**Moderate to moderately low** Ecological service provision has been reduced due to the lowered ecological integrity of the HGM unit. Nevertheless, services such as flood attenuation, sediment trapping and assimilation of nutrients and toxicants are likely to be provisioned. Socio-cultural service provisioning is relatively high, however this is largely due to the commercial agriculture associated with the HGM unit.

Photograph notes	Portions of HS HGM 1 associated with the OFT Eastern Underground Block, illustrating the railway line which has negatively impacted connectivity and impedes the movement of water to the downgradient portion of the system (left) and one of the impoundments (yellow arrow) and artificial trenches (red arrow) within the hillslope seep wetland.

The hydraulic regime has been altered primarily due to the construction of the railway line through, construction of three impoundments within the HGM unit. Additional modifiers include increased runoff due to irrigation of crops immediately adjacent to the HGM unit as well as from the railway line and R555 road, and artificial trenches within the HGM unit, all of which have changed the pattern, timing and flow of water through the landscape, leading to ponding and reduction of recharge to downgradient portions of the larger freshwater ecosystem.

The abovementioned modifiers are also largely responsible for alterations to the geomorphological processes within the HGM unit, in particular the sediment balance (increased sediment inputs from the adjacent crop fields are likely) and the movement of sediment within the HGM unit, which in turn may have an effect on the floral assemblages present.

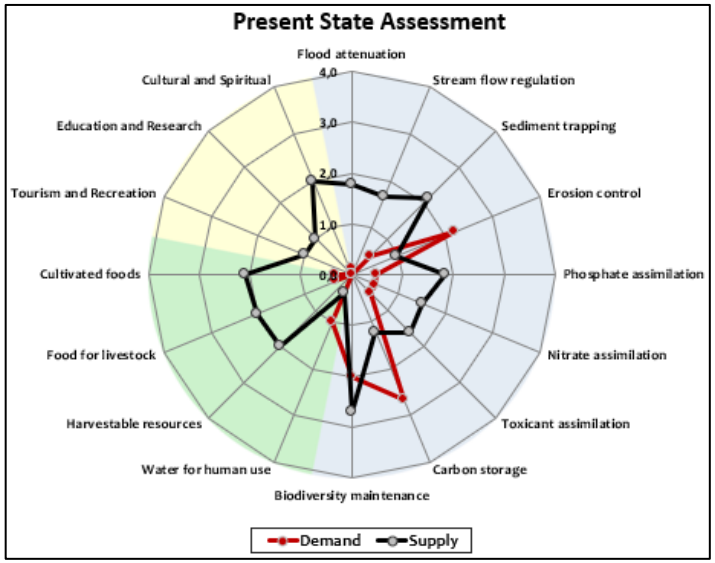
The vegetation community, although dominated by indigenous species, has nonetheless undergone modification as a result of the removal of vegetation along the outer boundary to allow for increased crop cultivation, as well as by the encroachment of alien and invasive species such as *Verbena sp* and *Tagetes minuta*. Although not directly within the HGM unit, *Acacia mearnsii* was observed adjacent to the HGM unit in the vicinity of the impoundments and may potentially encroach into wetland areas over time.

As no surface water was present at the time of the assessment, water quality parameters could not be assessed. However, given the proximity of agricultural activities as well as of transportation infrastructure, it is likely that runoff into the HGM unit may transport increased volumes of phosphates, nitrates and hydrocarbons.

EIS discussion	**Moderate** The reduced ecological integrity of the HGM unit has led to lowered ecological importance and sensitivity, as a result of related changes to habitat and increased anthropogenic activity due to the commercial agriculture immediately adjacent to the HGM unit.		
Impact Significance, Business case, Conclusion and Mitigation Requirements:	No surface infrastructure is proposed within the delineated extent of this HGM unit, therefore the significance of risk is negligible, provided that appropriate mitigation measures are implemented to minimise the risk of subsidence (refer to Bare Rock Consulting, 2022).	**REC, RMO and BAS**	**REC Category: D** **BAS: Category D** **RMO: Improve** The overall ecological integrity of the HGM unit should preferably be improved, however it is acknowledged that it is not within the remit of the proponent to do so at this stage since the modifiers are not within the control of the proponent. However, the rehabilitation of the HGM unit should be accounted for within the mine's closure plans to ensure at minimum, any edge effects relating to the proposed underground mining activities are accordingly managed.
Extent of modification anticipated:	Low	The proposed surface infrastructure associated with the proposed underground mining activities does not encroach on this HGM unit, therefore, with the exception of potential risk of subsidence which was determined by Bare Rock Consulting (2022) to be negligible provided that adequate pillar support is maintained, the extent of modification expected is 'low'.	

Table 6: Summary of the assessment applied to the hillslope seep wetland 2 (HS HGM 2) associated with the OFT Southern Underground Block and Incline 2.

Ecological & socio-cultural service provision graph:



PES discussion	**PES Category: C (2.12)** The HS HGM unit 2 has been subjected to few modifications with the exception of commercial agriculture including crop cultivation and grazing of domestic livestock, as well as some informal gravel roads which traverse the low-lying sections adjacent to the channelled valley bottom HGM unit. Minimal infrastructure was noted but is present. Nevertheless alterations to the hydraulic and geomorphological regimes are anticipated as a result of sediment laden and nutrient enriched runoff from adjacent cultivated areas which in turn affect the floral assemblages and therefore ecological functioning and habitat provision.
Ecoservice provision	**Moderate** Due to fewer disturbances impacting on the wetland, as well as the diverse and relative intact floral community, HS HGM unit 2 is considered to provide intermediate levels of ecological services such as flood attenuation, sediment trapping, erosion control, toxicant and nutrient assimilation and biodiversity maintenance. Direct (socio-cultural) benefits are mostly of 'low' levels due to the absence of surface water, although some potential for education and recreational activities such as bird-watching exists.

Photograph notes	Representative photographs of portions of HS wetland 2, indicating moderate to high surface roughness (left), and fencing within the wetland (right).

Watercourse drivers and receptors discussion (hydrology, geomorphology and topography, water quality and habitat and biota):

The hydraulic regime of HS HGM unit 2 has been altered as a result of infrastructure construction within the wetland, including support towers for power lines and fencing. Other impacts noted included a drainage canal, which potentially was a small erosion gully caused by cattle but subsequently enlarged and now channels surface water flow in that portion of the wetland, potentially over time leading to some small scale desiccation in the immediately adjacent portions of the wetland. Increased surface water inputs from the adjacent railway line and surrounding crop fields, denuded of vegetation, are anticipated.

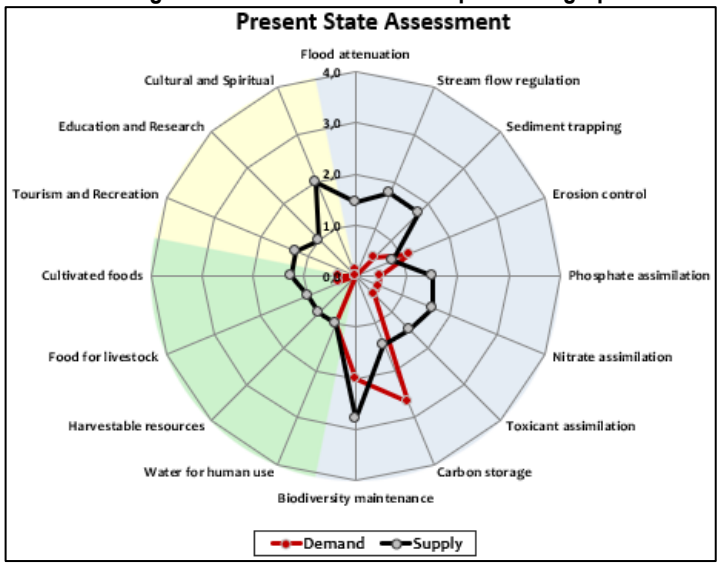
Whilst the inherent geomorphological structure of the HS HGM unit 2 remains largely intact, small impacts were observed including the aforementioned channel, various small berms presumably constructed to retain water (although mostly dry at the time of assessment) and a large impoundment in the east. Additionally increased sediment inputs from the adjacent, upgradient crop fields to the west are likely, although due to the basal cover in the western portions of the wetland most sediment is likely to be trapped around the western boundary thereof.

As the only surface water present at the time was within small areas of ponding or within the large impoundment, water quality parameters were not measured as these are unlikely to provide an accurate indication of water quality. However, based on the relatively unimpacted surrounds, water quality is likely to be relatively unimpaired although some inputs of agricultural chemicals and hydrocarbons are expected. Additionally, wind-borne sediment or mining-related chemicals may occasionally reach the wetland.

EIS discussion	**EIS Category: High** Given the ongoing and rapid expansion of mining activities within the greater area, HS wetland 2 is deemed to be of high ecological importance due to its contribution to the ecological processes both of the larger downstream system to which it is connected, as well those of the surrounding open spaces and provision of various ecological services in a landscape in which natural processes and habitat are increasingly under pressure from anthropogenic activities.	The floral species diversity within HS HGM unit 2 was notably higher than within HS HGM unit 1, with fewer alien invasive or encroacher species noted, although the vegetation in the eastern portion of the wetland towards the railway had undergone some transformation due to grazing and trampling by livestock. Habitat in the western portion of the wetland had indications of use by avifauna such as *Tyto capensis* (African Grass owl) or *Asio capensis* (Marsh Owl) and small rodents. According to the owners of the guesthouse adjacent to the wetland, historically, sightings of species such as *A. capensis, Ephippiorhynchus senegalensis* (Saddelbilled stork), *Lophaetus occipitalis* (Long-crested Eagle) and *Pyxicephalus adspersus* (Giant Bullfrog) were regular occurrences which have dwindled in frequency as various mining operations have expanded in the area. Nevertheless, the wetland habitat provides suitable habitat for these species and others, although encroaching anthropogenic activity in the greater area will continue to have an adverse effect on faunal assemblages.	
Impact Significance, Business case, Conclusion and Mitigation Requirements:	The HGM unit is at risk of potential impacts relating to subsidence and edge effects associated with the construction and subsequent operation of Incline 2. Assuming that the proposed opencast mining proceeds prior to the development of the incline, the perceived risks are likely to be of 'low' significance, since the majority of the wetland habitat will already have been lost during opencast operations.	**REC, RMO and BAS**	**REC Category: C** **BAS: Category B** **RMO: Improve / Maintain** HS Wetland 2 remains important in terms of ecological functioning and service provision despite the reduced ecological integrity, and should preferably be improved to a PES B or at minimum maintained at PES C. Should the proposed mining activities impact on the HS wetland 2 as well as on the associated channelled valley bottom wetland, rehabilitation thereof must be undertaken either concurrently or as part of the closure activities and adequate financial provision must be made for such activities.
Extent of modification anticipated:	Low	Provided that appropriate mitigation measures are implemented to minimise the potential risk of subsidence and edge effects associated with the construction and operation of the proposed Incline 2, the extent of modification is likely to be minimal.	

Table 7: Summary of the assessment applied to the channelled valley bottom HGM unit associated with the GGV East Underground Block and Incline 2.

Ecological & socio-cultural service provision graph:



Photograph notes	Portions of the channelled valley bottom wetland associated with the GGV East Underground Block and Incline 2, depicting a section of the channel (left) and the remains of a dam wall (right).

PES discussion

PES Category: C

The channelled valley bottom HGM unit has been modified as a result of historical and current agricultural activities, in particular the impoundment thereof, grazing by domestic livestock and commercial crop cultivation upgradient of the HGM unit which is likely to have impacted the geomorphological and hydraulic regimes, water quality and floral assemblages.

Watercourse drivers and receptors discussion (hydrology, geomorphology and topography, water quality and habitat and biota):

The hydraulic regime has largely been altered by the construction of several small impoundments within the HGM unit, thus modifying retention patterns and movement of water in the landscape. Increased runoff from adjacent crop fields and the R555 road is anticipated. This runoff is likely to transport additional sediment, nutrients and hydrocarbons to the wetland, thus altering water quality. Water quality parameters were not measured at the time of assessment due to the absence of surface water in quantities which would allow for meaningful assessment.

The geomorphological processes have similarly been altered by the impoundments which have not only physically changed the topography of the HGM unit but which are also likely to retain sediment, preventing the even distribution thereof within the HGM unit.

The altered geomorphological and hydraulic regimes, along with physical impacts such as grazing and trampling by livestock and seasonal fires, have in turn had an effect on the floral assemblages associated with the HGM unit. As depicted in the photographs above, vegetation comprises predominantly graminoid species, with low floral diversity observed although that may partially be due to the season in which the site assessment was undertaken. Nevertheless, the HGM unit is considered likely to provide important floral and faunal habitat, the latter particularly for small mammals such as rodents, and avifauna.

Ecoservice provision	**Moderate** Ecological services provisioned by the HGM unit include recharge of the larger drainage network, flood attenuation, sediment trapping, assimilation of nutrients and toxicants and biodiversity support. Socio-cultural services are largely limited to those associated with agriculture such as provision of grazing and water.	**REC, RMO and BAS**	**REC Category: C** **BAS: Category C** **RMO: Maintain** The ecological integrity of the channelled valley bottom HGM unit should be maintained, and it is preferable that the location of Incline 2 be optimised to avoid encroaching on the HGM unit. Provision must be made for the rehabilitation of any areas affected by edge effects associated with the proposed mining activities.
EIS discussion	**EIS Category: High** The HGM unit, although modified, is nevertheless considered of high ecological importance and sensitivity due to the extent of the HGM unit, and its importance for the provision of key ecological services, particularly recharge of the downstream system and biodiversity maintenance.		
Impact Significance, Business case, Conclusion and Mitigation Requirements:	The HGM unit is at risk of potential impacts relating to subsidence and edge effects associated with the construction and subsequent operation of Incline 2. Assuming that the proposed opencast mining proceeds prior to the development of the incline, the perceived risks are likely to be of 'low' significance, since the majority of the wetland habitat will already have been lost during opencast operations.		
Extent of modification anticipated:	Low	Provided that appropriate mitigation measures are implemented to minimise the potential risk of subsidence and edge effects associated with the construction and operation of the proposed Incline 2, the extent of modification is likely to be minimal.	

5 LEGISLATIVE REQUIREMENTS

According to Macfarlane *et al.* (2015) the definition of a buffer zone is variable, depending on the purpose of the buffer zone, however in summary, it is considered to be "a strip of land with a use, function or zoning specifically designed to protect one area of land against impacts from another". Buffer zones are considered to be important to provide protection of basic ecosystem processes (in this case, the protection of aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et. al,* 2015). It should be noted however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et. al,* 2015).

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

Table 8: 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 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)** In accordance with GN509 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998), 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 and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; • in the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or • a **500m radius from the delineated boundary (extent) of any wetland** or pan in terms of this regulation.
	Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998). These Regulations, forming part of the NWA, 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 proponent complies with GN 704 of the NWA, which 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 floodline or within a horizontal*

Regulatory authorisation required	Zone of applicability
	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 floodline of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest. Authorisation for activities within the regulated zone must be obtained.
Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) EIA Regulations (2014), as amended.	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No.107 of 1998) EIA regulations, 2014 (as amended) states that: *The development of:* *(xii) Infrastructure or structures with a physical footprint of 100 square meters or more;* *Where such development occurs—* *a) Within a watercourse;* *b) In front of a development setback; or* *c) If no development setback has been adopted, within **32 meters of a watercourse**, measured from the edge of a watercourse.* excluding— (dd) where such development occurs within an urban area; or (ee) where such development occurs within existing roads or road reserves or railway line reserves;

These zones of regulation must be taken into consideration during any future planning processes, in line with the mitigation hierarchy as advocated by the Department of Environmental Affairs (DEA) *et. al*, 2013, and should they be encroached upon then the relevant authorisations will need to be obtained prior to the commencement of any activities. Notwithstanding this, it should be noted that the areas targeted for underground mining and associated surface infrastructure were previously authorised for open cast mining. The delineated wetlands and the applicable zones of regulation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and GN509 and GN704 as they relate to the National Water Act, 1998 (Act No. 36 of 1998) are conceptually depicted in Figures 12 and 13 respectively overleaf.

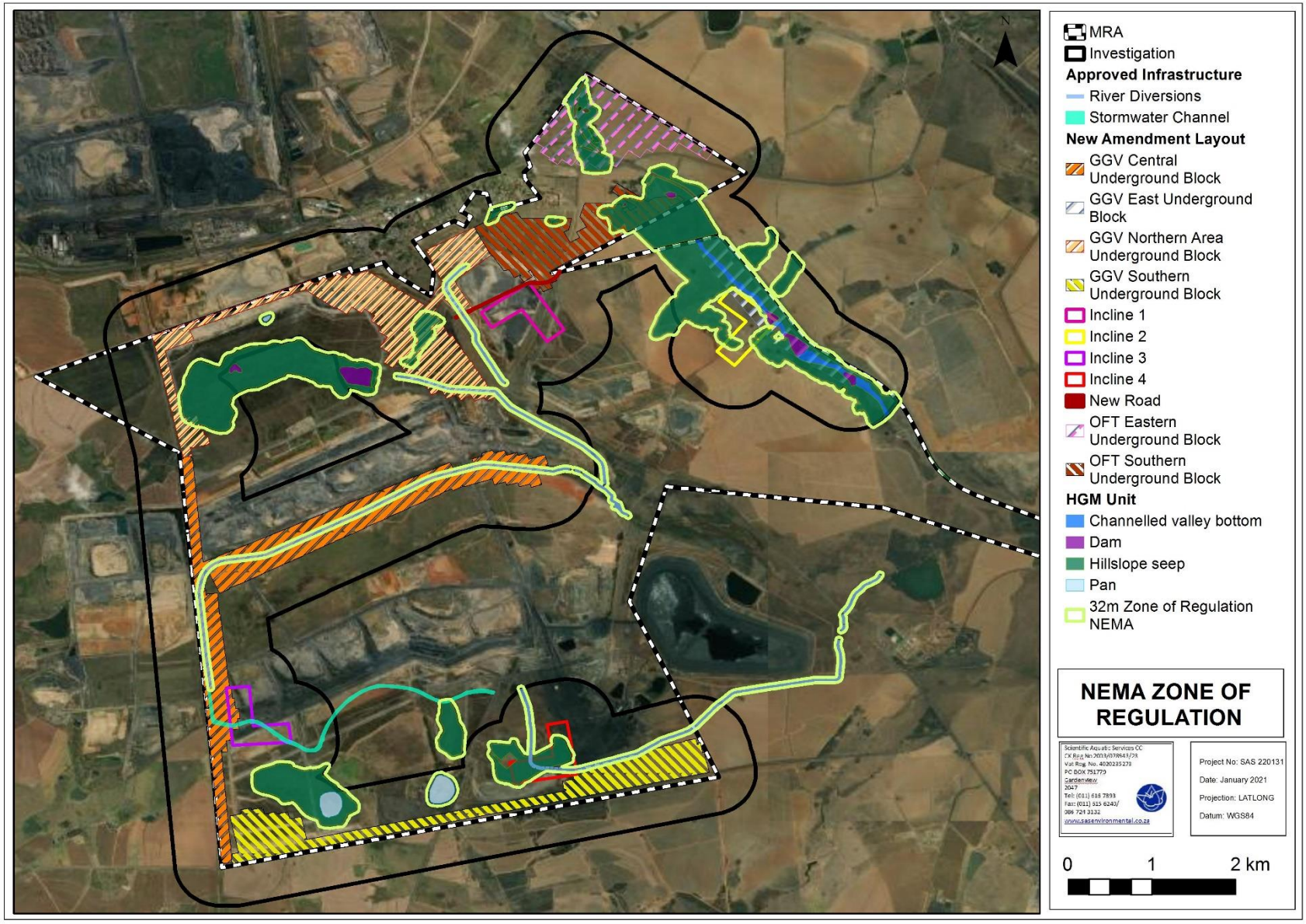


Figure 12: Conceptual presentation of the zones of regulation in terms of NEMA in relation to the HGM units associated with the proposed mining activities and investigation area.

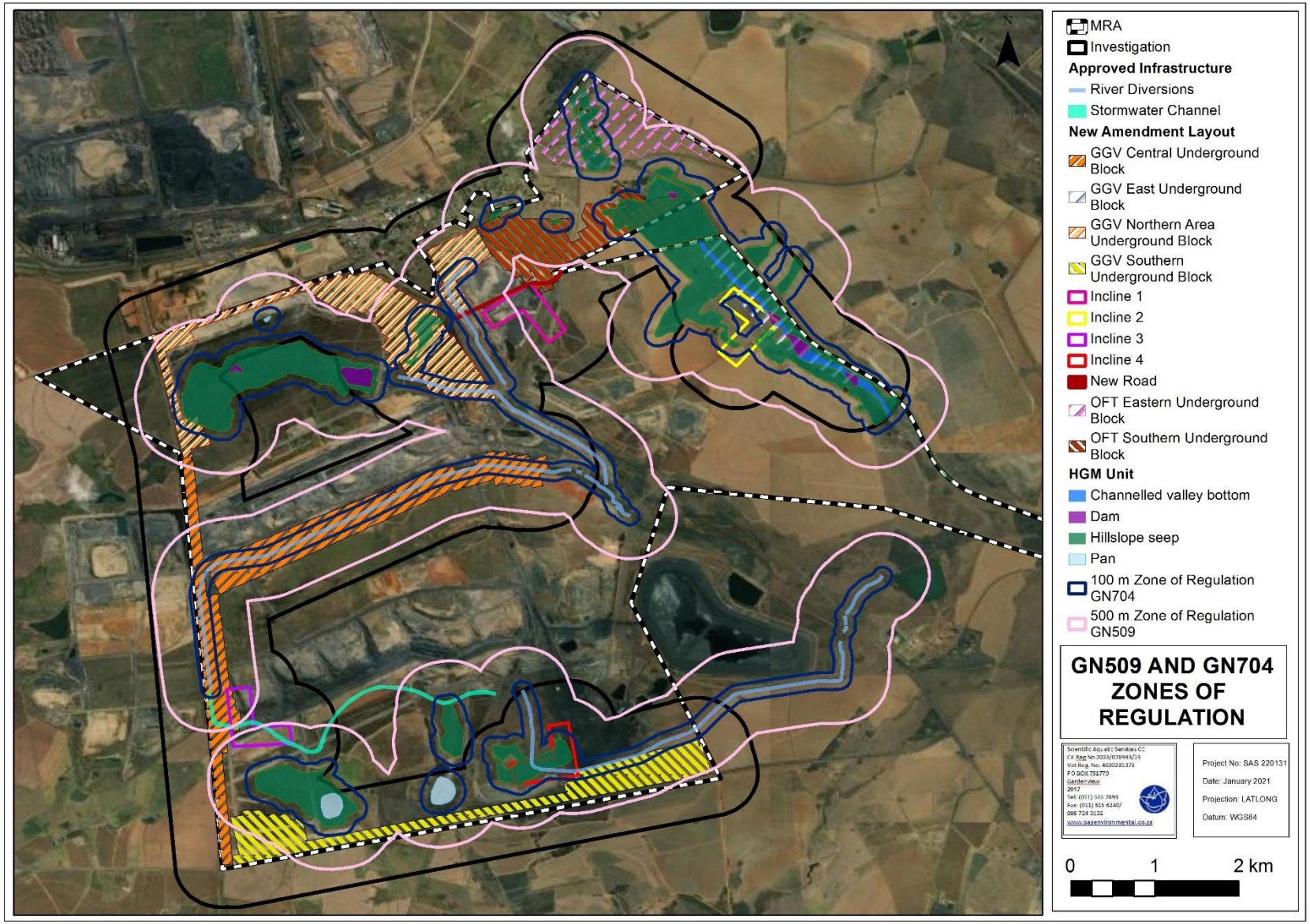


Figure 13: Conceptual presentation of the zones of regulation in terms of GN509 and GN704 as they relate to the National Water Act, 1998 (Act No. 36 of 1998) in relation to the HGM units associated with the proposed mining activities and investigation area

6 RISK ASSESSMENT

This section presents the significance of potential impacts on the freshwater ecology of the wetlands associated with the proposed mining activities. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts thereof 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 Glencore Risk Assessment Matrix was used to ascertain the risk significance of potential impacts to the receiving freshwater environment. It should be noted that this method does not account for the ecological integrity, importance or sensitivity of the receiving environment and therefore, the significance of some perceived risks may potentially be over- or understated.

6.1.1 Consideration of impacts and application of mitigation measures

Following the assessment of the freshwater ecosystems associated with the proposed mining activities and the investigation area, the Glencore Risk Assessment Matrix was applied to ascertain the significance of perceived impacts on the key drivers and receptors (hydrology, water quality, geomorphology, habitat and biota) of these wetlands. These results are summarised in Table 10 presented at the end of Section 6.1.2 of this report.

The points below summarise the considerations undertaken when applying the risk assessment matrix:

- Although the baseline study was undertaken considering the prevailing conditions (Grassland, farmland and freshwater ecosystems) at the time of the assessment in November 2020, it is acknowledged that authorization has previously been granted for opencast mining within the assessed areas. At the time of preparing this report, the mine plan entails undertaking opencast mining prior to the proposed underground mining, and as a result the proposed incline shafts will be developed into the high walls of the opencast areas. The risk assessment was therefore undertaken based on the chronological order of the proposed mine plan, i.e. that the opencast mining will occur prior to the development of the inclines. Should the mine plan change, the risk assessment will need to be revised accordingly to adequately consider the impact of the proposed development;
- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et al* (2013) would be followed, i.e. the impacts would first be

avoided, minimised if avoidance is not feasible, rehabilitated as necessary and offset if required; and

- Most impacts are considered to be easily detectable, with the exception of potential contamination of surface and groundwater as well as detection of subsidence which will require some effort. Assessing these potential impacts in detail falls outside of the scope of this freshwater ecological study although the potential impacts that subsidence may have were considered.

6.1.2 Impact discussion and essential mitigation measures

There are four key ecological impacts on the wetlands that are anticipated to occur namely,

- Loss of wetland habitat and ecological structure;
- Changes to the sociocultural and 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 risk assessment is provided in the table below, followed by a discussion of the outcome thereof.

Table 9: Summary of the results of the Glencore risk assessment matrix applied to the wetland HGM units associated with the proposed mining activities and investigation area.

Aspect	Risk Event & Cause	With or Without Mitigation	Risk Event Likelihood	Potential Consequences	Consequence Category	Consequence	Current Risk Rating	Mitigation Action
"PRE-CONSTRUCTION" PHASE (i.e. POST OPENCAST MINING BUT PRIOR TO DEVELOPMENT OF INCLINES)								
Wetland habitat, ecological structure, changes to sociocultural and ecological service provision, hydraulic and geomorphological regimes and water quality.	**RISK EVENT: Loss of or modification to sensitive wetland habitat.** CAUSE: Various activities associated with the planning phase of the project: *Potential inadequate planning of infrastructure placement and design (e.g., inappropriate placement of inclines within any remaining extent of sensitive habitat), leading to further loss of sensitive wetland habitat, as well as unnecessary edge effect impacts on areas outside of the authorised mining footprint; *Potential failure to design and initiate an AIP Management/Control plan before the commencement of mining activities, resulting in the spread of AIPs from the mining footprint to surrounding natural habitat (propagules "hitch-hike" with construction vehicles); *Potential failure to demarcate the authorised footprint areas so to avoid encroachment of the authorised footprint into sensitive wetland habitat occurring outside of the authorised project footprint before construction commences; and *Potential failure to set up an Erosion Control Plan and Stormwater Management Plan.	Pre-Mitigation	D	•Potential degradation and modification of the remaining extent of the receiving freshwater environment, further loss of wetland ecological structure and related ecological service provisioning.	Environment	2	5 (L)	•Minimise loss of indigenous vegetation and remaining natural habitat where possible through adequate planning and ensuring that the inclines and associated surface infrastructure remain within the disturbed (opencast) areas; *It must be ensured that, as far as possible, all proposed infrastructure, including temporary infrastructure, is placed outside of the remaining extent of wetland habitat; *Access roads should be kept to existing roads, as far as possible, so as to reduce fragmentation of wetland habitat outside of the authorised footprint; *It is recommended that prior to the commencement of construction activities that the construction servitude be fenced off
		Post-Mitigation	E		Environment	1	1 (L)	

Aspect	Risk Event & Cause	With or Without Mitigation	Risk Event Likelihood	Potential Consequences	Consequence Category	Consequence	Current Risk Rating	Mitigation Action
								and clearly demarcated; and *Prior to the commencement of construction activities, an AIP Management/Control Plan, and a Rescue and Rehabilitation Plan for floral Species of Conservation Concern (SCC) should be in place for implementation (refer to STS 2022: Floral Assessment for details in this regard).
MINING (CONSTRUCTION & OPERATIONAL) PHASE								
Wetland habitat, ecological structure, changes to sociocultural and ecological service provision, hydraulic and geomorphological regimes and water quality.	**RISK EVENT: Loss of or alteration to wetland habitat, leading to altered ecological service provision, decline in ecological integrity and** CAUSE: Various activities associated with the construction and operational phases: *Vehicular movement and access to the site; *Further removal of vegetation (terrestrial and wetland) and associated disturbances (rubble and litter) to soil and remaining extent of wetland habitats; and *Possible unplanned and uncontrolled movement of construction equipment through the remaining wetland habitat.	Pre-Mitigation	D	*Vehicular movement and access to the site, and the removal of natural wetland vegetation and associated disturbances (rubble and litter) to soils within the project area could lead to: *Exposure of soil, leading to increased runoff from cleared areas and erosion of the remaining extent of wetlands, and thus increased potential for sedimentation of the wetlands; *Increased sedimentation of the wetlands potentially leading to areas within the wetlands more suited to terrestrial vegetation; *Soil compaction; *Decreased ecoservice provision; *Proliferation of alien vegetation	Environment	2	5 (L)	*It is assumed that clean and dirty water separation systems will have been developed prior to opencast mining taking place, however, should additional systems be required, these must be constructed prior to the development of the inclines, to ensure that as site clearing takes place, dirty water runoff is appropriately managed; *Contractor laydown areas, and material storage facilities to remain outside of the remaining extents of
		Post-Mitigation	E		Environment	1	1 (L)	

Aspect	Risk Event & Cause	With or Without Mitigation	Risk Event Likelihood	Potential Consequences	Consequence Category	Consequence	Current Risk Rating	Mitigation Action
				as a result of disturbances; *Vegetation degradation, and the subsequent loss of habitat for wetland species; and *Soil and stormwater contamination from oils and hydrocarbons.				wetlands; *All vehicle re-fuelling is to take place outside of the remaining extent of wetlands; *Retain as much indigenous wetland vegetation as possible within the remaining extents of wetlands; and *The wetlands, and the 100m GN704 Zone of Regulation (the latter where feasible, considering the extent of the opencast mining operations) should be demarcated and defined as areas in which no activities are proposed should be marked as a no-go area wherever mining is not planned.
Wetland habitat, ecological structure, changes to sociocultural and ecological service provision, hydraulic and geomorphological regimes and water quality.	**RISK EVENT: Loss of recharge of wetland HGM units leading to altered hydroperiods, changes to water quality.** CAUSE: *Containment/diversion of all runoff into the clean and dirty water system; and *Potential of malfunctioning of the dirty water system.	Pre-Mitigation	D	Loss of catchment yield due to stormwater containment is expected to occur, which could lead to the following impacts: *Increased flood peaks into the CVB wetland as a result of formalisation and concentration of surface runoff; *Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the CVB wetland; *Reduction in volume of water entering the CVB wetland,	Environment	2	5 (L)	*Clean and dirty water systems must be kept separate in line with GN704 as it relates to the NWA; *Runoff from areas within the dirty water area should be captured in the sump and be pumped to the PCD, before being re-used as process water of the mine; and *All clean water diversions should be
			E		Environment	1	1 (L)	

Aspect	Risk Event & Cause	With or Without Mitigation	Risk Event Likelihood	Potential Consequences	Consequence Category	Consequence	Current Risk Rating	Mitigation Action
				leading to loss of recharge (and thus potential desiccation) of the wetland system; and *Further altered vegetation communities due to moisture stress.				maintained to accommodate the peak flow expected for at least a 1:50 year event.
Wetland habitat, ecological structure, changes to sociocultural and ecological service provision, hydraulic and geomorphological regimes and water quality.	**RISK EVENT: Development of underground mining access areas and underground mine shafts, and associated removal of waste material and other excavated materials.** CAUSE: Various activities associated with the construction and operational phases: *Mining and trenching leading to stockpiling of rock and soil; *Operation of construction vehicles on site.	Pre-Mitigation	D	*Potential subsidence of surrounding environment if pillars are insufficient or inadequate to support the ground or if the depth of mining is too shallow; *Potential creation of a cone of depression, which may drain water from surrounding wetland habitats, thus resulting in desiccation of the wetlands; *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 surrounding wetland environment; *Potential spillage of oils/hydrocarbons from construction vehicles.	Environment	2	5 (L)	•The recommendations contained in the rock engineering report (Bare Rock Consulting, 2022) must be adhered to; *During mining, stockpiles must remain within existing disturbed areas; *Excavated materials should not be contaminated, and it should be ensured that the minimum surface area is taken up; and *All exposed soil must be protected for the duration of the construction phase in order to prevent erosion and sedimentation of the downgradient wetlands.
		Post-Mitigation	E		Environment	1	1 (L)	
DECOMMISSIONING AND CLOSURE PHASE								
Wetland habitat, ecological structure, changes to sociocultural and ecological service provision, hydraulic and	**RISK EVENT: Decant of contaminated water from the rehabilitated mine area into the receiving environment.**	Pre-Mitigation	D	*Contamination of water within the receiving environment, and subsequent reduction in water quality (increase in salts and specific contaminants of	Environment	2	5 (L)	The management and mitigation measures as recommended in the geohydrological study should be implemented

Aspect	Risk Event & Cause	With or Without Mitigation	Risk Event Likelihood	Potential Consequences	Consequence Category	Consequence	Current Risk Rating	Mitigation Action
geomorphological regimes and water quality.	CAUSE: Inadequate post-closure management activities.	Post-Mitigation	E	concern and reduced pH); *Subsequent negative impacts on biota and vegetation; *Altered flow regimes (increased hydroperiod); and *Habitat degradation.	Environment	1	1 (L)	to mitigate the potential impacts arising from decant of contaminated water from the mine into the receiving environment.

7 CONCLUSION

Three wetland HGM units which form part of two larger drainage systems were identified in association with the OFT underground blocks and Incline 2. Of those, one hillslope seep HGM unit is considered largely to seriously modified and of moderate ecological importance and sensitivity whilst the second hillslope seep HGM unit and the channelled valley bottom HGM unit are both deemed moderately modified and of increased ecological importance and sensitivity. One wetland HGM unit was identified in association with Incline 4 however was not assessed as it is within an existing opencast mining area although the Ecostatus was inferred based on prior studies and digital satellite imagery. The results of the various ecological assessments undertaken are summarised in the table below:

Table 10: Summary of results of the field assessment as discussed in Section 4.

Wetland	PES	Ecoservices	EIS	REC / RMO / BAS
Hillslope seep HGM unit 1 (OFT Eastern Underground Block)	D/E	Moderate to moderately low	Moderate	D / D / Improve
Hillslope seep HGM unit 2 (OFT Southern Underground Block and Incline 2)	C	Moderate	High	C / B / Improve or Maintain
Channelled valley bottom HGM unit (GGV East Underground Block and Incline 2)	C	Moderate	High	C / C / Maintain
Hillslope seep (Incline 4)*	D/E	Moderate to moderately low	Low	D / D / Improve

*** Not assessed as part of this study; results inferred from WCS (2013) and analysis of digital satellite imagery.**

The outcome of the assessment largely concurs with the outcome of the WCS (2009; 2013) studies, although direct comparisons are difficult to make considering the changes in assessment methods subsequent to the WCS (2009; 2013) studies. Based on the outcome of this investigation the Ecostatus of the two hillslope seep wetlands appears to have remained largely the same, whilst that of the channelled valley bottom wetland appears to have improved, although this is likely only due to some level of recovery of the floral community associated with the wetland.

Following the freshwater ecological assessment, the Glencore Risk Assessment Matrix was applied to determine the significance of risks associated with the proposed underground mining activities and related surface infrastructure on the receiving environment.

Although the baseline study was undertaken considering the prevailing conditions (Grassland, farmland and freshwater ecosystems) at the time of the assessment in November 2020, it is acknowledged that authorization has previously been granted for opencast mining within the

assessed areas. At the time of preparing this report, the mine plan entails undertaking opencast mining prior to the proposed underground mining, and as a result the proposed incline shafts will be developed into the high walls of the opencast areas. The risk assessment was therefore undertaken based on the chronological order of the proposed mine plan, i.e. that the opencast mining will occur prior to the development of the inclines. Should the mine plan change, the risk assessment will need to be revised accordingly to adequately consider the impact of the proposed development.

Should the existing approved mine plan for opencast mining be followed, namely, to develop the incline shafts into the high wall of the opencast pits, the development of the proposed shafts and underground mining areas will have a negligible additional impact on the receiving freshwater environment, provided that sufficient pillar safety factors are employed to prevent subsidence in the undermined landscape. On this basis, the outcome of the risk assessment indicated that the risk is deemed to be of 'low' significance, since the majority of the wetlands associated with the proposed Inclines 2 and 4 and the associated underground mining will be completely lost assuming that opencast mining proceeds as per the mine plan.

However, in the event that opencast mining does not proceed, it will be necessary to revise the risk assessment accordingly to adequately consider the impact of the proposed development, and to ensure that appropriate mitigation measures are implemented to ensure that the significance of potential impacts are minimised as much as possible. In that scenario, it is the specialist's opinion that the proposed underground mining activities may be considered for authorisation, with the proviso that appropriate mitigation measures are implemented and strictly adhered to for the life of mine.

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APPENDIX A – Terms of Use and Indemnity

INDEMNITY AND TERMS OF USE OF THIS REPORT

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 and its staff reserve the right to, at their sole discretion, 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 – Legislation

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 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act 36 of 1998)	In accordance with Regulation GN509 of 2016, a 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 and/or delineated riparian habitat, whichever is the greatest distance, measured from the middle of the watercourse of a river, spring, natural channel, lake or dam; b) In the absence of a determined 1 in 100 year flood line or riparian area the area within 100 m from the edge of a watercourse where the edge of the watercourse is the first identifiable annual bank fill flood bench; or c) A 500 m radius from the delineated boundary (extent) of any wetland or pan. This notice **replaces GN1199** and may be exercised as follows: i) Exercise the water use activities in terms of Section 21(c) and (i) of the Act as set out in the table below, subject to the conditions of this authorisation; ii) Use water in terms of section 21(c) or (i) of the Act if it has a low risk class as determines through the Risk Matrix;

	iii) Do maintenance with their 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; iv) Conduct river and stormwater management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities has a LOW risk class as determined through the Risk Matrix; and vi) Conduct emergency work arising from an emergency situation or incident associated with the persons' existing lawful water use, provided that all work is executed and reported in the manner prescribed in the Emergency protocol. 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.
Specific guidelines for meeting minimum requirements for CBA and ESA wetlands (MBSP, 2014).	➢ All wetlands are protected under the National Water Act (Act No. 36 of 1998). ➢ In terms of the National Water Act, freshwater ecosystems (all wetlands included) should not be allowed to degrade to an unacceptably modified condition (E or F ecological category). ➢ Conduct a buffer determination assessment around all wetlands, regardless of ecological condition or ecosystem threat status. ➢ Any further loss of area or ecological condition must be avoided, including if needed, a 100 m generic buffer around the wetlands.

APPENDIX C – Method of Assessment

WATERCOURSE 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 C3: 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[4] (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.

[4] 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.

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 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

Impact category	Description	Impact score range	Present State category
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. General Habitat Integrity

The general habitat integrity of each site was discussed based on the application of the Index of Habitat Integrity (Kleynhans *et al.* 2008). It is important to assess the habitat at each site in order to aid in the interpretation of the results of the community integrity assessments, by taking habitat conditions and impacts into consideration. This method describes the Present Ecological State (PES) of both the in-stream and riparian habitat at each site. The method classifies habitat integrity into one of six classes, ranging from unmodified/natural (Class A) to critically modified (Class F), as indicated in Table C5 below.

Table C5: Classification of Present State Classes in terms of Habitat Integrity [Kleynhans *et al.*2008]

Class	Description	Score (% of total)
A	Unmodified, natural.	90 - 100
B	Largely natural with few modifications. The flow regime has been only slightly modified and pollution is limited to sediment. A small change in natural habitats may have taken place. However, the ecosystem functions are essentially unchanged.	80 - 89
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	60 - 79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20 – 39

F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0 - 19

5. WET-Health

The Riparian Vegetation Response Assessment Index (VEGRAI)
VEGRAI is designed for qualitative assessment of the response of riparian vegetation to impacts in such a way that qualitative ratings translate into quantitative and defensible results (Kleynhans *et al.*, 2007a). Results are defensible because their generation can be traced through an outlined process (a suite of rules that convert assessor estimates into ratings and convert multiple ratings into an Ecological Category).

Riparian vegetation is described in the National Water Act (Act No. 36 of 1998) as follows: 'riparian habitat' includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soil, 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 land areas.

Table C6: Descriptions of the A-F ecological categories.

Ecological category	Description	Score (% of total)
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitat and biota may have taken place but the ecosystem functions are essentially unchanged.	80-89
C	Moderately modified. Loss and change of natural habitat have occurred, but the basic ecosystem functions are still predominately unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Critically modified. Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances, the basic ecosystem functions have been destroyed and the changes are irreversible	0-19

6. Watercourse Functional 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".[5] 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;

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

- 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-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 C3: 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 C4: 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.

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

The purposed 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 C8) of the wetland system being assessed.

Table C8: 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

8. 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 C9: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

PES			Ecological and Importance Sensitivity (EIS)			
			Very High	High	Moderate	Low
	A	Pristine	A	A	A	A

			Maintain	Maintain	Maintain	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 C10: 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 – Impact Assessment Methodology

An impact assessment was not applied to this study; instead, a risk matrix was used to assess the environmental risk pertaining to the proposed mining activities. The tables below outlines the risk matrix as provided by the client.

Table D1: Glencore Corporate Risk Matrix.

CONSEQUENCE [potential foreseeable outcome of the event]		LIKELIHOOD [of the event occurring with that consequence]					
Environment		**Basis of Rating**	**E - Rare**	**D - Unlikely**	**C - Possible**	**B - Likely**	**A – Almost Certain**
		Lifetime	Unlikely to occur during a lifetime	Could occur about once during a lifetime	Could occur more than once during a lifetime	May occur about once per year	May occur several times per year
		OR	OR	OR	OR	OR	OR
		Project or Trial or Fixed Time Period	Very unlikely to occur	More likely NOT to occur than to occur	As likely to occur as not to occur	More likely to occur than not occur	Expected to occur
		OR	OR	OR	OR	OR	OR
		New Process / Plant / R&D	No known occurrences in broader worldwide industry	Has occurred at least once in broader worldwide industry	Has occurred at least once in the mining / commodities trading industries	Has occurred at least once within Glencore	Has occurred several times within Glencore
5 Catastrophic	» Unconfined and widespread » Environmental damage or effect (permanent; >10 years) » Requires major remediation		**15 (M)**	**19 (H)**	**22 (H)**	**24 (H)**	**25 (H)**
4 Major	» Long-term (2 to 10 years) impact » Requires significant remediation		**10 (M)**	**14 (M)**	**18 (H)**	**21 (H)**	**23 (H)**
3 Moderate	» Medium-term (<2 years) impact (typically within a year) » Requires moderate remediation		**6 (L)**	**9 (M)**	**13 (M)**	**17 (H)**	**20 (H)**
2 Minor	» Near source » Short-term impact (typically <week) » Requires minor remediation		**3 (L)**	**5 (L)**	**8 (M)**	**12 (M)**	**16 (M)**

CONSEQUENCE [potential foreseeable outcome of the event]		LIKELIHOOD [of the event occurring with that consequence]					
1 Negligible	» Near source and confined » No lasting environmental damage or effect (typically <day) » Requires minor or no remediation		**1 (L)**	**2 (L)**	**4 (L)**	**7 (M)**	**11 (M)**

Consequence Category	Consequence Type	Ownership	Action
Category 5	**Catastrophic Hazard**	Department / Functional / Operational / Asset Leadership	· Quantitative or semi-quantitative risk assessment required. · Capital expenditure will be justified to achieve ALARP ('As Low As Reasonably Practicable'). · Catastrophic Hazard Management Plans (CHMP) must be implemented where practical, Crisis Management Plans (CMP) tested and Catastrophic Event Recovery Plans (CERP) developed.
Category 4 **(Health & Safety consequence)**	**Fatal Hazard**	Department / Functional / Operational / Asset Leadership	· Glencore SafeWork Fatal Hazard Protocols or appropriate management plans must be applied. · Capital expenditure will be justified to achieve ALARP.
Risk Rank	**Risk Rating**	**Ownership**	**Action**
17 to 25	**High Risk**	Department / Functional / Operational / Asset Leadership	· Install additional HARD and SOFT controls to achieve ALARP. · Capital expenditure will be justified to achieve ALARP.
7 to 16	**Medium Risk**	Operational / Asset Leadership	· Install additional HARD and SOFT controls if necessary to achieve ALARP. · Capital expenditure may be justified.
1 to 6	**Low Risk**	Operational / Asset Leadership	· Install additional controls if necessary to achieve ALARP. · Capital expenditure is not usually justified.

Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation* and *performance improvement measures* and actions that address the risks and impacts[6] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation, or compensation.
- 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*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction, operation and decommissioning

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

APPENDIX E – Results of Field Investigation

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

Table E1: Presentation of the results of the WET-Health PES assessment applied to the wetlands associated with the OFT Southern and Eastern Underground Blocks, the GGV Eastern Underground Block and Incline 2.

Wetland	Hydrology		Geomorphology		Vegetation		Overall Score	Overall PES Category
	Impact Score & (PES Category)	Trajectory of Change	Impact Score & (PES Category	Trajectory of Change	Impact Score & (PES Category	Trajectory of Change		
HS HGM Unit 1	6.5 (E)	↓	5.1 (D)	↓	5.8 (D)	↓	5.91	D/E
HS HGM Unit 2	2.0 (C)	→	0.9 (A)	→	3.6 (C)	↓	2.13	C
Channelled Valley Bottom	3.5 (C)	→	a.3 (B)	↓	2.8 (C)	↓	2.68	C

Table E2: Presentation of the results of the Ecoservices assessment applied to Hillslope Seep 1 (HS HGM unit 1)

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1,4	0,2	0,0	Very Low
	Stream flow regulation	1,7	0,0	0,2	Very Low
	Sediment trapping	1,4	0,8	0,3	Very Low
	Erosion control	0,9	1,2	0,0	Very Low
	Phosphate assimilation	1,2	0,5	0,0	Very Low
	Nitrate assimilation	1,0	0,8	0,0	Very Low
	Toxicant assimilation	1,1	0,5	0,0	Very Low
	Carbon storage	1,2	2,7	1,1	Low
	Biodiversity maintenance	1,7	2,0	1,2	Low
PROVISIONING SERVICES	Water for human use	1,0	1,0	0,0	Very Low
	Harvestable resources	0,5	0,0	0,0	Very Low
	Food for livestock	1,0	0,3	0,0	Very Low
	Cultivated foods	2,1	0,3	0,8	Very Low
CULTURAL SERVICES	Tourism and Recreation	0,3	0,0	0,0	Very Low
	Education and Research	0,5	0,0	0,0	Very Low
	Cultural and Spiritual	0,0	0,0	0,0	Very Low

Table E3: Presentation of the results of the Ecoservices assessment applied to Hillslope Seep 2 (HS HGM unit 2)

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1,8	0,1	0,3	Very Low
	Stream flow regulation	1,7	0,0	0,2	Very Low
	Sediment trapping	2,1	0,5	0,9	Low
	Erosion control	0,9	2,2	0,5	Very Low
	Phosphate assimilation	1,8	0,5	0,6	Very Low
	Nitrate assimilation	1,5	0,5	0,3	Very Low
	Toxicant assimilation	1,6	0,5	0,4	Very Low
	Carbon storage	1,2	2,7	1,1	Low
	Biodiversity maintenance	2,7	2,0	2,2	Moderate
PROVISIONING SERVICES	Water for human use	0,4	1,0	0,0	Very Low
	Harvestable resources	2,0	0,0	0,5	Very Low
	Food for livestock	2,0	0,3	0,7	Very Low
	Cultivated foods	2,1	0,3	0,8	Very Low
CULTURAL SERVICES	Tourism and Recreation	1,0	0,0	0,0	Very Low
	Education and Research	1,0	0,0	0,0	Very Low
	Cultural and Spiritual	2,0	0,0	0,5	Very Low

Table E4: Presentation of the results of the Ecoservices assessment applied to the channelled valley bottom HGM unit

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

Table E4: Presentation of the results of the EIS assessments applied to the wetlands associated with the OFT Southern and Eastern Underground Blocks, the GGV Eastern Underground Block and Incline 2.

			CVB	HS 1	HS 2	
Ecological Importance and Sensitivity			Score (0-4)			*Confidence (1-5)*
Biodiversity support			A (average)	A (average)	A (average)	(average)
			1,67	0,33	1,67	4,00
Presence of Red Data species			2	0	2	4
Populations of unique species			0	0	1	4
Migration/breeding/feeding sites			3	1	2	4
Landscape scale			B (average)	B (average)	B (average)	(average)
			2,20	1,20	2,20	4,00
Protection status of the wetland			3	2	3	4
Protection status of the vegetation type			2	2	3	4
Regional context of the ecological integrity			2	1	2	4
Size and rarity of the wetland type/s present			2	1	2	4
Diversity of habitat types			2	0	1	4
Sensitivity of the wetland			C (average)	C (average)	C (average)	(average)
			1,33	0,67	0,67	4,00
Sensitivity to changes in floods			2	0	0	4
Sensitivity to changes in low flows/dry season			1	1	1	4
Sensitivity to changes in water quality			1	1	1	4
ECOLOGICAL IMPORTANCE & SENSITIVITY			**(max of A,B or C)**	**(max of A,B or C)**	**(max of A,B or C)**	*(average of A, B or C)*
		Fill in highest score:	**B**	**B**	**B**	**1,20 / 2.20**
HS HGM Unit 1 Moderate: Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.						
HS HGM Unit 2 and Channelled valley bottom: High: Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.						
Hydro-Functional Importance			Score (0-4)	Score (0-4)	Score (0-4)	*Confidence (1-5)*
Regulating & supporting benefits	**Flood attenuation**		1	1	2	4
	Streamflow regulation		2	2	2	4
	Water Quality Enhancement	***Sediment trapping***	2	1	2	4
		Phosphate assimilation	1	1	2	4
		Nitrate assimilation	2	1	1	4
		Toxicant assimilation	1	1	1	4
		Erosion control	1	1	1	4
	Carbon storage		1	1	1	4
HYDRO-FUNCTIONAL IMPORTANCE			1	1	2	4
Direct Human Benefits			Score (0-4)	Score (0-4)	Score (0-4)	Confidence (1-5)
Subsistence benefits	***Water for human use***		1	1	0	4
	Harvestable resources		1	0	2	4
	Cultivated foods		1	2	2	4
Cultural benefits	***Cultural heritage***		2	0	0	4
	Tourism and recreation		1	0	1	4
	Education and research		1	0	1	4
DIRECT HUMAN BENEFITS			1,17	0,50	1,00	4

APPENDIX F – Generic Mitigation Measures

General construction management and good housekeeping practices

Latent and general impacts which may affect the freshwater ecology and biodiversity of the receiving freshwater environment, will include any activities which take place in close proximity to the proposed haul road options that may impact on the receiving environment. Mitigation measures for these impacts are highlighted below and are relevant to the freshwater system identified in this report:

Development footprint

- All development footprint areas should remain as small as possible and should not encroach into the freshwater areas. It must be ensured that the freshwater habitat is off-limits to construction vehicles and non-essential personnel;
- The boundaries of footprint areas, including contractor laydown areas, are to be clearly defined and it should be ensured that all activities remain within defined footprint areas. Edge effects will need to be extremely carefully controlled;
- Planning of temporary roads and access routes should avoid freshwater areas and be restricted to existing roads;
- Appropriate sanitary facilities must be provided for the life of the construction phase and all waste removed to an appropriate waste facility;
- All hazardous chemicals as well as stockpiles should be stored on bunded surfaces and have facilities constructed to control runoff from these areas;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage;
- No fires should be permitted in or near the construction area; and
- Ensuring that an adequate number of waste and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills.

Vehicle access

- All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into the topsoil;
- In the event of a vehicle breakdown, maintenance of vehicles must take place with care and the recollection of spillage should be practiced near the surface area to prevent ingress of hydrocarbons into topsoil and subsequent habitat loss; and
- All spills should they occur, should be immediately cleaned up and treated accordingly.

Vegetation

- Proliferation of alien and invasive species is expected within any disturbed areas. The vegetation component within the freshwater environment is transformed to a minor extent by alien plant invasion; therefore, these species should be eradicated and controlled to prevent their spread beyond the project footprint. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on future rehabilitation, has to be controlled;
- Removal of the alien and weed species encountered within the wetlands must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act(Act No. 107 of 1998). Removal of species should take place throughout the construction, operational, and maintenance phases; and
- Species specific and area specific eradication recommendations:
  - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used;
  - Footprint areas should be kept as small as possible when removing alien plant species; and
  - No vehicles should be allowed to drive through designated freshwater habitat during the eradication of alien and weed species.

Soil

- Sheet runoff from access roads should be slowed down by the strategic placement of berms;

- As far as possible, all construction activities should occur in the low flow season, during the drier winter months;
- As much vegetation growth as possible (of indigenous floral species) should be encouraged to protect soil;
- No stockpiling of topsoil is to take place within close proximity to the freshwater habitat, and all stockpiles must be protected with a suitable geotextile to prevent sedimentation of the freshwater habitat;
- All soil compacted as a result of ongoing operational activities falling outside of project footprint areas should be ripped and profiled; and
- A monitoring plan for the development and the immediate zone of influence should be implemented to prevent erosion and incision.

Rehabilitation

- Construction rubble must be collected and disposed of at a suitable landfill site; and
- All alien vegetation in the footprint area as well as immediate vicinity of the proposed haul road options should be removed. Alien vegetation control should take place for a minimum period of two growing seasons after rehabilitation is completed.

APPENDIX G – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

Amanda Mileson Advanced Diploma: Nature Conservation (UNISA)

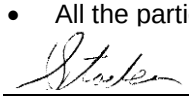
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
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 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)		

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, fluorspar
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 License 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 AMANDA MILESON

PERSONAL DETAILS

Position in Company	Senior Ecologist: Wetland Ecology
Joined SAS Environmental Group of Companies	2013

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Wetland Society (SAWS)
Member of the Gauteng Wetland Forum (GWF) and Northern Cape Wetland Forum (NCWF)

EDUCATION

Qualifications

N. Dip Nature Conservation (UNISA)	2017
Advanced Diploma: Nature Conservation (UNISA)	2020
Post Graduate Diploma: Nature Conservation (UNISA)	In progress

Short Courses

Wetland Management: Introduction and Delineation (University of the Free State)	2018
Tools for Wetland Assessment (Rhodes University)	2017
Wetland Rehabilitation (University of the Free State)	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape
Africa – Zimbabwe, Zambia

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

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

Biodiversity Assessments

- Ecological Scan
- Biodiversity Offset Plan