APPENDIX I: FRESHWATER ASSESSMENT

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FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL AND WATER USE AUTHORISATION PROCESSES FOR THE PROPOSED MOKALA MINE EXPANSION ACTIVITIES NEAR HOTAZEL, NORTHERN CAPE

Prepared for

SLR Consulting (South Africa) (Pty) Ltd.

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EXECUTIVE SUMMARY

The results of the assessment indicate that the assessed reach of the Ga-Mogara River associated with the existing Mokala Mine near Hotazel in the Northern Cape, is in a largely natural to moderately modified ecological state, although upstream impacts mostly relating to mining have resulted in various impacts including loss of recharge to the system, causing further moisture stress to riparian vegetation. The episodic nature of the system (last recorded surface flow prior to January 2021 was in 1988) reduces human reliance on the watercourse, however, it is deemed a vital component of the overall ecology of the focus area and greater region.

The majority of the proposed expansion activities are situated to the west of the open pit, which intercepts potential impacts arising from those activities. In addition, the majority of the proposed activities are situated further than 100 m from the delineated riparian zone. The proposed expansion of the open pit and the construction of berms will encroach within 55 m of the existing river diversion, and as such, pose an indirect risk to the ecological integrity and functioning of the river.

The majority of anticipated impacts are likely to be of medium to low significance, provided that strict implementation of mitigation measures takes place throughout the life of the project in order to ensure prevention / minimisation of direct impacts as well as ensuring that cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with those stipulated by other specialists, specifically the hydrologist and groundwater specialists, impact significance may be reduced. Taking the above into account, it is therefore the opinion of the specialist that the project is not fatally flawed from a freshwater resource management point of view and consideration of the value of this landscape must be considered from a freshwater and terrestrial biodiversity resource management point of view and juxtaposed with the responsibility to comply with Regulation 23 of the Mining and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) MPRDA pertaining to the optimisation of the Mining Right as well as the socio-economic and socio-cultural impact the project will have and the decision should be made and aligned with the principles of sustainable development and Integrated Environmental Management.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecosystem delineation and assessment as part of the Environmental Authorisation (EA) and Water Use License Application (WULA) process for the proposed Mokala Mine expansion activities, near Hotazel, Northern Cape.

The purpose of this report is to provide detailed information to guide the activities associated with the proposed expansion activities, to ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and water resource management initiatives and the provision of ecological services in the local area. The study also aimed to identify and quantify any impacts on the watercourse associated with the Mining Right Area (MRA) and project area (i.e. the Ga-Mogara River), and to present a set of mitigatory measures which could be employed to minimise impacts on the receiving freshwater environment.

The assessment took the following approach:

- A desktop study was conducted, and relevant national and provincial databases were consulted. The results of the desktop study are contained in Section 3 of this report;
- A field assessment took place in February 2021, to ground-truth pre-defined points of interest and delineate the reach of the Ga-Mogara River associated with the project area. During the

site assessment, factors influencing the habitat integrity of the river were noted, and the functioning and the environmental and socio-cultural services provided by the river were determined;
- A single watercourse – the Ga-Mogara River – was identified within the project area and was classified according to the Classification System (Ollis *et. al.,* 2013). The results of this classification are presented in Section 4.1 of this report;
- The characterisation of the watercourse is contained in Section 4.2 of this report and is summarised in the table below.

Table A: Summary of the results of the field assessment.

Present Ecological State (PES) Category	Ecological function and service provision	Ecological Importance and Sensitivity (EIS)	Recommended Ecological Class (REC) / Recommended Management Objective (RMO) and Best Attainable State (BAS)
Instream IHI: B Riparian IHI / VEGRAI: C	Moderately low to very low	Low / Moderate	B/C Maintain B

Following the assessment of the watercourse, the SLR Consulting (South Africa) (Pty) Ltd impact assessment method and the DWS Risk Assessment Matrix (2016) were applied to ascertain the significance of perceived impacts on the receiving environment, should the proposed expansion activities proceed. The results of the impact and risk assessments are contained in Section 5 of this report, and key mitigation measures are provided in Section 5 and general mitigation measures in Appendix F.

Mitigation measures were developed to aid in minimising potential direct, indirect, and cumulative impacts on the receiving freshwater environment. These measures are outlined in Section 5 of this report, however the key mitigation measures are summarised below:

- There should be no need for any personnel or equipment to enter the river; thus it is to be demarcated as a “no-go” zone and remain off-limits;
- Retention of as much indigenous vegetation as possible between the pit, berms and the river, which will assist in buffering the river from impacts such as sedimentation and erosion caused by surface water runoff;
- Construction and ongoing maintenance of sediment traps between the berms and the river, to aid in trapping sediment. These must be regularly inspected, and accumulated sediment removed by hand when required; and
- Regular dust suppression of the haul road (and other internal roads) must be undertaken, using recycled water (not dirty water, as per the definition thereof contained in GN704 as it relates to the National Water Act, 1998 (Act No 36 of 1998)) to minimise sedimentation.

It is imperative that mitigation measures are implemented throughout the life of the project in order to ensure that not only are direct impacts prevented/minimised, but that cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with those stipulated by other specialists, specifically the hydrologist and groundwater specialists, impact significance may be reduced.

Taking the above into account, it is therefore the opinion of the specialist that the project is not fatally flawed from a freshwater resource management point of view and consideration of the value of this landscape must be considered from a freshwater and terrestrial biodiversity resource management point of view and juxtaposed with the responsibility to comply with Regulation 23 of the Mining and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) pertaining to the optimisation of the Mining Right as well as the socio-economic and socio-cultural impact the project will have and the decision should be made and aligned with the principles of sustainable development and Integrated Environmental Management.

DOCUMENT GUIDE

No.	Requirement	Section in report
a)	Details of -	
(i)	The specialist who prepared the report	Appendix G
(ii)	The expertise of that specialist to compile a specialist report including a curriculum vitae	Appendix G
b)	A declaration that the specialist is independent	Appendix G
c)	An indication of the scope of, and the purpose for which, the report was prepared	Section 1.3
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1 and 3
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4 and 5
d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment	Section 2.1 and 4
e)	A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used	Appendix C
f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives	Section 4
g)	An identification of any areas to be avoided, including buffers	Section 4.3
h)	A map superimposing the activity including the associated structure and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers	Section 4.3
i)	A description of any assumption made and any uncertainties or gaps in knowledge	Section 1.4
j)	A description the findings and potential implication\s of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities	Section 4, 5, and 6
k)	Any mitigation measures for inclusion in the EMPr	Section 5.1
l)	Any conditions for inclusion in the environmental authorisation	Section 5
m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5
n)	A reasoned opinion -	
(i)	As to whether the proposed activity, activities or portions thereof should be authorised	Section 6
(iA)	Regarding the acceptability of the proposed activity or activities	Section 6
(ii)	If the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	Section 6
o)	A description of any consultation process that was undertaken during the course of preparing the specialist report	N/A
p)	A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q)	Any other information requested by the competent authority	N/A

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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.
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Base flow:	Long-term flow in a river that continues after storm flow has passed.
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.
Chroma:	The relative purity of the spectral colour which decreases with increasing greyness.
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".
Ephemeral stream:	Ephemeral systems flow for less time than they are dry. Flow or flood for short periods of most years in a five-year period, in response to unpredictable high rainfall events. Support a series of pools in parts of the channel.
Episodic stream:	Highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period, or may flow only once in several years**.**
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 soils).
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorphy:	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
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.
Intermittent flow:	Flows only for short periods.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	Soils 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.
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 soils, which may in turn have an influence on the ecological characteristics and functioning of wetlands.

ACRONYMS

°C	Degrees Celsius.
BAR	Basic Assessment Report
BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
CSIR	Council of Scientific and Industrial Research
DD	Data Deficient
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DMRE	Department of Mineral Resources and Energy
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Program
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	General Notice
GMP	Gold Mining Project
GPS	Global Positioning System
HGM	Hydrogeomorphic
IWUL	Integrated Water Use Licence
LC	Least Concern
m	Meter
MPRDA	Mineral and Petroleum Resources Development Act
NBA	National Biodiversity Assessment
N/A	Not Applicable
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NEMA	National Environmental Management Act
NEM:WA	National Environmental Management: Waste Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RHP	River Health Program
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAS	Scientific Aquatic Services
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WML	Waste Management Licence
WRC	Water Research Commission

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecosystem delineation and assessment as part of the Integrated Environmental Authorisation (IEA) and Water Use License Application (WULA) process for the proposed Mokala Mine expansion activities, near Hotazel, Northern Cape.

In order to identify all potential freshwater resources that may potentially be impacted by the proposed expansion activities, a 500m “zone of investigation” around the Mining Right Area (MRA), in accordance with Regulation 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 receiving environment. This area – i.e. the 500m zone of investigation around the MRA – will henceforth be referred to as the “investigation area”. The study and investigation areas are depicted in Figures 1 to 3.

The purpose of this report is to provide detailed information to guide the activities associated with the proposed Mokala Mine expansion to ensure the ongoing functioning of the ecosystem in such a way as to support local and regional conservation requirements and the provision of ecological services in the local area. The study also aimed to identify and quantify any impacts on the watercourse associated with the proposed expansion activities, and to present a set of mitigatory measures which could be employed to minimise impacts on the receiving freshwater environment.

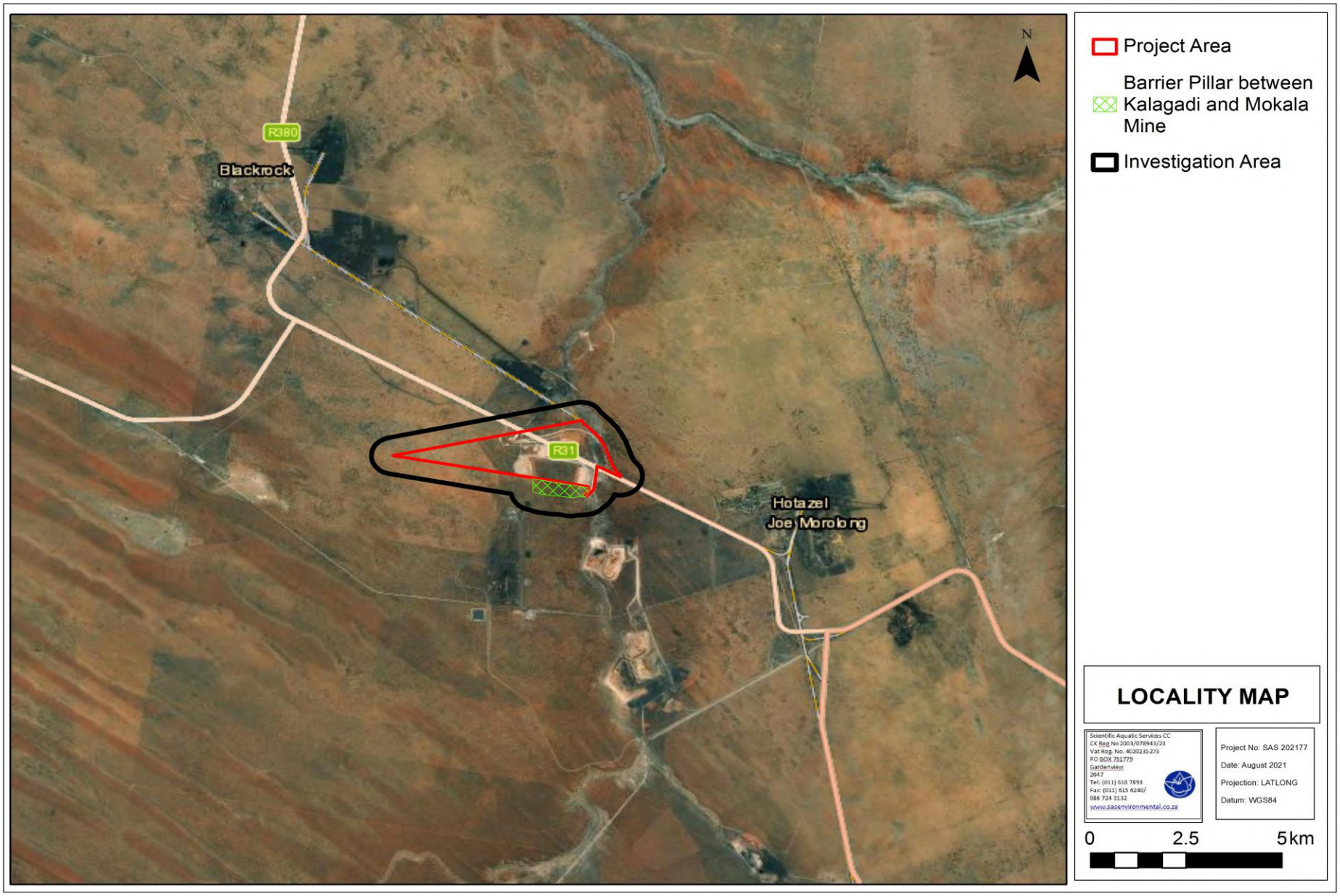


Figure 1: Digital satellite image depicting the location of the study and investigation areas in relation to surrounding areas.

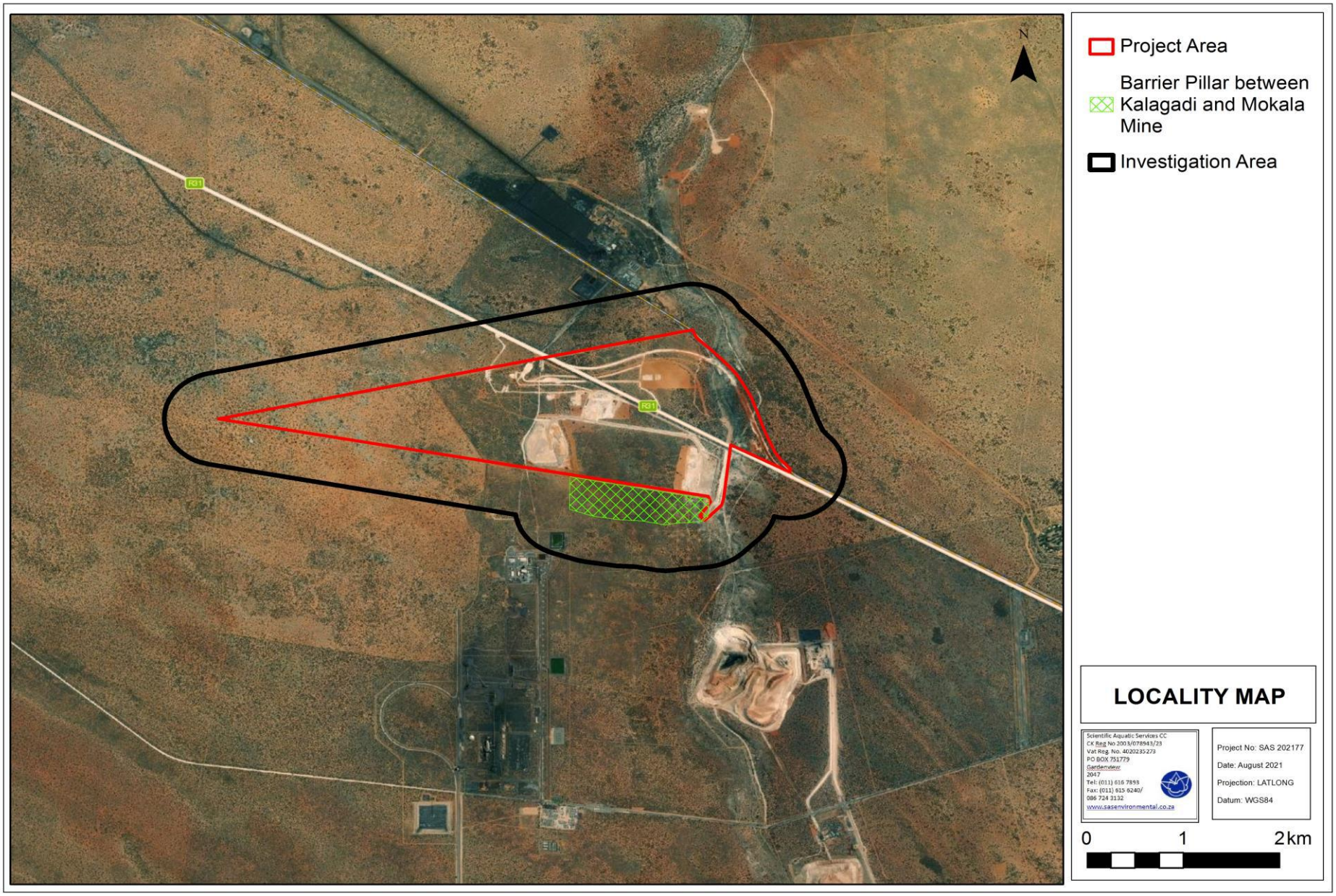


Figure 2: Digital satellite image depicting the location of the study and investigation areas in relation to surrounding areas.

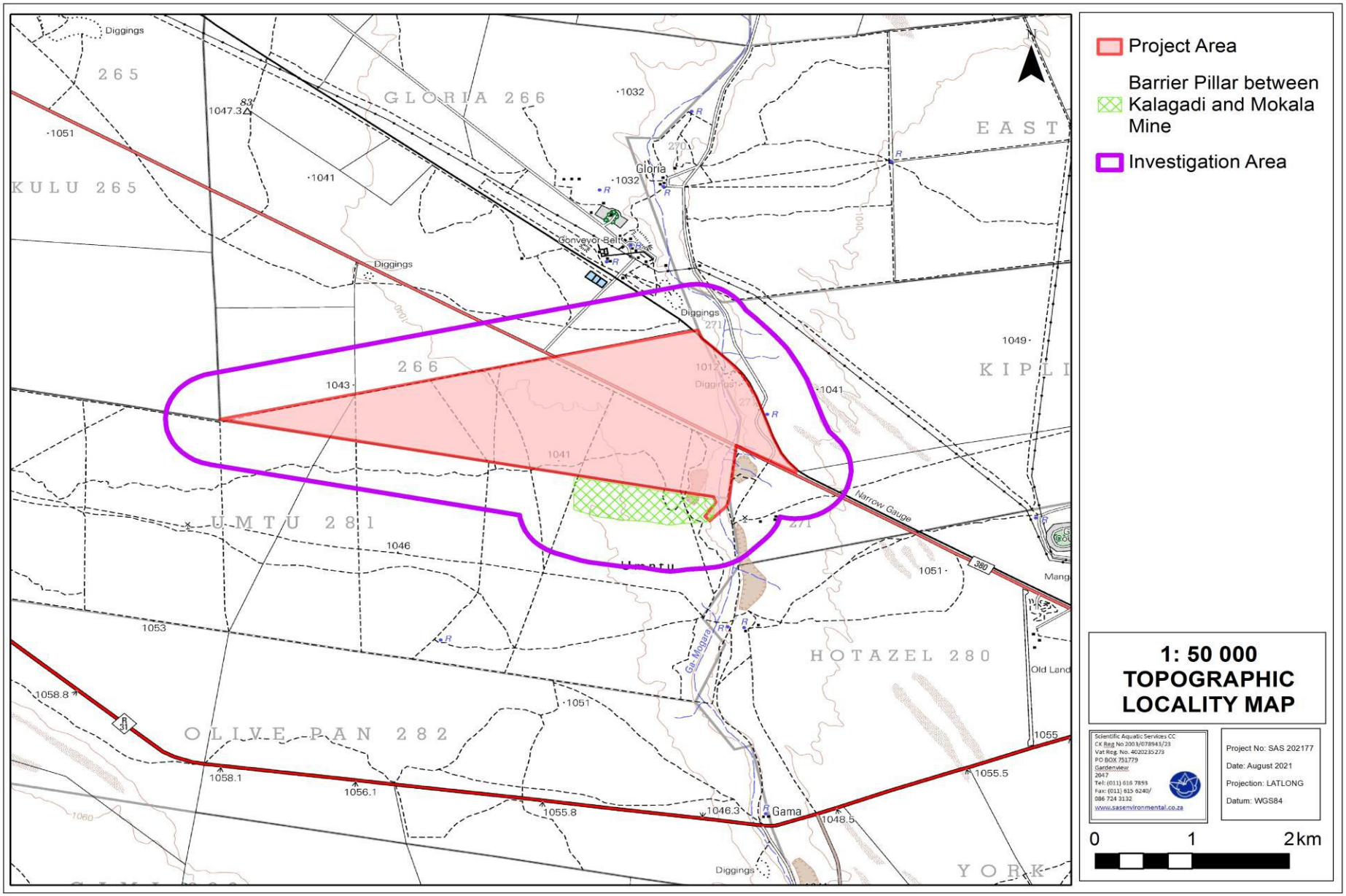


Figure 3: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.

1.2 Project Description

The information contained in this section is taken from the Scoping Report for the Changes to Surface Infrastructure at the Mokala Mine, March 2021, prepared by SLR Consulting (South Africa) (Pty) Ltd. SAS does not accept responsibilities for any errors or inaccuracies contained therein.

Please refer to Figure 4 below for the layout of the various project components described below.

The Mokala Mine is an open cast manganese mine with approved infrastructure components comprising a dry crushing and screening plant; Waste Rock Dumps (WRDs), Run of Mine (ROM) stockpiles; topsoil stockpiles; water storage facilities; stormwater management infrastructure and mine-related support facilities such as workshops, stores, and offices. Additional approved activities include:

- The realignment of the R380 road on the farm Kipling 271 and across the remaining extent of the farm of Gloria 266;
- Upgrading of the intersection to the mine on portion 1 of the farm Gloria 266 also serving the existing Gloria Mine;
- The realignment of a section of the Ga-Mogara drainage channel within the existing river channel. This realignment extends onto the farm Umtu 281.

The Mokala Mine is currently in the construction and operational phase of the project. In this regard, temporary infrastructure in support of the construction phase is currently on site. Construction facilities will either be removed at the end of the construction phase or incorporated into the layout of the operational mine. The mine has also begun with their open cast strip mining activities.

The mine currently operates under the following approved environmental authorisations:

- A Mining Right and an approved Environmental Management Programme (EMPr) in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 or 2002) (MPRDA). Authorisation was granted by the Department of Mineral Resources (DMR) (now the Department of Mineral Resources and Energy (DMRE)) on the 19 September 2017 as per reference NC30/5/1/2/2/10090 MR;
- An EA and an approved EMPr in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). Authorisation was granted by the DMR (now the DMRE) on the 15 August 2016 as per reference NC 30/5/1/2/2/(10090) EM;

- A Waste Management Licence (WML) from the DMR (now the DMRE) in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA). The WML was approved as part of the EA granted by the DMR on the 15 August 2016 as per reference NC 30/5/1/2/2/ (10090) EM; and
- An Integrated Water Use Licence (IWUL) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) issued by the Department of Human Settlements, Water and Sanitation (DHSWS) on 14 August 2020 (as per reference number 08/D41K/BCGIJA/9175).

Mokala is proposing to amend the approved mine layout to cater for activity/infrastructure changes that have already taken place and proposed changes. These changes are required to optimize their mining operations. Activity/infrastructure changes to the approved infrastructure that have already taken place include:

- The reconfiguration of plant area, ROM and high-grade product stockpiles to accommodate the expansion of the open pit;
- The relocation of the low-grade product stockpile;
- The relocation of support infrastructure (water storage facilities (potable and process water), workshops and washbay, change houses, sewage treatment plant, water treatment plant, fuel storage, administrative block (offices, kitchen, canteen, training centre, mustering centre, clinic, stores and waste storage);
- Relocation of transportation related facilities/infrastructure (internal haul road, weighbridges, parking areas, truck loading and staging facility);
- The relocation of the approved WRD to accommodate the expansion of the open pit; and
- The relocation of the approved topsoil stockpiles.

Proposed activity/infrastructure changes to the approved surface layout include:

- The proposed expansion of the open pit;
- The proposed increase in the capacity of the WRD and the establishment of an additional WRD;
- The proposed establishment of additional topsoil stockpiles;
- The proposed relocation of stormwater management infrastructure;
- The proposed increase in the capacity of product stockpiles (ROM and Low Grade, High Grade); and
- The proposed mining of the barrier pillar between the Kalagadi Mine and Mokala Mine.

No changes are anticipated to the realignment of the R380, the realignment of the Ga-Mogara drainage channel, or the intersection to the entrance of the mine.

A description of the activities that have already occurred and the proposed activities is provided below.

1.2.1 Layout/activities that have already taken place

1.2.1.1 Reconfiguration of the plant area, ROM stockpiles and product stockpile

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for a plant area (which comprises the Primary Crusher, Secondary Crusher and Screening Plant), ROM stockpiles and product stockpiles. According to the approved 2015 EIA and EMPr, these facilities were planned to the North of the approved open pit footprint. An expansion of the open pit is proposed toward a northerly and westerly direction. Due to this proposed activity, reconfiguration of the plant area, ROM stockpiles and product stockpiles is required.

1.2.1.2 The relocation of the ROM low grade product stockpile

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for the establishment of a ROM low grade stockpile North of the approved open pit footprint. The ROM low-grade stockpile has been relocated because the proposed open pit expansion will overlap with the approved ROM low grade product stockpile footprint.

1.2.1.3 The relocation of support infrastructure

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for the following support infrastructure:

- Water storage facilities (potable and process water);
- Workshops and washbay;
- Change houses;
- Sewage treatment plant;
- Water treatment plant;
- Fuel storage;
- Stores;
- Waste storage; and
- Administrative block including:
  - Offices;
  - Kitchen and canteen;
  - Training centre; and

- Mustering centre; and
- Clinic.

The above listed support infrastructure has been relocated to cater for the proposed expansion of the open pit.

1.2.1.4 The relocation of transportation related facilities/infrastructure

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for the following transportation facilities:

- Internal haul roads, turning circle and upgrading the intersection to Gloria Mine;
- Widening of existing gravel roads;
- Realignment of the R380;
- Loading, hauling and transportation of ROM, product and materials; and
- Conveyors and weighbridge.

The approved internal haul roads, weighbridges, parking areas, truck loading and staging facility have been relocated to cater for the optimised mine layout. It is important to note that no changes to the realignment of the R380 and the upgrade of the mine intersection are anticipated.

1.2.1.5 The relocation of the approved WRD

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for a single WRD. The approved WRD has been relocated to cater for the proposed expansion of the open pit. The approved 2015 EIA and EMPr (SLR, 2015) also makes provision for overburden berms situated along the approved river alignment. No changes to the overburden berms will be required for this project.

1.2.1.6 The relocation of the approved topsoil stockpiles

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for a designated topsoil stockpile area, a topsoil berm located along the R380 realignment route and a topsoil berm located on the southern edge of the open pit. The topsoil berm located along the R380 realignment route has been established, however the remaining stockpiles have been relocated to cater for the changes and reconfiguration of the layout as discussed in the sections above.

1.2.2 Proposed activity/infrastructure changes

1.2.2.1 Expansion of the open pit

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for an open pit with a footprint of 93 ha. Following an updated resource plan it became apparent that the extent of the approved open pit needs to be expanded. In this regard, Mokala is proposing to expand the open pit by approximately 80 ha in a northerly and westerly direction. Within approximately eight years the open pit would intersect with on-site surface support infrastructure. Once the open pit operations come into close proximity to the surface support infrastructure area, the intention is to relocate this infrastructure to a section of the backfilled open pit.

1.2.2.2 Increase in the capacity of the approved WRD and the establishment of an additional WRD

The approved 2015 EIA and EMPr (SLR, 2015) authorises a WRD footprint of 16 ha with a capacity of approximately 4 206 375 m^3. Mokala is proposing to expand the approved open pit footprint and as such additional waste rock storage space will be required to store additional waste rock stripped from the increased open pit footprint. Mokala is therefore proposing to increase the approved capacity of the WRD to approximately 15 665 819 m^3 with an additional footprint expansion of 29 ha.

In addition to the above, Mokala is proposing to establish an additional WRD to accommodate the additional waste rock tonnages. It is proposed that the additional WRD would be located to the west of the project area and will have a capacity of approximately 35 590 577 m^3 with a footprint area of 83.08 ha. The western part of the project area is currently utilised by the Kalagadi Mine for game farming purposes. This area has been fenced off from the rest of the remaining extent of the farm Gloria 266. Mokala will need to enter into discussions with Kalagadi regarding this game farming area as Kalagadi would not be able to make use of this area if it is earmarked for the establishment of the new WRD.

1.2.2.3 Establishment of additional topsoil stockpiles

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for topsoil stockpiles with a footprint of 5 ha and capacity of 51 114 m^3. Provision has also been made for topsoil berms along the realigned R380 and on the southern edge of the open pit. The total volume of topsoil (stockpiles and berms) approved is 236 812.57 m^3 covering a total topsoil footprint area of 15 ha. Mokala is proposing to expand the approved open pit footprint and as such additional topsoil storage space will be required to store topsoil stripped from the increased open pit footprint. The estimated additional footprint is 22.13 ha.

1.2.2.4 Relocation of stormwater management infrastructure

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for the establishment of stormwater management facilities such as recycle water ponds, drains and clean water realignment berms as required in terms of GNR 704. Due to the relocation of surface infrastructure the location of the approved stormwater management facilities will need to be re-evaluated. The locations will be determined during the EIA phase. It is understood from Mokala, that there is no intention of changing the capacities of the recycled water ponds.

1.2.2.5 Increase in the capacity of product stockpiles (ROM stockpiles and product stockpiles)

The approved 2015 EIA and EMPr (SLR, 2015) makes provision for a ROM Low Grade stockpile and ROM High Grade stockpile. The location of the stockpiles is illustrated in Figure 4. The approved area for the ROM low grade stockpile is approximately 1.03 ha with a capacity of 140 000 m^3. The approved area for the ROM high grade stockpile is approximately 1 ha with a capacity of 140 000 m^3. Mokala now proposes an increase in the capacity of these stockpiles to accommodate the increase in the production tonnages.

1.2.2.6 Mining of the barrier pillar between the Kalagadi Mine and Mokala Mine

The Mokala mining right area borders the farm Umtu 281 to the south, which is owned by Kalagadi Manganese (Pty) Ltd. Kalagadi Manganese (Pty) Ltd owns and operates the Kalagadi Mine. Manganese ore of commercial value is located on the border of these two mines. Mokala and Kalagadi are proposing to establish a joint agreement to mine the boundary pillar.

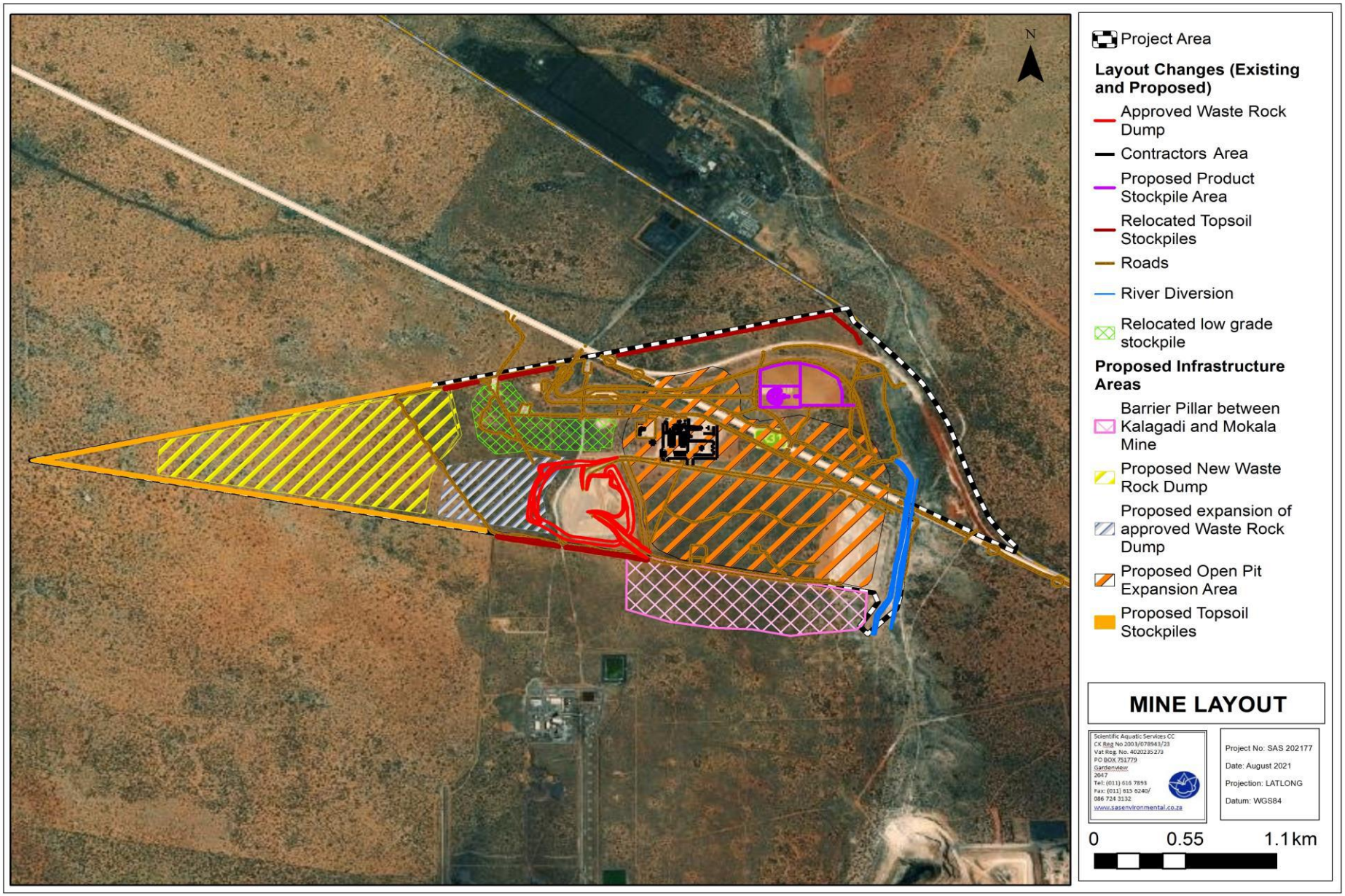


Figure 4: Layout of the existing and proposed infrastructure in relation to the surrounding areas.

1.3 Project Scope

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as National Freshwater Ecosystem Priority Areas [NFEPA] (2011), the National Biodiversity Assessment [NBA] (2018) database and the DWS RQS PES/EIS database) was undertaken to aid in defining the Ecological Importance and Sensitivity (EIS) of the watercourse;
- The reach of the watercourse within the Mokala Mine MRA was delineated according to "DWAF, 2008: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil morphological characteristics and vegetation indicators were used to delineate the riparian zone according to the guidelines. The applicable Zones of Regulation were then allocated to the watercourse;
- The classification assessment of the watercourse 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 reach of the watercourse within the Mokala Mine MRA was determined according to the method described by DWAF (1999);
- The services provided by the watercourse were assessed according to the method of Kotze *et al* (2020) in which services to the ecology of the site as well as services to the people of the area were defined;
- The PES of reach of the watercourse within the Mokala Mine MRA was assessed according to the resource directed measures guideline as advocated by Kleynhans *et al*., (2008);
- Watercourse areas were mapped in relation to the MRA. In addition to the watercourse boundaries, the applicable zones of regulation of in terms of both Government Notice 509 as published in the Government Gazette 40229 of 2016, and Government Notice 704 as published in the Government Gazette 20119 of 1999 as they relate to the National Water Act, 1998 (Act No. 36 of 1998), were depicted where applicable;
- The PES, EIS, and ecological service provision of the assessed reach of the watercourse were highlighted, and expected impacts on the system were assessed according to predefined impact and risk assessment methodologies; and

- Mitigation measures were presented in line with the impact mitigation hierarchy as advocated by the Department of Mineral Resources (DMR)[1], the Department of Environmental Affairs (DEA) and the Department of Water and Sanitation (DWS).

1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The watercourse assessment is confined to the MRA as illustrated in Figures 1 to 3 and does not include the neighbouring and surrounding properties outside of the focus area. The general surroundings and important catchment characteristics were, however, considered in the desktop assessment of the focus area;
- During the site assessment undertaken in May 2021, a single watercourse, identified as the Ga-Mogara River[2], was identified within the eastern portion of the MRA. No other watercourses within 500m of the MRA were identified using desktop assessment methods. The reach of the Ga-Mogara River located within 500m of the MRA was delineated on a desktop basis using topographic maps and digital satellite imagery, in line with 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). Only the reach located within the MRA was assessed as part of this investigation;
- At the time of the assessment, the approved diversion of a portion of the river within the MRA had not been completed although the initial preparation works had commenced. Thus, the results presented herein are based on conditions prior to diversion of the river;
- The application of aquatic assessment indices (such as the South African Scoring System version 5 [SASS5]) did not form part of the scope of work for this study, nor were conditions at the time assessment conducive to the application of such indices. Thus, instream conditions were inferred based on available databases, a visual assessment and professional experience of conditions in other reaches of the same watercourse. Therefore, although the instream Index of Habitat Integrity (IHI) (Kleynhans *et al*, 2008) was applied, it was undertaken with caution and a low degree

[1] The Department of Mineral Resources (DMR) is currently known as the Department of Mineral Resources and Energy (DMRE) and the Department of Environmental Affairs (DEA) is currently known as the Department of Environment, Forestry & Fisheries (DEFF). 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] Please note that for the purposes of this report the spelling “Gamagara River” and the spelling “Ga-Mogara River” as used in the DWS RQIS database, is to be considered synonyms and may be used interchangeably.

of confidence, with the aim of providing a 'snapshot' of instream habitat conditions at the time of assessment;

- The watercourse delineation as presented in this report is regarded as the best estimate of the watercourse boundaries based on the site conditions present at the time of assessment and based on the level of field verification possible. However, some limitations in the accuracy of the delineation due to historical and ongoing anthropogenic disturbances, in particular the alteration of the vegetation community composition and topography as a result of historical and current mining practices is deemed possible, although every effort has been made to ensure accuracy of the delineation;
- 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 watercourse zones will need to be surveyed and pegged according to surveying principles;
- Aquatic, riparian and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative/riparian zone species. Additionally, due to the naturally arid characteristics of the MRA, many species found in the riparian zone occur in terrestrial areas, albeit in diminished abundance and/or structure (e.g. height of individual plants may be greater in the riparian zone than in the adjacent terrestrial areas). Within the transition zone some variation of opinion on the riparian zone boundary may occur, however if the DWAF 2008 method is followed, all assessors should get largely similar results;
- Both the DWS Risk Assessment Matrix (2016) and the SLR Consulting (South Africa) (Pty) Ltd Impact Assessment method were applied to the watercourse. However, it is crucial to note that although these two methods may present different scores and impact significance ratings for the same activity, this is due to differences in their methodologies (refer to Appendix C) and not due to inconsistencies in their application. Each should be judged individually for their specified purpose; i.e. the use of the SLR Consulting (South Africa) (Pty) Ltd Impact Assessment method for the purposes of applying for amendment to the Environmental Authorisation, and the use of the DWS Risk Assessment Matrix to determine, in consultation with the relevant competent authority, whether there is a need to apply for a Water Use Licence (WUL); and
- Whilst numerous existing (authorised) and proposed activities are included in the project description, those which are located to the west of the proposed open pit expansion were excluded from the impact / risk assessment, as the quantum of significance of risk posed by these activities to the watercourse is deemed very low

to negligible. This is attributed to the distance of the activities from the watercourse, the topography of the project area, and, once the pit has been expanded, the zone o influence of impacts associated with activities west thereof will be reduced by the presence of the pit.

1.5 Legislative Requirements

The following legislative requirements were considered during the assessment:

- 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);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014); and
- The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA).

The details of each of the above as they pertain to this study, are provided in Appendix B of this report.

2 ASSESSMENT APPROACH

2.1 Freshwater Site Selection and Field Verification

For the purposes of this investigation, the following definitions as per the National Water Act, 1998 (Act No. 36 of 1998) are of relevance:

A **watercourse** means:

(a) a river or spring;

[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, 19996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.

(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the *Gazette,* declare a watercourse.

Riparian habitat includes-
"The physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas".

Regulated Area of a Watercourse means -

(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 100m 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.

Where the site characteristics had been significantly transformed (for example, complete loss of riparian vegetation in the vicinity of historical prospecting activities or road crossings) use was made of historical and current digital satellite imagery, topographic maps and available provincial and national databases to aid in the delineation of the watercourse following the field assessment. The following were taken into consideration when utilising the above desktop methods:

- Linear features: since water flows/moves through the landscape, watercourses often have a distinct linear element to their signature which makes them discernible on aerial photography or satellite imagery;
- Vegetation associated with watercourses: a distinct increase in density as well as shrub size near flow paths;
- Hue: water flow paths often show as white/grey or black and outcrops or bare soils displaying varying chroma created by varying vegetation cover, geology and soil conditions. Changes in the hue of vegetation with watercourse vegetation often indicated on black and white images as areas of darker hue (dark grey and black). In colour imagery these areas mostly show up as darker green and olive colours or

brighter green colours in relation to adjacent areas where there is less soil moisture or surface water present; and

- Texture: with areas displaying various textures, created by varying vegetation cover and soil conditions.

A field assessment was undertaken in May 2021 to conduct a watercourse delineation and ecological assessment. The delineation of the identified watercourse took place, as far as possible, according to the method presented in the "Updated manual for the identification and delineation of wetland and riparian resources" (DWAF, 2008). The foundation of the method is based on the fact that watercourses have several distinguishing factors including the following:

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

In addition to the delineation process, a detailed assessment of the delineated watercourse was undertaken, at which time factors affecting the integrity of the watercourse were taken into consideration and aided in the determination of the functioning and the ecological and socio-cultural services provided by the watercourse. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.2 Sensitivity Mapping

All the freshwater ecological resources of the MRA were considered, and sensitive areas were delineated with the use of a GPS. A Geographic Information System (GIS) was used to project the watercourse onto digital satellite imagery and topographic maps. The sensitivity map provided in Section 4.4 should guide the design and layout of the proposed prospecting activities.

2.3 Impact and Risk Assessments and recommendations

Following the completion of the assessment, a pre-defined impact assessment methodology, provided by the EAP and the DWS Risk Assessment Matrix (2016) were applied (please refer to Appendix D for the methods of approach) and recommendations were developed to address and mitigate impacts associated with the proposed activities. These recommendations also include general management measures which apply to the proposed

prospecting activities as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the proposed activities. The detailed mitigation measures are outlined in Section 5 of this report, whilst the general management measures which are considered to be best practice mitigation applicable to a project of this nature, are outlined in Appendix F.

3 RESULTS OF THE DESKTOP ANALYSES

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 in order 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 particular 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 MRA’s actual site characteristics at the scale required to inform the Environmental Impact Assessment (EIA) process. Given these limitations, this information is considered useful as background information to the study. It must however be noted that site verification 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. Thus, this data was used as a guideline to inform the watercourse assessment and to focus on areas and aspects of increased conservation importance during the site assessment.

Table 1: Desktop data relating to the characteristics of the watercourse within the MRA and surrounding region.

Aquatic ecoregion and sub-regions in which the MRA is located	
Ecoregion	Southern Kalahari
Catchment	Orange
Quaternary Catchment	D41K
WMA	Lower Vaal
subWMA	Molopo
Dominant characteristics of the Southern Kalahari (29.01) Aquatic Ecoregion Level 2 (Kleynhans *et al.,* 2007)	
Dominant primary terrain morphology	Plains; moderate relief, Closed Hills, mountains; moderate and high relief.
Dominant primary vegetation types	Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld
Altitude (m a.m.s.l)	700 - 1500
MAP (mm)	0 - 500
The coefficient of Variation (% of the MAP)	30 - 40
Rainfall concentration index	60 - >65
Rainfall seasonality	Late Summer
Mean annual temp. (°C)	16 - 22
Winter temperature (July)	0 - 22
Summer temperature (Feb)	16 - >32
Median annual simulated runoff (mm)	<5 – 40
National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (including te National Wetland Map 5 information)	
According to the NBA (2018): SAIIAE there are no wetlands associated with MRA or investigation area. According to the NBA Dataset the Ga-Mogara River is moderately modified (Class C), it is currently not protected (Ecosystem Protection Level) and therefore critically endangered (Ecosystem Threat Status).	
National Web Based Environmental Screening Tool (2020) (Figure 8)	
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.	
According to the screening tool the overall aquatic sensitivity of the MRA is **low.**	

Detail of the MRA in terms of the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database	
FEPACODE	The MRA is situated within a SubWMA considered an **upstream management area**, required to prevent the downstream degradation of FEPAS and Fish Support Areas.
NFEPA Wetlands	According to the NFEPA database (2011) there are no wetland features located within the MRA, however one natural "channelled valley bottom wetland" is indicated within the eastern portion of the investigation area, associated with the Ga-Mogara River. The "channelled valley bottom wetland" is indicated by NFEPA to be in a natural or good ecological condition (Class AB). The "channelled valley bottom wetland" indicated by NFEPA was not groundtruthed as it is located outside the MRA, however according to the scoping report (SLR, 2021) the area indicated by the NFEPA database is a decommissioned borrow pit. Visual analysis of the area indicated by NFEPA concurs with the maps contained in the Scoping Report prepared by SLR (2021).
Wetland Vegetation Type	The majority of the MRA is situated within the Eastern Kalahari Bushveld Group 3 and the remaining eastern portion falls within the Kalahari Duneveld vegetation type, considered Least Threatened according to SANBI, 2012 and Mbona *et al.* (2015).
NFEPA Rivers	According to the NFEPA Database the Ga-Mogara River traverses the eastern portion of the MRA. According to the PES 1999 Classification and the NFEPA Database, the Ga-Mogara River is considered largely natural (Class B) and an upstream management river and is moderately modified (Class C) according to the NFEPA Database.
Detail of the MRA in terms of the Northern Cape Critical Biodiversity Areas (2016)	
Ecological Support Area (ESA)	The southern portion associated with the Ga-Mogara River of the MRA is classified as an Ecological Support Area. ESAs are areas which must retain their ecological processes in order to meet biodiversity targets for ecological processes that have not been met in CBAs or protected areas; meet biodiversity targets for representation of ecosystem types or Species of special concern when it's not possible to meet them in CBAs; support ecological functioning of protected areas or CBAs or a combination of these (SANBI, 2017).
Other Natural Area	The majority of the MRA falls within an area classified as "Other Natural Areas (ONA)". ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs (SANBI, 2017).
Detail of the MRA in terms of the Mining and Biodiversity Guidelines (2013)	
According to the mining and biodiversity guidelines the mining right area is currently situated within an area that is not ranked.	

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.

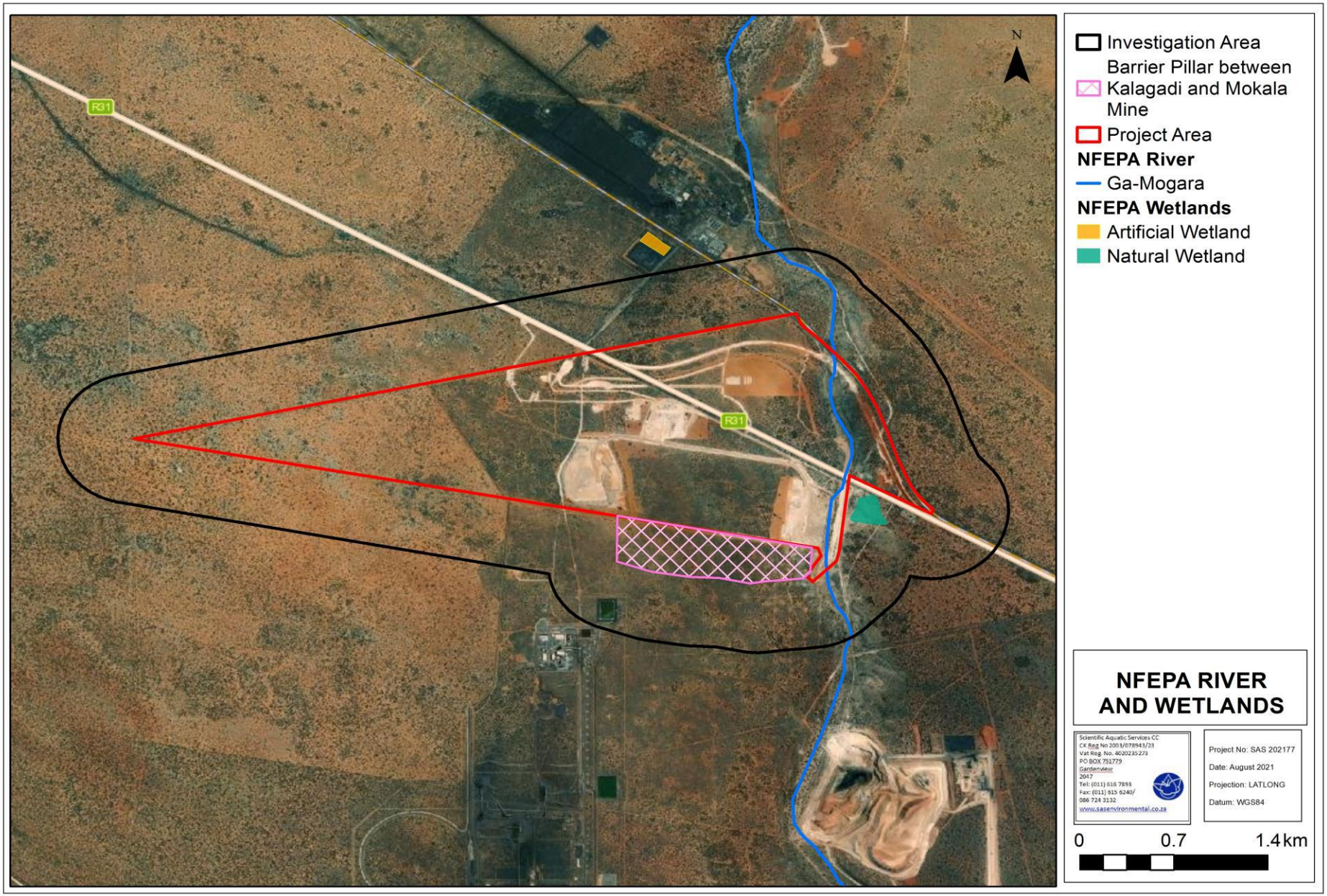


Figure 5: Rivers and wetlands associated with the project and investigation areas, according to the NFEPA Database (2011).

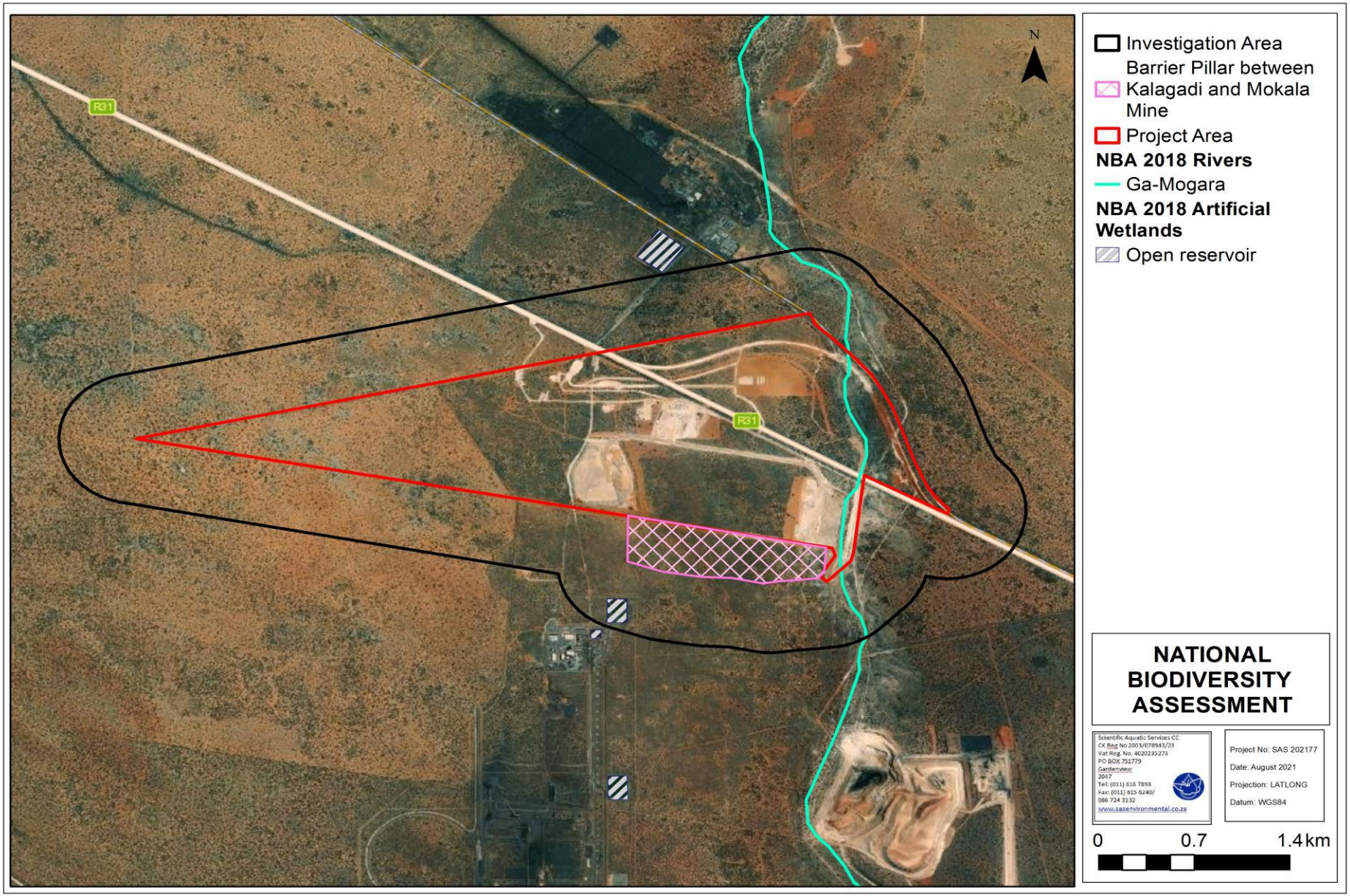


Figure 6: The watercourse (Ga-Mogara River) associated with the project area according to the National Biodiversity Assessment (2018).

Figure 7: Ecological Support Areas (ESAs) and Other Natural Areas (ONAs) associated with the project and investigation areas (NCCBA, 2016).

MAP OF RELATIVE AQUATIC BIODIVERSITY THEME SENSITIVITY

Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
			X

Sensitivity Features:

Sensitivity	Feature(s)
Low	Low sensitivity

Figure 8: Aquatic sensitivity of the project area according to the DEFF Screening Tool (2020).

4 RESULTS: WATERCOURSE ASSESSMENT

4.1 Delineation

During the site assessment undertaken in May 2021, a single watercourse, specifically the Ga-Mogara River, was identified within the eastern portion of the MRA, and delineated according to the method described by DWAF (2008).

Due to the episodic[4] characteristics of the Ga-Mogara River, the primary indicators utilised to delineate the riparian zone were topography and vegetation. Although there is little difference in the species composition of the vegetation assemblage comprising the riparian zone and adjacent terrestrial areas, noticeable differences in the levels of greening and structure of the two vegetation assemblages provided a distinct guide in limited sections of the river. However, it must be noted that the majority of the MRA has been transformed, in particular by vegetation losses due to historical and current mining related activities, in particular various road crossings. In areas where vegetation was sparse, use was made of historical digital satellite imagery to refine the delineation. The delineations as presented in this report are nevertheless regarded as a best estimate of the riparian zone boundaries based on the site conditions present at the time of the assessment undertaken in May 2021.

Soil morphological characteristics (such as mottling and gleying), which are typically associated with a fluctuating water table, were not found during the site assessment, nor was soil wetness considered a reliable indicator due to the naturally arid conditions of the region and exacerbated by several years of drought conditions in the area.

4.2 Drainage System Characterisation

The Ga-Mogara River, an episodic river system, is situated within the eastern portion of the MRA, draining in a northerly direction. Episodic systems generally only flow or flood once in several years in response to extreme rainfall events, usually within their catchment.

The MRA is located north, and therefore downstream of, the Anglo American-owned Sishen Iron Ore Mine. Sishen Mine started operations in 1953, and at that time it was assumed that little groundwater existed on the farm Sishen. Between the 1950's and mid-1970's

[4] Episodic streams are highly flashy systems that flow or flood only in response to extreme rainfall events, usually high in their catchments. May not flow in a five-year period or may flow only once in several years.

groundwater was abstracted sporadically from boreholes near the Ga-Mogara River for mining and processing purposes. For water supply for the town of Sishen, today known as Dingleton, water was abstracted from boreholes near the Ga-Mogara River and the Khai Appel area. In 1970s it was recognized that systematic dewatering needed to be done to secure safe mining conditions.

However, since 2000, complaints from landowners in the area were received by Sishen, with claims of lowered water levels and a subsequent decline in the yield of their boreholes over a prior number of years, indicating that dewatering of the Ga-Mogara River within the relevant geological compartment is likely to be occurring, impacting on the natural hydrological regime of the system downstream of the Sishen operations with the impact considered regional. Between 2002 and 2007, Kumba Iron Ore commissioned external consultants to conduct geohydrological studies, which confirmed that a number of private landowners to the south of Sishen Mine had indeed been affected. Following heavy rainfall during February 2006, landowners in the vicinity of Sishen Mine informed Kumba that the flow of the Ga-Mogara River had been interrupted, at a point on the Kumba property, which prevented further downstream flow. Investigations found that river-bed swallets (sinkholes) had formed, as a result of dewatering activities[5]. These swallets have subsequently intercepted surface flow, thus resulting in loss of recharge of the Ga-Mogara River downstream of Sishen Mine, which includes the portion of the river within the MRA. This has impacted negatively on the hydraulic regime and connectivity of the river downstream of the impact site. Nevertheless, following above-average rainfall in the region over December 2020 and January 2021, the Ga-Mogara River flowed, resulting in parts of the town of Deben (situated north of Sishen Mine) becoming flooded. These aspects are discussed in further detail in Section 4.3.

It should be further noted that although the watercourse extends beyond the MRA, only those portions located within the MRA were assessed and ground-truthed. Nevertheless, the potential impacts of activities within the greater catchment such as mining, agriculture, construction of infrastructure within and adjacent to the river (particularly river diversion structures upstream of the MRA), transformed vegetation assemblages, clearing of natural vegetation and erosion were taken into consideration during the assessment.

[5] http://www.overendstudio.co.za/online_reports/kumba_ar2011/sustainability/sus_environmental.php retrieved 11 January 2017.

The Ga-Mogara River (Figure 8) was classified according to the Classification System (outlined in Appendix C of this report) as an Inland System falling within the Southern Kalahari Aquatic Ecoregion, and within the Eastern Kalahari Bushveld Group 3 and Kalahari Dunveld Wetland Vegetation Types, both considered 'Least Threatened' according to SANBI (2012) and Mbona *et al* (2015). The table below presents the classification of the watercourse at Levels 3 and 4 of the Classification System (Ollis *et al,* 2013).

Table 2: Characterisation of the watercourse associated with the focus area, according to the Classification System (Ollis *et al*., 2013).

Watercourse	Level 3: Landscape unit	Level 4: Hydrogeomorphic Unit
Ga-Mogara River	**Valley floor:** The base of a valley, situated between two distinct valley side-slopes**.**	**River:** a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.

The locality and extent of the watercourse in relation to the study and investigation areas is depicted in the figure below.

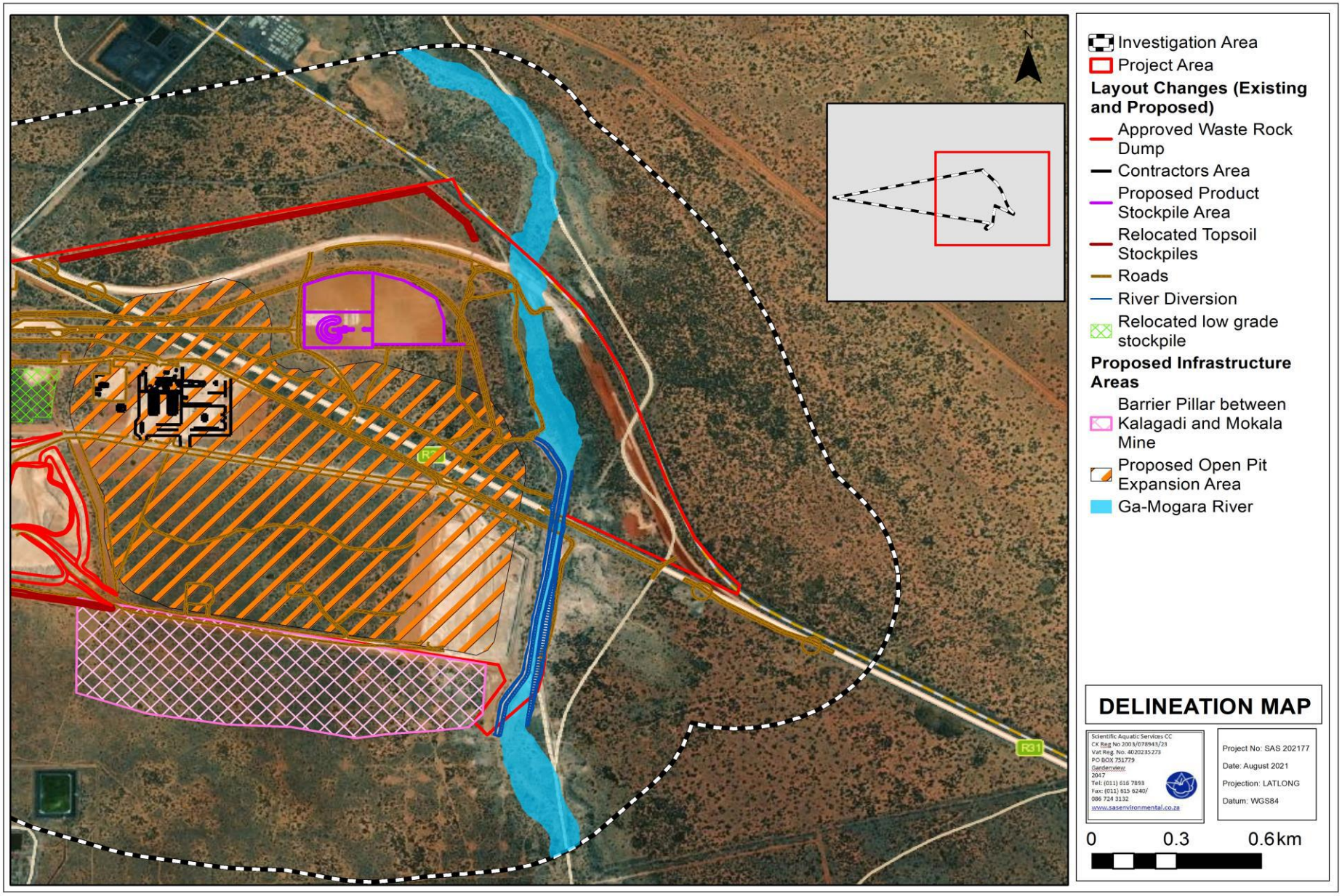


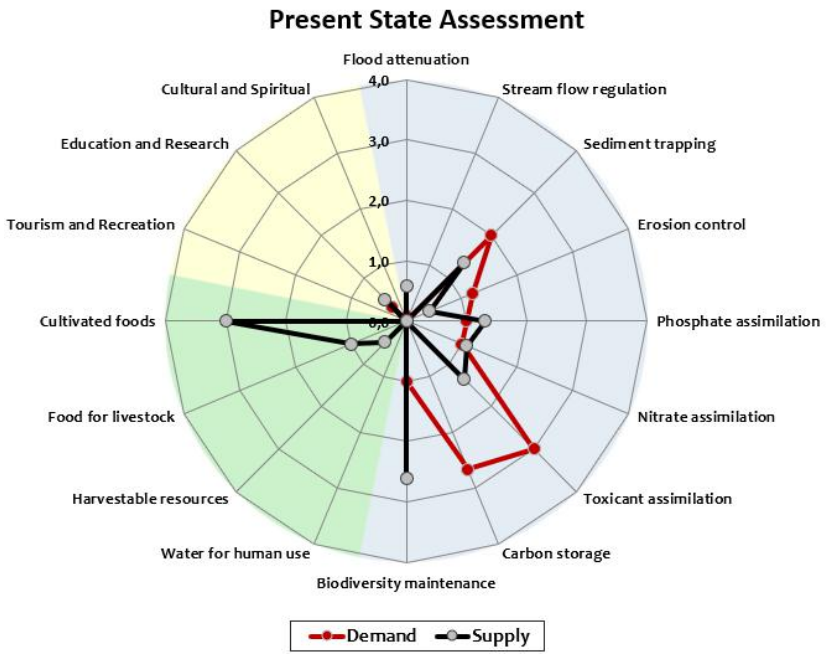
Figure 9: The reach of the Ga-Mogara River associated with the project and investigation areas.

4.3 Field Verification Results

The tables below summarise the findings of the field verification in terms of relevant aspects (hydrology, geomorphology and vegetation components) of freshwater ecology. The details pertaining to the method of assessment used to assess the watercourse are contained in Appendix C of this report. It should be noted that although water quality parameters are included in the method of assessment used, due to the episodic nature of the watercourse, testing of these parameters could not be undertaken. Given the surrounding land uses (predominantly agriculture though some mining occurs in the catchment) it is likely that when surface water is present, it is not likely to be impacted significantly by pollutants. Therefore, whilst the tables below include a discussion on water quality, information contained therein was based on information contained within available databases, as well as the anticipated impacts of the surrounding land uses within the catchment on water quality. The results of the assessments are presented in the table below.

Table 3: Summary of results of the assessment of the reach of the Ga-Mogara River within the MRA.

Ecological & socio-cultural service provision graph:



Photograph notes:	Representative photographs of the reach of the Ga-Mogara River associated with the MRA, illustrating the weakly-formed riparian zone.

PES discussion	**PES Category: B/C** **Instream IHI: B** **Riparian IHI: C** **VEGRAI: C** Major impacts to the reach of the Ga-Mogara River associated with the MRA include soil disturbances leading to the proliferation of alien invasive species, various road crossings including the bridge crossing of the re-aligned R380, a railway crossing and removal of riparian vegetation during construction and operations of the Mokala Mine.

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

The Ga-Mogara River is a highly episodic system, flowing sporadically only when large volumes of rainfall are received in the region. The river most recently flowed in January 2021, flooding the town of Deben situated approximately 45 km south of the MRA, but apparently not reaching Mokala, according to various mine personnel on neighbouring properties as well as residents of the town of Deben (*Pers. Comm.* July 2021). Although hydraulic connectivity and impacts to the reach of the river associated with the MRA are minimal, numerous upstream impacts have occurred, including various river diversions and most notably, the formation of swallets in the active channel south of the Sishen Mine operations (due to dewatering of the aquifer). The episodic nature of the river means that the severity of most impacts to the hydrology are likely to be relatively low, although the swallet formation has negatively affected recharge of the reaches downstream thereof. Whilst the increasing extent of mining operations in the catchment and the MRA may contribute to increased runoff entering the river, again, due to the semi-arid climate the risk of this occurring is reduced.

Ecoservice provision	**Moderately low to very low** Ecological service provision of the riparian zone associated with the assessed reach of the Ga-Mogara River is considered moderately low to very low, largely due to the absence of water. The semi-arid climate means that vegetation cover is rarely as extensive as it was at the time of assessment, leading to a reduction in the capacity of the riparian zone to effectively provide services such as flood attenuation, sediment trapping and nutrient and toxicant assimilation. Nevertheless, the contribution made by the system to those services should not be overlooked on a larger scale.	The MRA is largely characterised by relatively flat, uniform topography. Some bank incision was evident but was not considered to be extensive in extent nor severe. Geomorphological characteristics in the upstream reaches have been affected by various river diversions, and the diversion at Mokala (which had not been completed at the time of assessment) will contribute to the cumulative impact of the various diversions along the Ga-Mogara River. Surface water was absent at the time of assessment and therefore, water quality parameters could not be assessed. Nevertheless, with the exception of possible contamination originating from mining activities in the catchment, surface water when present may be impacted by large volumes of iron-rich sediment thus increasing turbidity, as seen in January 2021.
EIS discussion	**EIS Category: Moderate to low** The ecological importance and sensitivity of the Ga-Mogara River is deemed moderate to low, largely due to the combined taxon / species richness of both instream and riparian biota. Aspects such as habitat diversity, potential occurrence of populations of unique or threatened species and faunal utilisation of the riparian zone are only marginally important.	Habitat diversity is low, as the weakly formed riparian zone is mostly characterised by graminoid species and a few low shrubs, as well as the alien invasive *Prosopis sp.* Historical agricultural and mining-related activities encroaching on the riparian habitat have contributed to altered floral assemblages, leading to increased occurrence of alien and encroacher species. However, due to above-average rainfall received in the preceding rainy season, vegetation cover was good and likely provides suitable habitat for a number of small mammals and reptiles. Although the episodic nature of the river is a notable limiting factor for instream biota, e.g. banks of some less sensitive aquatic macroinvertebrates such as Nepidae (water scorpion) may be present, hatching out when sufficient rainfall is received. The proximity of mining activities is likely to deter more sensitive fauna from utilising the river as a migratory corridor, however it is nevertheless likely to provide some cover and foraging habitat.
REC, RMO and BAS Categories	**REC Category: B/C** **BAS Category: B** **RMO Category: Maintain** The Ga-Mogara River is under increasing pressure from expansion of mining activities in the catchment. It is imperative therefore that appropriate mitigation measures are implemented to avoid (preferable) or minimise perceived impacts which may arise as a result of the proposed Mokala expansion activities, to maintain the ecostatus of the reach of the Ga-Mogara River associated with the MRA.	**Business case, Impact Significance, Conclusion and Mitigation Requirements:** Most of the proposed expansion activities are planned to the west of the open pit (which will be expanded) and therefore the pit will intercept any potential impacts arising from activities such as the WRDs. Additionally, due to the semi-arid climate of the region, aspects such as the hydraulic regime of the river are unlikely to be significantly changed as a result of impacts such as increased stormwater runoff, simply due to the low rainfall volumes generally received in the area. The expansion of the pit, and construction of berms within 55 m of the diverted portion of the river pose the greatest potential risk to the river, and therefore strict mitigation will be required for those activities. Key mitigation measures include, but are not limited to: ➢ There should be no need for any personnel or equipment to enter the river; thus it is to be demarcated as a "no-go" zone and remain off-limits; ➢ Retention of as much indigenous vegetation as possible between the pit, berms and the river, which will assist in buffering the river from impacts such as sedimentation and erosion caused by surface water runoff; ➢ Construction and ongoing maintenance of sediment traps between the berms and the river, to aid in trapping sediment. These must be regularly inspected and accumulated sediment removed by hand when required; and ➢ Regular dust suppression of the haul road (and other internal roads) must be undertaken, using recycled water (not dirty water) to minimise sedimentation. In addition to the provided mitigation measures, it is strongly recommended that the proponent make provision for rehabilitation of affected areas (both due to the activities assessed in this report as well as due to historical and any future mining activities). A Landscaping and Plant Species Plan has been developed to aid in guiding future rehabilitation activities (SAS, 2021).
Extent of modification anticipated:	**Low**	The proposed expansion activities are largely situated further than 100 m from the Ga-Mogara River and are therefore unlikely to contribute to further modification of the river. The proposed mining of the barrier pillar within 25 m of the river, and the expansion of the open pit and construction of berms within 55 m of the river may impact indirectly on the river but are not likely to have a direct impact on ecological integrity and functionality.

4.4 Zones of Regulation Mapping

4.4.1 Legislative requirements and national guidelines pertaining to the application of buffer zones

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 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 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). Therefore, it is highly recommended that a specialist hydrologist be appointed (if a study has not already been undertaken) to determine the risk of contamination of groundwater which could in turn manifest as surface water impacts. Mitigation measures contained in such an assessment must then be implemented.

Legislative requirements were taken into consideration when determining a suitable buffer zone for the watercourse. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the watercourse can be summarised as follows:

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

Regulatory authorisation required	Zone of applicability
Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998).	**General 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 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 21c and 21i 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, as well as General Notice no. 509 of 2016 as it relates to the NWA.

Regulatory authorisation required	Zone of applicability
	Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) regarding the use of water for mining and related activities aimed at the protection of water resources. These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the National Water Act**,** 1998 (Act No. 36 of 1998) which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(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 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.
Listed activities in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) EIA Regulations (2014).	**Activity 12** of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act 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.*

The Ga-Mogara River and the applicable zones of regulation as summarised above are conceptually depicted in the figure below.

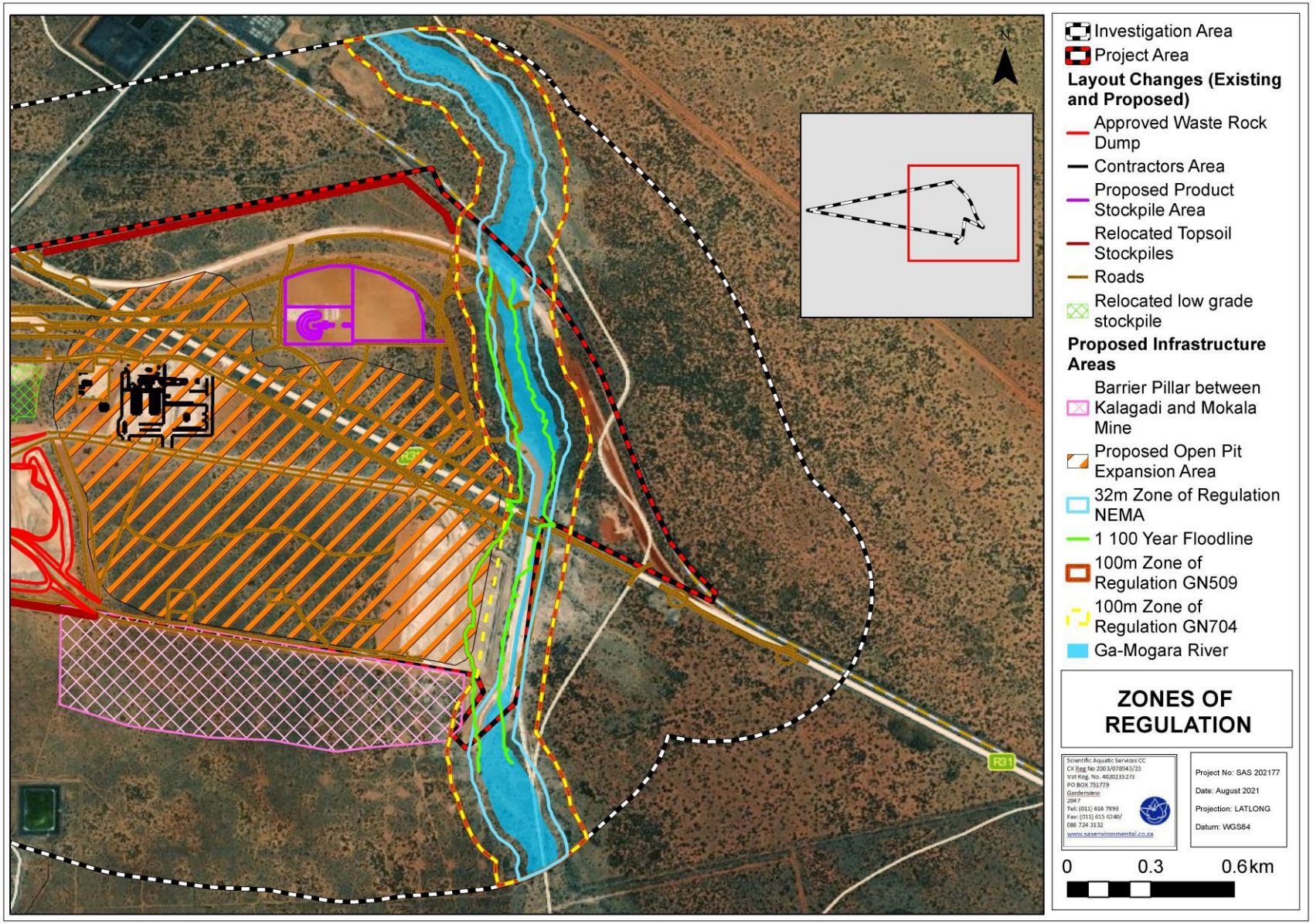


Figure 10: Conceptual presentation of the watercourse within the study and investigation areas and the applicable zones of regulation in terms of NEMA and GN509 (combined 1:100 year floodline and 100m) and GN704 of the NWA.

5 IMPACT AND RISK ASSESSMENTS

This section presents the significance of potential impacts on the ecology of the reach of the Ga-Mogara River associated with the proposed Mokala expansion activities. In addition, it indicates the required mitigatory measures needed to minimise the perceived impacts of the proposed activities 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 impact significances were determined using the method provided by the Environmental Assessment Practitioner (EAP) (SLR Consulting (Pty) Ltd) and the DWS Risk Assessment Matrix (2016).

The results of the SLR Consulting (South Africa) (Pty) Ltd Impact Assessment as presented here will be utilised in the Environmental Authorisation process, whilst the results of the DWS Risk Assessment Matrix will be utilised in the Water Use Licence (WUL) amendment in consultation with the relevant competent authority. Thus, although the two methods may present different scores for the same activity, this is due to differences in their methodologies (refer to Appendix D) and not due to inconsistencies in their application, and each will be judged individually for their specified purpose as discussed above.

5.1 Impact Analyses

5.1.1 Mitigation hierarchy and considerations given to application of mitigation measures

The impact and risk assessments were based on a description of the proposed expansion activities and the layout provided by the proponent (refer to Section 1.2). The points below summarise the considerations undertaken:

- The only activities which were assessed were the expansion of the open pit and barrier pillar mining between Mokala and Kagaladi mines, proposed berms situated between the extended pit and the river, the Plant Area, High Grade and ROM stockpiles and the internal haul road, all in the north-eastern portion of the project area. All other proposed activities are located to the west of the open cast pit which will intercept any potential impacts arising as a result of those activities;
- The DWS Risk Assessment Matrix was applied assuming that a high level of mitigation is implemented, thus the results of the DWS Risk Assessment as presented in this report are *post-mitigation*. The impact assessment was undertaken considering both pre- and post-mitigation scenarios, and is presented accordingly;

- In applying the impact and risk assessments, 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;
- The perceived impacts of the various activities on the watercourse ecology took into consideration the chronological order in which the activities will occur. Thus, for example, the impact intensity pertaining to habitat loss during the construction phase is considered “very high” (without mitigation) but is deemed “medium” in terms of the operational phase, as the habitat will have already been affected during construction; and
- The potential impact of possible changes to the baseflow of the Ga-Mogara River as a result of groundwater drawdown associated with the proposed expansion of the open pit was not assessed, as according to the Integrated Waste and Water Management Plan (IWWMP) compiled by SLR (2018), the groundwater study (SLR, 2015) did not identify an aquifer associated with the Ga-Mogara River. Thus, the baseflow of the Ga-Mogara River is very unlikely to be affected by the drawdown associated with the open pit.

Watercourse impact discussion

Four aspects of freshwater ecology are considered when assessing the impacts of the proposed mining related activities:

- Loss of habitat and ecological structure (including alien plant invasion);
- Changes to ecological and sociocultural service provision;
- Hydrological function and sediment balance; and
- Impacts on water quality (when surface water is present).

The assessed reach of the Ga-Mogara River is deemed of increased ecological integrity, and although capacity to provide specific ecological and socio-cultural services is restricted by the episodic nature of the system, it nevertheless forms part of the continuum of ecological processes within the focus area, immediate surrounds, and downstream areas.

Although the Ga-Mogara River is a highly episodic system, flowing once every few decades, riverine systems and particularly ephemeral / episodic riverine systems or river systems that have very low flows as part of their annual hydrological cycles are particularly susceptible to changes in habitat condition, and changing climatic conditions and rainfall patterns may result in changes to the hydraulic regime of the system. As experienced in January 2021, flooding of the Ga-Mogara River can have economically and ecologically devastating effects.

Thus, potential impacts on habitat and ecological structure, hydrological function, sediment balance and water quality were considered to have a 'high' intensity but are mostly site specific and therefore limited in extent, although the duration during construction particularly may be short but occur daily. Thus, for activities occurring within 60 m of the Ga-Mogara River (i.e., the mining of the barrier pillar, expansion of the open pit and the construction of berms between the pit and the diverted portion of the river), the pre-mitigation significance is 'medium' or 'high'. However, since none of these activities occur directly within the river and taking into consideration the episodic nature of the system, impact significance can be effectively and efficiently reduced with the implementation of mitigation measures, thus reducing the intensity, extent and consequence, leading to decreased impact significance. Activities such as blasting and initial overburden removal will occur within close proximity to the river but should not encroach directly on the system, and therefore the pre- and post-mitigation rating is 'medium'. A summary of the DWS Risk Assessment Matrix (2016) is presented in Table 6 below, whilst the results of the SLR impact assessment are provided in Table 7. The recommended mitigation measures are presented in Table 8. The following abbreviations were utilised when illustrating the various criteria (e.g. High Medium, Low) used when applying the SLR impact assessment method:

Table 5: List of Abbreviations used in the SLR impact assessment table (Table 7).

Abbreviation	Meaning
VH	Very High
H	High
M	Medium
L	Low
VL	Very Low

Table 6: Summary of the impact assessment conducted for the proposed mining expansion activities (in accordance with the DWS Assessment Matrix).

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	PES AND EIS OF WATERCOURSE
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)										
1	**Construction**	Site preparation prior to construction / upgrade of the internal haul road located approximately 140 m west of the Ga-Mogara River, including placement of contractor laydown areas and storage facilities if existing laydown facilities cannot be utilised for practical reasons.	*Vehicular transport and access to the site, site clearing; *Removal of vegetation and associated disturbances to soil *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff, erosion and transport of sediment in runoff or by wind, leading to increased sedimentation of the river; *Increased sedimentation of already transformed riparian habitat, leading to smothering of flora and of egg banks of macroinvertebrate taxa and potentially further altering surface water quality when present; *Decreased ecoservice provision; and *Further proliferation of alien vegetation as a result of disturbances.	**1**	**4**	**8**	**32**	**L**	Unlikely to be significantly changed.
2		Construction of proposed internal haul road	*Potential indiscriminate encroachment of the watercourse by personnel and construction vehicles; *Possible spills / leaks from construction vehicles; *Removal of topsoil and creation of soil stockpiles upgradient of the river; *Disturbances to soil leading to proliferation of alien vegetation which may spread to the river; and *Possible discard of construction material within the river.	*Disturbances of soil leading to increased alien vegetation proliferation, and in turn to further altered riparian habitat; *Possible contamination of freshwater soil and surface water, leading to reduced ability to support biodiversity; *Altered runoff patterns, leading to increased erosion and sedimentation of the instream and/or riparian habitat.	**1**	**4**	**8**	**32**	**L**	
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River										
3	**Construction**	Site preparation prior to construction of Plant Area, and various High Grade and ROM stockpiles	*Vehicular transport and access to the site, site clearing; *Removal of vegetation and associated disturbances to soil; *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff, erosion and transport of sediment in runoff or by wind, and thus increased sedimentation of the watercourse; *Increased sedimentation of already transformed riparian habitat, leading to smothering of flora and of egg banks of macroinvertebrate taxa and potentially further altering surface water quality when present; *Decreased ecoservice provision; and *Further proliferation of alien vegetation as a result of disturbances.	**1**	**4**	**4**	**16**	**L**	Unlikely to be significantly changed.

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	PES AND EIS OF WATERCOURSE
4		Removal of topsoil from Plant Area and stockpiles footprint and stockpiling thereof for rehabilitation.	Topsoil removal and creation of temporary stockpiles.	*Increased risk of transportation of sediment from exposed soil in stormwater runoff or by wing, leading to increased turbidity of surface water when present, sedimentation of watercourse and changing the characteristics of the stream bed, smothering of vegetation and/or altered vegetation composition, smothering of egg banks of macroinvertebrate taxa and/or destruction of suitable macro-invertebrate habitats; *Indirect impacts on riparian areas due to the disturbance of the activity, such as increased dust generation leading to smothering of riparian vegetation; *Exposure of soils, leading to increased runoff and erosion, and thus increased risk of sedimentation of the river; *Increased sedimentation of the river, leading to smothering of flora and egg banks of macro-invertebrates, and potentially altering surface water quality when present; *Increased hardened surfaces and compacted soils thus altering the pattern, timing and distribution of recharge of the river; and *Increased proliferation of alien vegetation as a result of disturbances.	1	4	4	16	L	
5		Clearing of vegetation upgradient of (but further than 500 m from the Ga-Mogara River) for construction of the Plant Area and establishment of the various ROM and High Grade stockpiles.	Establishment of laydown areas, site clearing, removal of vegetation and associated disturbances to soils.		1	4	4	16	L	
Perceived Impacts: Barrier pillar mining within 25 m, and expansion of open pit to within 55 m of diverted segment of Ga-Mogara River										
6	**Construction**	Site clearing prior to commencement of construction activities related to the open pit expansion area, including placement of contractor laydown areas and storage facilities.	*Vehicular movement and access to the site; and *Removal of vegetation (terrestrial and riparian) and associated disturbances (rubble and litter) to soil and potential indirect disturbances of the river.	*Damage to marginal and non-marginal vegetation, leading to exposure and compaction of soil, in turn leading to further increased runoff and erosion *Exposure of soil, leading to increased runoff from cleared areas and further erosion of the river, and thus increased potential for further sedimentation of the river;	1	4	8	32	L	Unlikely to be significantly changed.
7		Removal of topsoil from open pit footprint and stockpiling thereof for rehabilitation.	*Increased risk of transportation of sediment from exposed soil via wind or potentially in stormwater.	*Increased sedimentation of the river may lead to changes in instream habitat, potentially altered surface water quality when present and smothering of vegetation and/or altered vegetation composition; *Decreased ecoservice provision; *Further decreased ability to support biodiversity, specifically downstream of the MRA; and *Increased proliferation of alien vegetation as a result of disturbances.	1	4	8	32	L	
8		Potential indiscriminate disposal of hazardous and non-hazardous material and waste in the Ga-Mogara River.	*Altered surface water quality (when present); and *Possible changes to flow patterns as a result of blockages caused by solid waste/rubble.		1	4	10	40	L	
9		Surface impact during blasting and	*Contamination of river with chemicals		2	5	9	45	L	

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	PES AND EIS OF WATERCOURSE
		initial removal of overburden.	and hydrocarbons in runoff (decreased water quality); and *Increased sedimentation and erosion resulting from altered run-off patterns may have a negative impact on riparian and in-stream habitat and/or biota.							
Perceived Impacts: Construction of berms within 30 m of diverted segment of Ga-Mogara River										
10		Site preparation and construction of berms	*Clearing of vegetation and levelling of ground; *Establishment of berms between open pit and Ga-Mogara River	*Sediment-laden runoff entering riparian habitat from berms, leading to altered water quality when present; and *Altered drainage/flow regimes, leading to altered runoff patterns and formation of preferential flow paths, leading to erosion.	**1,25**	**4,25**	**6**	**25,5**	**L**	Unlikely to be significantly changed.
OPERATIONAL PHASE IMPACTS										
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)										
11	**Operational**	Discharge of water into the river when rainfall occurs	*Increased impermeable surface areas upgradient of the river, potentially resulting in increased runoff entering the river.	*Altered runoff patterns and increased water inputs to the riverine environment, resulting in altered flow regime, erosion and incision. *Altered flow regime may lead to possible impacts on vegetation (increased growth of riparian vegetation).	**1**	**3**	**4**	**12**	**L**	Unlikely to be significantly changed.
12		Regular vehicular traffic on internal access and haul roads upgradient of and within 140 m of the Ga-Mogara River	*Increased risk of sedimentation and/or hydrocarbons entering the river via stormwater runoff	*Altered water quality (when present) as a result of increased availability of pollutants	**1**	**3**	**4**	**12**	**L**	
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River										
13	**Operational**	Alteration of the local hydrological regime due to potentially poorly managed stormwater and increased extent of impermeable surfaces upgradient of but further than 500 m from the river.	*Altered drainage patterns, potentially leading to the formation of preferential flow paths and/or concentrated flows.	* Erosion of terrestrial areas as preferential flow paths are formed in the landscape, resulting in sedimentation of the river, leading to altered channel competency, altered vegetation community structures, and loss of riparian and terrestrial habitat.	**1**	**3**	**4**	**12**	**L**	Unlikely to be significantly changed.
14		Presence of clean and dirty separation infrastructure between the Plant Area and the Ga-Mogara River	*Loss of catchment yield due to stormwater containment	* Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river * Reduction in volume of water entering the river, leading to further loss of recharge of downstream system.	**1**	**4**	**4**	**16**	**L**	

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	PES AND EIS OF WATERCOURSE
Perceived Impacts: Barrier pillar mining within 25 m, and expansion of open pit to within 55 m of diverted segment of Ga-Mogara River										
15	Operational	Operation of expanded open pit within 55 m of diverted segment of Ga-Mogara River; mining of barrier pillar between Mokala and Kalagadi mines within 25 m of Ga-Mogara River.	*Removal of topsoil and overburden and stockpiling thereof; *Transport of manganese to High Grade stockpile and Plant Area	*Increased risk of pollution of surface water when present, which may affect the downstream reaches of the river, leading to impaired water quality and salination of soil within the river; *Increased risk of sediment transport via wind and/or surface runoff from the overburden stockpile into the river, potentially leading to altered water quality, further altered channel competency and further altered vegetation community composition; and *Increased risk of erosion, leading to further altered topography/geomorphology, in turn resulting in altered runoff patterns and formation of preferential flow paths.	1	4	6	24	L	Unlikely to be significantly changed.
16			*Blasting/mining activities in order to remove overburden and to extract the manganese; *Removal of manganese and overburden from the open cast pits.	*Nitrates from blasting leading to potential eutrophication of the receiving environment and resulting in impairment of water quality within the catchment.	2	5	7	35	L	
Perceived Impacts: Presence of berms within 30 m of diverted segment of Ga-Mogara River										
17	Operational	Presence of impeding feature (i.e. Berms) upgradient of the river.	*Potential loss of catchment yield; *Alterations to timing, movement and flow of water through the landscape; and *Increased risk of transport of sediment from exposed berms via wind or in runoff to the river.	*Sediment-laden runoff entering riparian habitat from berms, leading to altered water quality when present; *Altered drainage/flow regimes, leading to altered runoff patterns and formation of preferential flow paths, leading to erosion.	1	4	6	24	L	Unlikely to be significantly changed.

Table 7: Summary of the SLR Conuslting (South Africa) (Pty) Ltd Impact Assessment applied to the various proposed activities within 600 m of the Ga-Mogara River.

Project Phase	Activity	Aspect	Unmanaged						Managed					
			Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
CONSTRUCTION PHASE IMPACTS														
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)														
Construction	Site preparation prior to construction / upgrade of the internal haul road located approximately 140 m west of the Ga-Mogara River, including placement of contractor laydown areas and storage facilities if existing laydown facilities cannot be utilised for practical reasons.	Loss of watercourse habitat and ecological structure	VL	VL	VL	VL	VL	Negligible	VL	VL	VL	VL	VL	Negligible
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												
	Construction of proposed internal haul road	Loss of watercourse habitat and ecological structure	VL	VL	VL	VL	VL	Negligible	VL	VL	VL	VL	VL	Negligible
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River														
Construction	Site preparation prior to construction of Plant Area, and various High Grade and ROM stockpiles	Loss of watercourse habitat and ecological structure	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												
	Removal of topsoil from Plant Area and stockpiles footprint, and stockpiling thereof for rehabilitation.	Loss of watercourse habitat and ecological structure	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												

Project Phase	Activity	Aspect	Unmanaged						Managed					
			Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
	Clearing of vegetation upgradient of (but further than 500 m from the Ga-Mogara River) for construction of the Plant Area and establishment of the various ROM and High Grade stockpiles.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
Perceived Impacts: Expansion of open pit to within 55 m of diverted segment of Ga-Mogara River and mining of barrier pillar between Mokala and Kalagadi Mines within 25 m of Ga-Mogara River														
Construction	Site clearing prior to commencement of construction activities related to the open pit expansion area, including placement of contractor laydown areas and storage facilities, if existing facilities cannot be utilised for practical reasons.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
	Removal of topsoil from open pit footprint, and stockpiling thereof for rehabilitation.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
	Potential indiscriminate disposal of hazardous and non-hazardous material and waste in the Ga-Mogara River	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	H	VH	M	H	H	High	VL	VL	VL	VL	VL	Negligible
	Surface impact during blasting and initial removal of overburden.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	M	H	M	M	H	Medium	M	H	L	M	M	Medium

Project Phase	Activity	Aspect	Unmanaged						Managed					
			Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
Perceived Impacts: Construction of berms within 30 m of diverted segment of Ga-Mogara River														
Construction	Site preparation and construction of berms	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	H	M	VL	M	M	Medium	L	M	VL	L	L	Low
OPERATIONAL PHASE IMPACTS														
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)														
Operational	Discharge of water into the river when rainfall occurs	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	VL	VL	VL	VL	VL	Negligible	VL	VL	VL	VL	VL	Negligible
	Regular vehicular traffic on internal access and haul roads upgradient of and within 140 m of the Ga-Mogara River.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	VL	VL	VL	VL	VL	Negligible	VL	VL	VL	VL	VL	Negligible
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River														
Operational	Alteration of the local hydrological regime due to potentially poorly managed stormwater and increased extent of impermeable surfaces upgradient of but further than 500 m from the river.	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision Hydrological function and sediment balance Impacts on water quality	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low
	Presence of clean and dirty separation infrastructure between the Plant Area and the Ga-Mogara River	Loss of watercourse habitat and ecological structure Changes to ecological and sociocultural service provision	L	VL	VL	VL	L	Very Low	L	VL	VL	VL	L	Very Low

Project Phase	Activity	Aspect	Unmanaged						Managed					
			Intensity	Duration	Extent	Consequence	Probability	Significance	Intensity	Duration	Extent	Consequence	Probability	Significance
		Hydrological function and sediment balance												
		Impacts on water quality												
Perceived Impacts: Expansion of open pit to within 55 m of diverted segment of Ga-Mogara River and mining of barrier pillar between Mokala and Kalagadi Mines within 25 m of Ga-Mogara River														
Operational	Operation of expanded open pit within 55 m of diverted segment of Ga-Mogara River: • Removal of topsoil and overburden and stockpiling thereof; • Transport of manganese to High Grade stockpile and Plant Area • Blasting/mining activities in order to remove overburden and to extract the manganese; • Removal of manganese and overburden from the open cast pits.	Loss of watercourse habitat and ecological structure	H	H	M	H	H	High	H	H	L	H	M	Medium
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												
		Loss of watercourse habitat and ecological structure												
Perceived Impacts: Presence of berms within 30 m of diverted segment of Ga-Mogara River														
Operational	Presence of impeding feature (i.e. berms) upgradient of the river.	Loss of watercourse habitat and ecological structure	H	M	VL	M	M	Medium	L	M	VL	L	L	Low
		Changes to ecological and sociocultural service provision												
		Hydrological function and sediment balance												
		Impacts on water quality												

5.2 Mitigation measures applicable to the assessed activities and associated aspects and impacts.

The table below presents the key mitigation measures applicable to the assessed activities. Although aspects and impacts such as potential loss of catchment yield and changes to the hydraulic regime were considered, due to the semi-arid climate of the region, it is highly unlikely that any notable loss of catchment yield, or changes to the hydraulic regime of the Ga-Mogara River will occur as a result of the proposed activities and thus mitigation measures have not been provided.

Table 8: Mitigation measures applicable to the assessed activities and associated aspects and impacts.

No.	Phases	Activity	Aspect	Impact	Mitigation measures
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)					
1	Construction	Site preparation prior to construction / upgrade of roadway, including placement of contractor laydown areas and storage facilities.	*Vehicular transport and access to the site, site clearing; *Removal of vegetation and associated disturbances to soil; and *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff, erosion and transport of sediment in runoff or by wind, leading to increased sedimentation of the watercourse; *Increased sedimentation of already transformed riparian habitat, leading to smothering of flora and of egg banks of macroinvertebrate taxa and potentially further altering surface water quality when present; *Decreased ecoservice provision; and *Further proliferation of alien vegetation as a result of disturbances.	*There should be no need for any personnel or construction equipment to enter the delineated river or associated setback area, as the internal haul road is planned approximately 100 m from the river. Therefore, the river must be demarcated as a 'no go' area; *No construction material or waste matter is to be discarded or disposed of within the river; *Contractor laydown areas, vehicle re-fuelling areas and material storage facilities to remain outside of the delineated river and applicable setback area; *Vehicle refuelling is to take place on sealed surfaces, and all spills are to be cleaned and treated in accordance with an approved emergency spills plan' *Construction of a temporary sediment trap downgradient of the haul road construction area is strongly recommended, to minimise the volume of sediment reaching the river; *Construction footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential; *Vegetation removal to be kept to a minimum, and preferably only alien floral species to be removed; and *Retain as much indigenous vegetation as possible.
2		Construction of proposed internal haul road	*Potential indiscriminate encroachment of the watercourse by personnel and construction vehicles; *Possible spills / leaks from construction vehicles; *Removal of topsoil and creation of soil stockpiles upgradient of the river; *Disturbances to soil leading to proliferation of alien vegetation which may spread to the river; and *Possible discard of construction material within the watercourse	*Disturbances of soil leading to increased alien vegetation proliferation, and in turn to further altered riparian habitat; *Possible contamination of freshwater soil and surface water, leading to reduced ability to support biodiversity; *Altered runoff patterns, leading to increased erosion and sedimentation of the instream and/or riparian habitat.	

No.	Phases	Activity	Aspect	Impact	Mitigation measures
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River					
3	**Construction**	Site preparation prior to construction of Plant Area, and various High Grade and ROM stockpiles	*Vehicular transport and access to the site, site clearing; *Removal of vegetation and associated disturbances to soils; *Miscellaneous activities by construction personnel.	*Exposure of soil, leading to increased runoff, erosion and transport of sediment in runoff or by wind, and thus increased sedimentation of the watercourse; *Increased sedimentation of already transformed riparian habitat, leading to smothering of flora and of egg banks of macroinvertebrate taxa and potentially further altering surface water quality when present; *Decreased ecoservice provision; and *Further proliferation of alien vegetation as a result of disturbances.	As per Activity 1.
4		Removal of topsoil from Plant Area and stockpiles footprint and stockpiling thereof for rehabilitation.	Topsoil removal and creation of temporary stockpiles.	* Increased risk of transportation of sediment from exposed soil in stormwater runoff or by wind, leading to increased turbidity of surface water when present, sedimentation of watercourse and changing the characteristics of the stream bed, smothering of vegetation and/or altered vegetation composition, smothering of egg banks of macroinvertebrate taxa and/or destruction of suitable macro-invertebrate habitats; * Indirect impacts on riparian areas due to the disturbance of the activity, such as increased dust generation leading to smothering of riparian vegetation; * Exposure of soils, leading to increased runoff and erosion, and thus increased risk of sedimentation of the river; * Increased sedimentation of the river, leading to smothering of flora and egg banks of macro-invertebrates, and potentially altering surface water quality when present; * Increased hardened surfaces and compacted soils thus altering the pattern, timing and distribution of recharge of the river; and * Increased proliferation of alien vegetation as a result of disturbances.	*The footprint area of the construction activity must be limited to what is absolutely essential in order to minimise the loss of clean water runoff areas and catchment yield, and concomitant recharge of the Ga-Mogara River; *Prior to bulk earthworks either the existing clean and dirty water management system must be extended or, construction of new clean and dirty water management systems around the Plant must be prioritised for construction prior to commencing all other construction activities, to ensure that all “dirty water” areas can be managed as they are created; *Design of the Plant, High Grade and ROM stockpiles must be environmentally and structurally sound and all possible precautions taken to prevent contamination of surface water.
5		Clearing of vegetation upgradient of (but further than 500 m from the Ga-Mogara River) for construction of the Plant Area and establishment of the various ROM and High Grade stockpiles.	Establishment of laydown areas, site clearing, removal of vegetation and associated disturbances to soils.		*Limit the footprint of vegetation clearing to what is absolutely essential, retaining as much indigenous vegetation as possible; *Rehabilitation and revegetation of disturbed areas (as a result of construction) must take place immediately after construction; and *If an alien vegetation control plan has been developed for the mine, this must be implemented at this site. Alternatively, a suitable alien vegetation control plan must be developed by a suitably qualified specialist and implemented as soon as possible

No.	Phases	Activity	Aspect	Impact	Mitigation measures
Perceived Impacts: Expansion of open pit to within 55 m of diverted segment of Ga-Mogara River and mining of barrier pillar between Mokala and Kalagadi Mines within 25 m of Ga-Mogara River					
6	**Construction**	Site clearing prior to commencement of construction activities related to the open pit expansion area, including placement of contractor laydown areas and storage facilities.	*Vehicular movement and access to the site; and *Removal of vegetation (terrestrial and riparian) and associated disturbances (rubble and litter) to soil and potential indirect disturbances of the river.	*Damage to marginal and non-marginal vegetation, leading to exposure and compaction of soil, in turn leading to further increased runoff and erosion; *Exposure of soil, leading to increased runoff from cleared areas and further erosion of the river, and thus increased potential for further sedimentation of the river; *Increased sedimentation of the river may lead to changes in instream habitat, potentially altered surface water quality when present and smothering of vegetation and/or altered vegetation composition; *Decreased ecoservice provision; *Further decreased ability to support biodiversity, specifically downstream of the MRA; and *Increased proliferation of alien vegetation as a result of disturbances.	*Contractor laydown areas, and material storage facilities to remain outside of the delineated river and its 32m NEMA zone of regulation beyond the extent of the planned pit expansion; *All vehicle re-fuelling is to take place outside of the river and its 32m NEMA zone of regulation; *All clean and dirty water separation areas are to be developed first prior to any other major earthworks to reduce risk of erosion and sedimentation; *All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is absolutely essential; *Retain as much indigenous wetland and riparian vegetation as possible; *It should be feasible to utilise existing roads to gain access to the site, and crossing the river in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles; *Areas where bank failure is observed as a result of such river crossings should be immediately repaired; and *The watercourse areas beyond the proposed footprint of development and the NEMA zone of regulation (32m) should be clearly demarcated with danger tape and areas in which no activities are proposed should be marked as a no-go areas.
7		Removal of topsoil from open pit footprint and stockpiling thereof for rehabilitation.	*Increased risk of transportation of sediment from exposed soil via wind or potentially in stormwater.		
8		Potential indiscriminate disposal of hazardous and non-hazardous material and waste in the Ga-Mogara River.	*Altered surface water quality (when present); and *Possible changes to flow patterns as a result of blockages caused by solid waste/rubble.		
9		Surface impact during blasting and initial removal of overburden.	*Contamination of river with chemicals and hydrocarbons in runoff (decreased water quality); and *Increased sedimentation and erosion resulting from altered run-off patterns may have a negative impact on riparian and in-stream habitat and/or biota.		*During construction, the topsoil should be removed up to a depth of 150mm and be carefully stockpiled, for use during rehabilitation, outside of the river and its 32m NEMA Zone of Regulation; *Excavated materials should not be contaminated and it should be ensured that the minimum surface area is taken up. The stockpiles may not exceed 2m in height; *All exposed soils must be protected for the duration of the construction phase in order to prevent erosion and further sedimentation of the reach of the river proximal to these stockpiles.

No.	Phases	Activity	Aspect	Impact	Mitigation measures
Perceived Impacts: Construction of berms within 30 m of diverted segment of Ga-Mogara River					
10		Site preparation and construction of berms	*Clearing of vegetation and levelling of ground; *Establishment of berms between open pit and Ga-Mogara River.	*Sediment-laden runoff entering riparian habitat from berms, leading to altered water quality when present; and *Altered drainage/flow regimes, leading to altered runoff patterns and formation of preferential flow paths, leading to erosion.	*Construction of sediment traps downgradient of the berms (i.e. between the berms and the river) are strongly recommended prior to construction of the berms, to minimise sediment volumes entering the river. These must be regularly inspected and accumulated sediment removed by hand when required.
OPERATIONAL PHASE IMPACTS					
Perceived Impacts: Internal Haul Road (approximately 140 m west of the Ga-Mogara River)					
11	**Operations**	Discharge of water into the river when rainfall occurs	*Increased impermeable surface areas upgradient of the river, potentially resulting in increased runoff entering the river.	*Altered runoff patterns and increased water inputs to the riverine environment, resulting in altered flow regime, erosion and incision; *Altered flow regime may lead to possible impacts on vegetation (increased growth of riparian vegetation).	*The design criteria of stormwater management structures are important to mitigate the operational impacts of the release of stormwater into the river when rainfall occurs, *Regular inspection of the stormwater outlet structures should be undertaken in order to monitor the occurrence of erosion. If erosion has occurred, it should immediately be rehabilitated through stabilisation of the embankments and revegetation; *Only indigenous vegetation species may be used as part of the rehabilitation process and invasive plant species should be eradicated.
12		Regular vehicular traffic upgradient of and within 150 m of the Ga-Mogara River	*Increased risk of sedimentation and/or hydrocarbons entering the river via stormwater runoff	*Altered water quality (when present) as a result of increased availability of pollutants.	*Regular dust suppression of the haul road (and other internal roads) must be undertaken, using recycled water (not dirty water) to minimise sedimentation.
Perceived impacts: Plant Area, High Grade and Run of Mine (ROM) Stockpiles approximately 575 m from and upgradient of the Ga-Mogara River					
13	**Operations**	Alteration of the local hydrological regime due to potentially poorly managed stormwater and increased extent of impermeable surfaces upgradient of but further than 500 m from the river.	*Altered drainage patterns, potentially leading to the formation of preferential flow paths and/or concentrated flows.	* Erosion of terrestrial areas as preferential flow paths are formed in the landscape, resulting in sedimentation of the river, leading to altered channel competency, altered vegetation community structures, and loss of riparian and terrestrial habitat.	Significant alterations to the local hydrological regime are not expected due to the semi-arid climate and intermittent rainfall patterns in the region. Nevertheless, all areas must be monitored for erosion, which must be managed and rectified according to existing soil management commitments should it occur.
14		Presence of clean and dirty separation infrastructure between the Plant Area and the Ga-Mogara River	*Loss of catchment yield due to stormwater containment	* Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river; * Reduction in volume of water entering the watercourse, leading to further loss of recharge of downstream system.	

No.	Phases	Activity	Aspect	Impact	Mitigation measures
Perceived Impacts: Expansion of open pit to within 55 m of diverted segment of Ga-Mogara River and mining of barrier pillar between Mokala and Kalagadi Mines within 25 m of Ga-Mogara River					
15	**Operations**	Operation of expanded open pit within 55 m of diverted segment of Ga-Mogara River	*Removal of topsoil and overburden and stockpiling thereof; *Transport of manganese to High Grade stockpile and Plant Area	*Increased risk of pollution of surface water when present, which may affect the downstream reaches of the river, leading to impaired water quality and salination of soil within the river; *Increased risk of sediment transport via wind and/or surface runoff from the overburden stockpile into the river, potentially leading to altered water quality, further altered channel competency and further altered vegetation community composition; and *Increased risk of erosion, leading to further altered topography/geomorphology, in turn resulting in altered runoff patterns and formation of preferential flow paths.	*Pollution prevention through appropriate management and monitoring of pollution prevention systems, with specific mention of the management of clean and dirty water separation systems, in order to prevent, eliminate and/or control potential pollution of soils, groundwater and surface water must be implemented; *Implement a monitoring programme to detect and prevent the pollution of soils, surface water and groundwater; and *Regular dust suppression of all internal transport routes must be undertaken, using recycled water (not dirty water) to minimise sedimentation.
16			*Blasting/mining activities in order to remove overburden and to extract the manganese; *Removal of manganese and overburden from the open cast pits.	*Nitrates from blasting leading to potential eutrophication of the receiving environment and resulting in impairment of water quality within the catchment.	*Reduce airborne dust during blasting activities through damping dust generation areas with water (although not in sufficient quantities to generate runoff).
Perceived Impacts: Presence of berms within 30 m of diverted segment of Ga-Mogara River					
17	**Operations**	Presence of impeding feature (i.e. Berms) upgradient of the river.	*Potential loss of catchment yield; *Alterations to timing, movement and flow of water through the landscape; and Increased risk of transport of sediment from exposed berms via wind or in runoff to the river.	*Sediment-laden runoff entering riparian habitat from berms, leading to altered water quality when present; *Altered drainage/flow regimes, leading to altered runoff patterns and formation of preferential flow paths, leading to erosion.	*Retain sediment traps downgradient of the berms, and continue with regular inspection and removal of accumulated sediment as necessary.

5.3 Cumulative Impact Statement

Cumulative impacts are activities and their associated impacts on the past, present and foreseeable future, both spatially and temporally, considered together with the impacts identified above.

The assessed reach of the Ga-Mogara River associated with the Mokala Mine has already been influenced by impacts which have occurred upstream of the mine, including the formation of swallets (refer to Section 4.2), upstream river diversion structures and encroachment of various mining activities on portions of the river. These impacts have most likely had an effect on the ecological functioning of downstream reaches, and the proposed and existing activities at Mokala Mine are likely to contribute to further impacts downstream of the mine.

6 CONCLUSION

The results of the ecological assessment indicate that the assessed reach of the Ga-Mogara River is in a largely natural ecological state (PES category B/C) although the riparian zone has been impacted in places by loss of, or transformation of the vegetation assemblage. Erosion was also observed in portions of the active channel, and this was attributed to the various anthropogenic activities in the area, mostly mining-related. Although the Ga-Mogara River is an episodic system and is therefore not necessarily a valuable resource from an anthropocentric perspective, it forms a crucial component of the overall ecology of the area, being a key contributor to biodiversity maintenance as well as providing valuable breeding and foraging habitat and connectivity to surrounding natural areas.

Although surface flow in the river occurs sporadically (every few decades), changing climate patterns (including rainfall patterns) may change the frequency of flow periods. The devastating impact of the flooding which occurred in January 2021 (albeit mostly localised around the town of Deben, upstream of Mokala Mine) speaks to the importance of maintaining hydraulic connectivity and ensuring that potential impacts to water quality are minimised. Thus, whilst the likelihood of impacts on aspects such as hydrological patterns and water quality arising from the proposed expansion activities may be low, the impact significance may potentially be ‘high’ in the event that such a flood event occurs during the ongoing mining activities. The impact significance presented in this report is lowered due to the anticipated probability, duration and limited footprint of the proposed activities, although

in the event of flooding, the impacts may extend beyond the project footprint and have a residual effect.

The risk of an extreme flood event aside, activities adjacent to or within the Ga-Mogara River and associated riparian zone will nevertheless lead to loss of, or changes to, the watercourse habitat, ecological structure, and the associated ability of the system to provide various ecological and socio-cultural benefits.

Based on the findings of this study, it is the opinion of the freshwater specialists that the project is regarded as having potentially medium to high impact significance *without* mitigation, although the results of the impact and risk assessments indicate that the post-mitigation impact significance is of medium to low levels. With suitable management and strict implementation of mitigation measures, impact significance can be adequately reduced. It is imperative, however, that mitigation measures are implemented throughout the life of the project in order to ensure that not only are direct impacts prevented/minimised, but that further cumulative impacts on the larger drainage network are also prevented. Provided that the mitigation measures supplied in this report are implemented in conjunction with existing commitments in relation to the R380 road realignment and the river diversion, as well as those those stipulated by other specialists in relation to the proposed activities, specifically the geohydrological specialist, impact significance may be reduced. Taking the above into account, it is therefore the opinion of the specialist that consideration of the value of this landscape must be considered from a freshwater and terrestrial biodiversity resource management point of view and juxtaposed with the responsibility to comply with Regulation 23 of the Mining and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) pertaining to the optimisation of the Mining Right as well as the socio-economic and socio-cultural impact the project will have, and the decision should be made and aligned with the principles of sustainable development and Integrated Environmental Management.

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APPENDIX A – Indemnity and Terms of Use

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APPENDIX B - Legislation

LEGISLATIVE REQUIREMENTS

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.
Government Notice 704 Regulations as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	These Regulations were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the proposed project complies with Regulation GN 704 of the NWA which contains regulations on the use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may:* *(b) 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 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.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA)	The obtaining of a New Order Mining Right (NOMR) is governed by the MPRDA. The MPRDA requires the applicant to apply to the DMR for a NOMR which triggers a process of compliance with the various applicable sections of the MPRDA. The NOMR process requires environmental authorisation in terms of the MPRDA Regulations and specifically requires the preparation of a Scoping Report, an EIA, an Environmental Management Programme (EMP), and a Public Participation Process (PPP).

APPENDIX C – Method of Assessment

WATERCOURSE ASSESSMENT APPROACH

1. Literature Review

A desktop study was compiled with all relevant information as presented by the South African National Biodiversity Institutes (SANBI's) Biodiversity Geographic Information Systems (BGIS) website (http://bgis.sanbi.org). Wetland specific information resources taken into consideration during the desktop assessment of the subject property included:

- National Freshwater Ecosystem Priority Areas (NFEPAs, 2011)
  - NFEPA water management area (WMA)
  - FEPA (sub)WMA % area
  - Sub water catchment area FEPAs
  - Water management area FEPAs
  - Fish sanctuaries
  - Wetland ecosystem types
- Limpopo Conservation Plan V2, 2013
- Mining and Biodiversity Guidelines, 2013.

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), Department of Water Affairs (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 resources present within the subject property.

2. Classification System for Wetlands and other Aquatic Ecosystems in South Africa (2013)

All wetland or riparian resources encountered within the focus area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems, hereafter referred to as the "Classification System" (Ollis *et. al*., 2013). A summary on Levels 1 to 4 of the classification system are presented in the tables below.

Table C1: Classification System for Inland Systems, up to Level 3.

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

Table C2: Hydrogeomorphic (HGM) Units 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**[6] (i.e. characterised by the complete absence of marine exchange and/or tidal influence) but **which are inundated or saturated with water, either permanently or periodically.** It is important to bear in mind, however, that certain Inland Systems may have had a historical connection to the ocean, which in some cases may have been relatively recent.

Level 2: Ecoregions & NFEPA Wetland Vegetation Groups
For Inland Systems, the regional spatial framework that has been included in Level 2 of the classification system is that of the 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) groups' 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 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

[6] 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.

- **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. Watercourse Function Assessment

“The importance of a water resource, in ecological social or economic terms, acts as a modifying or motivating determinant in the selection of the management class”.[7] The assessment of the ecosystem services supplied by the identified freshwater features was conducted according to the guidelines as described by Kotze *et al.* (2020). An assessment was undertaken that examines and rates 16 different ecosystem services, selected for their specific relevance to the South African situation, as follows:

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

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

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

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.

4. Index of 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 C3 below.

5. 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. Aquatic Ecological Importance and Sensitivity (EIS) Method of assessment (DWAF, 1999)

The EIS method considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table C10). The median of the resultant score is calculated to derive the EIS category (Table C11).

Table C6: Definition of the four-point scale used to assess biotic and habitat determinants presumed to indicate either importance or sensitivity

Four point scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table C7: Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General Description	Range of median
Very high	Quaternaries/delineations that are considered to be unique on a national and international level based on unique biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations that are considered to be unique on a national scale based on their biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3

Moderate	Quaternaries/delineations that are considered to be unique on a provincial or local scale due to biodiversity (habitat diversity, species diversity, unique species, rare and endangered species). These rivers (in terms of biota and habitat) are not usually very sensitive to flow modifications and often have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers (in terms of biota and habitat) are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

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

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

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

Table C8: 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 Maintain	A Maintain	A Maintain	A Maintain
	B	Natural	A Improve	A/B Improve	B Maintain	B Maintain
	C	Good	A Improve	B/C Improve	C Maintain	C Maintain
	D	Fair	C Improve	C/D Improve	D Maintain	D Maintain
	E/F	Poor	D* Improve	E/F* Improve	E/F* Maintain	E/F* Maintain

***PES Categories E and F are considered ecologically unacceptable (Malan and Day, 2012) and therefore, should a freshwater resource fall into one of these PES categories, a 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 freshwater resource.

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

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

7. Watercourse Delineation

The freshwater resource delineation took place according to the method presented in the “Updated manual for the identification and delineation of wetland and riparian resources” published by DWAF in 2008. The foundation of the method is based on the fact that wetlands and riparian zones have several distinguishing factors including the following:

- The presence of water at or near the ground surface;
- Distinctive hydromorphic soils;
- Vegetation adapted to saturated soils; and
- The presence of alluvial soils in stream systems.

According to the DWA (2005) like wetlands, riparian areas have their own unique set of indicators. It is possible to delineate riparian areas by checking for the presence of these indicators. Some areas may display both wetland and riparian indicators, and can accordingly be classified as both. If you are adjacent to a watercourse, it is important to check for the presence of the riparian indicators described below, in addition to checking for wetland indicators, to detect riparian areas that do not qualify as wetlands. The delineation process requires that the following be taken into account:

- topography associated with the watercourse;
- vegetation; and
- alluvial soils and deposited material.

By observing the evidence of these features in the form of indicators, wetlands and riparian zones can be delineated and identified. If the use of these indicators and the interpretation of the findings are applied correctly, then the resulting delineation can be considered accurate (DWA, 2005).

APPENDIX D – Impact Assessment Methodology

PART A: DEFINITIONS AND CRITERIA*		
Definition of SIGNIFICANCE		**Significance = consequence x probability**
Definition of CONSEQUENCE		**Consequence is a function of intensity, spatial extent and duration**
Criteria for ranking of the ITY of environmental s	**VH**	Severe change, disturbance or degradation. Associated with severe consequences. May result in severe illness, injury or death. Targets, limits and thresholds of concern continually exceeded. Substantial intervention will be required. Vigorous/widespread community mobilization against project can be expected. May result in legal action if impact occurs.
	H	Prominent change, disturbance or degradation. Associated with real and substantial consequences. May result in illness or injury. Targets, limits and thresholds of concern regularly exceeded. Will definitely require intervention. Threats of community action. Regular complaints can be expected when the impact takes place.
	M	Moderate change, disturbance or discomfort. Associated with real but not substantial consequences. Targets, limits and thresholds of concern may occasionally be exceeded. Likely to require some intervention. Occasional complaints can be expected.
	L	Minor (Slight) change, disturbance or nuisance. Associated with minor consequences or deterioration. Targets, limits and thresholds of concern rarely exceeded. Require only minor interventions or clean-up actions. Sporadic complaints could be expected.
	VL	Negligible change, disturbance or nuisance. Associated with very minor consequences or deterioration. Targets, limits and thresholds of concern never exceeded. No interventions or clean-up actions required. No complaints anticipated.
	VL+	Negligible change or improvement. Almost no benefits. Change not measurable/will remain in the current range.
	L+	Minor change or improvement. Minor benefits. Change not measurable/will remain in the current range. Few people will experience benefits.
	M+	Moderate change or improvement. Real but not substantial benefits. Will be within or marginally better than the current conditions. Small number of people will experience benefits.
	H+	Prominent change or improvement. Real and substantial benefits. Will be better than current conditions. Many people will experience benefits. General community support.
	VH+	Substantial, large-scale change or improvement. Considerable and widespread benefit. Will be much better than the current conditions. Favourable publicity and/or widespread support expected.
Criteria for ranking the DURATION of impacts	**VL**	Very short, always less than a year. Quickly reversible
	L	Short-term, occurs for more than 1 but less than 5 years. Reversible over time.
	M	Medium-term, 5 to 10 years.
	H	Long term, between 10 and 20 years. (Likely to cease at the end of the operational life of the activity)
	VH	Very long, permanent, +20 years (Irreversible. Beyond closure)
Criteria for ranking the EXTENT of impacts	**VL**	A part of the site/property.
	L	Whole site.
	M	Beyond the site boundary, affecting immediate neighbours
	H	Local area, extending far beyond site boundary.
	VH	Regional/National

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PART B: DETERMINING CONSEQUENCE							
			EXTENT				
			A part of the site/property	Whole site	Beyond the site, affecting neighbours	Local area, extending far beyond site.	Regional/ National
			VL	L	M	H	VH
INTENSITY = VL							
DURATION	Very long	VH	Low	Low	Medium	Medium	High
	Long term	H	Low	Low	Low	Medium	Medium
	Medium term	M	Very Low	Low	Low	Low	Medium
	Short term	L	Very low	Very Low	Low	Low	Low
	Very short	VL	Very low	Very Low	Very Low	Low	Low
INTENSITY = L							
DURATION	Very long	VH	Medium	Medium	Medium	High	High
	Long term	H	Low	Medium	Medium	Medium	High
	Medium term	M	Low	Low	Medium	Medium	Medium
	Short term	L	Low	Low	Low	Medium	Medium
	Very short	VL	Very low	Low	Low	Low	Medium
INTENSITY = M							
DURATION	Very long	VH	Medium	High	High	High	Very High
	Long term	H	Medium	Medium	Medium	High	High
	Medium term	M	Medium	Medium	Medium	High	High
	Short term	L	Low	Medium	Medium	Medium	High
	Very short	VL	Low	Low	Low	Medium	Medium
INTENSITY = H							
DURATION	Very long	VH	High	High	High	Very High	Very High
	Long term	H	Medium	High	High	High	Very High
	Medium term	M	Medium	Medium	High	High	High
	Short term	L	Medium	Medium	Medium	High	High
	Very short	VL	Low	Medium	Medium	Medium	High
INTENSITY = VH							
DURATION	Very long	VH	High	High	Very High	Very High	Very High
	Long term	H	High	High	High	Very High	Very High
	Medium term	M	Medium	High	High	High	Very High
	Short term	L	Medium	Medium	High	High	High
	Very short	VL	Low	Medium	Medium	High	High

PART C: DETERMINING SIGNIFICANCE							
PROBABILITY (of exposure to impacts)	Definite/ Continuous	VH	Very Low	Low	Medium	High	Very High
	Probable	H	Very Low	Low	Medium	High	Very High
	Possible/ frequent	M	Very Low	Very Low	Low	Medium	High
	Conceivable	L	Insignificant	Very Low	Low	Medium	High
	Unlikely/ improbable	VL	Insignificant	Insignificant	Very Low	Low	Medium
			VL	L	M	H	VH
			CONSEQUENCE				

PART D: INTERPRETATION OF SIGNIFICANCE	
Significance	**Decision guideline**
Very High	Potential fatal flaw unless mitigated to lower significance.
High	It must have an influence on the decision. Substantial mitigation will be required.
Medium	It should have an influence on the decision. Mitigation will be required.
Low	Unlikely that it will have a real influence on the decision. Limited mitigation is likely to be required.
Very Low	It will not have an influence on the decision. Does not require any mitigation
Insignificant	Inconsequential, not requiring any consideration.

DWS RISK ASSESSMENT MATRIX (2016)

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that are possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[8]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or well-being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the table below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary[9].

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information,

[8] The definition has been aligned with that used in the ISO 14001 Standard.
[9] Some risks/impacts that have low significance will however still require mitigation

by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table D1: Criteria for assessing significance of impacts.

"RISK ASSESSMENT KEY" (Based on DWS 2015 publication: Section 21 c and i water use Risk Assessment Protocol)

Table D1: Severity (How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

Table D2: Spatial Scale (How big is the area that the aspect is impacting on)

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

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

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, an E or F	5
PES and EIS (sensitivity) must be considered.	

Table D4: Frequency of the activity (How often do you do the specific activity)

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

Table D5: The frequency of the incident or impact (How often does the activity impact on the resource quality)

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

Table D6: Legal issues (How is the activity governed by legislation)

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

Table D7: Detection (How quickly or easily can the impacts/risks of the activity be observed on the resource quality, people and resource)

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

Table D8: Rating Classes

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

Table D9: Calculations

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for construction phase and operational phase; and
  - Individuals or groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status were assessed.

Control Measure Development

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

- Mitigation and performance improvement measures and actions that address the risks and impacts[10] are identified and described in as much detail as possible. Mitigating measures are investigated according to the impact minimisation hierarchy as follows:
  - Avoidance or prevention of impact;
  - Minimisation of impact;
  - Rehabilitation; and
  - Offsetting.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation; and
- Desired outcomes are defined and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, wherever possible.

Recommendations

Recommendations were developed to address and mitigate potential impacts on the freshwater ecology of the resources in traversed by or in close proximity of the proposed infrastructure.

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

APPENDIX E – Results of the Field Investigation

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

Table E1: Presentation of the results of the Index of Habitat Integrity (IHI) applied to the assessed reach of the Ga-Mogara River.

INSTREAM IHI	
Base Flows	0,0
Zero Flows	0,0
Floods	0,0
HYDROLOGY RATING	**0,0**
pH	1,0
Salts	1,0
Nutrients	1,0
Water Temperature	1,0
Water clarity	1,0
Oxygen	1,0
Toxics	1,0
PC RATING	**1,0**
Sediment	2,0
Benthic Growth	0,0
BED RATING	**1,2**
Marginal	3,0
Non-marginal	2,0
BANK RATING	**2,6**
Longitudinal Connectivity	1,0
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,0**
INSTREAM IHI %	**80,6**
INSTREAM IHI EC	**B/C**
INSTREAM CONFIDENCE	**3,0**

RIPARIAN IHI	
Base Flows	0,0
Zero Flows	0,0
Moderate Floods	0,0
Large Floods	0,0
HYDROLOGY RATING	**0,0**
Substrate Exposure (marginal)	1,0
Substrate Exposure (non-marginal)	1,0
Invasive Alien Vegetation (marginal)	1,0
Invasive Alien Vegetation (non-marginal)	1,0
Erosion (marginal)	1,0
Erosion (non-marginal)	1,0
Physico-Chemical (marginal)	0,0
Physico-Chemical (non-marginal)	0,0
Marginal	3,0
Non-marginal	3,0
BANK STRUCTURE RATING	**3,0**
Longitudinal Connectivity	1,0
Lateral Connectivity	1,0
CONNECTIVITY RATING	**1,0**
RIPARIAN IHI %	**68,9**
RIPARIAN IHI EC	**C**
RIPARIAN CONFIDENCE	**3,3**

Table E2: Presentation of the results of the VEGRAI assessment applied to the assessed reach of the Ga-Mogara River within the MRA.

LEVEL 3 ASSESSMENT					
METRIC GROUP	**CALCULATED RATING**	**WEIGHTED RATING**	**CONFIDENCE**	**RANK**	**% WEIGHT**
MARGINAL	72,6	45,4	3,3	1,0	100,0
NON MARGINAL	76,3	28,6	0,0	2,0	60,0
2,0					160,0
LEVEL 3 VEGRAI (%)				74,0	
VEGRAI EC				**C**	
AVERAGE CONFIDENCE				1,7	

Table E3: Presentation of the results of the Ecoservices assessments applied to the assessed portion of the Ga-Mogara River in the MRA.

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

***Streamflow regulation is excluded from the suite of services assessed for riparian areas owing to a lack of relevant studies (Kotze *et al*, 2020).**

Table E4: Presentation of the results of the EIS assessment (DWAF 1999) applied to the assessed reach of the Ga-Mogara River within the MRA.

PRIMARY DETERMINANTS	SCORE	CONFIDENCE
Biotic Determinants		
Rare & Endangered Species	0	4
Populations of unique species	1	4
Intolerant biota	0	4
Species / taxon richness	2	4
Aquatic Habitat Determinants		
Diversity of aquatic habitat types or features	1	4
Refuge value of habitat type	1	4
Sensitivity of habitat to flow changes	0	4
Sensitivity of flow-related water quality changes	1	4
Migration route/corridor for instream and riparian biota	1	4
Nature Reserves, Natural Heritage sites, Natural areas, PNEs	1	4
TOTAL	**8**	**40**
MEAN	**0,8**	**4**
OVERALL EIS	**Low/Marginal**	

APPENDIX F – Impact Analysis and Mitigation

IMPACT ANALYSIS AND MITIGATION MEASURES

1. General management and good housekeeping practices

The following essential mitigation measures are considered to be standard best practice measures applicable to development of this nature and must be implemented during all phases of the proposed prospecting activities, in conjunction with those stipulated in Section 5 of this report which define the mitigatory measures specific to the minimisation of impacts on the Ga-Mogara River.

Development and operational footprint

- Sensitivity maps have been developed for the focus area, indicating the watercourse, and relevant regulatory zones in accordance with NEMA, Regulation GN509 and Regulation GN704, as shown in Figure 9 (Section 4.4.1). It is recommended that this sensitivity map be considered during all phases of the development and with special mention of the planning of any future infrastructure layout, to aid in the conservation of the watercourse habitat within the MRA;
- All future prospecting or development footprint areas should remain as small as possible and should not encroach onto surrounding, more sensitive areas. Prospecting must only take place in the demarcated areas. If prospecting or development is to occur within the watercourse, strict regulation of activities therein must take place, and non-prospecting areas are to be considered off-limits to personnel and vehicles;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Planning of temporary roads and access routes should take the site sensitivity plan into consideration, and wherever possible, existing roads should be utilised. If additional roads are required, then wherever feasible such roads should be constructed a distance from the watercourse areas and not directly adjacent thereto.
- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel;
- Appropriate sanitary facilities must be provided for the life of the proposed project and all waste removed to an appropriate waste facility;
- All hazardous chemicals should be stored on bunded surfaces and no storage of such chemicals should be permitted within the freshwater buffer zones;
- No informal fires should be permitted in or near the construction areas;
- Ensuring that an adequate number of rubbish and “spill” bins are provided will also prevent litter and ensure the proper disposal of waste and spills; and
- Edge effects of activities, particularly erosion and alien/weed control need to be strictly managed.

Vehicle access

- All areas of increased ecological sensitivity should be marked as such and kept off limits to all unauthorised construction and maintenance vehicles as well as personnel;
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil; and
- All spills, should they occur, should be immediately cleaned up and treated accordingly.

Alien plant species

- Proliferation of alien and invasive species is expected within any disturbed areas. 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 on the property 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, 1998). Removal of species should take place throughout the construction, operational, closure/decommissioning and rehabilitation/ 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*;*
  - No vehicles should be allowed to drive through designated sensitive watercourse areas during the eradication of alien and weed species.

Freshwater habitat

- Ensure that as far as possible all infrastructure is placed outside of watercourse areas and applicable regulatory zones. A minimum buffer of 100m around all watercourse/freshwater systems should be maintained in line with the requirements of regulation GN704 of the NWA for all non-resource dependent infrastructure. If these measures cannot be adhered to, strict mitigation measures will be required to minimize the impact on the receiving watercourses. Such measures include those stipulated in Section 5 of this report, in addition to the following:
  - Ensuring that measures are implemented to prevent dirty runoff water entering the watercourse habitat; and
  - Ensuring that where necessary, exposed soils in the vicinity of watercourse habitat are protected from erosion by means of reinstating natural vegetation following construction,
- Permit only essential personnel within 100m of the watercourse habitat, if absolutely necessary that they enter the regulatory zone;
- Limit the footprint area of the construction activities to what is absolutely essential in order to minimise environmental damage;
- During prospecting, no vehicles should be allowed to indiscriminately drive through the freshwater areas;
- All waste materials generated during any phase of the proposed activities must be prevented from entering the watercourses; and
- Implement effective waste management in order to prevent construction related waste from entering the watercourse environments.

Soils

- To prevent the erosion of soils, management measures may be determined by the site engineer at their discretion and may include mechanisms such as temporary silt traps or hessian curtains. Revegetation with indigenous graminoid species is however recommended for long-term protection of soils and it is suggested that such revegetation of disturbed areas is undertaken concurrently with prospecting;
- Maintain topsoil stockpiles below 2 meters in height;
- As far as possible, all construction activities should occur in the low flow season, during the drier winter months;
- All soils compacted as a result of construction activities falling outside of project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas; and
- Monitor all areas for erosion and incision. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible.

Rehabilitation

- All soils compacted as a result of construction activities falling outside of project footprint areas should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all construction and rehabilitation phases to prevent loss of floral habitat;
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas;
- As far as possible, all rehabilitation activities should occur in the low flow season, during the drier winter months.
- As much vegetation growth (of indigenous/endemic floral species) as possible should be promoted within the proposed development area in order to protect soils;

- All alien vegetation in the watercourse areas should be removed from rehabilitated areas and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist);
- All areas affected by prospecting activities should be rehabilitated upon completion of the activities.

APPENDIX G – Specialist CVs and Declaration

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)

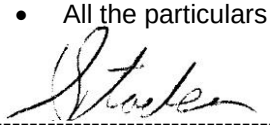
1.(a).(ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Aquatic Services		
Name / Contact person:	Stephen van Staden		
Postal address:	29 Arterial Road West, Oriel, Bedfordview		
Postal code:	2007	Cell:	083 415 2356
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	stephen@sasenvironmental.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		

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

Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Biodiversity Assessments

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

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Hydropedological Assessment

Visual Impact Assessment

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

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF 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)

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 Plans
- Freshwater Offset Plans

Biodiversity Assessments

- Ecological Scans
- Biodiversity Offset Plans