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FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED Mn48 (PTY) LTD MINING PROJECT NEAR HOTAZEL, NORTHERN CAPE PROVINCE

Prepared for

SLR Consulting (Pty) Ltd

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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

The Mn48 (Pty) Ltd project consists of mining surface infrastructure and underground manganese mining. The non-perennial Kuruman River was identified along the south western boundary of the surface infrastructure footprint area. Based on the groundwater specialist input, dewatering of the underground mine and dewatering of the proposed mine well field would result in a Medium to Low impact significance (unmitigated) on the regional groundwater flow input (SLR Consulting, 2013). The resultant cone of depression will be limited and the measured groundwater levels are far below the base of the non-perennial Kuruman River.

As all surface infrastructure is located above the 1:100 year floodline of the Kuruman river and assuming the implementation of the set out mitigation measures (specifically with regards to stormwater management) presented in this report, the anticipated impact significance of the construction and use of the surface infrastructure is 'low'. The proposed access road will be the only surface infrastructure to encroach on the Kuruman River and its 1:100 year floodline, by means of a culvert crossing. The construction and operation of the access road poses a 'moderate' risk significance to the river. However, the significance of this impact is deemed to be of acceptably low levels on a local and regional level. Adherence to cogent, well-conceived and ecologically sensitive site development plans, and the mitigation measures provided in this report as well as general good construction practice, is essential if the significance of perceived impacts is to be reduced. It is the opinion of the freshwater specialist that the proposed mining activities, from a freshwater ecological perspective, are considered acceptable, with the proviso that strict adherence to mitigation measures is enforced to ensure that the ecological integrity of the freshwater environment is not further compromised.

MANAGEMENT SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the Environmental and Water Use Authorisation processes for the proposed surface mining activities for the proposed Mn48 (Pty) Ltd mining project on Portion 1 of the farm Lehating 741 and for underground mining activities on Portion 2 of the farm Wessels 227 and the remaining extent and portion 3 and 4 of the farm Dibiaghomo 226, approximately 20km north of Hotazel, Northern Cape (hereafter referred to as the 'mining right area' (MRA)). Surface infrastructure will only be located on Portion 1 of the farm Lehating 741. The surface infrastructure footprint will hereafter be referred to as the 'study area'.

Proposed surface infrastructure entails an access road (traversing the Kuruman River via a culvert crossing), shafts, buildings, stockpiles and stormwater management infrastructure. The underground manganese will be mined using this surface infrastructure.

The purpose of this report is to define the ecology of the study area in terms of watercourse characteristics, including mapping and classification of the watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and to define the Present Ecological State (PES) of the watercourses associated with the study area. In addition, this report aims to define the socio-cultural and ecological service provision of the watercourse and the Recommended Ecological Category (REC) for the watercourse. It is a further objective of this study to provide detailed information to guide the proposed mining activities in the vicinity of the watercourse, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.



As part of this assessment a desktop study was conducted, and the results thereof are contained in Section 3 of this report. A field assessment took place in March 2014, to delineate the watercourse, and ground-truth pre-defined points of interest. Factors influencing the habitat integrity of the watercourse identified during the field survey were noted, and the functioning and the environmental and socio-cultural services provided by the watercourse were determined. During the site assessment the Kuruman River was identified along the south western boundary of the study area. This river is non-perennial in spite of its large catchment due to the arid nature of the climate in the Northern Cape. The river would only have surface flow after rainfall events, and only for a few hours, potentially a few days, depending on the magnitude of the rainfall event.

The results of the field assessment are contained in Section 4 of this report and are summarised in the table below.

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

Present Ecological State (PES)	Ecological Importance and Sensitivity (EIS)	Ecoservices Provision	Recommended Ecological Category (REC)
B (Largely natural with few modifications)	High	Intermediate (1,8)	B (Largely natural)

Following the assessment of the Kuruman River, the Department of Water and Sanitation (DWS) Risk Assessment Matrix as defined in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) was applied to ascertain the significance of possible impacts which may occur because of the proposed mining activities. This is required to inform the Water Use Licence Application process. The risk assessment was undertaken based on the layout provided by the proponent, which indicates that the proposed access road will traverse the Kuruman River. No other surface infrastructure is located within the delineated boundary of the river or the GN509/704 Zone of Regulation (ZoR). However, the south western boundary of the surface infrastructure footprint and a portion of the well fields is located in the 32m NEMA ZoR. Based on the outcome of the specialist groundwater input as provided by SLR Consulting (2013) the dewatering of the underground mine and dewatering of the proposed mine well field would result in a Medium to Low impact significance (unmitigated) on the regional groundwater flow, while contamination by various storage sources will be of High to Medium impact significance (unmitigated). As such, the DWS Risk Assessment did not include the assessment of the impact of dewatering on the Kuruman River, as based on the specialist groundwater input (SLR Consulting, 2013) the resultant cone of depression will be limited and the measured groundwater levels are far below the base of the non-perennial Kuruman River.

Table B below provides a summary of the outcome of the DWS Risk Assessment.



Table B: Summary of the results of the DWS Risk Assessment applied to the Kuruman River.

Phases	Activity	Risk Rating
CONSTRUCTION PHASE	<p>Site preparation prior to construction of activities related to the proposed surface infrastructure which include site clearing, placement of contractor laydown areas and storage facilities.</p> <p>This is applicable to the surface infrastructure activities above the 1:100 year floodline and outside the delineated edge of the Kuruman River (outside the GN509/704 Zones of Regulation (ZoR)).</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Exposure of soils, leading to increased runoff from cleared areas and erosion of the river, and thus increased potential for sedimentation of the river; *Increased sedimentation can lead to changes in instream habitat and potentially alter surface water quality (if present); *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances. 	L
	<p>Site preparation prior to construction activities related to the proposed access road which will directly traverse the Kuruman River.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Removal of riparian vegetation causes decrease in habitat provisioning and reduced surface roughness; *Trampling within the river leading to soil compaction and altered flow patterns in the river; and *Potential proliferation of alien and invasive vegetation species due to disturbances in the river. 	M
	<p>Development of clean and dirty water separation systems located inside the study area boundaries and the various ZoRs.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Increased flood peaks as a result of formalisation and concentration of surface runoff in clean water diversion structures; *Potential for erosion, leading to sedimentation of the Kuruman River; *Reduction in surface water runoff volume of water entering the Kuruman River, leading to loss of recharge of the river; *Altered vegetation communities due to moisture stress. 	L
	<p>Construction of the proposed culvert access road crossing over the Kuruman River.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Impact on the riparian vegetation, leading to habitat degradation and loss of ecoservice provisioning; *Contamination of surface water (if present). 	M
	<p>Re-profiling of river embankment in the vicinity of the access road crossing.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Increased sedimentation as a result of disturbances; *Potential further loss of indigenous vegetation and the increased proliferation of alien floral species due to disturbances. 	M
	<p>Construction of all surface infrastructure above the 1:100 year floodline and outside the delineated edge of the Kuruman River (above the GN509/704 ZoR).</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Disturbance to the terrestrial buffer zone surrounding the Kuruman River leading to decreased biodiversity; *Loss of migratory corridors; *Potential sedimentation of the river due to increased dust in the larger study area. 	L
	<p>Operation of the access road across the Kuruman River.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Runoff from the road could be contaminated and could impact on the surface water quality of the river (when present); and *Increased erosion can potentially increase the sediment load of the river. 	M
OPERATIONAL PHASE		



Phases	Activity	Risk Rating
	Operation and maintenance of the stormwater management system associated with the proposed surface mining infrastructure. This may result in: *Increased flood peaks into the river as a result of formalisation and concentration of surface runoff; *Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river; *Reduction in volume of water entering the river, leading to loss of recharge (and thus potential desiccation) of downstream reach of the river; and *Altered vegetation communities due to moisture stress.	L
DECOMMISSIONING PHASE	Rehabilitation of mining footprint areas (with specific focus on the access road crossing through the Kuruman River (if applicable)). This may result in: *Compaction of soils due to vehicular movement; *Compacted soils underneath the various stockpiles which have been removed; *Latent impacts of vegetation losses (due to lack of re-establishing after rehabilitation activities); *Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils.	M

While the reach of the Kuruman River has not received water from the upstream areas in many years, the possibility of loss of connectivity (due to the construction of the access road) being rehabilitated and flow restored cannot be ruled out at this time (although it is possible that this is unlikely). Nevertheless, should aforementioned rehabilitation take place, in order to prevent possible cumulative impacts downstream of the study area in future, it is considered important that connectivity of the Kuruman River be retained. Similarly, although the vegetation community has undergone modification, further deterioration should be prevented as far as practicable, and vegetation management during construction and operations along with rehabilitation following de-commissioning should be implemented in order to minimise the cumulative impacts on the vegetation community, with specific mention of alien floral invasion. Careful planning of the location of the infrastructure and implementation of mitigation measures throughout all phases of the proposed activities, will contribute to reduced impact significance on the river. Assuming that a high level of mitigation takes place, the anticipated impact significance of the proposed mining activities ranges from 'low' to 'moderate' throughout the construction and operational phases. Decommissioning activities are considered similar in nature and impact significance to those during the construction and operations phases.

The table below serves as a summary of the key findings made during the impact assessment applied (to inform the Environmental Authorisation process as per National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)). If mitigation and management measures are implemented as outlined in this document, the likelihood of impacts occurring and the consequence of all potential impacts may be significantly reduced. A summary of the impact assessment is presented in the following table.

Impact	Unmanaged	Managed
IMPACT 1: LOSS OF RIPARIAN HABITAT AND ECOLOGICAL STRUCTURE		
Operational Phase	Very High (-ve)	Medium High (-ve)
Rehabilitation Phase	Medium High (-ve)	Low (-ve)
IMPACT 2: CHANGES TO RIVER ECOLOGICAL AND SOCIO-CULTURAL SERVICE PROVISION		
Operational Phase	Medium High (-ve)	Low(-ve)
Rehabilitation Phase	Medium Low (-ve)	Very Low (-ve)
IMPACT 3: IMPACTS ON RIVER HYDROLOGICAL FUNCTION AND SEDIMENT BALANCE		
Operational Phase	High(-ve)	Medium Low(-ve)
Rehabilitation Phase	Medium High (-ve)	Very Low (-ve)



Based on the findings of the freshwater ecological assessment, the recommended mitigation measures as provided in Section 5 should be implemented to minimise the impact on the ecology of the Kuruman River within the study area, with specific mention of the following:

- Construction should be initiated by first constructing clean and dirty water separation systems thus ensuring that as site clearing takes place, dirty water runoff is appropriately managed;
- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential. Vegetation removal should be phased in such a manner that vegetation is not cleared all at once but is cleared systematically with the expansion of the open cast pit. This is specifically recommended for the riparian vegetation proposed to be removed as part of the access road footprint area;
- The Kuruman River and its 1:100 year floodline (whichever is the greatest) where no activities are proposed must demarcated with painted wooden stakes at 30 m intervals and marked as a no-go area;
- The design of the access road crossing should ensure adequate flow connectivity between the upstream and downstream portions of the river; and
- The culvert structures must extend the width of the river to ensure recharge of the river area downgradient of the crossing during high rainfall events.

Based on the findings of the freshwater ecological assessment and the results of the DWS Risk Assessment and the impact assessment, as the reach of the Kuruman River is considered largely natural, and assuming that responsible implementation of the mitigation hierarchy, as well as strict adherence to cogent, well-developed mitigation measures takes place throughout all phases of the proposed mining development, the significance of potential impacts arising from the proposed mining activities is deemed to be of low to medium levels.

Thus, it is the opinion of the freshwater specialist that, providing the recommendations made in this report are strictly adhered to, from a freshwater ecological perspective, the proposed mining activities may be considered acceptable.



DOCUMENT GUIDE

The following table indicates the requirements for Specialist Studies as per Appendix 6 of Government Notice 326 of 2017, amendments to the Environmental Impact Assessment (EIA) Regulations, 2014 as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998), promulgated in Government Notice 40772 of 2017

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 1.2
cA)	An indication of the quality and age of base data used for the specialist report	Section 2.1
cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 4
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
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 1.3
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.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Catchment:	The area where water is collected by the natural landscape, where all rain and run-off water ultimately flows into a river, wetland, lake, and ocean or contributes to the groundwater system.
Delineation (of a wetland):	To determine the boundary of a wetland based on soil, vegetation and/or hydrological indicators.
Ecoregion:	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endorheic	As it relates to a depression wetland: inward-draining with no transport of water into downstream systems via subsurface or surface flow. Water leaves via evapotranspiration and infiltration only.
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.
Hydrophyte:	Any plant that grows in water or on a substratum that is at least periodically deficient of oxygen as a result of soil saturation or flooding; plants typically found in wet habitats.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Mottles:	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.
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: <ul style="list-style-type: none"> • 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
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EC	Ecological Class or Electrical Conductivity (use to be defined in relevant sections)
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMC	Ecological Management Class
EMP	Environmental Management Program
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GIS	Geographic Information System
GN	Government Notice
GPS	Global Positioning System
HGM	Hydrogeomorphic
m	Meter
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
RMO	Resource Management Objective
RQIS	Research Quality Information Services
SACNASP	South African Council for Natural Scientific Professions
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SQR	Sub quaternary catchment reach
subWMA	Sub-Water Management Area
WetVeg Groups	Wetland Vegetation Groups
WMA	Water Management Areas
WMS	Water Management System
WRC	Water Research Commission
WULA	Water Use License Application



1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a watercourse assessment as part of the Environmental and Water Use Authorisation processes for the proposed surface mining activities on Portion 1 of the farm Lehating 741 and for underground mining activities on Portion 2 of the farm Wessels 227 and the remaining extent and portion 3 and 4 of the farm Dibiaghomo 226, approximately 20 km north of Hotazel, Northern Cape (hereafter referred to as the 'mining right area' (MRA)). Surface infrastructure will only be located on Portion 1 of the farm Lehating 741. The surface infrastructure footprint will hereafter be referred to as the 'study area' (Figure 1 and 2).

In order to identify all watercourses that may potentially be impacted by the proposed mining activities, a 500 m "zone of investigation" around the study area, in accordance with Government Notice (GN) 509 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) (NWA), was used as a guide in which to assess possible sensitivities of the receiving watercourse environment. This area – i.e. the 500 m zone of investigation around the study area - will henceforth be referred to as the "investigation area".

The purpose of this report is to define the ecology of the area in terms of the location, extent and characteristics the watercourse, including mapping of the watercourses, defining areas of increased Ecological Importance and Sensitivity (EIS), and to define the Present Ecological State (PES) of the watercourses associated with the study area. Additionally, this report aims to define the socio-cultural and ecological service provision of the watercourse and the Recommended Ecological Category (REC) for the watercourse. It is a further objective of this study to provide detailed information when considering the proposed mining activities in the vicinity of the watercourse, to ensure the ongoing functioning of the ecosystems, such that local and regional conservation requirements and the provision of ecological services in the local area are supported while considering the need for sustainable economic development.

The Department of Water and Sanitation (DWS) Risk Assessment Matrix (2016) as it relates to activities as stipulated in Section 21(c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) was applied to determine the significance of the perceived impacts associated with the proposed mining related activities, and the operational activities impact on the receiving freshwater environment. In addition, mitigatory measures were developed which aim to



minimise the perceived impacts associated with the proposed mining activities, followed by an assessment of the significance of the impacts after mitigation, assuming that they are fully implemented.

This report, after consideration and a description of the ecological integrity of the watercourse associated with the proposed mining related activities, must guide the Environmental Assessment Practitioner (EAP) as well as the proponent and the relevant authorities, by means of a reasoned opinion and recommendations, as to the viability of the proposed mining activities from a freshwater resource management point of view and provide recommendations to minimise the impacts on the receiving freshwater environment in line with the requirements of the mitigation hierarchy as advocated by the Department of Environmental Affairs (DEA) and DWS.

1.1.1 Project description

Lehating Mining (Pty) Ltd (Lehating Mine) holds a mining right and approved Environmental Management Programme report (EMPr) for the development of a new underground manganese mining operation near Black Rock in the Joe Morolong Local Municipality, located in the John Taolo Gaetsewe District Municipality, Northern Cape Province. The approved mine will be located on Portion 1 of the farm Lehating 741.

Immediately adjacent and to the south of Lehating Mine, Khwara Manganese (Pty) Ltd (Khwara Mine) holds an approved EMPr for underground mining of manganese on portion 2 of the farm Wessels 227 and the remaining extent and portion 3 and 4 of the farm Dibiaghomo 226. The Khwara Mine underground resource will be accessed via/through the Lehating Mine, using the Lehating Mine approved surface infrastructure. In this regard, no surface infrastructure will be established as part of the Khwara Mine.

Khwara Mine and Lehating Mine have entered into an amalgamation agreement which combines the two adjacent, contiguous mineral resources and surface rights comprising the Khwara and Lehating Mines into a single, high-grade manganese mining company known as Mn48 (Pty) Ltd (hereafter referred to as 'Mn48'). Mn48 is now proposing to consolidate the Lehating and Khwara mining rights and associated EMPrs. In addition, Lehating Mine needs to amend its approved surface infrastructure layout to cater for the above consolidation of operations.

The underground Khwara Mine resource will be mined from the north (i.e. from the Lehating Mine side) and the planned Life of Mine (LOM) with both the Khwara and Lehating Mine resources combined will be 28 years. The surface infrastructure proposed to be developed as part of the mining activities includes (Figure 3):

- Access road (traversing the Kuruman River) and internal roads. The preliminary design of the culvert access road crossing is presented in Figure 4;
- Shafts;
- Buildings (including offices, lamp and crush rooms, change/laundry house, storage centres, medical facility, workshops);
- Parking areas;
- Crusher;
- Crushing and screening plant;
- Stockpiles (Crushed ore, fines, lumpy, waste and topsoil); and
- Stormwater management infrastructure (Figure 5), consisting of:
 - Concrete lined dirty water diversion channels; and
 - Unlined clean water diversion channels.



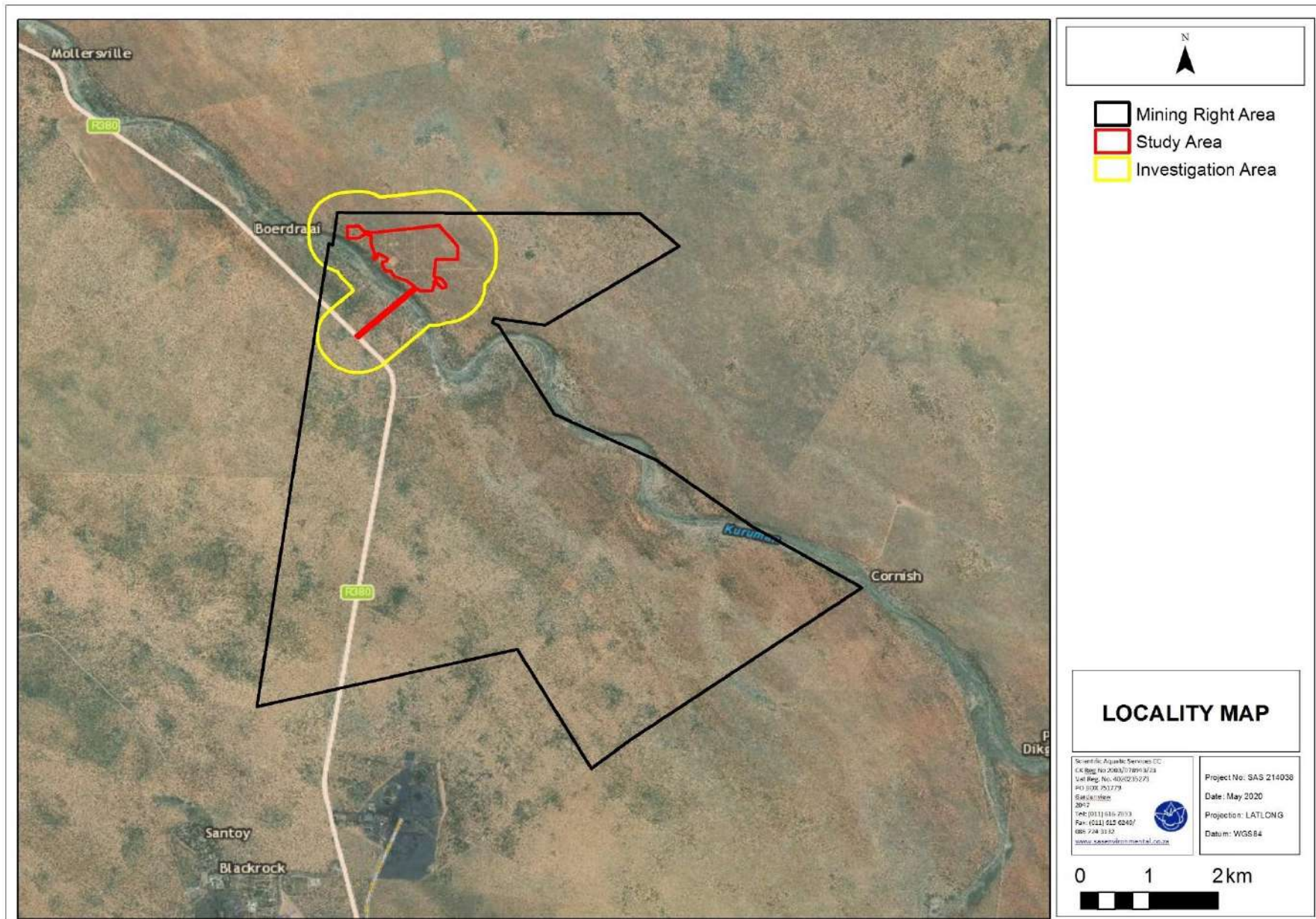


Figure 1: A digital satellite image depicting the location of the study and investigation areas in relation to the surrounding environment.



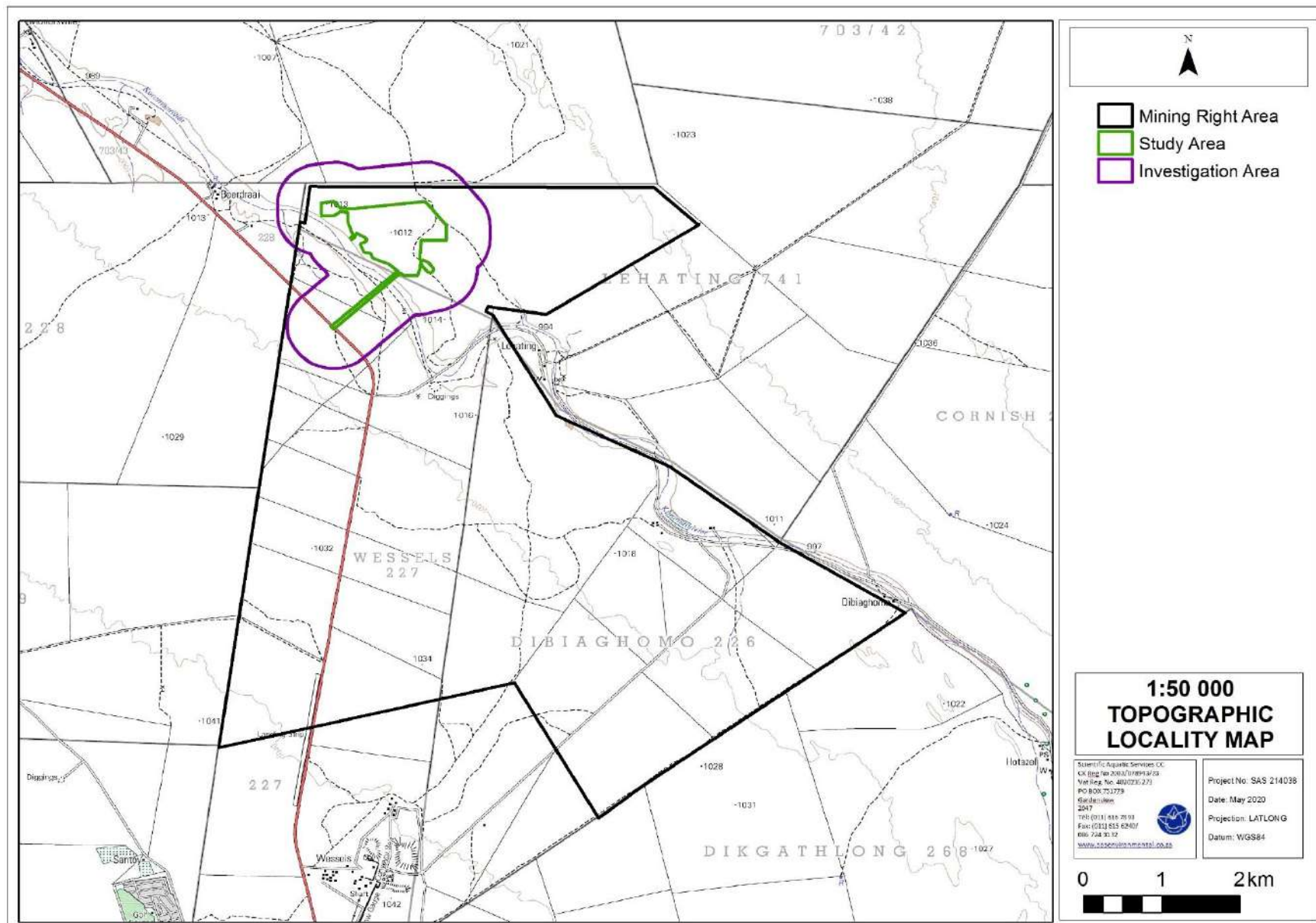


Figure 2: The study and investigation areas depicted on a 1:50 000 topographical map in relation to the surrounding area.



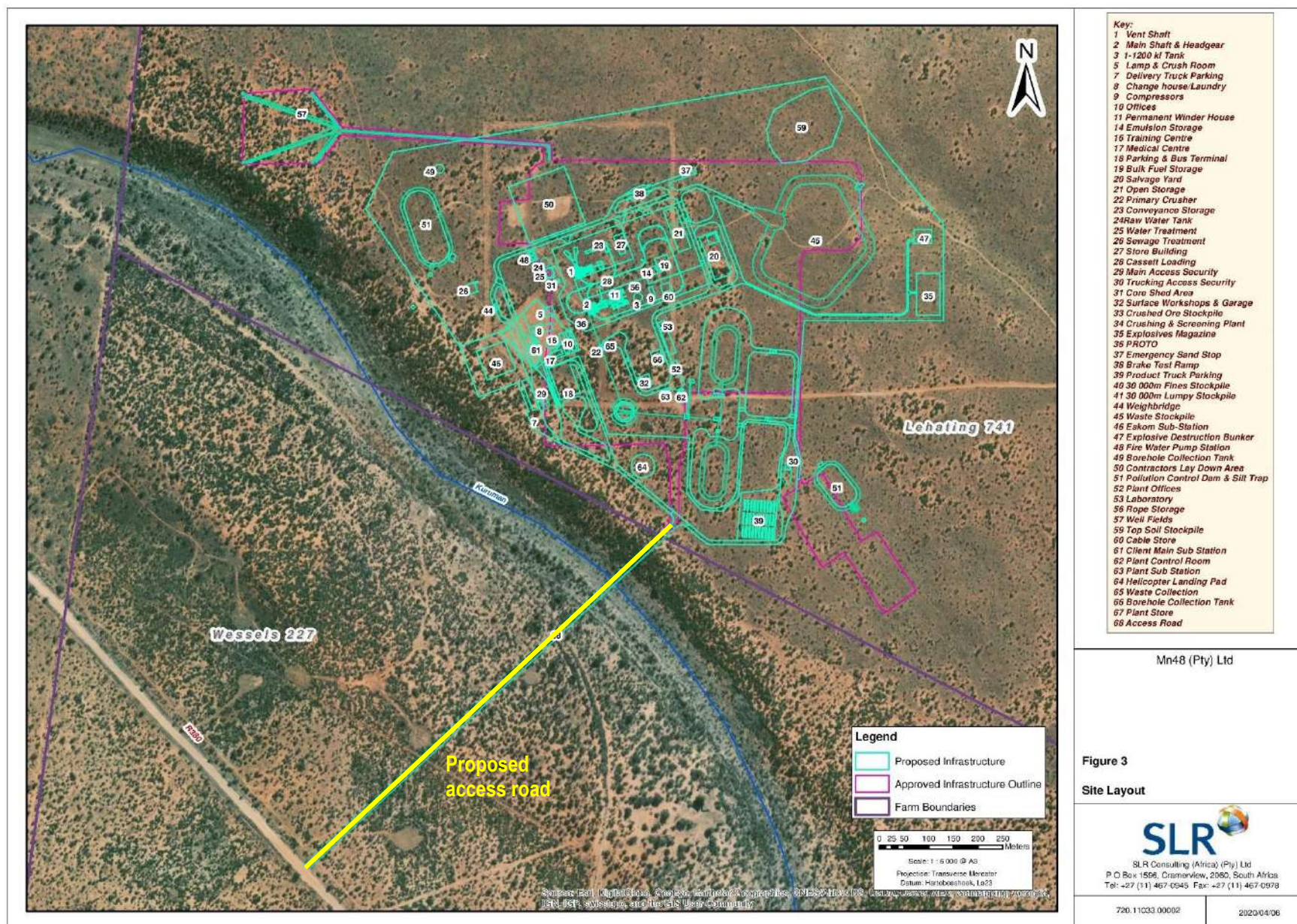


Figure 3: Conceptual depiction of the surface infrastructure layout for the proposed Mn48 mining project (courtesy SLR Consulting).



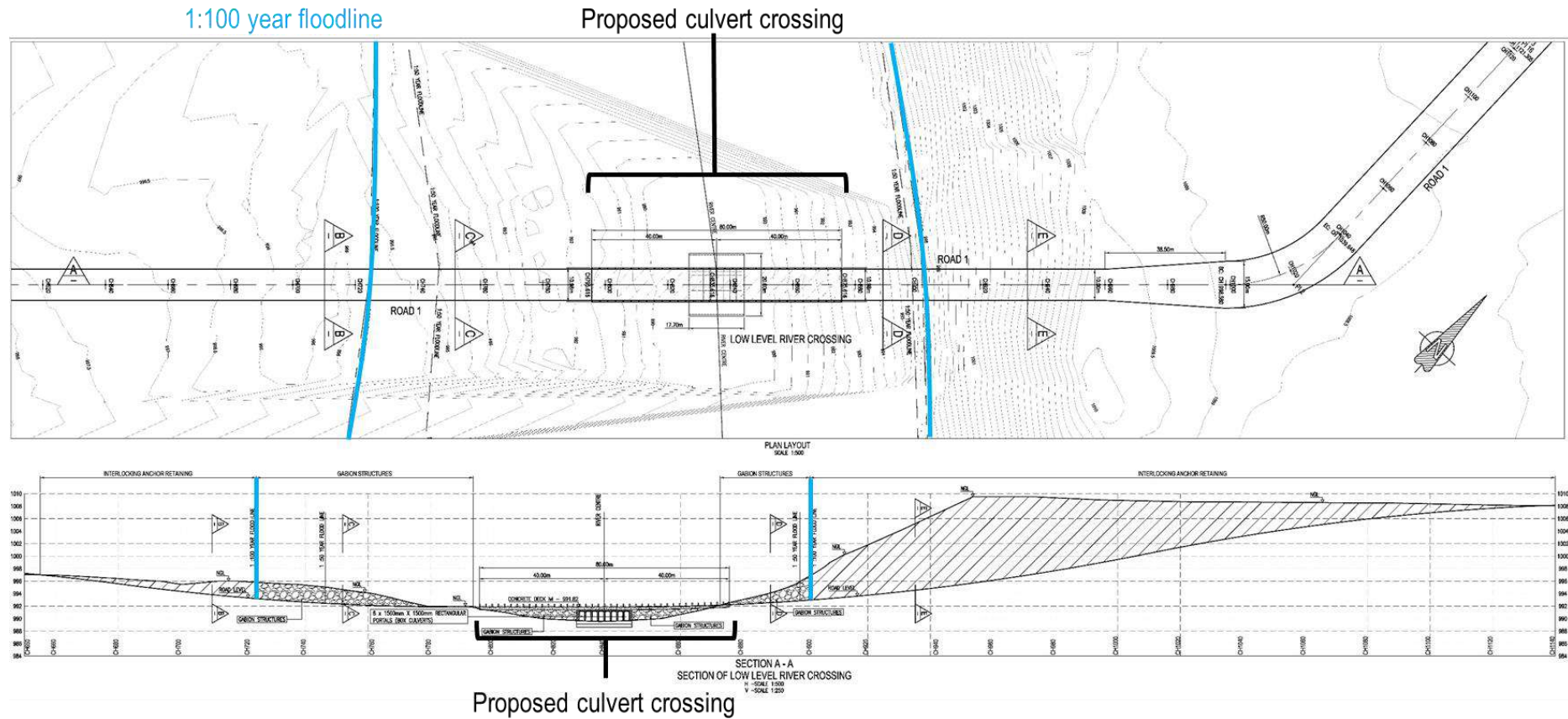


Figure 4: Preliminary design of the proposed culvert access road crossing over the Kuruman River (provided by TWP Projects (Pty) Ltd). The extent of the proposed culvert crossing is presented relative to the 1:100 year floodline (blue lines).

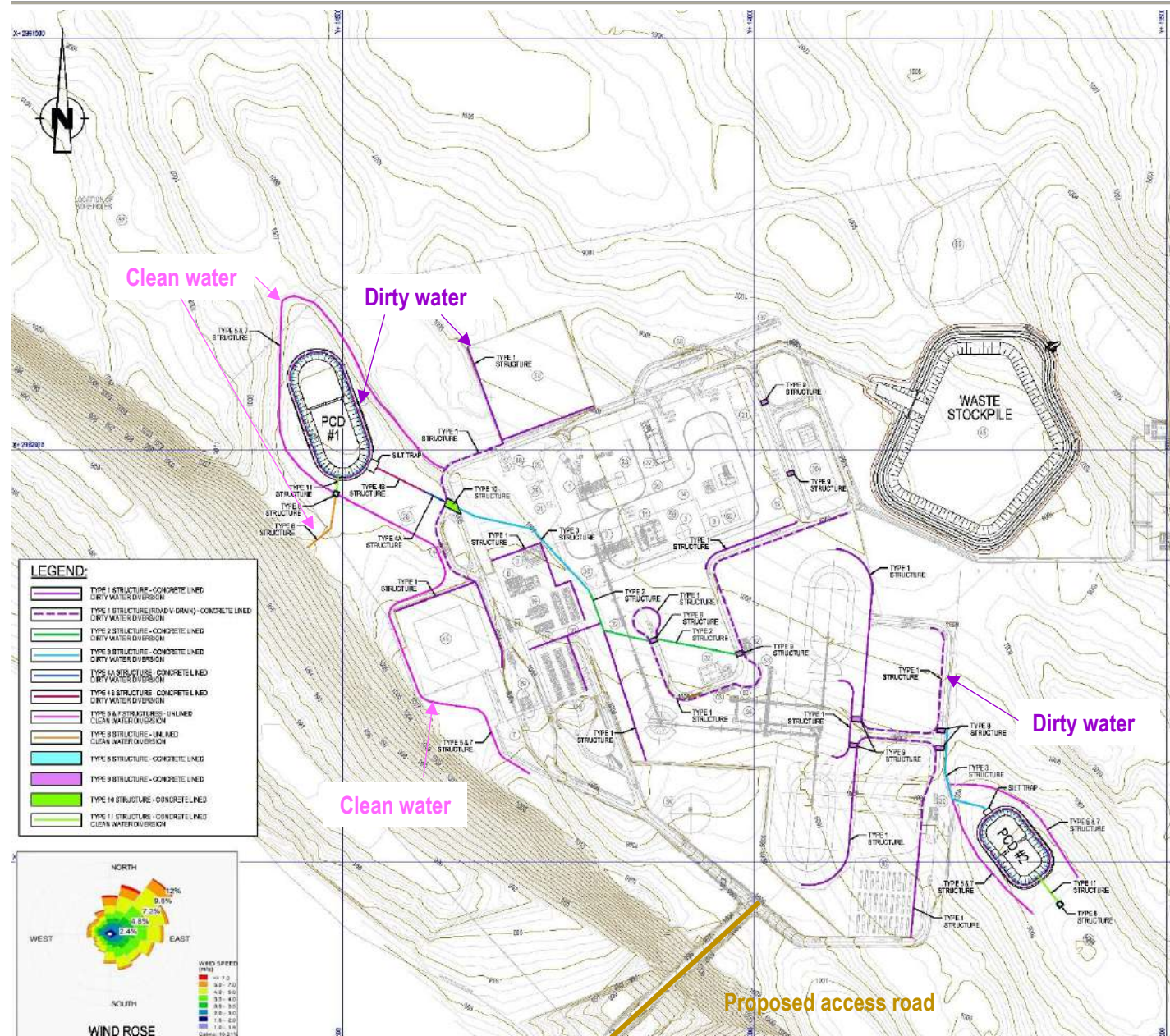


Figure 5: Proposed stormwater management layout associated with the surface infrastructure layout (WorleyParsons, 2019).



1.2 Scope of Work

Specific outcomes in terms of this report are outlined below:

- A background study of relevant national, provincial and municipal datasets (such as the National Freshwater Ecosystem Priority Areas [NFEPA] 2011 database, the National Biodiversity Assessment (2018), and the Department of Water and Sanitation Research Quality Information Services [DWS RQIS PES/EIS], 2014 database was undertaken to aid in defining the PES and EIS of the watercourse;
- Watercourse delineation according to the method presented in “A practical field procedure for identification and delineation of wetlands and riparian areas” published by DWAF in 2005;
- The watercourse classification assessment 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 watercourse was determined according to the method described by Rountree and Kotze (2013);
- The PES of the watercourse was assessed according to according to the Index of Habitat Integrity (IHI) for South African floodplain, channelled and channelled valley bottom wetland types (DWAF Resource Quality Services, 2007);
- The watercourse was mapped according to the ecological sensitivity of each hydrogeomorphic unit in relation to the study area. In addition to the watercourse boundaries, the appropriate provincial recommended buffers and legislated zones of regulation were depicted where applicable;
- Allocation of a suitable Recommended Ecological Category (REC) and Recommended Management Objective (RMO) to the watercourse based on the results obtained from the PES and EIS assessment;
- The application of the SAS impact assessment method to identify potential impacts that may affect the watercourse as a result of the proposed mining related activities, and to aim to quantify the significance thereof;
- Additional to the above, the DWS Risk Assessment Matrix (2016) was applied for the same purposes and to determine the way forward in terms of the Water Use Licence Application process; and
- To present management and mitigation measures which should be implemented during the various development phases to assist in minimising the impact on the receiving watercourse environment.



1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- This report (originally submitted in April 2014) was updated in May 2020 following the consolidation of the Lehating and Khwara Mines, now known as the Mn48 (Pty) Ltd mining project to inform the Environmental Authorisation and Water Use License Application process. The scope of pertaining to the updating the report was limited to on the incorporation of the latest information pertaining to available desktop datasets, legislation and the inclusion of the DWS Risk Assessment matrix. As such, no further investigation regarding the project and the potential impact thereof on watercourses in the MRA were assessed. All field assessment data as presented in this report is based on the field assessment undertaken in March 2014;
- The watercourse assessment is confined to the study area as illustrated in Figures 1 and 2 and does not include the neighbouring and surrounding properties outside of the study area. The general surroundings were however considered in the desktop assessment of the study area;
- All watercourses identified within 500 m of the study area were delineated in fulfilment of GN509 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) using desktop methods; however, these watercourses were not assessed individually;
- Due to the extent of the mining rights area, potential watercourses were identified and delineated using desktop methods prior to the site assessment. During the site assessment, undertaken in 2014, every effort was made to groundtruth as many pre-identified features as possible; however, less distinct features may not have been identified;
- Limitations in the accuracy of the delineation in some areas due to anthropogenic disturbances such as old access roads for sinking of boreholes and agricultural activities are deemed possible and therefore the delineations presented in this report are regarded as a best estimate of the watercourse boundaries based on site conditions present at the time of the assessment (March 2014). The presented delineations are however considered sufficiently accurate for decision making purposes;
- 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;
- Watercourses and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate



species. Within the transition zone some variation of opinion on the watercourse boundary may occur, however if the Department of Water Affairs and Forestry (DWAF), 2008 method is followed, all assessors should get largely similar results; and

- With ecology being dynamic and complex, certain aspects (some of which may be important) may have been overlooked. It is, however, expected that the watercourse in the investigation area have been accurately assessed and considered, based on the field observations undertaken in terms of the freshwater ecology.

1.4 Legislative Requirements and Provincial Guidelines

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

- The Constitution of the Republic of South Africa, 1996¹;
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- The National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 704 as published in the Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998);
- Government Notice 864 Alien and Invasive Species Regulations as published in the Government Gazette 40166 of 2016 as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004);
- The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA);
- The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA); and
- The Northern Cape Nature Conservation Act, 2009 (Act No 9. of 2009).

¹ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996'. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



2 ASSESSMENT APPROACH

2.1 Watercourse 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;
 - (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 to be a watercourse,
- and a reference to a watercourse includes where relevant, its bed and banks.

Wetland habitat is “land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

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

A field assessment was undertaken on the 5th of March 2014, during which the presence of any watercourse characteristics as defined by DWAF (2008) and by the National Water Act, 1998 (Act No. 36 of 1998), were noted (please refer to Section 4 of this report). The



watercourse delineation took place, as far as possible, according to the method presented in “A practical field procedure for identification and delineation of wetlands and riparian areas” published by DWAF in 2005. 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; and
- Vegetation adapted to saturated soils.

In addition to the delineation process, a detailed assessment of the watercourse associated with the study area was undertaken, whereby factors affecting the integrity of the watercourse were taken into consideration and aided in the determination of the functioning as well as the provision of ecological and socio-cultural services by the watercourse. A detailed explanation of the methods of assessment undertaken is provided in Appendix C of this report.

2.2 Sensitivity Mapping

The watercourse identified in the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (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 mining activities.

2.3 Impact and Risk Assessment and Recommendations

Following the completion of the assessment, an impact assessment and a risk assessment (as promulgated by the DWS) were conducted (please refer to Appendix D for the method of approach) and recommendations were developed to address and mitigate impacts associated with the proposed mining activities. These recommendations also include general ‘best practice’ management measures, which apply to the proposed mining related activities as a whole, and which are presented in Appendix F. Mitigation measures have been developed to address issues in all phases throughout the life of the operation including planning, construction and operation. The detailed site-specific mitigation measures are outlined in Section 5 of this report.



3 RESULTS OF THE DESKTOP ANALYSIS

3.1 Analyses of Relevant Databases

The following section contains data accessed as part of the desktop assessment and are presented as a “dashboard style” 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.

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 study area’s actual site characteristics at the scale required to inform the environmental authorisation and/or water use licencing processes. Given these limitations, this information is considered useful as background information to the study, is important in legislative contextualisation of the risks and impacts, and was thus used as a guideline to inform the assessment and to focus on areas and aspects of increased conservation importance during the field survey. 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.

Table 1: Desktop data relating to the character of the watercourses associated with the study area and surrounding region.

Aquatic ecoregion and sub-regions in which the study area is located		National Biodiversity Assessment (2018): South African Inventory of Inland Aquatic Ecosystems (SAIIAE) (Figure 7)		
Ecoregion	Southern Kalahari Ecoregion	According to the NBA 2018 dataset a river is located outside the study area, along its south western boundary. This corresponds to the Kuruman River identified by the NFEPA database (2011). This river is poorly protected, and its Ecosystem Threat Status is critically endangered.		
Catchment	Orange			
Quaternary Catchment	D41M			
WMA	Lower Vaal			
subWMA	Molopo	Detail of the study area in terms of the Northern Cape Critical Biodiversity Areas (2016) (Figure 8)		
Detail of the study area in terms of the National Freshwater Ecosystem Priority Area (NFEPA) (2011) database		The southern portion of the study area is defined as a Critical Biodiversity area (CBA) 1. According to the Technical Guidelines for CBA Maps document (SANBI, 2017), CBAs are areas that must remain in good ecological condition in order to meet biodiversity targets for ecosystem types, species of special concern or ecological processes. CBA 1 areas that are considered to be irreplaceable or near irreplaceable for meeting biodiversity targets. The remaining north eastern extent of the study area is defined as “Other Natural Areas” (ONA). ONA’s consist of all areas in good or fair ecological condition, that fall outside the protected area network and have not been identified as CBAs or Ecological Support Area (ESAs) (SANBI, 2017).		
FEPACODE	The study area is located within a sub quaternary catchment classified as a FEPA catchment. River Freshwater Ecosystem Priority Areas (FEPA) achieve biodiversity targets for river ecosystems and threatened fish species and were identified by the NFEPA project in rivers that are currently in a good condition (A or B ecological category). Although the FEPA status applies to the actual river reach, surrounding land and smaller stream network needs to be managed in a way that maintains the good condition of the river reach.			
NFEPA Wetlands (Figure 6)	According to the NFEPA database, a single natural floodplain wetland is located outside the south western boundary of the study area. According to the NFEPA database this floodplain wetland is considered in a natural or good condition (WETCON = Class AB).	Ecological Status of the most proximal sub-quaternary reach (DWS, 2014)		
		Sub-quaternary reach	D41M – 01756 (Kuruman River)	D41L-02042 (Kuruman River)
		Proximity to the study area	±23km north west of study area (downstream)	±15km south east of study area (upstream)
		Assessed by expert?	Yes	Yes
		PES Category Median	Largely Natural (Class B)	Moderately modified (Class C)
		Mean Ecological Importance (EI) Class	Moderate	Moderate
Wetland Vegetation Type	The study area falls within the Eastern Kalahari Bushveld Group 1 considered Least Threatened by Mbona <i>et al.</i> (2015).	Mean Ecological Sensitivity (ES) Class	Very Low	Moderate
		Stream Order	4	3
		Default Ecological Class (based on median PES and highest EI or ES mean)	Moderately Modified (Class C)	Moderately Modified (Class C)
NFEPA Rivers (Figure 6)	According to the NFEPA Database the Kuruman River is located on the south western boundary of the study area. According to the NFEPA Database the Kuruman River is classified as a FEPA River and therefore, in terms of the NFEPA Implementation Manual (2011), mining (and/or prospecting) is not considered a compatible land use within 1km (1000m) of a riverine buffer around a river FEPA. The PES 1999 Classification as well as the NFEPA Database classifies the river as largely natural (Class B).	Dominant characteristics of the Southern Kalahari (29.01) Ecoregion Level 2 (Kleynhans <i>et al.</i> , 2007)		
		Dominant primary terrain morphology	Plains; moderate relief, Closed Hills, mountains; moderate and high relief; Extremely Irregular Plains (Almost Hilly), Lowlands and Hills, Slightly Irregular Plains (Scattered low hills) and Pans.	
Primary vegetation types		Karroid Kalahari Bushveld, Kalahari Mountain Bushveld, Kalahari Plateau Bushveld		
Importance of the study area according to the Mining and Biodiversity Guidelines (2013)				
The study area is situated within an area that is ranked as ‘Highest Biodiversity Importance’ under the Mining and Biodiversity Guidelines. These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for particular communities or the country as a whole. An environmental impact assessment should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and red flags for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.				
Altitude (m a.m.s.l)		700 - 1500		
MAP (mm)		0 - 500		
Coefficient of Variation (% of MAP)		30 - 40		
Rainfall concentration index		60 - >65		
Rainfall seasonality		Late Summer, Very late Summer, Mid Summer.		
Mean annual temp. (°C)		16 - 22		
Winter temperature (July) (°C)		0 - 22		
Summer temperature (Feb) (°C)		16 - 32		
Median annual simulated runoff (mm)	<5 – 40			

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; MBSP = Municipal Biodiversity Summary Project; NFEPA = National Freshwater Ecosystem Priority Areas; PES = Present Ecological State WMA = Water Management Area.



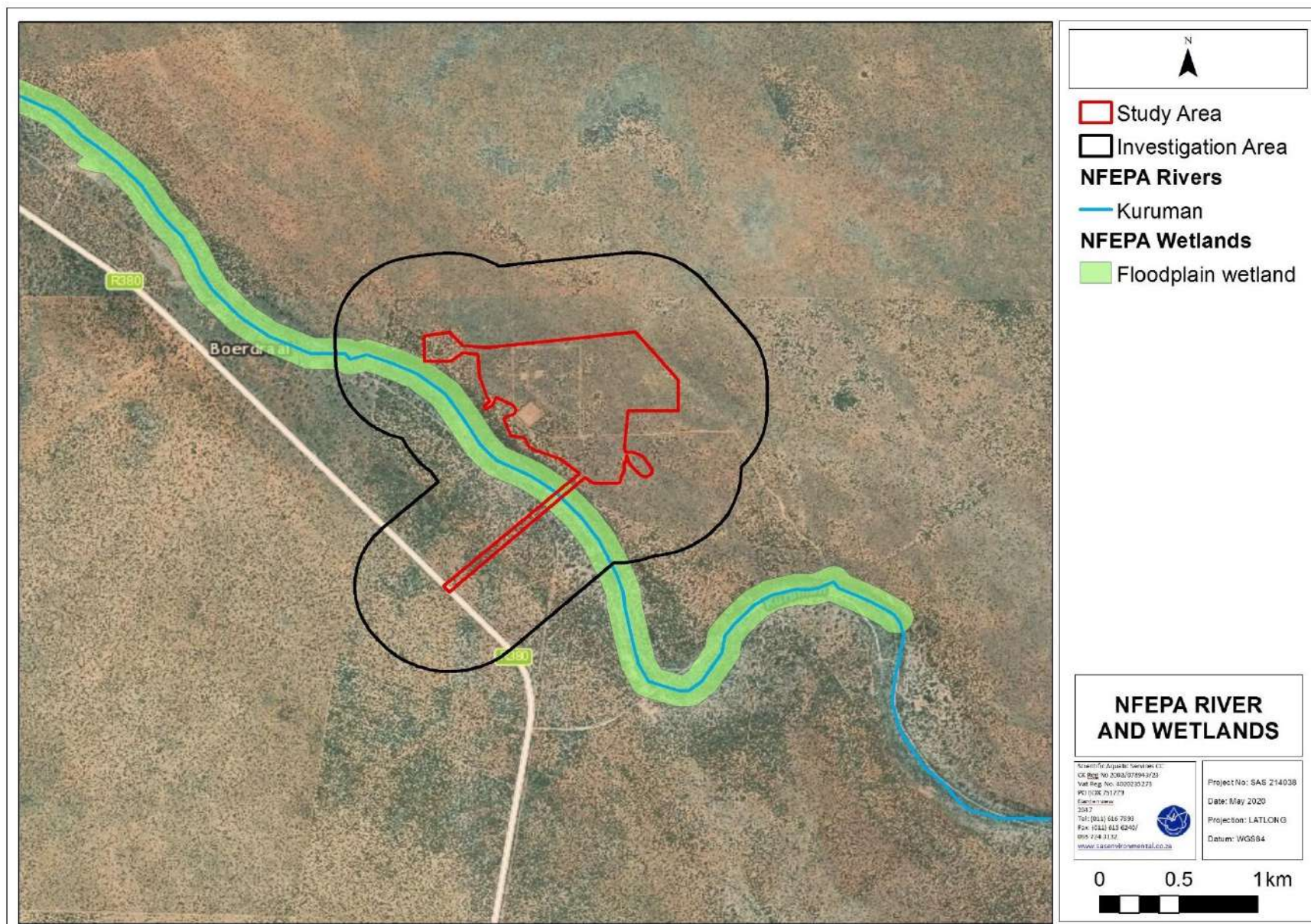


Figure 6: The river and wetland resources associated with the study area and investigation area (NFEPA, 2011).

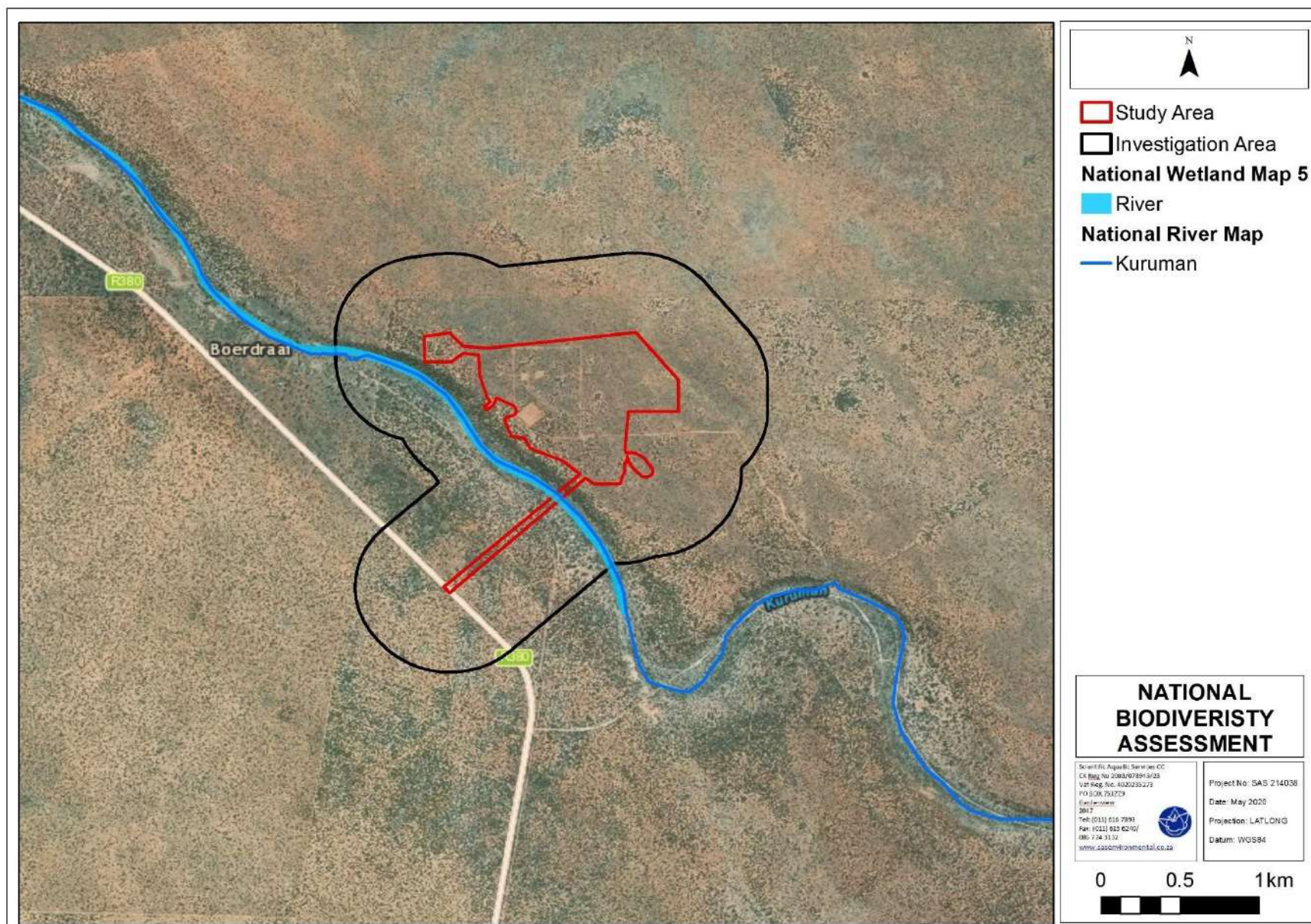


Figure 7: The National Biodiversity Assessment 2018 indicating the wetland and river associated with the study area and investigation area.

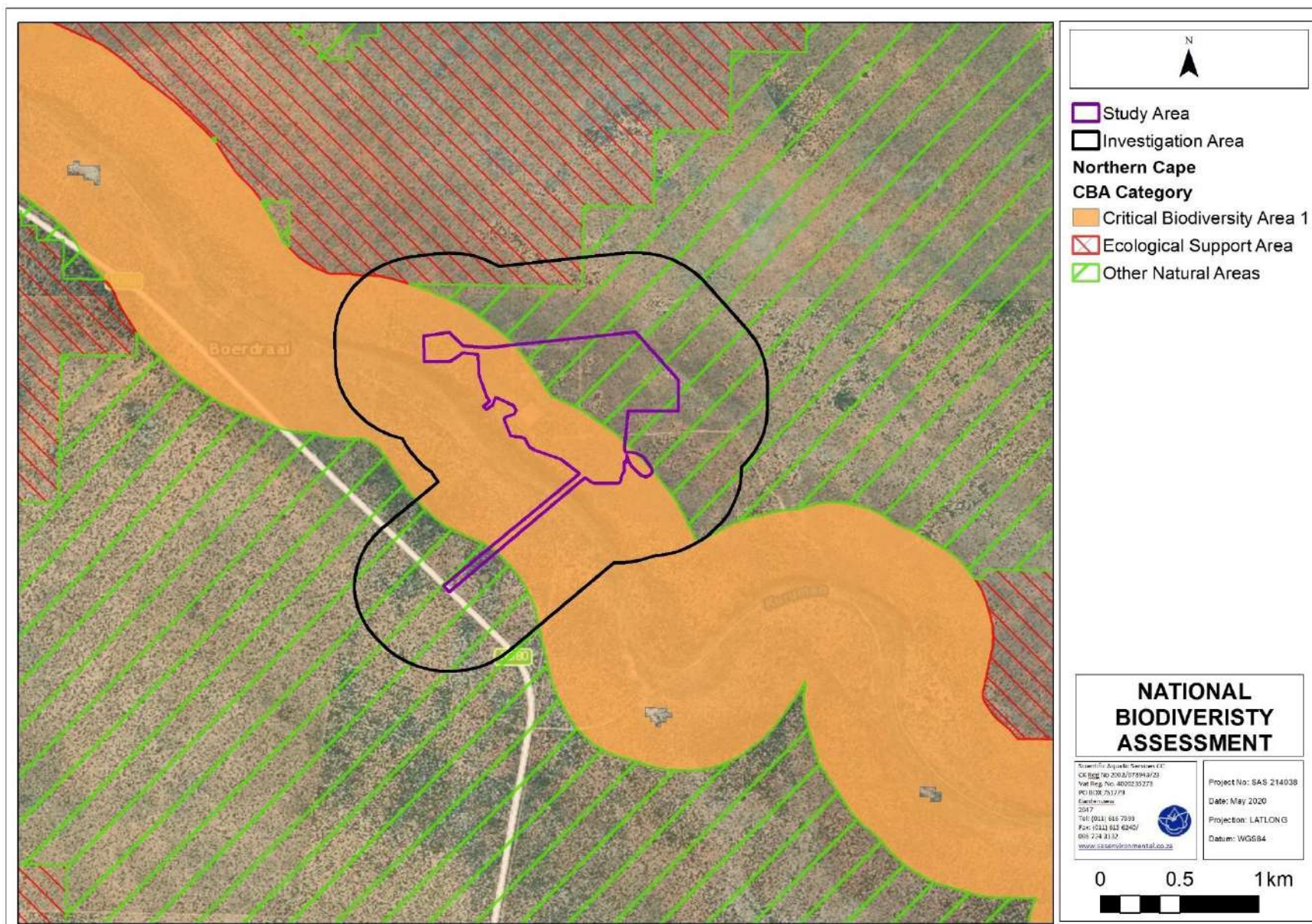


Figure 8: Critical Biodiversity Areas associated with the study area as per the Northern Cape Critical Biodiversity Area dataset (2016).

4 RESULTS: WATERCOURSE ASSESSMENT

4.1 Watercourse System Characterisation

The Kuruman River was identified outside the south western boundary of the study area but will be traversed by the proposed access road. No other watercourses were identified within the investigation area. The Kuruman River is located within a region primarily dominated by livestock farming and mining. As a result, many of the larger river systems have been impacted by overgrazing, unsustainable water abstraction as well as earth moving activity associated with mining. Furthermore, alien vegetation with special mention of *Prosopis glandulosa* is regarded a significant threat to indigenous riparian communities.

Presently the study area as well as immediate surroundings have remained free from mining activity with livestock farming being the dominant land use. The nearest mining activity is associated with the Assmang Black Rock Operation located approximately 7km south of the study area. As a result, large portions of the Kuruman River near the study area can still be considered largely representative of a river feature within the Southern Kalahari Aquatic Ecoregion.

During the site assessment it was found that the portion of the Kuruman River flowing past the study area can be divided into two sub units based on the perceived EIS. Only isolated areas were encountered where overgrazing was evident within the northern portion and therefore this portion was considered to be in a high EIS at the time of the assessment. However, *P. glandulosa* encroachment within the active channel of the river increased gradually towards the south and ultimately to such an extent that the extreme southern portion of the river was dominated by this alien species (Figure 9). As a result, the southern portion was considered to be in a lower EIS. However, it should be noted that both portions form part of the same river system and therefore the possible mining related impact should be considered for the entire river system and not just on a local scale due to different degrees of vegetation transformation.





Figure 9: Northern portion of the Kuruman River (left) and southern portion dominated by *P. glandulosa*

It was indicated that the last recorded flow within the Kuruman River was in 1988 (Shaw *et al.* 1992). Therefore, historically the Kuruman River would have been considered freshwater habitat with higher EIS due to the presence of surface water providing niche aquatic habitat for obligate floral and faunal species, even if only for a short period after heavy rainfall. However, sufficient water volumes still flow sub surface that presently still sustain facultative floral species such as *Panicum coloratum* and *Urochloa* sp., species not identified within any of the terrestrial zones investigated along the river. Furthermore, the subWMA is considered to be a high groundwater recharge area and therefore aquifer dependent tree species such as *Acacia erioloba* would most likely die out should the ground water table decrease significantly. It would therefore be of utmost importance that ground water be monitored should the mining activities prove feasible. Furthermore, it is considered highly likely that the water volume within the river can be increased if the *P. glandulosa* is successfully eradicated. Therefore, effective alien vegetation control is also considered one of the key mitigation measures in order to ensure environmentally responsible mining takes place.

The reach of the Kuruman River identified in the study area 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. The study area is located Eastern Kalahari Bushveld Group 1 Wetland Vegetation Type group. The table below presents the classification of the resource at levels 3 and 4 of the Classification System (Ollis *et al.*, 2013).

Table 2: Characterization of the Kuruman River identified within the study area, according to the Classification System (Ollis *et al.*, 2013).

Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit	
			HGM Type	Longitudinal zonation / landform / Inflow drainage
An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	The study area falls within the Southern Kalahari Ecoregion and the Eastern Kalahari Bushveld Group 1 wetland vegetation group (NFEPA WetVeg).	Plain: An extensive area of low relief characterised by relatively level, gently undulating or uniformly sloping land.	River: a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water.	Lowland river with distinct active channel present.

The delineated boundary of the Kuruman River relative to the proposed surface mining infrastructure is presented in Figure 10.



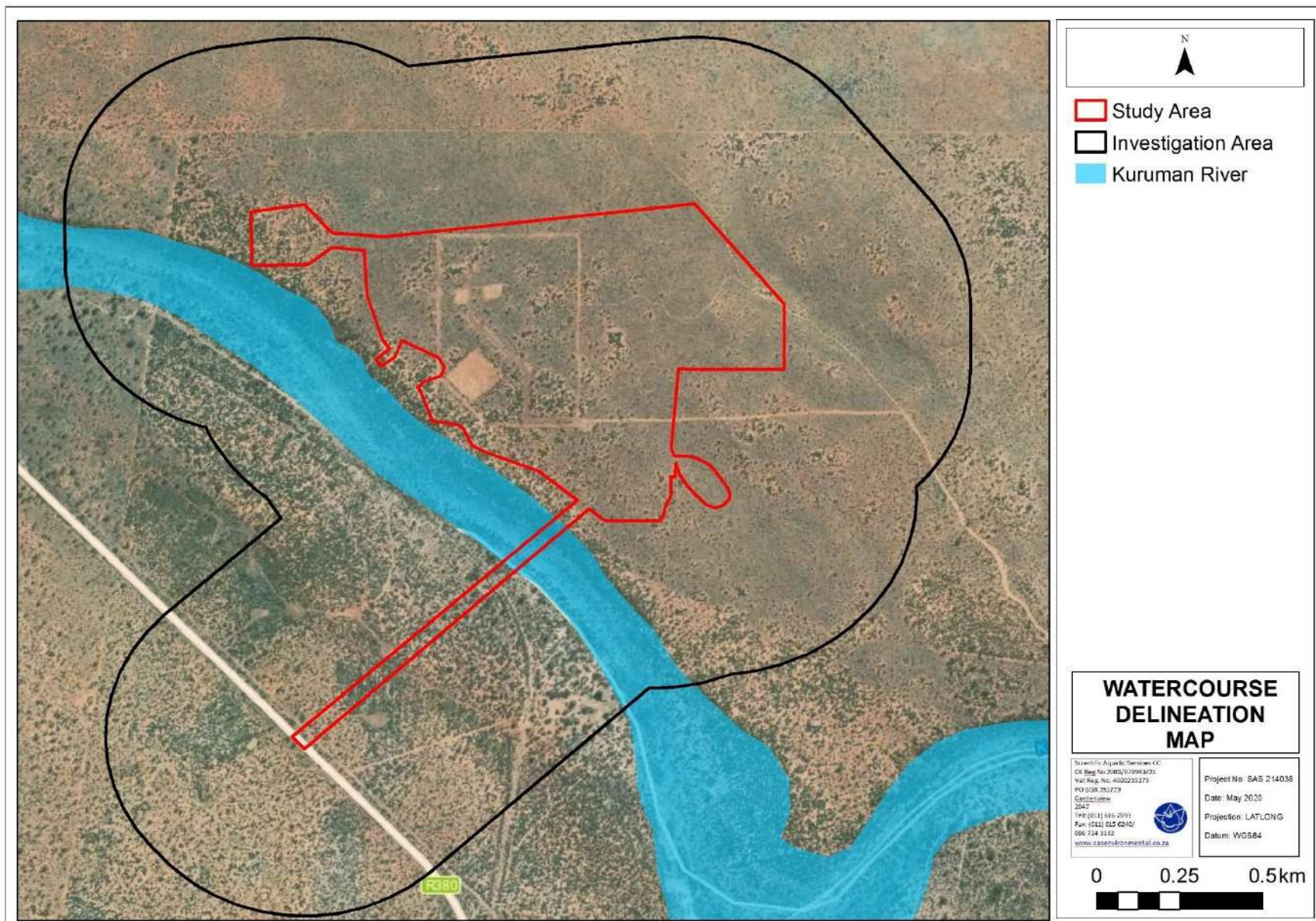


Figure 10: The location of the delineated Kuruman River relative to the study area.



4.2 Watercourse Delineation

The Kuruman River was delineated according to the guidelines advocated by DWA (2005). It should be noted that the identification of the temporary zone did prove difficult in some areas as a result of general disturbance and overgrazing. However, the delineation as presented in this report is regarded as a best estimate of the temporary boundary based on the site conditions present at the time of assessment.

During the assessment, the following temporary zone indicators were used:

- Riparian vegetation proved to be the most indicative of the temporary zone with a distinct decrease in *Grewia flawa* and *Acacia karroo* within the outer boundary of the temporary zone and increase in terrestrial species such as *Acacia melifera*;
- For the soil form indicator, the presence of gleyed soils (most of the iron has been leached out of the soil leading to a greyish/greenish/bluish colour) and mottling (created by a fluctuating water table) were investigated to aid in identifying areas with wetland characteristics (Figure 11);
- Due to the Kuruman River flowing at the bottom of the topographical sequence as well as the incised nature of the river (Figure 11), terrain units were useful in identifying the temporary zone boundary and in support of the vegetation or landscape characteristics;
- Surface water was restricted to the small isolated pools within the permanent zone within the northern portion of the Kuruman River. As a result, surface water and wet soils were of limited use as indicator during the wetland temporary zone delineation.



Figure 11: Incised riparian areas (left) and gleyed soils (right).

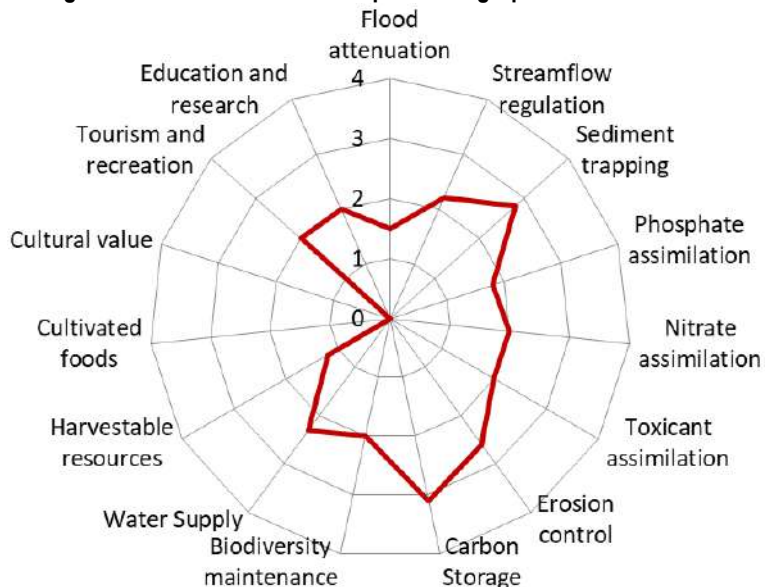

4.3 Field Verification Results

Following the site visit, various assessments were undertaken in order to determine the following:

- PES, incorporating aspects such as hydrology, vegetation and geomorphology;
- Service provision of the Kuruman River, which incorporates biodiversity maintenance, flood attenuation and assimilation of nutrients and toxicants, to name a few;
- The EIS is guided by the results obtained from the assessment of PES and service provision of the Kuruman River;
- An appropriate REC to guide the management of the Kuruman River with the intent of enhancing the ecological integrity of the river where feasible; and
- Assessment of impacts of the construction and operation of the proposed mining activities on the Kuruman River.

The result of the assessment is presented in the dashboard report that follows

Table 3: Summary of the assessment of the reach of the Kuruman River associated with the study area.

<p>Ecological & socio-cultural service provision graph:</p> 	 <p>Figure 12: (Left) Gravel road within the active channel of the southern portion of the river. (Right) erosion and incision of the river embankment with <i>P. glandulosa</i> encroachment encountered.</p>
<p>PES discussion</p>	<p>PES Category: B (Largely natural with few modifications)</p> <p>Primary aspects and activities noted during the field assessment that would have resulted in a change of the natural hydrological regime include the construction of a gravel road within the active channel of the southern portion of the river as well as a decrease in water quantity due to uptake by woody alien invasive such as <i>P. glandulosa</i>.</p> <p>Isolated instances of erosion and sedimentation were encountered within the southern portion of the Kuruman River. Furthermore, the presence of the gravel road running through the active channel and the disturbance associated with the movement of vehicles along this road is likely to have resulted in an increase in the sedimentation of the river and may have therefore had an impact on the geomorphological health of the system.</p> <p>Although activities such as road construction and subsequent alien vegetation encroachment resulted in a higher degree of landscape as well as vegetation transformation within the southern portion of the river, the river still functions as one system. Therefore, the overall score calculated is considered a median, taking into consideration less disturbed areas as well as areas where alien vegetation encroachment was considered severe.</p>

VEGRAI discussion	<p>VEGRAI Class: Class C (Moderately modified)</p> <p>The overall VEGRAI score calculated for the northern portion of the Kuruman River falls within the ecological category (EC) Class B (Largely natural with few modifications). Vegetation associated with the northern portion of the Kuruman River is in a largely natural condition with only small isolated areas encountered which have been impacted by overgrazing and by the encroachment of <i>P. glandulosa</i>. Impacts on vegetation cover, abundance and species composition within this portion of the river are therefore limited.</p> <p>The overall VEGRAI score calculated for the southern portion of the Kuruman River falls within the EC Class C (moderately modified). Vegetation associated with the southern portion of the Kuruman River has been significantly impacted by the encroachment of the alien <i>P. glandulosa</i>. The proliferation of this species within this portion of the river is likely to have resulted in an increase in water abstraction from the river and is therefore likely to have had an impact on water quantity within the system.</p> <p>The overall score calculated for the Kuruman River, taking into consideration both the northern and southern portions of the river, falls within an EC Class C (moderately modified). If an access road is to be developed through the Kuruman River it is recommended that the road traverse the southern portion of the river where impacts as a result of alien encroachment are currently high, and that any roads which are to be developed follow existing gravel roads wherever possible. However, in order to minimise impacts as a result of road construction mitigation measures as listed in Section 5 must be adhered to.</p>		
Ecoservice provision	<p>Intermediate (1,8)</p> <p>The highest scores were calculated for biodiversity maintenance, sediment trapping and erosion control. Biodiversity maintenance calculated a high score due to the riparian vegetation which is considered unique within a relatively dry region as well as due to the presence of the protected species <i>Acacia erioloba</i> and <i>Nerine laticoma</i> which were identified within the temporary zone of the feature. Although <i>A. erioloba</i> does occur within terrestrial areas as well, the individuals along the river banks were significantly larger if compared to individuals within terrestrial areas, this is considered a result of higher ground water volumes. Sediment trapping and erosion control are also considered important services provided by the river, mainly as a result of the sandy soil of the area which is prone to erosion.</p> <p>Assimilation of chemicals calculated moderate scores; this is not necessarily related to the capability of the river to remove these substances but is more related to the quantity of substances expected within a relatively isolated area. Although the river is more than likely capable of assimilating chemicals, it is located within a largely natural area in which limited sources of toxicants, phosphates and nitrates are available. Assimilation will therefore be restricted to the limited chemicals which enter into the feature from surrounding agricultural areas.</p> <p>No evidence was encountered during the field assessment that the river system is used by the local community and therefore the feature cannot be considered to be of significant importance in terms of water supply, harvestable resources, cultivated foods or cultural value.</p>		
EIS discussion	<p>EIS Category: High</p> <p>The high EIS category is considered representative of the degree of transformation encountered within the northern portion of the Kuruman River. However, the southern portion of the river is considered to be more representative of a river with an EIS considered to be of moderate EIS (which area rivers that are considered to be ecologically important and sensitive on a provincial or local scale). It is however deemed possible that the EIS within the southern portion of the river can be increased to a higher EIS category with the effective eradication of the <i>P. glandulosa</i> community.</p>	REC Category	<p>REC Category: B (Largely natural)</p> <p>Should the mine development prove feasible an appropriate and achievable REC for the Kuruman River is deemed to be Category B (Largely natural). Therefore, alien vegetation control and groundwater monitoring should be strictly implemented during all phases of the mine. Furthermore, it is recommended that the mine consider the implementation of a river alien vegetation control plan in association with the farmers in order to curb the rapid proliferation of <i>P. glandulosa</i> within the system.</p>



Watercourse drivers and receptors discussion (hydraulic regime, geomorphological processes, water quality and habitat and biota):

As mentioned previously, aspects and activities noted during the field assessment that would have resulted in a change of the natural hydrological regime include the construction of a gravel road within the active channel of the southern portion of the river as well as a decrease in water quantity due to uptake by woody alien invasive such as *P. glandulosa*. Surface water was last documented within the Kuruman River in 1988 (Shaw *et al.* 1992). Therefore, the hydrological regime has changed to some degree (although it is considered that the river is non-perennial) and presently only sub surface flow with isolated depressions with surface water were identified during the assessment. However, water volumes transported through the river are sufficient to sustain facultative species and depression areas will most likely also support faunal aquatic communities after heavy rainfall events. Furthermore, the river forms part of a longitudinal system extending past the study area boundary. Therefore, water flow within the river is considered important in terms of water provision for downstream areas. Activities which may have impacted on water quality within the Kuruman River are limited to activities such as marginal modifications in flow conditions, agricultural activities, road crossings and alien vegetation encroachment. These activities may have resulted in a marginal decrease in pH and a slight increase in salt content of ground and surface water. However, the impacts on the water quality of the system are not considered significant and the water quality therefore calculated a high score.

The presence of the gravel road running through the active channel of the river and the disturbance associated with the movement of vehicles along this road is likely to have resulted in an increase in the sedimentation of the river and may have therefore had an impact on the geomorphological health of the system. However, no other significant impacts to the geomorphological processes of the river was noted.

The riparian vegetation community dominated by *Grewia flava*, *Acacia karroo*, *Tragus racemosus*, *Schmidtia kalahariensis* and *Eragrostis* sp. could be clearly distinguished from the terrestrial community dominated by *Acacia mellifera*. This indicated less disturbed areas where the biodiversity and habitat provisioning of the river is considered to be natural. This was also helpful with the delineation of the riparian zone within areas where *P. glandulosa* encroachment was significant due to the *P. glandulosa* being restricted to the active channel of the river. Dominant species were characterised as either riparian (including banks and active channel) or terrestrial species as listed in the Table A.

Table A: Dominant floral species identified during the assessment of the Kuruman River.

Riparian species		Terrestrial species
<i>Panicum coloratum</i>	<i>Eragrostis truncata</i>	<i>Eragrostis lehmanniana</i>
<i>Tragus racemosus</i>	<i>Prosopis glandulosa</i>	<i>Cenchrus ciliaris</i>
<i>Urochloa</i> sp.	<i>Grewia flava</i>	<i>Cenchrus ciliaris</i>
<i>Schmidtia kalahariensis</i>	<i>Acacia karroo</i>	<i>Eragrostis echinocloidea</i>
<i>Eragrostis</i> sp.	<i>Acacia erioloba</i>	<i>Acacia mellifera</i>
<i>Cenchrus ciliaris</i>	<i>Nerine laticoma</i>	<i>Acacia erioloba</i>
<i>Cynodon dactylon</i>	<i>Pentzia calcarea</i>	<i>Grewia flava</i>
		<i>Ziziphus mucronata</i>
		<i>Setaria verticillata</i>
		<i>Senna italica</i>

Risk Assessment Outcome & Business Case:

Although the reach of the Kuruman River within the study area has undergone some modifications, most notably in terms of vegetation transformation due to the invasion of *Prosopis glandulosa*, it is still considered to be largely natural (PES Category B). As such, the proposed surface mining infrastructure, with specific mention of the access road crossing has the potential to impact on the characteristics of the river ('Moderate' risk significance). However, it is important to note that the significance of this impact is deemed to be of acceptably low on a local and regional level. All other proposed surface infrastructure is located outside the Kuruman River and above its 1:100 year floodline ('Low' risk significance). The design of the road crossing should ensure adequate flow connectivity between the upstream and downstream portions of the river and the culvert structures must extend the width of the river to ensure recharge of the river area downgradient of the crossing during high rainfall events.

Assuming that a high level of mitigation takes place, the anticipated impact significance of the proposed mining activities ranges from 'low' to 'moderate' throughout the construction and operational phases. Decommissioning activities are considered similar in nature and impact significance to those during the construction and operations phases. It is the opinion of the specialist that, providing the recommendations made in this report are strictly adhered to, from a freshwater ecological perspective, the proposed mining activities may be considered acceptable.



4.4 Sensitivity Mapping

4.4.1 Legislative Requirements, national and provincial 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 aquatic and wetland ecological services), reduce impacts on water resources arising from upstream activities (e.g. by removing or filtering sediment and pollutants), provision of habitat for aquatic and wetland species as well as for certain terrestrial species, and a range of ancillary societal benefits (Macfarlane *et al.*, 2015). It should be noted however that buffer zones are not considered to be effective mitigation against impacts such as hydrological changes arising from stream flow reduction, impoundments or abstraction, nor are they considered to be effective in the management of point-source discharges or contamination of groundwater, both of which require site-specific mitigation measures (Macfarlane *et al.*, 2015).

Legislative requirements were first taken into consideration when determining a suitable buffer zone for the Kuruman River. The definition and motivation for a regulated zone of activity as well as buffer zone for the protection of the river 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
<p>Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended).</p> <p>The Department of Environmental Affairs</p>	<p>➤ Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment (EIA) regulations, 2014 (as amended) states that:</p> <p>The development of:</p> <p>(xii) infrastructure or structures with a physical footprint of 100 square metres or more;</p> <p>Where such development occurs—</p> <ol style="list-style-type: none"> Within a watercourse; In front of a development setback; or If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.

Regulatory authorisation required	Zone of applicability
<p>Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).</p> <p>The Department of Water and Sanitation</p>	<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act (Act No. 36 of 1998) (NWA).</p> <p>In accordance with GN509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> 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 Government Notice no. 509 of 2016 as it relates to the NWA.
	<p>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).</p> <p>These Regulations, forming part of the NWA, were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the Mn48 (Pty) Ltd mining project complies with GN 704 of the NWA, which states that:</p> <p><i>No person in control of a mine or activity may:</i></p> <p>(a) <i>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;</i></p> <p>According to the above, the <u>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.</u> Authorisation for activities within the regulated zone must be obtained.</p>

The delineated Kuruman River and its applicable zones of regulation in terms of National Environmental Management Act, 1998 (Act No. 107 of 1998), Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) and 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) are conceptually depicted in Figure 13.

Since the 1 in 100 year floodline is determined, based on Table 4 above, it can be regarded as the GN509 regulated zone. However, as the delineated boundary of the Kuruman River extend beyond the 1:100 year floodline in some areas, the outermost edge of both the riparian zone and the 1:100 year floodline must be taken as the Regulated Area in terms of the



definition stipulated in Government Notice 509 of 2016, as it relates to the National Water Act, 1998 (Act No. 36 of 1998) and 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), as underlined in Table 4.

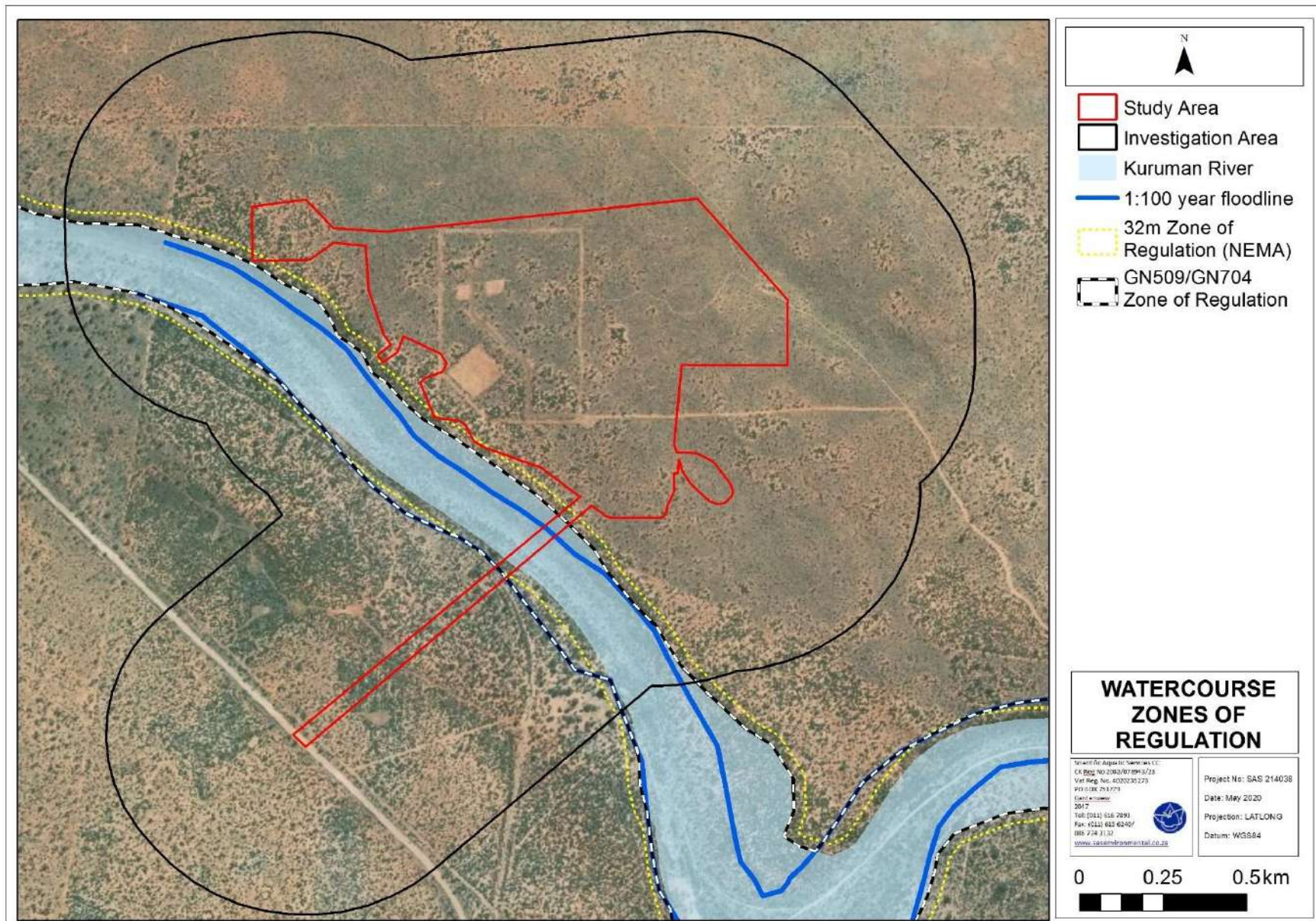


Figure 13: Conceptual presentation of the zones of regulation in terms of NEMA and GN509 of 2016 as it relates to the NWA in relation to the Kuruman River.



5 RISK AND IMPACT ASSESSMENT

This section presents the significance of potential impacts on the Kuruman River associated with the proposed mining activities in the study area. When evaluating the perceived impacts of the proposed activities on the river, the impact significance was ascertained based on the assumption that the recommended mitigation measures will be implemented, in order to reduce the impact/risk significance.

5.1 DWS Risk Assessment

5.1.1 Consideration of impacts and application of mitigation measures

The following aspects were taken into consideration when evaluating the potential impacts of the proposed Mn48 mining development:

- The DWS Risk Assessment was undertaken based on the proposed layout provided by the EAP (Figure 3), which indicates that the proposed access road will traverse the Kuruman River. No other surface infrastructure is located within the delineated boundary of the river or below the GN509/704 zone of regulation. However, the south western boundary of the surface infrastructure footprint and a portion of the well fields is located in the 32 m NEMA Zone of Regulation (ZoR).
- The Kuruman River is a non-perennial system which flows only after significant rainfall has been received. The study area is located within the D41M quaternary catchment, which has a catchment area of 2628 km² and a Mean Annual Runoff (MAR) of 2.05 million m³ (WR, 2012²). From the proposed stormwater management infrastructure layout (Figure 5), several berm and channel clean and dirty water diversion channels will limit catchment runoff from entering the Kuruman River. Although the size of the contained dirty water area was not available at the time of composing this report, it is not considered to equate to a significant reduction of catchment yield into the Kuruman River. Thus, the containment of dirty stormwater within the mining area will make negligible difference to flows of the Kuruman River;
- The groundwater specialist input presented in the Groundwater Flow and Contaminate Transport Modelling report undertaken by SLR Consulting (2013b³) reports on the impact of mine dewatering, well field development and seepage originating from

² Water Resources of South Africa, 2012 study. Water Research Commission Report Number TT 380/08, Water Research Commission, Pretoria, South Africa

³ SLR. 2013b. Lehigh 741 Groundwater Flow and Contaminate Transport Modelling. SLR Project No.: 710.12015.00001. Report No.: 01. August 2013



various sources (including Tailings Storage Facilities (TSFs), waste rock stockpiles and other stockpiles) on the regional groundwater flow and the baseflow of the Kuruman River, and concludes the following:

- Impacts on mine dewatering: potential impacts associated with the deep mine inflows (i.e. dewatering) on the regional groundwater flow are insignificant (w.r.t. the Kalahari Aquifer) and unlikely to impact groundwater contribution to baseflow. Groundwater contribution to baseflow represents high frequency low flows during the dry season. Such flows are not evident for the non-perennial Kuruman River. The cone of depression will be limited to the study area for the Kalahari Aquifer and reversible over time once dewatering stops.
- Impacts based on well field development: the potential impacts associated with the well field (i.e. well dewatering) on the regional groundwater flow are likely to occur. The impact will be limited (up to 1 km) and slightly beyond the study area with regard to interception of recharge and potentially result in partial reduction in subsurface contribution to baseflow to the Kuruman River and reversible over time once well field stops abstracting groundwater. The cone of depression extends beyond the mining boundary and extent below the non-perennial Kuruman River. However, measured groundwater levels are far below the base of the non-perennial Kuruman River. As a result, an impact on the non-perennial Kuruman River due to dewatering of the well field is not expected; and
- Impacts based on seepages associated with various sources: potential impacts originating from storage sources on groundwater quality are highly likely to occur and over a long term. However, the pollution spread (plume migration) are localised within the wider mine site boundaries if surface run-off is contained. The contamination plume will in all likelihood be contained within the mine lease area due to the simulated cone of depression as result of mine dewatering. The simulated pollution plume spread (up to 100 years) will impact the groundwater as resource; however, no indication of third-party groundwater users or surface water will be impacted.

Based on the outcome of the specialist groundwater input as presented by SLR Consulting (2013) the dewatering of the underground mine and dewatering of the proposed mine well field would result in a Medium to Low impact significance (unmitigated) on the regional groundwater flow, while contamination by various storage sources will be of High to Medium impact significance (unmitigated). As such, the DWS Risk Assessment did not include the assessment of the impact of dewatering on the Kuruman River, as based on the specialist groundwater input

(SLR Consulting, 2013) the resultant cone of depression will be limited and the measured groundwater levels are far below the base of the non-perennial Kuruman River.

- In applying the risk assessment, it was assumed that the mitigation hierarchy as advocated by the DEA *et. al* (2013) would be followed, i.e. the impacts would first be avoided (as the proposed access road will directly travers through the Kuruman River, this is not feasible), minimised if avoidance is not feasible, rehabilitated as necessary and offset if required;
- The risk assessment was applied assuming that a high level of mitigation is implemented, thus the results of the risk assessment provided in this report presents the perceived impact significance *post-mitigation*;
- The risk of subsidence caused by underground mining was not assessed as no information was available at the time of preparing this report, including the location of the targeted seams. This must be determined by a suitably qualified specialist;
- Some of the activities (such as the proposed access road crossing) are all highly site specific, not of a significant extent relative to the area of the reach of the Kuruman River assessed, and therefore have a limited spatial extent. However, some activities have a larger spatial extent (e.g. underground mining) and thus have the potential to impact on downgradient neighbouring areas;
- Most impacts are considered to be easily detectable; however, impacts such as surface water contamination would entail specific monitoring to ascertain the occurrence of impacts,

5.1.2 Impact discussion and essential mitigation measures

There are four key ecological impacts on the Kuruman River that are anticipated to occur namely:

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

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

adherence to these measures will assist in minimising the significance of impacts on the receiving environment.

A summary of the risk assessment is provided in the table that follows, followed by a discussion of the outcome thereof.

Table 5: Summary of the results of the risk assessment applied to the Kuruman River associated with the proposed mining activities.

No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
1	CONSTRUCTION PHASE	Site preparation prior to construction of activities related to the proposed surface infrastructure which include site clearing, placement of contractor laydown areas and storage facilities. This is applicable to the surface infrastructure activities above the 1:100 year floodline and outside the delineated edge of the Kuruman River (outside the GN509/704 Zones of Regulation (ZoR)).	Vehicular movement and access to the site, and the removal of vegetation and associated disturbances to soils within the project area.	*Exposure of soils, leading to increased runoff from cleared areas and erosion of the river, and thus increased potential for sedimentation of the river; *Increased sedimentation can lead to changes in instream habitat and potentially alter surface water quality (if present); *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances.	1	3	8	24	L	<ul style="list-style-type: none"> *Construction should be initiated by first constructing clean and dirty water separation systems thus ensuring that as site clearing takes place, dirty water runoff is appropriately managed; *Contractor laydown areas and material storage facilities to remain outside of the river and GN509/704 ZoR; *All vehicle re-fuelling is to take place outside of the river and GN509/704 ZoR; *All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential; *Retain as much indigenous riparian vegetation as possible; *It should be feasible to utilise existing roads to gain access to sites, and crossing the river is considered unnecessary, with the exception of where the proposed access road will traverse the river, and may not be tolerated; *The Kuruman River and the GN509/704 ZoR where no activities are proposed must be demarcated with danger tape (or any other suitable material) and marked as a no-go area; *Removed vegetation must be stockpiled outside the GN509/704 ZoR for the duration of the construction phase and must be disposed of at a licensed disposal facility. No burning of vegetation on site may be permitted, as seed dispersal may occur, which must be prevented for alien and invasive species.
2		Site preparation prior to construction activities related to the proposed access road which will directly traverse the Kuruman River		*Removal of riparian vegetation causes decrease in habitat provisioning and reduced surface roughness; *Trampling within the river leading to soil compaction and altered flow patterns in the river; and *Potential proliferation of alien and invasive vegetation species due to disturbances in the river.	2,75	4,75	16	76	M	



No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
3		Development of clean and dirty water separation systems located inside the study area boundaries and the various ZoRs.	Loss of catchment yield resulting from stormwater containment.	<ul style="list-style-type: none"> *Increased flood peaks as a result of formalisation and concentration of surface runoff in clean water diversion structures; *Potential for erosion, leading to sedimentation of the Kuruman River; *Reduction in surface water runoff volume of water entering the Kuruman River, leading to loss of recharge of the Kuruman River; *Altered vegetation communities due to increased moisture stress. 	1,5	3,5	9	31,5	L	<p>Due to the semi-arid nature of the region in which the Kuruman River is located, it is not expected that the river receives any significant surface runoff during annual rainfall events (with the exception of major rainfall events with a low return period), thus the containment of surface runoff in the mining area is not expected to have any significant impact on the Kuruman River. Nevertheless, the following is recommended:</p> <ul style="list-style-type: none"> *Dirty water areas should be kept as small as possible, but must still be adequately sized (as per the GN704 Regulatory Requirements), to prevent failure thereof and the discharge of contaminated water into the Kuruman River; *All stormwater management infrastructure must be inspected after heavy rainfall events, to ensure they are still functioning and to identify any damages/non-functional areas. Should infrastructure be damaged, all effort must be made to prevent spills from occurring during the repair activities.



4		Construction of the proposed culvert access road crossing over the Kuruman River.	<p>*Trampling by construction personnel and equipment;</p> <p>*Potential for hydrocarbons and oil spills from vehicles crossing the river, to enter into the river;</p> <p>*Construction of a formal road crossing would entail the use of concrete, which could impact on the surface water quality of the downstream portion of the river (only if present at the time of construction).</p>	<p>*Impact on the riparian vegetation, leading to habitat degradation and loss of ecoservice provisioning;</p> <p>*Contamination of surface water (if present).</p>	2,75	4,75	16	76	M	<p>The design criteria as compiled by the freshwater ecologist (SAS, 2017a⁴) must be adhered to. Additionally, the following is also recommended:</p> <p>*The design of the road crossing should ensure adequate flow connectivity between the upstream and downstream portions of the river;</p> <p>*The culvert structures must extend the width of the river to ensure recharge of the river area downgradient of the crossing during high rainfall events;</p> <p>*The extent to which culverts are used across the river should reach as far as possible (over the streambed and banks) to ensure that during freshets the broadest possible area becomes inundated allowing for recharge of the marginal soils, and minimise or prevent the need for bed and bank reinforcement. This reduces the risk of creating a barrier to faunal species and allows small faunal species passage under the structure;</p> <p>*The design of the culverts should have a cross fall (be slightly sloped) in order to accommodate the directional flow of the river. The inlet side of the river crossing should be at a slightly higher elevation than that of the downstream outlet side, in order to facilitate the natural flow and velocity of water through the culverts;</p> <p>*The crossings and the through-flow structures should be sized to accommodate any specific DHSWS requirements;</p> <p>*The duration of impacts within the river should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised. Therefore, the construction period should be kept as short as possible;</p> <p>*Silt traps should be installed at the construction areas. This would limit the sediment load entering the river; and</p> <p>*Restrict construction activities to the drier months as far as possible, to limit the possibility of permanent changes to the system;</p> <p>*No mixed concrete/grout may be deposited outside of the designated construction footprint, to limit it from entering the downstream reach of the river;</p> <p>*A batter/dagga board mixing trays and impermeable sumps should be provided, onto which any mixed concrete/grout can be deposited while it awaits placing; and</p>
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No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
										*Concrete/grout spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site.
5	CONSTRUCTION PHASE	Re-profiling of river embankment in the vicinity of the access road crossing.	*Ongoing disturbances to soils; and *Removal of vegetation.	*Increased sedimentation as a result of disturbances; *Potential further loss of indigenous vegetation and the increased proliferation of alien floral species due to disturbances.	2,25	4,25	16	68	M	*Duration of impacts must be minimised; *Re-seed with indigenous species as soon as culvert crossing construction is completed; and *Stabilisation of the banks and side slopes are required, by employing techniques, such as: - resloping of banks to a maximum of a 1:3 slope; - revegetation of re-profiled slopes; - temporary stabilisation of slopes using geotextiles; and - installation of gabions and reno-mattresses. *The gabions proposed to be installed adjacent to the culvert structure should be filled with in situ material preferably originating from the surrounding area. Nevertheless, the material used must be sustainably sourced.
6		Construction of all surface infrastructure above the 1:100 year floodline and outside the delineated edge of the Kuruman River (above the GN509/704 ZoR).	*Earthwork and construction activities in the catchment of the Kuruman River; *Heavy vehicle movement; and *Stockpiling of construction material.	*Disturbance to the terrestrial buffer zone surrounding the Kuruman River leading to decreased biodiversity; *Loss of migratory corridors; *Potential sedimentation of the river due to increased dust in the larger study area.	1,5	3,5	8	28	L	*All construction activities, including construction personnel and vehicle movement must be located outside the delineated edge of the Kuruman River and the GN509/704 ZoR. Due to the presence of the clean and dirty water separation system (constructed prior to the surface infrastructure), it is unlikely that the construction activities would impact on the Kuruman River. Nevertheless, construction activities must be undertaken as quickly as possible to prevent prolonged impacts to the faunal species reliant on the ecotone between the Kuruman River and its surrounding terrestrial area.



No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
7	OPERATIONAL PHASE	Operation of the access road across the Kuruman River.	<ul style="list-style-type: none"> *Runoff from the roads entering the river; *Potential erosion of the river in the area of the crossing. 	<ul style="list-style-type: none"> *Runoff from the road could be contaminated and could impact on the surface water quality of the river (when present); and *Increased erosion can potentially increase the sediment load of the river. 	1,25	6,25	12	75	M	<ul style="list-style-type: none"> *Ensure that routine inspections and monitoring of the crossing is implemented; *No unnecessary movement in the river should be permitted during the visual inspection; *Repair activities to the access road crossing (when needed) should be undertaken when no surface flow is present; *The culverts which allow for flow connectivity between the upstream and downstream sections should be regularly cleared from debris and litter.
8		Operation and maintenance of the stormwater management system associated with the proposed surface mining infrastructure	Loss of catchment yield due to storm water containment.	<ul style="list-style-type: none"> *Increased flood peaks into the river as a result of formalisation and concentration of surface runoff; *Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river; *Reduction in volume of water entering the river, leading to loss of recharge (and thus potential desiccation) of downstream reach of the river; and *Altered vegetation communities due to moisture stress. 	1,5	3,5	8	28	L	<ul style="list-style-type: none"> *Clean and dirty water separation systems must be implemented and be kept separate in line with Regulation GN704, and maintained to ensure that any contaminated water does not reach the Kuruman River; *Stormwater infrastructure should be regularly inspected in order to prevent the failure thereof and the spilling of contaminated water into the clean water areas or the Kuruman River; and *Where clean water would be released into the river (if applicable), proposed stormwater management outlets should be designed and constructed with erosion prevention structures (such as reno-mattresses) to limit the velocity of stormwater inflow from eroding the river.



No.	Phases	Activity	Aspect	Impact	Severity	Consequence	Likelihood	Significance	Risk Rating	Control Measures
9	DECOMMISSIONING PHASE	Rehabilitation of mining footprint areas (with specific focus on the access road crossing through the Kuruman River (if applicable))	<ul style="list-style-type: none"> *Rehabilitation of stockpile footprint areas through contouring and revegetation; *Removal of stormwater management infrastructure; *Removal of access road crossing through the Kuruman River 	<ul style="list-style-type: none"> *Compaction of soils due to vehicular movement; *Compacted soils underneath the various stockpiles which have been removed; *Latent impacts of vegetation losses (due to lack of re-establishing after rehabilitation activities); *Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils. 	2,75	4,75	16	76	M	<ul style="list-style-type: none"> *All infrastructure used to construct the access road must be decommissioned. All materials must be removed from the river and may temporarily be stockpiled outside the GN509/704 ZoR, where after is must be removed from site and disposed of at a registered disposal facility; *The access road footprint area in the river must be levelled to the same level and shape as that of the upstream and downstream river reaches. This will ensure a continuous riverbed level and prevent any concentration of surface flow from occurring; *River embankments must be suitably rehabilitated (shaped end revegetated) to prevent any erosion from occurring; *All bare areas in the study area should be revegetated within suitable indigenous vegetation species; *Follow up revegetation should take place in areas where initial revegetation is not successful; *Rehabilitation measures stipulated in the Surface Water Rehabilitation and Management Plan (SWRMP) by SAS (2017b)⁵ must be implemented. Implementation must be overseen by a suitably qualified Environmental Site Officer (ESO) and the ESO must sign off the rehabilitation before the relevant contractors leave site; *Post-closure monitoring of the Kuruman River (for a period of 5 years), with specific mention of the invasion of alien vegetation species) is recommended to be undertaken.

⁵ SAS. 2017b. Surface Water Rehabilitation and Management Plan as part of the water management system of the proposed Mn48 (Pty) Ltd Mining Project, near Hotazel, Northern Cape Province. Compiled for SLR Consulting (Pty) Ltd. Compiled by: Scientific Aquatic Services (SAS). Report nr: SAS217053. August 2017 (Updated May 2020).



Four aspects of freshwater ecology are considered when assessing the impacts of the proposed mining activities: loss of habitat and ecological structure, changes to ecological and sociocultural service provision, hydrological function and sediment balance, and water quality impacts.

Although the reach of the Kuruman River within the study area has undergone some modifications, most notably in terms of vegetation transformation due to the invasion of *Prosopis glandulosa*, it is still considered to be largely natural (PES Category B). As such, the proposed surface mining infrastructure, with specific mention of the access road crossing has the potential to impact on the characteristics of the river. However, it is important to note that the significance of this impact is deemed to be of acceptably low significance on a local and regional level.

Of particular concern is the potential loss of connectivity. Whilst this reach of the river has not received water from the upstream areas in many years, the possibility of that impact being rehabilitated to restore flow cannot be ruled out at this time (although it is possible that this is unlikely). Nevertheless, should aforementioned rehabilitation take place, in order to prevent possible cumulative impacts downstream of the study area in future, it is considered important that connectivity of the Kuruman River be retained. Similarly, although the vegetation community has undergone modification, further deterioration should be prevented as far as practicable, and vegetation management during construction and operations along with rehabilitation following de-commissioning should be implemented in order to minimise the cumulative impacts on the vegetation community, with specific mention of alien floral invasion. Careful planning of the location of the infrastructure and implementation of mitigation measures throughout all phases of the proposed activities, will contribute to reduced impact significance on the river. Assuming that a high level of mitigation takes place, the anticipated impact significance of the proposed mining activities ranges from 'low' to 'moderate' throughout the construction and operational phases. Decommissioning activities are considered similar in nature and impact significance to those during the construction and operations phases.



5.2 Impact Assessment

The tables below serve to summarise the significance of potential impacts on the Kuruman River. Impacts associated with the operational and rehabilitation phases have been assessed separately. The sections below present the impact assessment according to the method described in Appendix D. In addition, it also indicates the required mitigatory and management measures needed to minimise potential ecological impacts and presents an assessment of the significance of the impacts taking into consideration the available mitigatory measures, assuming that they are fully implemented.

5.2.1 Impact 1: Loss of river habitat and ecological structure

Potential edge effects of mining related activities as well as access road construction activities through the Kuruman River will result in the loss or transformation of riparian habitat and its ecology. The Kuruman River is considered a highly sensitive system which calculated a high EIS score (refer to Section 4.3) and the loss of riparian habitat, which is already considered scarce within the region, is considered to be of a very high significance.

Table 6: Aspects and activities register – Impact 1

Planning of mine	Construction and operational	Decommissioning and closure
Poor planning of infrastructure placement	Site clearing and the disturbance of soils and the associated erosion and sedimentation of riparian habitats	Inadequate rehabilitation
Inadequate design of infrastructure	Site clearing and the removal of vegetation	Decommissioning activities such as removal of temporary infrastructure encroaching into riparian habitat
	Construction of access roads through the Kuruman River	Indiscriminate movement of vehicles through riparian habitat
	Contamination of groundwater as a result of spillages and seepage of hazardous waste material	Lack of alien and weed control
	Indiscriminate movement of vehicles through riparian habitat	Dust generation
	Abstraction due to boreholes and the cone of dewatering	
	Stockpiling of construction and waste material within riparian habitat	
	Increased runoff or altered runoff patterns from disturbed areas and areas where vegetation has been cleared	
	Dust generation	



Table 7: Impact on riparian habitat and ecology

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	5	5	3	5	10	13	130 (Very High) Negative
Decommissioning and closure phase	3	5	3	3	5	8	11	88 (Medium High) Negative

Essential mitigation measures during the construction and operational phase:

- Refer to the control measures as presented in Table 5 for Activity 1 and 2;
- Demarcate the GN509/GN704 zone of regulation (Figure 13) as a sensitive area and allow only authorized mining personnel and activities within this area;
- The mining footprint area must be limited to what is absolutely essential in order to minimise environmental damage;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Should access roads be developed through the Kuruman River the following mitigation measures must be adhered to:
 - Obtain the relevant approvals from DWS for any activities within the river and its associated zones of regulations. In this regard special mention is made of water use licences in terms of section 21 (c) and (i) of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). As well as exemption in terms of 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);
 - It should be feasible to utilise existing roads to gain access to sites during site establishment, until such time as the river crossing is established;
 - Demarcate the construction footprint where the access roads through the Kuruman River need to be constructed;
 - Keep construction related activities strictly within the demarcated area;
 - Remove material e.g. danger tape (or any other suitable material) used for demarcation purposes after construction activities are completed;
 - Ensure that culverts do not alter stream flow patterns or result in the diversion of flow or create upstream ponding and downstream erosion and incision;
 - Rehabilitate all riparian areas impacted during the construction of the access roads through the Kuruman River.
- Edge effects of activities including erosion and alien/ weed proliferation need to be strictly controlled;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the riparian areas;
- Prevent run-off from work areas entering the river;
- Ensure that seepage from dirty water systems is prevented as far as possible;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act (NEMA) (Act No. 107 of 1998). Species specific and area specific eradication recommendations:
 - Take care with the choice of herbicide to ensure that no additional impacts on riparian habitat occur due to the herbicide used;
 - Keep footprint areas as small as possible when removing alien plant species;
 - Do not allow vehicles to drive through designated sensitive riparian areas during the eradication of alien and weed species;
 - Dispose of removed alien plant material at a registered waste disposal site;
- Implement waste management as contemplated in the Environmental Management Programme in order to prevent construction related waste from entering the riparian environment;
- Ensure no dumping of waste material or temporary storage of any material take place within any riparian area or its zones of regulation;
- Inspect all vehicles for leaks regularly;
- All vehicles must remain on designated roads with no indiscriminate driving through adjacent riparian areas;



- Re-fuel vehicles in a designated area;
- All spills should be immediately cleaned up and treated accordingly;
- Provide appropriate sanitation facilities for the duration of any activity and remove all waste to an appropriate facility. These facilities must be located outside of the riparian area and associated zones of regulation and must be regularly serviced;
- *Nerine laticoma* (protected under the Northern Cape Nature Conservation Act (NCNCA) (Act No. 9 of 2009) and *Acacia erioloba* (protected under the National Forests Act) occur within riparian areas. If these protected species are to be removed from the study area, the required permit must be applied for from the Northern Cape Department of Environment and Nature Conservation (*N. laticoma*) and from the Department of Agriculture, Forestry and Fisheries (*A. erioloba*), and as many individuals as possible must be rescued and relocated;
- Ensure that abstraction from boreholes does not lower the water table through sustainable abstraction; and
- A groundwater monitoring programme must be implemented with monitoring taking place at regular intervals.

Recommended mitigation measures during the construction and operational phase:

- Restrict activities to winter months in order to limit impact on aquatic species utilising the river as foraging and breeding habitat;
- Implement a river alien vegetation control plan in association with the farmers in order to curb the rapid proliferation of *P. glandulosa* within the system.

Essential mitigation measures during the decommissioning and closure phase:

- All vehicles must remain on designated roads with no indiscriminate driving through adjacent riparian areas;
- Remove alien and weed species in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act (NEMA) (Act No. 107 of 1998);
- Rehabilitate and reshape all areas disturbed by mining to be as representative of pre-mining terrain units as possible in order to re-instate natural runoff patterns; and
- Remove the access road and rehabilitate areas impacted by the crossing. The rehabilitated crossing should be monitored, and alien vegetation removed for as long as it takes for natural vegetation to re-establish in the area.

Recommended mitigation measures during the decommissioning and closure phase:

- N/A.

With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	5	3	2	4	10	9	90 (Medium High) Negative
Decommissioning and closure phase	2	5	1	1	2	7	4	28 (Low) Negative

Probable latent impacts

- The riparian system within the study area may be permanently altered or lost if inadequate rehabilitation takes place;
- Alien vegetation proliferation; and
- Localised erosion and sedimentation



During the construction and operational phase, the potential edge effects of mining related activities may impact on the Kuruman River and access roads will be developed through the Kuruman River. This will result in a definite loss of riparian habitat and ecology. The Kuruman River calculated a high EIS (refer to Section 4.3) and impacts on habitat as a result of mining activity are likely to be significant. Therefore, the impact is considered to be of a very high (negative) significance prior to the implementation of mitigation measures. Although access roads will be developed traversing the Kuruman River, mitigation measures should be undertaken to prevent the loss of habitat as a result of the development of the road, and if disturbed areas are adequately rehabilitated and *P. glandulosa* is removed from the riparian areas then the PES of surrounding areas may improve. Furthermore, the implementation of mitigation measures will result in mining activities being restricted to areas outside of the GN509/704 zone of regulation which is likely to safeguard the riparian habitat to some degree. However, edge effects and the encroachment of activities into the buffer area are still likely to occur and the impact significance may therefore only be reduced to a medium high (negative) significance with the implementation of mitigation measures.

The impact on riparian habitat during the decommissioning and closure phase is not considered as severe as that associated with the operational phase. If mitigation measures are adhered to, impact probability, duration and severity can be reduced, and the overall impact significance can be decreased to a low (negative) significance.

5.2.2 Impact 2: Changes to river ecological and socio-cultural service provision

Potential edge effects of mining related activities and the development of access roads through the Kuruman River may result in the loss of important ecoservices and function from the system such as stream flow regulation, sediment trapping and erosion control abilities. Furthermore, impacts may result an inability of the system to support biodiversity as a result of changes to water quality, increased sedimentation and alteration of natural hydrological regimes.

Table 8: Aspects and activities register – Impact 2

Planning of mine	Construction and operational	Decommissioning and closure
Poor planning of infrastructure placement	Site clearing and the removal of vegetation	Inadequate rehabilitation
Inadequate design of infrastructure	Construction of access roads through the Kuruman River	Lack of alien and weed control
	Indiscriminate movement of vehicles through riparian habitat	Indiscriminate movement of vehicles through riparian habitat
	Earthworks in the vicinity of the river leading to altered runoff patterns and erosion	
	Abstraction due to boreholes and the cone of dewatering	
	Spill of waste material and waste deposits into the riparian habitat	

Table 9: Impact on ecological structure and services

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	3	3	3	5	8	11	88 (Medium High) Negative
Decommissioning and closure phase	3	3	3	3	5	6	11	66 (Medium Low) Negative
<p>Essential mitigation measures during the construction and operational phase: Refer to Table 6</p> <p>Recommended mitigation measures during the construction and operational phase: Refer to Table 6</p> <p>Essential mitigation measures during the decommissioning and closure phase: Refer to Table 6</p> <p>Recommended mitigation measures during the decommissioning and closure phase: ➤ N/A</p>								
With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	3	2	1	2	8	5	40 (Low) Negative
Decommissioning and closure phase	1	3	1	1	1	4	3	12 (Very Low) Negative
Probable latent impacts								



- Overall river function and service provision may be reduced permanently, should mitigation measures not be strictly adhered to.

Potential edge effects of mining activities and the development of access roads through the Kuruman River during the construction and operational phase will result in the definite loss of river function and service provision. The impact is likely to extend beyond the mining footprint as localised activities within the river system are highly likely to affect areas up and downstream. However, the overall score calculated for function and service provision by the Kuruman River was calculated to be of an intermediate level and therefore the sensitivity of the receiving environment and the severity of the impact is decreased. The impact is therefore considered to be of a medium high (negative) significance prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the impact can be reduced to a low (negative) significance. If adequate rehabilitation is undertaken, the impact significance as a result of the construction of an access road through the river will be decreased and the duration of the impact will be restricted to the time it takes to construct the road and undertake rehabilitation. Furthermore, *P. glandulosa* will be removed from the riparian areas which may result in an improvement of river function and service provision.

Ineffective rehabilitation and the movement of vehicles through riparian areas during decommissioning and closure activities may have a negative impact on the function and service provision of the system. However, the impact during the decommissioning and closure phase is not considered as severe as that associated with the operational phase. If mitigation measures are implemented, impact probability, severity, duration and spatial scale can be reduced, and the overall impact significance can be decreased to a very low (negative) significance.

5.2.3 Impact 3: Impacts on river hydrological function and sediment balance

Potential edge effects of mining related activities and the development of access roads through the Kuruman River are likely to have a significant impact on the hydrology of the system. Site clearing and the removal of vegetation may result in an increase in runoff from disturbed areas and an increase in the erosion and sedimentation of the system. An increase in runoff from disturbed areas may also alter flow patterns within the system and may have an impact on the natural hydrological zonation within the system. Furthermore, the development of access roads may result in the alteration of stream and baseflow patterns through the river and may impede the flow of water through the system during high rainfall periods. In addition, the abstraction of groundwater from boreholes for use in mining activities may result in the



general lowering of the water table in the area and could have disastrous effects on the hydrology of the river which is an important groundwater recharge area.

Table 10: Aspects and activities register – Impact 3

Planning of mine	Construction and operational	Decommissioning and closure
Poor planning of infrastructure placement	Site clearing and the removal of vegetation	Inadequate rehabilitation
Inadequate design of infrastructure	Site clearing and the disturbance of soils	Lack of alien and weed control
	Construction of access roads through the Kuruman River	Indiscriminate movement of vehicles through riparian habitat
	Earthworks in the vicinity of riparian areas	
	Stockpiling of topsoil adjacent to riparian areas and runoff from stockpiles	
	Abstraction due to boreholes and the cone of dewatering	
	Compaction of soils	
	Increased stormwater runoff from cleared areas	
	Dust generation	
	The separation of clean and dirty water areas will lead to a very small loss of catchment yield however due to the low flows in the system this may be significant	

Table 11: Impact on riparian hydrology and sediment balance

Without Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	4	5	3	5	9	13	117 (High) Negative
Decommissioning and closure phase	3	4	3	3	5	7	11	77 (Medium High) Negative

Essential mitigation measures during the construction and operational phase:

Refer to Table 6

Recommended mitigation measures during the construction and operational phase:

- Restrict activities associated with the development of an access road through the Kuruman River to the drier winter months, if possible, to avoid erosion of exposed soils and sedimentation of riparian habitat;
- Implement a river alien vegetation control plan in association with the farmers in order to curb the rapid proliferation of *P. glandulosa* within the system;
- Slow runoff from hardened surfaces down by the strategic placement of berms. The following points should serve to guide the placement of erosion berms:
 - Where the track has a slope of less than 2%, berms every 50m should be installed;
 - Where the track slopes between 2% and 10%, berms every 25m should be installed;



<ul style="list-style-type: none"> Where the track slopes between 10%-15%, berms every 20m should be installed; and Where the track has a slope greater than 15%, berms every 10m should be installed. <p>Essential mitigation measures during the decommissioning and closure phase: Refer to Table 6</p> <p>Recommended mitigation measures during the decommissioning and closure phase: ➤ N/A.</p>								
With Management	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction and operational phase	5	4	2	2	2	9	6	54 (Medium Low) Negative
Decommissioning and closure phase	1	4	1	2	1	5	4	20 (Very Low) Negative
<p>Probable latent impacts ➤ N/A</p>								

Prior to mitigation, the hydrology of the Kuruman River may be significantly altered by the potential edge effects of mining related activities and by the development of access roads through the river. The edge effects of mining related activities and road construction are likely to result in the alteration of flow patterns and may cause the sedimentation and erosion of the system. This impact will be permanent and will be of a high severity. The impact is therefore considered to be of a high (negative) significance prior to the implementation of mitigation measures. However, with the implementation of mitigation measures the significance of the impact can be reduced to a medium low level. The alteration of hydrological patterns within the Kuruman River will be restricted to the duration of access road construction activities. Areas disturbed due to the construction of the access road must be rehabilitated and the bridge design must minimise any impacts on the riparian and instream zone substrate as well as hydrological function and sediment balance and should allow for continued flow through the system. With the removal of *P. glandulosa* the quantity of water within the system is also likely to increase and the hydrology of the system is likely to improve slightly.

The impact of decommissioning and closure activities, if left unmitigated, will have a medium high (negative) significance. However, the severity of the impact during the decommissioning and closure phase is not as high as that associated with the operational phase and if mitigation measures are implemented the impact can be reduced to a very low (negative) significance.



5.2.4 Impact Assessment Conclusion

If mitigation and management measures are implemented as outlined in this document, the likelihood of impacts occurring, and the consequence of all potential impacts may be significantly reduced. The following table serves as a summary of the key findings made during the impact assessment process.

Table 12: A summary of impact significance before and after mitigation.

Impact	Unmanaged	Managed
IMPACT 1: LOSS OF RIPARIAN HABITAT AND ECOLOGICAL STRUCTURE		
Operational Phase	Very High (-ve)	Medium High (-ve)
Rehabilitation Phase	Medium High (-ve)	Low (-ve)
IMPACT 2: CHANGES TO RIVER ECOLOGICAL AND SOCIO-CULTURAL SERVICE PROVISION		
Operational Phase	Medium High (-ve)	Low (-ve)
Rehabilitation Phase	Medium Low (-ve)	Very Low (-ve)
IMPACT 3: IMPACTS ON RIVER HYDROLOGICAL FUNCTION AND SEDIMENT BALANCE		
Operational Phase	High (-ve)	Medium Low (-ve)
Rehabilitation Phase	Medium High (-ve)	Very Low (-ve)

From the results of the impact assessment it was observed that three major impacts are likely to affect the Kuruman River. All the impacts are likely to have an effect on the receiving environment if unmanaged. However, the majority of the impacts can be mitigated to some degree by adequate planning, management and implementation of an effective rehabilitation plan.

5.3 Cumulative Impact Summary

Rivers and wetlands within the region are under continued and increasing threat due to ongoing mining development in the area, particularly upstream of the study area as existing mining activities in the vicinity of Hotazel undergo expansion. The disturbance of the reach of the Kuruman River associated with the study area is expected to contribute to the cumulative effect on the loss of riparian and wetland areas within the region. Although the Kuruman River is a non-perennial 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. Continued pressure arising from mining (in particular) in the greater catchment of the river may lead to loss of ecological



service provision, biodiversity maintenance and potentially threatening the survival of floral and faunal Species of Conservation Concern.

6 CONCLUSION

Following the results of the assessment, it is apparent that the reach of the Kuruman River assessed is deemed to be of largely natural and of high ecological importance and sensitivity. As such, degradation of the system may not be permitted, and it is deemed essential that connectivity in particular be preserved in order to prevent further cumulative impacts on the system downstream of the study area. Assuming that responsible implementation of the mitigation hierarchy, as well as strict adherence to cogent, well-developed mitigation measures takes place throughout all phases of the proposed mining development, the significance of potential impacts arising from the proposed mining activities is deemed to be of low to moderate levels.

Thus, it is the opinion of the specialist that, providing the recommendations made in this report are strictly adhered to, from a freshwater ecological perspective, the proposed mining activities may be considered acceptable.

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APPENDIX A – Terms of Use and Indemnity

INDEMNITY AND TERMS OF USE OF THIS REPORT

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APPENDIX B – Legislation

LEGISLATIVE REQUIREMENTS

The Constitution of the Republic of South Africa, 1996	<p>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.</p>
National Environmental Management Act (NEMA) (Act No. 107 of 1998)	<p>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.</p>
The National Water Act (NWA) (Act No. 36 of 1998)	<p>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).</p>
National Environmental Management: Biodiversity Act (2004) (Act 10 of 2004) (NEMBA)	<p>Ecosystems that are threatened or in need of protection</p> <p>(1) (a) The Minister may, by notice in the Gazette, publish a national list of ecosystems that are threatened and in need of protection.</p> <p>(b) An MEC for environmental affairs in a province may, by notice in <i>the Gazette</i>, publish a provincial list of ecosystems in the province that are threatened and in need of protection.</p> <p>(2) The following categories of ecosystems may be listed in terms of subsection (1):</p> <p>(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;</p> <p>(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;</p> <p>(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</p> <p>(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).</p>
Government Notice 864 Alien and Invasive Species Regulations as published in the Government Gazette 40166 of 2016 as it relates to the National Environmental Management Biodiversity	<p>NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. This act in terms of alien and invasive species aims to:</p> <ul style="list-style-type: none"> ➤ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➤ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➤ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.



<p>Act, 2004 (Act No 10 of 2004);</p>	<p>Alien species are defined, in terms of the NEMBA as:</p> <ul style="list-style-type: none"> (a) A species that is not an indigenous species; or (b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. <p>Categories according to NEMBA (Alien and Invasive Species Regulations, 2017):</p> <ul style="list-style-type: none"> ➤ Category 1a: Invasive species that require compulsory control; ➤ Category 1b: Invasive species that require control by means of an invasive species management programme; ➤ Category 2: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and ➤ Category 3: Ornamentally used plants that may no longer be planted.
<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the NWA (Act 36 of 1998)</p>	<p>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:</p> <ul style="list-style-type: none"> 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. <p>This notice replaces GN1199 and may be exercised as follows:</p> <ul style="list-style-type: none"> 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 have 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. <p>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.</p> <p>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.</p>
<p>Mineral and Petroleum Resources Development Act, No 28 of 2002 (MPRDA)</p>	<p>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).</p>
<p>MPRDA GN 704 – Regulations on the use of water for</p>	<p>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</p>



mining and related activities aimed at the protection of water resources, 1999	<p>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:</p> <p><i>No person in control of a mine or activity may:</i></p> <p>(b) <i>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;</i></p> <p>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.</p>
National Environmental Management: Waste Act, No 59 of 2008 (NEMWA)	<p>NEMWA, which reforms the law regulating waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution; provides for national norms and standards for regulating the management of waste by all spheres of government, and provides for the licensing and control of waste management activities</p>

APPENDIX C – Method of Assessment

WATERCOURSE METHOD OF ASSESSMENT

1. Desktop Study

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

1.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011)

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

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

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

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

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

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

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



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

FUNCTIONAL UNIT		
LEVEL 4: HYDROGEOMORPHIC (HGM) UNIT		
HGM type	Longitudinal zonation/ Landform / Outflow drainage	Landform / Inflow drainage
A	B	C
River	Mountain headwater stream	Active channel
		Riparian zone
	Mountain stream	Active channel
		Riparian zone
	Transitional	Active channel
		Riparian zone
	Upper foothills	Active channel
		Riparian zone
	Lower foothills	Active channel
		Riparian zone
	Lowland river	Active channel
		Riparian zone
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 ocean⁶ (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.

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.



Level 2: Ecoregions & NFEPA Wetland Vegetation Groups

For Inland Systems, the regional spatial framework that has been included at Level 2 of the classification system is that of DWA's Level 1 Ecoregions for aquatic ecosystems (Kleynhans *et al.*, 2005). There is a total of 31 Ecoregions across South Africa, including Lesotho and Swaziland. DWA Ecoregions have most commonly been used to categorise the regional setting for national and regional water resource management applications, especially in relation to rivers.

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

Level 3: Landscape Setting

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

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

Level 4: Hydrogeomorphic Units

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

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



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

3. 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 watercourses was conducted according to the guidelines as described by Kotze *et al.* (2009). An assessment was undertaken that examines and rates the following services according to their degree of importance and the degree to which the service is provided:

- Flood attenuation;
- Stream flow regulation;
- Sediment trapping;
- Phosphate trapping;
- Nitrate removal;
- Toxicant removal;
- Erosion control;
- Carbon storage;
- Maintenance of biodiversity;
- Water supply for human use;
- Natural resources;
- Cultivated foods;
- Cultural significance;
- Tourism and recreation; and
- Education and research.

The characteristics were used to quantitatively determine the value, and by extension sensitivity, of the watercourses. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to the watercourses.

Table C4: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

4. Index of Habitat Integrity (IHI)

To assess the Present Ecological State (PES) of the drainage feature the Index of Habitat Integrity (IHI) for South African floodplain, channelled and channelled valley bottom wetland types (DWAF Resource Quality Services, 2007) were used.

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



The WETLAND-IHI is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The WETLAND-IHI has been developed to allow the NAEHMP to include floodplain and channelled valley bottom wetland types to be assessed. The output scores from the WETLAND-IHI model are presented in A – F ecological categories (Table 3 below), and provide a score of the PES of the habitat integrity of the wetland system being examined.

Table C5: Descriptions of the A – F ecological categories (after Kleynhans, 1996, 1999).

Ecological Category	PES % Score	Description
A	90-100%	Unmodified, natural.
B	80-90%	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.
C	60-80%	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
D	40-60%	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred. E 20-40% Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
E	20-40%	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.
F	0-20%	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.

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

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

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

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

The highest of these three suites of scores is then used to determine the overall Importance and Sensitivity category (Table C5) of the wetland system being assessed.



Table C6: Ecological Importance and Sensitivity Categories and the interpretation of median scores for biota and habitat determinants (adapted from Kleynhans, 1999).

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

6. Recommended 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 watercourse (sections above), with the objective of either maintaining, or improving the ecological integrity of the watercourse in order to ensure continued ecological functionality.

Table C7: Recommended management objectives (RMO) for water resources based on PES & EIS scores.

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

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

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



Table C8: 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 watercourse 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 and Risk Assessment Methodology

Impact Assessment Methodology

In order for the Environmental Assessment Practitioner (EAP) to allow for sufficient consideration of all environmental impacts, impacts are assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below. The first stage of the risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An activity is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is 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 wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- Receptors can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- Resources include components of the biophysical environment.
- 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 necessary⁹.

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- 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



The assessment of significance is undertaken twice. Initially, 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, 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.

LIKELIHOOD DESCRIPTORS

Probability of impact	RATING
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	RATING
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3
Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	RATING
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear features affected > 100m and <1000m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear features affected > 1000m and < 3000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear features affected > 3000m and <10 000 m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear features affected > 10 000m	5
Duration of impact	RATING



One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table D2: Significance rating matrix

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

Table D3: Positive/Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management



DWS Risk Assessment Methodology

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

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

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'¹⁰. 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 wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as watercourses, 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, impact, legal issues and the detection of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 20. 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 necessary¹¹.

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, 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.

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

¹⁰ The definition has been aligned with that used in the ISO 14001 Standard.

¹¹ Some risks/impacts that have low significance will however still require mitigation



Table D4: 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 D5: 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 D6: 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 D7: 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 D8: 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 D9: 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 D10: 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 D11: 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 D12: 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.
- vii) 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 impacts¹² 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.

¹² Mitigation measures should address both positive and negative impacts



APPENDIX E – Results of Field Investigation

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

Table E1: Presentation of the results of the IHI assessment applied to the Kuruman River.

OVERALL PES SCORE					
	Ranking	Weighting	Score	Confidence Rating	PES Category
DRIVING PROCESSES:		100	0.8		
Hydrology	1	100	0.9	4.0	B
Geomorphology	2	80	0.9	4.0	B
Water Quality	3	30	0.3	2.0	A
WETLAND LANDUSE ACTIVITIES:		80	1.0	3.9	
Vegetation Alteration Score	1	100	1.0	3.9	B/C
OVERALL SCORE:			0.9	Confidence Rating	
PES %			82.4		
PES Category:			B		1.7

Table E2: Presentation of the results of the Ecoservices assessment applied to the Kuruman River.

Ecosystem service	PES
Flood attenuation	1.5
Streamflow regulation	2.2
Sediment trapping	2.8
Phosphate assimilation	1.8
Nitrate assimilation	2
Toxicant assimilation	2
Erosion control	2.6
Biodiversity maintenance	3.1
Carbon Storage	2
Water Supply	2.3
Harvestable resources	1.2
Cultural value	0
Cultivated foods	0
Tourism and recreation	2
Education and research	2
SUM	27.5
Average score	1.8



Table E3: Presentation of the results of the EIS assessment applied to the Kuruman River

Determinant	PES	
	Score	Confidence
PRIMARY DETERMINANTS		
1.Rare & Endangered Species	4	4
2.Populations of Unique Species	3	4
3.Species/taxon Richness	3	3
4.Diversity of Habitat Types or Features	2	3
5.Migration route/breeding and feeding site for wetland species	3	3
6.PES as determined by IHI assessment	2	4
7.Importance in terms of function and service provision	2	4
MODIFYING DETERMINANTS		
8.Protected Status according to NFEPA Wetveg	4	4
9.Ecological Integrity	3	4
TOTAL	26	
MEDIAN	2.9	
OVERALL EIS Category	B	



APPENDIX F – Risk Analysis and Mitigation Measures

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 mining activities, in conjunction with those stipulated in Section 5 of this report which define the mitigatory measures specific to the minimisation of impacts on aquatic resources.

Development and operational footprint

- Sensitivity maps have been developed for the study area, indicating the location of the Kuruman River and the relevant regulatory zones in accordance with 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), as shown in Section 4.4. It is recommended that these sensitivity maps be considered during all phases of the development and with special mention of the planning of any additional infrastructure layout, to aid in the conservation of riparian habitat and environmental resources within the study area;
- All development footprint areas should remain as small as possible and should not encroach onto surrounding more sensitive areas. It must be ensured that the Kuruman River, and the associated regulatory zones are off-limits to construction vehicles and personnel;
- 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 more sensitive riparian areas and not directly adjacent thereto. If crossings are required they should cross the system at right angles, as far as possible to minimise impacts in the receiving environment, and any areas where bank failure is observed due to the effects of such crossings should be immediately repaired by reducing the gradient of the banks to a 1:3 slope and where needed necessary, installing support structures. This should only be necessary if existing access roads are not utilised;
- All areas of increased ecological sensitivity should be marked as such and be off limits to all unauthorised construction and maintenance vehicles and personnel;
- The duration of impacts on the freshwater system should be minimised as far as possible by ensuring that the duration of time in which flow alteration and sedimentation will take place is minimised;
- 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 riparian 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, particularly as the study area is located within a sensitive area. 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 (Act No. 43 of 1983) and Section 28 of the National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA)). 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 drainage line and riparian areas during the eradication of alien and weed species.

Riparian habitat

- Ensure that as far as possible all infrastructure is placed outside of the Kuruman River and applicable regulatory zones. A minimum buffer of 100m around all freshwater features should be maintained in line with the requirements of 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), 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 receiving freshwater environment; and
 - Ensuring that where necessary, exposed soils in the vicinity of Kuruman River habitat are protected from erosion by means of reinstating natural vegetation following construction, or installation of an appropriate commercially available product such as Geojute or MacMatR;
 - Any additional measures which may be considered necessary by the Mine Environmental Officer during the construction and/or operational phases;
- Permit only essential construction personnel within 100m of the Kuruman River, 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 the construction phase, no vehicles should be allowed to indiscriminately drive through the riparian areas;
- The characteristics of the Kuruman River could potentially be altered locally, if construction materials, such as rock and rubble created during construction which is likely to have sharp edges (and not the smooth surfaces typically associated with river rocks and pebbles) are not prevented from entering these features. Such material must therefore be prevented from entering the Kuruman River or within 100m thereof, and all construction related waste must be removed from the study area once construction has been completed; and
- Implement effective waste management in order to prevent construction related waste from entering the freshwater environments.

Soils

- To prevent the erosion of soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas particularly susceptible to erosion;
- Install erosion berms during construction to prevent gully formation. Berms every 50m should be installed where any disturbed soils have a slope of less than 2%, every 25m where the track slopes between 2% and 10%, every 20m where the track slopes between 10% and 15% and every 10m where the track slope is greater than 15%;
- Sheet runoff from access roads should be slowed down by the strategic placement of berms and sandbags;
- Maintain topsoil stockpiles below 5 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, particularly any riparian crossings. Any areas where erosion is occurring excessively quickly should be rehabilitated as quickly as possible and in conjunction with other role players in the catchment.

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;
- Rehabilitate the Kuruman River habitat areas affected by mining operations to ensure that the ecology of these areas is re-instated during all phases. In this regard, special mention is made of the need to stockpile soils separately during the construction and/or operation phase where relevant in order for these soils to be utilised during the rehabilitation phase;
- 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 should be removed from rehabilitated areas and reseeded with indigenous grasses as specified by a suitably qualified specialist (ecologist);
- All areas affected by construction and operation should be rehabilitated upon completion of the specific construction and operation activity throughout the life of the mine;
- Kuruman River vegetation cover should be monitored to ensure that sufficient vegetation is present to bind the soils and prevent erosion and incision; and
- It is recommended that a detailed rehabilitation/closure plan be developed by a suitably qualified ecologist prior to commencement of the operations phase in order to address specific rehabilitation requirements.



Table F1: DWS Risk Assessment applied to the Kuruman River.

No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
1	CONSTRUCTION PHASE	Site preparation prior to construction of activities related to the proposed surface infrastructure which include site clearing, placement of contractor laydown areas and storage facilities. This is applicable to the surface infrastructure activities above the 1:100 year floodline and outside the delineated edge of the Kuruman River (outside the GN509/704 Zones of Regulation (ZoR)).	Vehicular movement and access to the site, and the removal of vegetation and associated disturbances to soils within the project area.	*Exposure of soils, leading to increased runoff from cleared areas and erosion of the river, and thus increased potential for sedimentation of the river; *Increased sedimentation can lead to changes in instream habitat and potentially alter surface water quality (if present); *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances.	1	1	1	1	1	1	1	3	5	1	1	1	8	24	L
2		Site preparation prior to construction activities related to the proposed access road which will directly traverse the Kuruman River		*Removal of riparian vegetation causes decrease in habitat provisioning and reduced surface roughness; *Trampling within the river leading to soil compaction and altered flow patterns in the river; and *Potential proliferation of alien and invasive vegetation species due to disturbances in the river.	2	1	4	4	2,75	1	1	4,75	5	5	5	1	16	76	M



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
3		Development of clean and dirty water separation systems located inside the study area boundaries and the various ZoRs.	Loss of catchment yield resulting from stormwater containment.	*Increased flood peaks as a result of formalisation and concentration of surface runoff in clean water diversion structures; *Potential for erosion, leading to sedimentation of the Kuruman River; *Reduction in surface water runoff volume of water entering the Kuruman River, leading to loss of recharge of the Kuruman River; *Altered vegetation communities due to moisture stress.	2	2	1	1	1,5	1	1	3,5	5	2	1	1	9	31,5	L



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
4		Construction of the proposed culvert access road crossing over the Kuruman River.	<ul style="list-style-type: none"> *Trampling by construction personnel and equipment; *Potential for hydrocarbons and oil spills from vehicles crossing the river, to enter into the river; *Construction of a formal road crossing would entail the use of concrete, which could impact on the surface water quality of the downstream portion of the river (only if present at the time of construction). 	<ul style="list-style-type: none"> *Impact on the riparian vegetation, leading to habitat degradation and loss of ecoservice provisioning; *Contamination of surface water (if present). 	2	1	4	4	2,75	1	1	4,75	5	5	5	1	16	76	M
5		Re-profiling of river embankment in the vicinity of the access road crossing.	<ul style="list-style-type: none"> *Ongoing disturbances to soils; and *Removal of vegetation. 	<ul style="list-style-type: none"> *Increased sedimentation as a result of disturbances; *Potential further loss of indigenous vegetation and the increased proliferation of alien floral species due to disturbances. 	2	1	3	3	2,25	1	1	4,25	5	5	5	1	16	68	M



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
6		Construction of all surface infrastructure above the 1:100 year floodline and outside the delineated edge of the Kuruman River (above the GN509/704 ZoR).	*Earthwork and construction activities in the catchment of the Kuruman River; *Heavy vehicle movement; and *Stockpiling of construction material.	*Disturbance to the terrestrial buffer zone surrounding the Kuruman River leading to decreased biodiversity; *Loss of migratory corridors; *Potential sedimentation of the river due to increased dust in the larger study area.	1	1	2	2	1,5	1	1	3,5	5	1	1	1	8	28	L
7	OPERATIONAL PHASE	Operation of the access road across the Kuruman River	*Runoff from the roads entering the river; *Potential erosion of the river in the area of the crossing.	*Runoff from the road could be contaminated and could impact on the surface water quality of the river (when present); *Increased erosion can potentially increase the sediment load of the river.	1	2	1	1	1,25	1	4	6,25	5	1	5	1	12	75	M
8		Operation and maintenance of the stormwater management system associated with the proposed surface mining infrastructure	Loss of catchment yield due to storm water containment.	*Increased flood peaks into the river as a result of formalisation and concentration of surface runoff; *Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river; *Reduction in volume of water entering the river, leading to	2	2	1	1	1,5	1	1	3,5	5	1	1	1	8	28	L



No.	Phases	Activity	Aspect	Impact	Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph+Vegetation)	Biota	Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating
				loss of recharge (and thus potential desiccation) of downstream reach of the river; and *Altered vegetation communities due to moisture stress.															
9	DECOMMISSIONING PHASE	Rehabilitation of mining footprint areas (with specific focus on the access road crossing through the Kuruman River)	*Rehabilitation of stockpile footprint areas through contouring and revegetation; *Removal of stormwater management infrastructure; *Removal of access road crossing through the Kuruman River	*Compaction of soils due to vehicular movement; *Compacted soils underneath the various stockpiles which have been removed; *Latent impacts of vegetation losses (due to lack of re-establishing after rehabilitation activities); *Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils.	2	1	4	4	2,75	1	1	4,75	5	5	5	1	16	76	M



APPENDIX G – Specialist information

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

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

Christel du Preez MSc Environmental Sciences (North West University)

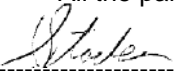
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

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@sasenvgroup.co.za		
Qualifications	MSc (Environmental Management) (University of Johannesburg)		
Registration / Associations	Registered Professional Natural 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



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

I, Christel du Preez, 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

C du Preez



**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
Tools for wetland assessment short course Rhodes University	2016
Legal liability training course (Legricon Pty Ltd)	2018
Hazard identification and risk assessment training course (Legricon Pty Ltd)	2013

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

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



KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Soil and Land Capability Assessment

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

Visual Impact Assessment

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

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





SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

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Joined SAS Environmental Group of Companies	Watercourse ecology 2016

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP)
Member of the Western Cape Wetland Forum (WCF)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Sciences (North West University)	2017
BSc Hons Environmental Sciences (North West University)	2012
BSc Environmental and Biological Sciences (North West University)	2011

Short Courses

Wetland and Aquatic plant Identification presented by Carin van Ginkel	2019
Wetland Management: Introduction and Delineation presented by the Centre of Environmental Management University of the Free State	2018
Tools for Wetland Assessment presented by Prof. F. Ellery and Rhodes University	2017
Basic Principles of ecological rehabilitation and mine closure presented by the Centre for Environmental Management North West University	2015

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Limpopo, Western Cape, Northern Cape, Eastern Cape

KEY SPECIALIST DISCIPLINES

Freshwater Assessments

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





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**SURFACE WATER REHABILITATION AND MANAGEMENT
PLAN AS PART OF THE WATER MANAGEMENT SYSTEM
OF THE PROPOSED Mn48 (Pty) Ltd MINING PROJECT,
NEAR HOTAZEL, NORTHERN CAPE PROVINCE**

Prepared for

SLR Consulting (Pty) Ltd

August 2017

(Amended October 2020)

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SAS Environmental Group of Companies

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GLOSSARY OF TERMS

Alien invasive vegetation:	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biodiversity:	The number and variety of living organisms on earth, the millions of plants, animals and micro-organisms, the genes they contain, the evolutionary history and potential they encompass and the ecosystems, ecological processes and landscape of which they are integral parts.
Buffer:	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.
Hydrology:	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Indigenous vegetation:	Vegetation occurring naturally within a defined area.
Watercourse:	<p>In terms of the definition contained within the National Water Act, a watercourse means:</p> <ul style="list-style-type: none"> • 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

LIST OF ACRONYMS

AIP	Alien invasive plant
CMA	Catchment Management Agency
DHSWS	Department of Human Settlements, Water and Sanitation
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
FEPA	Freshwater Ecosystem Priority Areas
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
mbgl	meter below ground level
NEMBA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act No 35 of 1998)
PES	Present Ecological State
PCD	Pollution Control Dam
REC	Recommended Ecological Category
RoD	Record of Decision
SAS	Scientific Aquatic Services
TSF	tailings storage facility
WRD	Waste Rock Dump
SWRMP	Surface Water Rehabilitation Management Plan
WUL	Water Use Licence



1. INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to compile a Surface Water Rehabilitation and Management Plan (SWRMP) as part of the water management system for the proposed surface mining activities on Portion 1 of the farm Lehating 741 and for underground mining activities on Portion 2 of the farm Wessels 227 and the remaining extent and portion 3 and 4 of the farm Dibiaghomo 226, approximately 20km north of Hotazel, Northern Cape (hereafter referred to as the 'mining right area' (MRA)). Surface infrastructure will only be located on Portion 1 of the farm Lehating 741. The surface infrastructure footprint will hereafter be referred to as the 'study area' (Figure 1).

This SWRMP was compiled to provide measures to manage and rehabilitate potential impacts that could affect the Kuruman River (as an access road traverses the river) and to inform the stormwater management infrastructure that will be required in order for the mine to comply with 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). Consideration is also given to the stormwater management from the road and the entirety of the proposed mining surface infrastructure area.

This SWRMP follows a system which supports the resource quality objectives for the identified watercourse and describes how activities that have or could have a negative impact on the system will be managed and monitored. The SWRMP also identifies the responsible parties and relevant timeframes (where applicable) which will be tasked with implementing these measures.

The key objective of this SWRMP is to ensure that impacts are managed in line with the impact mitigation hierarchy as advocated by the DEA *et. al* (2013) and that ecological integrity within the receiving environment is maintained or improved upon. The management and rehabilitation assessment is a system that seeks to achieve a required end state and describes how activities that have, or could have, a negative impact on the freshwater resource will be controlled and monitored.

This SWRMP advocates the use of several environmental management tools and mitigatory measures appropriate to the overall planning process of the construction, operational and



rehabilitation phases of the existing and proposed mining activities and infrastructure and should be implemented by the proponent as soon as it has been approved by all the relevant authorities.

1.2 Structure of the plan

This report investigates the need for rehabilitation and maintenance activities for the proposed mining activities. The plan has been structured in the following way:

Chapter 1: Introduction

Provides an introduction, the structure of this report, the assumptions and limitations, as well as the relevant legislation.

Chapter 2: Project Description

Provides the location of the focus area as well as a brief summary of the proposed mining activities.

Chapter 3: Receiving Freshwater Environment

This section includes a summary of the watercourse site assessment findings undertaken by SAS in 2014.

Chapter 4: Legal Framework

This section provides a breakdown of the legal framework relevant to the proposed development activities as well as the compilation of this SWRMP.

Chapter 5: Description of Impacts

This section presents a summary of the impact assessment outcome as per the assessment of SAS (2014).

Chapter 6: Surface Water Rehabilitation and Management Plan

This section comprises site specific details pertaining to the management and rehabilitation activities to be implemented. A list of the roles and responsibilities of all individuals involved in the implementation of this SWRMP is provided. This section also provides the required monitoring actions for the mining infrastructure and activities post-construction.

Chapter 7: Conclusion

This section summarises the key findings and recommendations based on the recommended rehabilitation and management actions listed and the overall requirements in order to ensure the management of watercourse impacts and to provide the best possible management and rehabilitation methods for the disturbed watercourse area.

2. LEGAL FRAMEWORK FOR THE WATERCOURSE REHABILITATION AND MANAGEMENT PLAN

The following legislative documents were considered and the aspects which are pertinent to watercourse management including the rehabilitation of disturbed areas, were utilised.

- Constitution of the Republic of South Africa Act, 1996¹;
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- National Environmental Management: Biodiversity Act, 2014 (Alien and Invasive Species Regulations, 2014);
- 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); and
- Government Notice 704 as promulgated in Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998).

Section 21 of the National Water Act (Act No. 36 of 1998) lists the following activities as water uses:

- Section 21(c): impeding or diverting the flow of water in a watercourse; and
- Section 21(i): altering the bed, banks, course or characteristics of a watercourse.

Table 1 that follows specify how the above mentioned legislative requirements relate to the Kuruman River and the proposed development:

¹ Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996'. It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it nor the acts amending it are allocated act numbers.



Table 1: Articles of Legislation and the relevant zones of regulation applicable to each article.

Regulatory authorisation required	Zone of applicability
<p>Listed activities in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014 (as amended).</p> <p>The Department of Environmental Affairs</p>	<p>➤ Activity 12 of Listing Notice 1 (GN 327) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) Environmental Impact Assessment (EIA) regulations, 2014 (as amended) states that:</p> <p>The development of:</p> <p>(xii) infrastructure or structures with a physical footprint of 100 square metres or more;</p> <p>Where such development occurs—</p> <ol style="list-style-type: none"> Within a watercourse; In front of a development setback; or If no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse. <p>Lehating Mine holds an Environmental Authorisation (EA), issued by the Department of Environment and Nature Conservation (DENC) (DENC Ref: NC/EIA/JTG/JOEL/LEH2/2012) in September 2014 in terms of National Environmental Management Act, 107 of 1998 (NEMA). Lehating Mine needs to amend its approved surface infrastructure layout to cater for the consolidation of operations as described in Section 1.1.1. It should be noted that the planned amendments relate only to changes in footprints/orientation of already approved infrastructure and activities.</p>
<p>Water Use License Application in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA).</p> <p>The Department of Water and Sanitation</p>	<p>Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act (Act No. 36 of 1998) (NWA).</p> <p>In accordance with GN509 of 2016 as it relates to the NWA, a regulated area of a watercourse for section 21c and 21i of the NWA, 1998 is defined as:</p> <ul style="list-style-type: none"> 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 Government Notice no. 509 of 2016 as it relates to the NWA. <p>As the proposed access road will traverse through the Kuruman River, application of a Water Use Licence in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) is required.</p> <p>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).</p> <p>These Regulations, forming part of the NWA, were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining. It is recommended that the Mn48 (Pty) Ltd mining project complies with GN 704 of the NWA, which states that:</p> <p><i>No person in control of a mine or activity may:</i></p> <ol style="list-style-type: none"> locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year



Regulatory authorisation required	Zone of applicability
	<p><i>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;</i></p> <p>According to the above, the <u>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.</u> Authorisation for activities within the regulated zone must be obtained, since the proposed access road is located in the GN704 regulated zone</p>

The rehabilitation process is set to minimise the impacts of the existing and proposed development activities on the identified watercourse and rehabilitate the area which will be impacted by the proposed mining activities. These activities trigger a Section 21(c) and (i) water use as it refers to the NWA as well as activities 12 and 19 of the Environmental Impact Assessment Regulations Listing Notice 1 of 2014 (as amended) as it relates to the NEMA, as listed in Table 1.

The conditions for Section 21(c) and (i) activities, in terms of Government Notice 509 of 2016 (as listed in Table 1) require that a SWRMP be developed and must address the following:

1. Identify a SWRMP domain, preferably from a whole -catchment perspective;
2. Identify an accountable, representative body that should take unbiased custodianship of the SWRMP and drive its implementation;
3. Identify key stakeholders;
4. Identify major drivers of watercourse disturbance and instability - human and natural, and their primary and secondary effects;
5. Complete a risk assessment as per the Department of Human Settlements, Water and Sanitation (DHSWS) Risk Assessment Matrix (Section 5) for identified impacts and their mitigation activities. Refer to (SAS, 2014);
6. Significance of perceived impacts on the drivers and receptors of the watercourse;
7. Solicit input from stakeholders on their priorities and objectives;
8. Define best practice measures for rehabilitation and maintenance implementation;
9. Design a plan for ecological monitoring which is specifically linked to the stated objectives; and
10. Develop an implementation programme and review mechanism.

The report should contain supporting technical information used to ensure low risk to resource quality such as:



- a) Impact assessment and mitigation report completed by an independent consultant as required by the NEMA and the NWA;
- b) All the relevant specialist reports supporting the proposed mitigation measures;
 - i. Specialists Reports must address the level of modification /risk posed to resource quality i.e.: flow regime, water quality, geomorphological processes, habitat and biota of the watercourses and contain PES and Ecological Importance and Sensitivity (EIS) data for relevant watercourses.
- c) Environmental Management Plan (EMP) giving effect to all actions required to mitigate impacts (What, When, Who, Where and How);
- d) Best practices applicable to these activities, where applicable;
- e) Generic designs and method statements, where applicable;
- f) Norms and standards, where available;
- g) Monitoring programme that must include "present day" conditions to be used as base line values;
- h) Monitoring, auditing and reporting programme (reports must be sent on request to the region or Catchment Management Agency (CMA); and
- i) Internalised controls and auditing, where applicable.

Please refer to **Annexure B** for additional a generalised description of the legislative requirements as listed in .

2.1 Watercourse Management Plan Framework

2.1.1 Principles of the Surface Water Rehabilitation and Management Plan

To assist in achieving the objectives of the SWRMP, a set of principles were applied which contributed to formulating action plans and specific management measures.

Loss of biodiversity puts aspects of the economy, well-being and quality of life at risk, and reduces socio-economic options for future generations. The importance of maintaining biodiversity and intact ecosystems for ensuring the on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National



Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) and is fundamental to the notion of sustainable development. In addition, international guidelines and commitments, as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa.

Impacts on biodiversity can mainly take place in four ways:

- **Direct impacts:** are impacts directly related to the proposed development activities including project aspects such as the construction of the access road over the Kuruman River.
- **Indirect impacts:** are impacts associated with the zone of influence associated with the proposed development activities, such as the surrounding terrestrial areas and downstream areas on the watercourse.
- **Induced impacts:** impacts that directly attributable to the proposed development activities but are expected to occur due to the activities of the proposed development activities. Factors included here are existing surrounding mining activities and hardened surface within the catchment.
- **Cumulative impacts:** can be defined as the sum of the impact of the proposed development activities as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining developments within the same drainage catchment.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted in the identification of spatial biodiversity priorities or biodiversity priority areas.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of anthropogenic activities. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level.

The mitigation hierarchy, as advocated by DEA *et al.* (2013) in general consists of the following in order of which impacts should be mitigated:

1. **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases, if impacts are expected to be too high, the “no project” option should also be considered, especially where it is expected that recommended mitigations measures will not be adequate to limit environmental damage and eco-service provision to suitable levels;
2. **Minimise impact:** can be done through the utilisation of alternatives that will ensure that impacts on biodiversity and ecosystem services provision are reduced. Impact minimisation is considered an essential part of any development project;
3. **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable. As such, impacted areas must be returned to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation cannot, however, be considered as the primary mitigation tool as even with significant resources and effort of rehabilitation usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
 - a. **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long term sustainable ecological structure;
 - b. **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources associated with the proposed development activities and its footprint supports the intended land uses. In this regard, special mention is made of the need to ensure the continued functioning and integrity of the watercourses throughout and after the rehabilitation phase.
 - c. **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community or community suitable for supporting the intended land use.
 - d. **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species reinstatement need only occur if deemed necessary.
4. **Offset impact:** The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss of irreplaceable biodiversity, the residual



impacts should be considered to be of a *very high significance* and offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.

A summary of how the above relates specifically to the proposed development activities in terms of measures which must be applied in order to ensure the minimisation of negative impacts and maximisation of positive impacts as a result of the proposed development activities is provided below:

- **Avoiding impacts** by not performing environmentally detrimental actions;
- **Minimising impacts** by limiting aspects of an action, optimising processes, structural elements and other design features; and
- **Rectifying impacts** through rehabilitation, restoration, etc. of the affected environment.

2.1.2 Objectives of the Watercourse Rehabilitation and Management Plan

The objectives of this SWRMP are to:

- Meet the requirements of relevant local and regional authorities;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts on the receiving environment to minimal or acceptable levels;
- Manage activities to maintain and/ or improve the ecological integrity of the associated watercourses;
- Maximise the ecological functioning and service provision of the watercourses;
 - Increase the perennial vegetation cover on disturbed and erosion prone areas to reduce the erosive potential of runoff and to trap sediment;
- To control and manage alien and invasive plant (AIP) species and re-introduce indigenous floral species;
- To provide an improved and more suitable habitat for faunal species;
- Detail specific actions deemed necessary to assist in mitigating the potential environmental impacts on the watercourses; and
- Ensure as far as is practicable that the measures contained in the report are implemented.

3. PROJECT DESCRIPTION

Lehating Mining (Pty) Ltd (Lehating Mine) holds a mining right and approved Environmental Management Programme report (EMPr) for the development of a new underground manganese mining operation near Black Rock in the Joe Morolong Local Municipality, located in the John Taolo Gaetsewe District Municipality, Northern Cape Province. The approved mine will be located on Portion 1 of the farm Lehating 741.

Immediately adjacent and to the south of Lehating Mine, Khwara Manganese (Pty) Ltd (Khwara Mine) holds an approved EMPr for underground mining of manganese on portion 2 of the farm Wessels 227 and the remaining extent and portion 3 and 4 of the farm Dibiaghomo 226. The Khwara Mine underground resource will be accessed via/through the Lehating Mine, using the Lehating Mine approved surface infrastructure. In this regard, no surface infrastructure will be established as part of the Khwara Mine.

Khwara Mine and Lehating Mine have entered into an amalgamation agreement which combines the two adjacent, contiguous mineral resources and surface rights comprising the Khwara and Lehating Mines into a single, high-grade manganese mining company known as Mn48 (Pty) Ltd (hereafter referred to as 'Mn48'). Mn48 is now proposing to consolidate the Lehating and Khwara mining rights and associated EMPrs. In support of this, Lehating Mine needs to amend its approved surface infrastructure layout to cater for the above consolidation of operations. It should be noted that the planned amendments relate only to changes in footprints/orientation of already approved infrastructure and activities, therefore no new activities or infrastructure are planned. In summary, the amendments include the following:

- The extension of the footprint of the approved Waste Rock Dump (WRD);
- The addition of a second Pollution Control Dam (PCD), and relocation of the footprint of the already approved PCD;
- General re-configuration of approved supporting surface infrastructure on the farm Lehating 741;
- The revision of the site Stormwater Management Plan (SWMP) due to the changes of the surface infrastructure layout; and
- The establishment of proposed new support infrastructure such as a helicopter pad and weighbridge.

The underground Khwara Mine resource will be mined from the north (i.e. from the Lehating Mine side) and the planned Life of Mine (LOM) with both the Khwara and Lehating Mine



resources combined will be 28 years. The surface infrastructure proposed to be developed as part of the mining activities includes (Figure 2):

- Access road (traversing the Kuruman River) and internal roads;
- Shafts;
- Buildings (including offices, lamp and crush rooms, change/laundry house, storage centres, medical facility, workshops);
- Parking areas;
- Crusher;
- Crushing and screening plant;
- Stockpiles (Crushed ore, fines, lumpy, waste and topsoil); and
- Stormwater management infrastructure, consisting of:
 - Concrete lined dirty water diversion channels; and
 - Unlined clean water diversion channels.

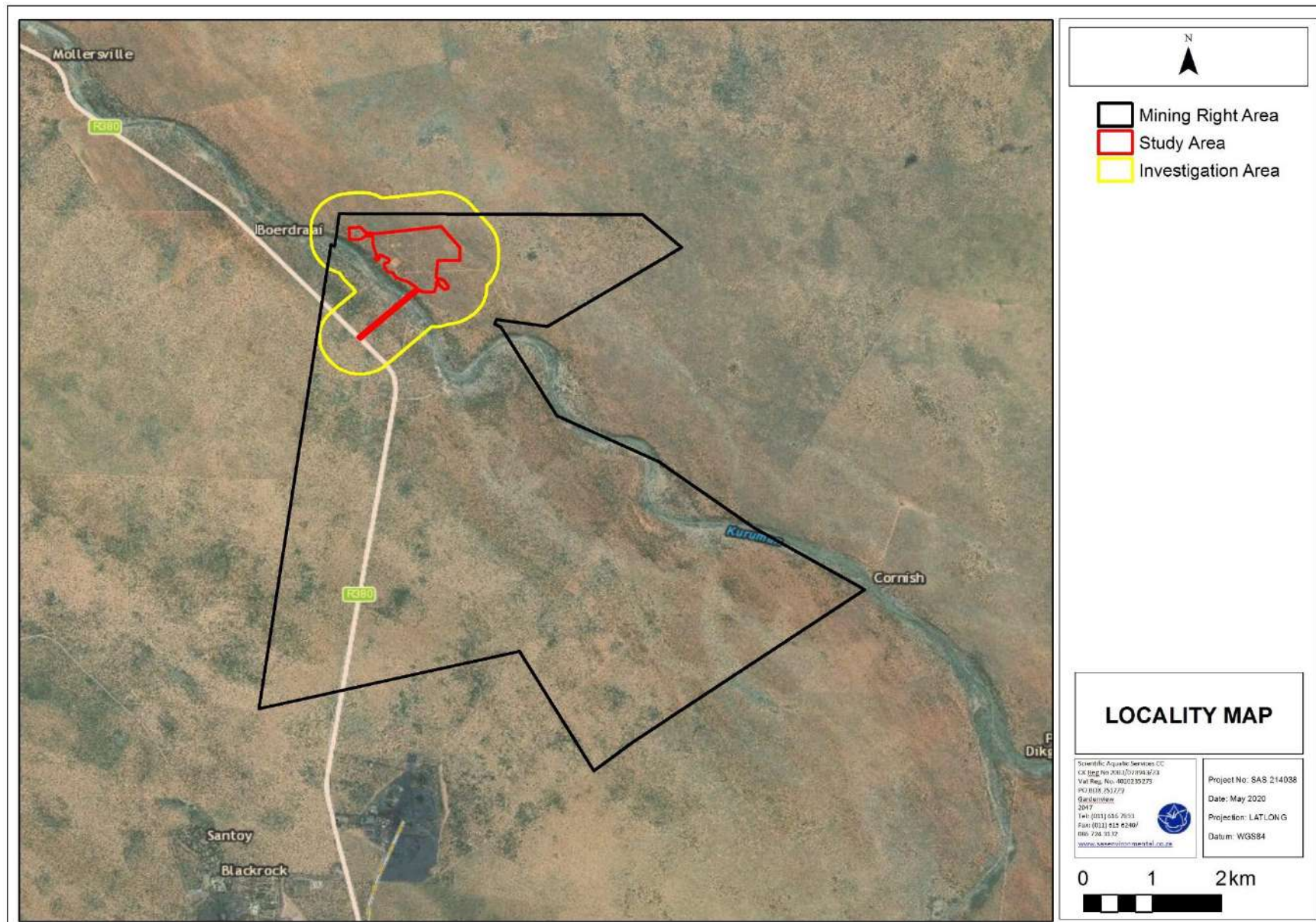


Figure 1: A digital satellite image depicting the location of the study and investigation areas in relation to the surrounding environment.





4. RECEIVING ENVIRONMENT

The following information on the ecological characteristics of the watercourses associated with the proposed mining development are taken from a report entitled: “Freshwater ecological assessment as part of the environmental assessment and authorisation process for the proposed Mn48 Mine, near Hotazel, Northern Cape Province” (SAS, 2014), which also provides further information if required.

The National Freshwater Ecosystem Priority Areas (NFEPA; 2011), database was consulted to define the freshwater environment of the mining surface infrastructure area. This database identified only the Kuruman River to be traversed by the proposed access road (Figure 3). The NFEPA database (2011) identified this river to be a floodplain wetland, in a Category B river condition (Largely natural with few modifications).

Following the completion of a site visit in March 2014², the portion of the Kuruman river located south of the proposed surface mining infrastructure area were assessed. Overall, the surrounding environment to the Kuruman River were found to be dominated by livestock farming and are mostly overgrazed, and some gravel roads are traversing through the active channel of this river, mainly due to its ephemeral nature. The Present Ecological State (PES) of the river was determined according to the WET-Health method described by MacFarlane *et al.* (2008). The Kuruman River is considered to be largely natural with only a few modifications (PES Category B), with intermediate levels of ecological and socio-cultural service provision (as determined by the WET-Ecoservices method, described by Kotze *et al.* (2009)). The overall riparian vegetation is considered to be in a relatively natural condition in terms of species composition, however evidence of alien invasive floral species (*Prosopis glandulosa*) was apparent towards the southern portion of the river, ultimately to such an extent that the extreme southern portion of the river was dominated by this alien species (Figure 3). The Kuruman River is considered to be of high ecological importance (EIS Category B). A summary of the above is provided in the following table. Kindly refer to the Freshwater Ecological Assessment (SAS, 2014) for a detailed analysis.

² All field assessment data as presented in this report is thus based on the field assessment undertaken in March 2014, which is still considered relevant since no significant land use transformation within the catchment of the Kuruman has occurred over the past six (6) years (SAS, 2014);



Table 2: Summary of results of the field assessment of the Kuruman River undertaken by SAS (2014).

Present Ecological State (PES)	VEGRAI	Ecological Importance and Sensitivity (EIS)	Ecoservices Provision	Recommended Ecological Category (REC)
Category: B (Largely natural with few modifications)	Class C (Moderately modified)	High	Intermediate (1,8)	B (Largely natural)

**Figure 3: (Left) Gravel road within the active channel of the southern portion of the river. (Right) erosion and incision of the river embankment with *P. glandulosa* encroachment encountered.**

The delineated Kuruman River and its applicable zones of regulation in terms of National Environmental Management Act, 1998 (Act No. 107 of 1998), Government Notice 509 as published in the Government Gazette 40229 of 2016 as it relates to the National Water Act, 1998 (Act No. 36 of 1998) and 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) are conceptually depicted in Figure 4.

Since the 1 in 100 year floodline is determined it can be regarded as the GN509 zone of regulation. However, as the delineated boundary of the Kuruman River extend beyond the 1:100 year floodline in some areas, the outermost edge of both the riparian zone and the 1:100 year floodline must be taken as the Regulated Area in terms of the definition stipulated in Government Notice 509 of 2016, as it relates to the National Water Act, 1998 (Act No. 36 of 1998) and 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).

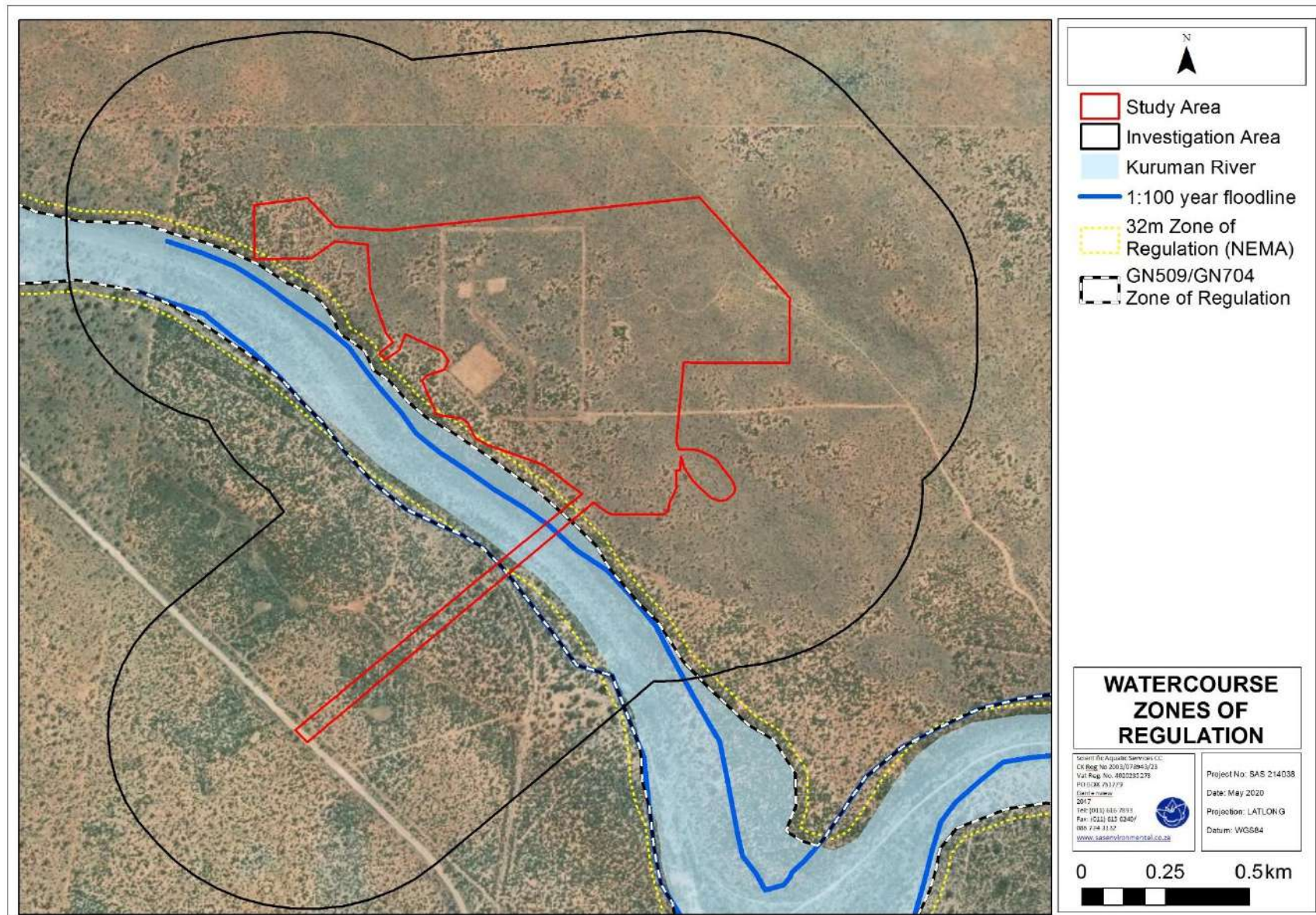


Figure 4: Conceptual presentation of the locality of the Kuruman River relative to the study area and its associated zones of regulation in terms of NEMA and GN509 of 2016 as it relates to the NWA.



5. DESCRIPTION OF IMPACTS

The DHSWS Risk Assessment and Impact Assessment was undertaken to determine the risk/impact significance the proposed mining development may pose on the receiving Kuruman River, as presented in the Freshwater Ecological Assessment by SAS (2014). The following table presents the summary of the outcome of the DHSWS Risk Assessment. Please refer to SAS (2014) for more details.

Table 3: Summary of the results of the DHSWS Risk Assessment applied to the Kuruman River.

Phases	Activity	Risk Rating
CONSTRUCTION PHASE	<p>Site preparation prior to construction of activities related to the proposed surface infrastructure which include site clearing, placement of contractor laydown areas and storage facilities.</p> <p>This is applicable to the surface infrastructure activities above the 1:100 year floodline and outside the delineated edge of the Kuruman River (outside the GN509/704 Zones of Regulation (ZoR)).</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Exposure of soils, leading to increased runoff from cleared areas and erosion of the river, and thus increased potential for sedimentation of the river; *Increased sedimentation can lead to changes in instream habitat and potentially alter surface water quality (if present); *Decreased ecoservice provision; and *Proliferation of alien vegetation as a result of disturbances. 	L
	<p>Site preparation prior to construction activities related to the proposed access road which will directly traverse the Kuruman River.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Removal of riparian vegetation causes decrease in habitat provisioning and reduced surface roughness; *Trampling within the river leading to soil compaction and altered flow patterns in the river; and *Potential proliferation of alien and invasive vegetation species due to disturbances in the river. 	M
	<p>Development of clean and dirty water separation systems located inside the study area boundaries and the various ZoRs.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Increased flood peaks as a result of formalisation and concentration of surface runoff in clean water diversion structures; *Potential for erosion, leading to sedimentation of the Kuruman River; *Reduction in surface water runoff volume of water entering the Kuruman River, leading to loss of recharge of the river; *Altered vegetation communities due to moisture stress. 	L
	<p>Construction of the proposed culvert access road crossing over the Kuruman River.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Impact on the riparian vegetation, leading to habitat degradation and loss of ecoservice provisioning; *Contamination of surface water (if present). 	M
	<p>Re-profiling of river embankment in the vicinity of the access road crossing.</p> <p>This may result in:</p> <ul style="list-style-type: none"> *Increased sedimentation as a result of disturbances; *Potential further loss of indigenous vegetation and the increased proliferation of alien floral species due to disturbances. 	M



Phases	Activity	Risk Rating
	Construction of all surface infrastructure above the 1:100 year floodline and outside the delineated edge of the Kuruman River (above the GN509/704 ZoR). This may result in: *Disturbance to the terrestrial buffer zone surrounding the Kuruman River leading to decreased biodiversity; *Loss of migratory corridors; *Potential sedimentation of the river due to increased dust in the larger study area.	L
OPERATIONAL PHASE	Operation of the access road across the Kuruman River. This may result in: *Runoff from the road could be contaminated and could impact on the surface water quality of the river (when present); and *Increased erosion can potentially increase the sediment load of the river.	M
	Operation and maintenance of the stormwater management system associated with the proposed surface mining infrastructure. This may result in: *Increased flood peaks into the river as a result of formalisation and concentration of surface runoff; *Potential for erosion of terrestrial areas as a result of the formation of preferential flow paths, leading to sedimentation of the river; *Reduction in volume of water entering the river, leading to loss of recharge (and thus potential desiccation) of downstream reach of the river; and *Altered vegetation communities due to moisture stress.	L
DECOMMISSIONING PHASE	Rehabilitation of mining footprint areas (with specific focus on the access road crossing through the Kuruman River (if applicable)). This may result in: *Compaction of soils due to vehicular movement; *Compacted soils underneath the various stockpiles which have been removed; *Latent impacts of vegetation losses (due to lack of re-establishing after rehabilitation activities); *Increased runoff volumes and formation of preferential surface flow paths as a result of compacted soils.	M

Four aspects of freshwater ecology are considered when assessing the impacts of the proposed mining activities: loss of habitat and ecological structure, changes to ecological and sociocultural service provision, hydrological function and sediment balance, and water quality impacts.

Although the reach of the Kuruman River within the study area has undergone some modifications, most notably in terms of vegetation transformation due to the invasion of *Prosopis glandulosa*, it is still considered to be largely natural (PES Category B). As such, the proposed surface mining infrastructure, with specific mention of the access road crossing has the potential to impact on the characteristics of the river. However, it is important to note that the significance of this impact is deemed to be of acceptably low significance on a local and regional level.



Of particular concern is the potential loss of connectivity. Whilst this reach of the river has not received water from the upstream areas in many years, the possibility of that impact being rehabilitated to restore flow cannot be ruled out at this time (although it is possible that this is unlikely). Nevertheless, should aforementioned rehabilitation take place, in order to prevent possible cumulative impacts downstream of the study area in future, it is considered important that connectivity of the Kuruman River be retained. Similarly, although the vegetation community has undergone modification, further deterioration should be prevented as far as practicable, and vegetation management during construction and operations along with rehabilitation following de-commissioning should be implemented in order to minimise the cumulative impacts on the vegetation community, with specific mention of alien floral invasion. Careful planning of the location of the infrastructure and implementation of mitigation measures throughout all phases of the proposed activities, will contribute to reduced impact significance on the river. Assuming that a high level of mitigation takes place, the anticipated impact significance of the proposed mining activities ranges from 'low' to 'moderate' throughout the construction and operational phases. Decommissioning activities are considered similar in nature and impact significance to those during the construction and operations phases.

6. WATERCOURSE REHABILITATION AND MANAGEMENT PLAN

A detailed site specific SWRMP has been developed for the proposed mining activities, as described in Section 2 of this report. Successful rehabilitation depends upon cogent conceptual planning, research and design flexibility. The proposed site-specific mitigation measures for the rehabilitation phase is listed in Tables 6 and 7.

Prudent monitoring of infrastructure and the rehabilitated areas associated with the access road river crossing is of utmost importance. A list of monitoring and auditing requirements has been provided to maximise the success of the implementation of the control measures.

This implementation of the WRMP is based on four (4) key actions illustrated in Figure 4 and discussed in detail in Section 6.1 to 6.4.



Figure 5: The four (4) key actions of the WRMP implementation.

6.1 Action 1: Site investigation and literature review

A site investigation of the study area should be undertaken to determine site limitations and rehabilitation possibilities. Available literature (SAS, 2014) and scientific assessments referenced in Section 4, 8 and Annexure A should also be reviewed to further gain background and support the determination of the required rehabilitation activities and future monitoring needs.

6.2 Action 2: Planning

Economically feasible and successful management and rehabilitation are dependent upon cogent conceptual planning. One of the aims of the planning process is to limit edge effects and residual impacts of the Mn48 Mine activities and operations on the Kuruman River. The following table provides requirements to be considered before any rehabilitation activities commence.

Table 4: Planning requirements to be considered prior to the implementation of the SWRMP.

1.1 Obtaining all relevant authorisations and permits

Before rehabilitation activities can commence all necessary permits and authorisations will be required, including but not limited to:

- Environmental Authorisation (as applicable); and
- Water Use Authorisation from the DHSWS.

1.2. Appointment of a Contractor

During the planning phase certain aspects need to be considered in order to effectively implement this plan. This includes:

- Appointment of a suitably qualified Contractor(s) to undertake the required work;
- Appointment of an Environmental Manager to audit and monitor the management and rehabilitation activities as well as to undertake the required monitoring;
- Appoint any specialist consultants required for guidance, management and monitoring that may need to be retained; and
- The Environmental Manager is to compile a monthly audit report indicating all observations, actions and any remediation measures that were implemented and the reports are to be submitted to the competent authorities.

Note: Should the Contractor not have the appropriate expertise for implementation of this plan then it is the responsibility of the Contractor to retain a suitably qualified freshwater ecologist to oversee the implementation.

1.3 Alien Invasive Plant Species (AIP) control

The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA) Section 73 requires every person to exercise a Duty of Care relating to alien invasive plant (AIP) species within their property, and as such the landowner is responsible for AIP species control. AIPs have a number of detrimental effects on biodiversity, from nutrient enrichment of watercourses, increased erosion, out-competing indigenous floral vegetation and limiting habitat diversity and for availability for faunal species. The requirements for AIP monitoring, control and eradication are included in Table 4 below.

1.4 Budgetary Allowance

A rehabilitation budget needs to be prepared prior to the commencement of rehabilitation activities. This budget must form part of the operational costs to implement the rehabilitation activities from the onset and ongoing through the LOM. The preparation of a budget is a crucial step in planning of a project, as it allows for the prediction and calculation of all the costs related to implementation of the rehabilitation activities, including, but not limited to labour, material, expertise and post rehabilitation maintenance and management.

1.6 Timing

Management and rehabilitation of the Kuruman River (Post construction of the proposed access road) should commence as soon as possible and should optimally be concurrent as work progress.

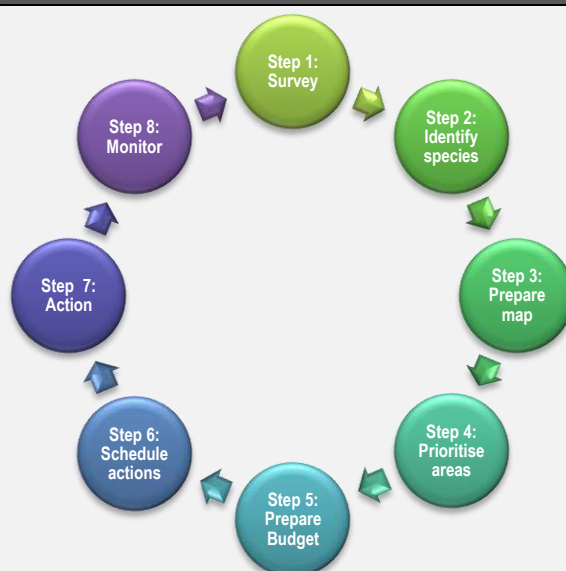
1.7 Kick-off meeting

Before commencing with the rehabilitation activities, a kick-off session associates all the responsible persons involved in the implementation of the SWRMP. The key aims of the meeting are:

- Agreeing on the timeline for rehabilitation activities;
- Identifying the rehabilitation expectations and limitations; and
- Validating the SWRMP rehabilitation strategies and the involvement of all the responsible persons in the implementation process.

Table 5: AIP Monitoring, Control and Eradication Plan requirements.

An AIP Monitoring, Control and Eradication Plan must be developed for the focus areas to ensure compliance with The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA). The following eight (8) steps should be considered for AIP Management.



Requirements: Content of the AIP Control Plan

Description

1. Details of the focus areas, name, address and province;
2. A map indicating the location of the rehabilitation focus area with administrative boundaries of local or district municipality and province;
3. Types of land use;
4. Property size in hectares (ha);
5. Contact details and name of the landowner(s);

Extent and distribution of the invasive species at the focus areas

1. Reflect AIP infestation as a percentage (%) cover per area. Prepare a map of area showing the property boundaries;
2. Divide the focus areas into manageable units (management units), reflected as polygons on the property map. Use natural boundaries (rivers) or infrastructure (roads, fences) to distinguish between the management units;
3. Assign an alpha-numeric identification number using the first three letters of the focus areas name followed by a three digit number, starting at 001;



6. Purpose of the control plan; 7. Timeframe: the timeframe for implementation should be realistic depending on the property size, infestation levels, species present and available funding. (Timeframe can range between 3 and 10 years); and 8. The desired result (e.g. remove invasive plants and restore watercourse habitat) should be determined. 9. A list of all AIPs on detected at the focus area. The list to include Species name, common name and NEMBA Category).	4. Survey each management unit, list and describe the species present according to their size (i.e. seedlings, young, mature). Also indicate what proportion (percentage %) of the management unit is covered by the invasive plants, capture the information as follow: <ol style="list-style-type: none"> Management Unit and hectares Extent of overall invasion (%) Comments and remarks; and Priority (High: clear within 6 - 12 months, Medium 12 - 24 months; Low 24 + months). Objectives and actions <ol style="list-style-type: none"> Set objectives to demine the desired state to reach compliance. Provide actions to reach the relevant objectives. The following are examples of objectives: <ol style="list-style-type: none"> Objective 1: Control AIP Infestation - Bring the AIP infestation on the focus areas under control by 2025. Objective 2: Prevention - put measures in place to prevent the introduction of new NEMBA listed AIP onto the focus area, and from spreading from the property to neighbouring properties. Objective 3: Early Detection and Rapid Response (EDRR) and eradication - To detect emerging AIPs through regular surveys and remove them before they become established, produce seeds or offspring and start spreading.
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6.3 Action 3: Surface Water Rehabilitation and Management Plan Compilation and Implementation

A site-specific SWRMP has been developed to provide step-by-step implementation measures to rehabilitate disturbances to the Kuruman River. The implementation of the provided control measures is the core of the SWRMP, as this entails execution and shaping of the rehabilitation and management activities into visible outputs. A list of the roles and responsibilities of the individuals involved in the implementation of this SWRMP is provided in the table that follows.

Table 6: Summary of various parties involved with the implementation of this SWRMP.

Party	Responsibility
Proponent	<ul style="list-style-type: none"> The Proponent will be responsible for the appointment of a suitably qualified Environmental Manager whom is responsible for the monitoring of the rehabilitation activities for the duration of the LOM, including aftercare and maintenance; A management body (i.e. Mine Manager) must be appointed to ensure compliance with the SWRMP; The Proponent will be responsible for ensuring all Contractors receive a copy of this document and understand its contents; The Proponent is responsible to ensure there is sufficient funding for the required rehabilitation and management actions as set out in this SWRMP; and The Proponent can also be the Mine Manager should Mn48 not wish to appoint a separate manager.
Mine Manager	<ul style="list-style-type: none"> The Mine Manager must ensure a clear communication line between all parties working on the project, to ensure all environmental concerns and measures as stipulated within this SWRMP are implemented/adhered to; The Mine Manager should have direct communication with the Environmental Manager; The Mine Manager should call a meeting with all responsible parties should there be conflict/remediation requirements to ensure a suitable solution is found and implemented; The Mine Manager must ensure that there is sufficient funding and resources for an Environmental Manager to adequately perform their role; and



Party	Responsibility
	<ul style="list-style-type: none"> The Mine Manager must ensure that the SWRMP is implemented and that suitable penalties are in place for non-conformance to the SWRMP by Contractors (as indicated by the Environmental Manager).
Engineering Manager	<ul style="list-style-type: none"> Issue all specifications/ instructions/ drawings to the Contractor; Must immediately inform the Mine Manager and Environmental Manager if any changes to the project are envisaged; Must immediately inform the Mine Manager and Environmental Manager if any aspects of the SWRMP and/or Record of Decision (RoD) for the relevant authorities cannot be complied with; and Must remain in communication with the Environmental Manager and the Mine Manager to ensure that any design changes required are issued to the Contractor.
Environmental Manager	<ul style="list-style-type: none"> The Environmental Manager is the person responsible for the monitoring of the implementation of the SWRMP during the implementation of the activities and for reporting on the degree of compliance. The Environmental Manager should ideally be appointed at the start of construction activities and be responsible for ensuring that all rehabilitation activities are implemented. The Environmental Manager is mandated to do the following: <ul style="list-style-type: none"> Ensure that all Contractors/ subcontractors/ employees/ construction workers are fully aware of their environmental responsibilities. This should take the form of an initial environmental awareness-training program in which requirements of this document will be explained; Monitor site activities on a regular basis to ensure that there is minimal environmental impact due to construction activities. A monitoring report should be submitted to the Contractor, the Civil Engineer (should there be any design changes required) and the Mine Manager; Ensure that a 'hotline' exists for reporting incidents and resolving any problems rapidly; The Environmental Manager must regularly audit the operation and establish whether the measures in the SWRMP are applied, where after the Environmental Manager reports to the lead Mine Manager; All reports compiled by the Environmental Manager must be submitted to the relevant compliance office within the DHSWS and any other legal authorities; The Environmental Manager has the authority to stop works if in his/her opinion there is/may be a serious threat to or impact on the environment caused directly by the construction operations; and Conduct a final environmental audit and a review of management and rehabilitation measures. Should the appointed Environmental Manager not have any freshwater ecological experience, a suitably qualified Freshwater Ecologist should be appointed to assist the Environmental Manager as and when needed.
Contractor	<ul style="list-style-type: none"> The Contractor/s in this case refers to any contractor/s on site, including the mining staff / contractor/s and sub-contractors on any item of infrastructure being erected or demolished; or contractors appointed to mine on behalf of the proponent; Such contractor/s will take full responsibility for each of his/her employees and any penalties imposed; The Contractor must immediately inform the Mine Manager and Environmental Manager if any changes to the project are envisaged and if any aspects of this SWRMP or the RoD cannot be complied with; All design change instructions must come from the Mine Manager and/or Engineering Manager. It is the responsibility of the Contractor/s to ensure that the measures stipulated within this SWRMP are adhered to; and. Should the Contractor require clarity on any aspect of the SWRMP the Contractor must contact the Environmental Manager for advice.

The tables below serve to present the rehabilitation and management plans for the Kuruman river being affected by the proposed mining activities. Both general and specific mitigation and rehabilitation actions are outlined in the tables below. These mitigation measures, unless otherwise specified, are applicable to all aspects of the construction and operational phases of the proposed mining operations.



6.3.1 Management measures pertaining to the rehabilitation phase of the proposed activities

Table 7: Control and mitigation measures for the rehabilitation phase of the Kuruman River during the construction the river crossing

	Objective requirements	Protective measures	Key Performance Indicator (KPI)
1	Authorisations, Permits, Licenses and appointment of Personnel	<ul style="list-style-type: none"> All necessary authorisations, permits and licenses must be obtained prior to construction; Prior to commencement of work within the subject property, this SWRMP must be approved by the relevant authorities; It must be ensured that the SWRMP forms part of the contractual agreement with the contractors and sub-contractors for the duration of the proposed mining activities; The contractor must ensure adequate provision in their budgets for the implementation of the SWRMP; Permit applications for relocation of faunal and floral SCC should be obtained from the relevant authorities where applicable; and Before any work commences on site the proponent must appoint an independent Environmental Manager for the mine that will have the responsibility to ensure that the mitigation / rehabilitation measures and recommendations are implemented and to ensure compliance with the provisions of the SWRMP as well as the environmental authorisation from the DMR and the Water Use Licence issued by DHSWS. 	<ul style="list-style-type: none"> All necessary authorisations, licenses and permits are obtained; The SWRMP is approved by relevant authorities. The SWRMP, WULA and environmental authorisation formed part of the contract; and A qualified Environmental Manager has been appointed at the mine. The necessary permits are in place for the relocation, removal or propagation of protected SCC (if encountered).
2	Site establishment and Access	<ul style="list-style-type: none"> All construction footprint areas, including where roadways are constructed should be barricaded with hessian sheets to prevent silt runoff into the Kuruman river; Planning of temporary roads and access routes should avoid the Kuruman River (with the exception of the proposed access road) and be restricted to existing or planned roads; The site must have strict access control to ensure that no unauthorised persons are onsite; All sensitive areas presented in the Landscape Plan (SAS, 2017a), with specific mention of the area below the 1:100 year floodline, must be demarcated and considered as no-go areas; The 1:100 year floodline should be barricaded with hessian sheets to prevent sediment laden runoff from the active construction areas entering the river area below the 1:100 year floodline; The construction footprint areas must remain as small as possible and only specified activities (river crossing) may occur within the river and its 1:100 year floodline; Adequate signage must be placed around the construction area to ensure that the public has been notified of the activities taking place; Dedicated parking area for construction vehicles must be located away from sensitive areas, and drip trays must be located beneath any leaking equipment and lubricant/fuel absorbing media (moss/peat type products) within drip trays must be used to contain spilled material. The absorbing material in the drip trays must be replaced regularly as to prevent over-saturation and potential spillage. This hazardous waste must be collected by an approved contractor/delivered to an approved waste disposal site; and A speed limit of a maximum of 40km/h are to be implemented and adhered to at all times. 	<ul style="list-style-type: none"> All footprint areas temporarily barricaded and marked. Care taken not to influence faunal mitigatory measures. Sensitive areas (i.e. the 1:100 year floodline) are clearly demarcated and hessian drift fences are put in place and signage erected to indicate the area as "no-go". Strict site access is implemented, and approval from the responsible person must be obtained. Appropriate parking areas for construction vehicles have been located outside of the demarcated 1:100 year floodline. Signage is present stating the speed limit of 40km/h.
3	Education of the rehabilitation team	<ul style="list-style-type: none"> The SWRMP document must be made available to all relevant contractors and subcontractors and all members of the construction and rehabilitation team must be informed of the contents and importance of the SWRMP; An environmental incident management reporting procedure for incidents relating to the freshwater resource must be implemented; 	<ul style="list-style-type: none"> The project team was informed of the SWRMP and educated about the "do's and don'ts" during the rehabilitation activities.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
		<ul style="list-style-type: none"> • Every effort should be made to avoid potential impacts on the freshwater resource for the duration of the construction and rehabilitations phase in order to prevent or limit impacts on the receiving environment. No contamination of the freshwater resource may occur; • The boundaries of the allowable construction area (1:100 year floodline), must be clearly communicated to the employees and construction workers, clearly marked on site, and the freshwater resource in which no activities should occur, must be treated as a "No-Go Zone" for general construction workers; • To ensure that it reaches most people, signs must be written in the languages of the area (not just English), informing people that the freshwater resource is a strictly no-go area. This ensures that non-English speakers can understand and will hopefully cooperate in reducing pollution of the freshwater resource by the measures indicated on the sign. 	<ul style="list-style-type: none"> • The freshwater resource zone/No-Go area are clearly defined to the construction workers and understanding of workers not allowed to go into these areas. • Appropriate signage to inform the public of the rehabilitation activities have been erected in the area.
		<ul style="list-style-type: none"> • The wearing of Personal Protective Equipment (PPE) on site is mandatory for all personnel and construction/rehabilitation workers. No one will be allowed on site without PPE; and • All personnel must be trained in basic site safety procedures and First Aid kits must be on hand at all times 	<ul style="list-style-type: none"> • Personnel know of the whereabouts of the first aid kits. • All personnel adhere to wearing PPE on construction site
		<ul style="list-style-type: none"> • Construction/rehabilitation activities must meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993) and within reasonable hours during the day (07:00-18:00 during weekdays and 07:00-17:00 on weekends); 	<ul style="list-style-type: none"> • Construction/rehabilitation activities remain within reasonable working hours. • Noise levels meet the requirements as stipulated by the Occupational Health and Safety Act (Act No 85 of 1993).
4	Ablution/Sanitation for contractors	<ul style="list-style-type: none"> • Contractor's camp, storage areas and sanitary areas, must be kept above the 1:100 floodline, as agreed by the Principal Agent, environmental manager, and Contractor prior to work commencement at the site; • These sites must be kept tidy, in good condition and sanitary throughout the whole project. Refuse bins must be cleaned/ emptied and the waste must be removed at regular intervals; • A minimum of 1 chemical lavatory per 10 individuals must be provided. All portable lavatories must be secured to the ground to prevent them from toppling due to wind, and should be located at least 50m away from the Kuruman River; • All waste material must be stored and disposed of at a registered waste disposal site or collected by a suitable waste contractor on a regular basis; • Unauthorised dumping of waste material from toilets into the Kuruman River and burying of waste is strictly prohibited. 	<ul style="list-style-type: none"> • Storage and sanitary facilities (including lavatories) are located as far as possible from the Kuruman River. • The sites are cleaned on a daily basis, once work for the day has been completed. • Waste removal occurs on a daily basis.
5	Storage, handling and spills	<ul style="list-style-type: none"> • Storage areas must be demarcated and fenced, not be located within the 1:100 year floodline/100m of the edge of the Kuruman river, and must be placed on impermeable surfaces such as concrete bunds, to prevent contamination of soil and water; • Adequate storage facilities for the storage of oils, paints, grease, fuel, chemical and hazardous materials to be utilised must be provided to prevent contamination of ground and surface water and soils; • Used cement bags are to be stored in weatherproof containers to prevent cement dust from being windblown into water resources 	<ul style="list-style-type: none"> • Storage areas are clearly demarcated. • All hazardous storage containers comply with the relevant SABS standards • Cement bags are stored in appropriate weatherproof containers. • An incident management reporting procedure has been implemented and recorded.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
		<ul style="list-style-type: none"> All fuel storage tanks must be designed in accordance to the relevant oil industry standards, SABS Code and other relevant requirements; All waste must be removed from site and disposed of at a licensed landfill site; 	
		<ul style="list-style-type: none"> Pre-cast concrete must be used whenever possible; No mixed concrete shall be deposited outside of the designated construction footprint areas. A batter / dagga board mixing trays and impermeable sumps is to be provided onto which any mixed concrete can be deposited whilst it awaits placing. Concrete spilled outside of the demarcated area must be promptly removed and taken to a suitably licensed waste disposal site; Concrete washouts are used to contain concrete and liquids when the chutes of concrete mixers and hoppers of concrete pumps are rinsed out after delivery. The washout facilities consolidate solids for easier disposal and prevent runoff of liquids. The wash water is alkaline and contains high levels of chromium, which can leach into the ground and contaminate groundwater. It can also migrate to a storm drain, which can increase the pH of local waters and harm aquatic life. Solids that are improperly disposed of can clog storm drainpipes and cause flooding; 	<ul style="list-style-type: none"> Appropriate mixing trays and impermeable sumps are utilized during the mixing of concrete. Concrete washouts are installed at appropriate demarcated areas.
		<ul style="list-style-type: none"> In the case of spillage, the spill should be contained and the material together with any contaminated soil must be disposed of as hazardous waste; and Only non-toxic paint should be used on the outside of buildings (where applicable) to limit contamination of stormwater runoff. 	<ul style="list-style-type: none"> Non-toxic paint is used. In the event of spillage, the spill and associated material has been removed from site and disposed of at licensed waste facilities.
6	Structures, Construction and Materials	<ul style="list-style-type: none"> It must be ensured that the proposed Kuruman river crossing will take place only within the approved portions of the Kuruman river, and in line with the set-out design criteria (SAS, 2017b) and method statement to be provided by the project engineers (Carlisle & Associates, 2012). 	<ul style="list-style-type: none"> The placement of structures of the crossing within the Kuruman river is compliant with the relevant authorities and design and construction plans.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
7	Storm Water Management	<ul style="list-style-type: none"> The footprint area of all the construction activities should be limited to what is absolutely essential in order to minimise the loss of clean water runoff areas, unto this no activities should take place within the 1:100 year floodline of the Kuruman River with the exception of the culvert crossing construction; Storm water on the site must be managed so as to reduce the silt loads and runoff peaks into the river as per the proposed Surface Water Management Plan (SLR, 2013) through use of stormwater trenches. No dirty water runoff will be permitted to reach the river or pollute the surrounding clean water areas during the entire life of operation, and clean and dirty water management systems must be put in place to prevent the contaminated runoff (suspended solids and salts and water with low pH) from entering the receiving freshwater environment. Clean and dirty water runoff systems should be constructed before construction of any other infrastructure takes place – special mention is made here of the construction of a stormwater trenches and storage dams, to intercept stormwater prior to discharge (if applicable) into the receiving environment; The proposed apron slabs (Carlisle & Associates, 2012) should offer scour protection. Proper drainage design of culverts within the aprons must be undertaken to reduce the velocity of water that may be discharged into the river – this will limit erosion of the river bed and disruption of the flow characteristics; The banks of the Kuruman River should be monitored for erosion and incision. In the event that any gabions and hessian sheets installed fail to prevent further erosion, immediate action should be taken to stabilize the banks. A suitably qualified specialist should be informed and the erosion control plan must be amended in accordance to the mitigation measures provided and initiated. The width between the pre-cast culverts should be designed in such a way so as to ensure that turbulent flow is minimised. Permanent roadside swales, especially across the river crossing, must be created and maintained at places where runoff from the proposed on-land and bridge roadway is not collected in a stormwater system as to allow it to be biologically cleansed prior to release into the river. Runoff that is collected from the roads should be integrated into the stormwater management plan and consideration should be given to the attenuation of runoff from paved surfaces by the strategic placement of swales to prevent gully formation and siltation of the river; 	<ul style="list-style-type: none"> Regular inspection is done by the environmental manager to identify issues or potential infrastructure encroaching in the no-go areas (Kuruman River and the 1:100 year floodline). Excavation and vegetation clearance is limited to what absolutely essential.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
		<ul style="list-style-type: none"> Any dirty water runoff containment facilities should remain outside of the river and its 1:100 year floodline as a measure to minimise the impact on the receiving environment; Due to climate change and increasing severity of storms and the relatively long life of mine all dirty water containment structures should be designed to contain a minimum storm event of a 24 hour 1 in 100 year flood event; All pollution control facilities should be managed in such a way as to ensure that storage and surge capacity is available if a rainfall event occurs; The stormwater trenches should have a maximum slope of 1:3 to ensure reasonable stability and in order to ensure that revegetation and slope stabilisation will be successful, especially in light of the highly erodible nature of the local soils; If any areas of steep slope occur which would create super critical flow, gabions and reno mattresses can be used to protect these vulnerable areas; 	
		<ul style="list-style-type: none"> As far as possible, all construction activities occurring within the river should occur in the low flow season, during the drier winter months; Excavations should be limited in extent to ensure that drainage patterns within the riparian zone and the river returns to normal as soon as possible after construction; Surface run-off from cleared areas must be reduced as far as possible for the duration of the construction of the river crossing in order to limit further erosion of the Kuruman river; Reduce airborne dust at construction sites through: <ul style="list-style-type: none"> Damping dust generation areas with freshwater (although not in sufficient quantities to generate runoff); and Use of cloth or brush barrier fences. 	
8	Prevent and restrict erosion and siltation of the Kuruman River	<ul style="list-style-type: none"> Vegetation clearing should be done in a phased manner to reduce the exposure time of bare soils at any time in order to limit erosion and siltation of the river further down from the river crossing construction activities; All topsoil stockpiles should be managed in accordance with the soil management measures as per the Environmental Impact Assessment and Environmental Management Programme Report for the Lehating Mine (SLR, 2014); To prevent the erosion of soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas particularly susceptible to erosion; Sheet runoff from access roads should be slowed down by the strategic placement of berms or other material, such as soil traps, hessian curtains, etc.; Monitor all areas for erosion and incision, particularly within or close to the river area. Any areas where erosion is occurring excessively quickly, should be rehabilitated as quickly as possible and in conjunction with other role players in the catchment. Use of hessian, brush packing or barrier fences and fibre rolls or fibre bags can be used. Monitoring of erosion and stormwater structures should be done after a heavy rainstorm (more than 30 mm) by the environmental officer and engineers as part of their monthly internal audit of the site; The river conditions need to be assessed on an annual basis to report deterioration or improvements in the habitat, function and sensitivity of the system. 	<ul style="list-style-type: none"> Vegetation clearing was done in a phased manner to prevent erosion and excessive dust in the area. Adequate erosion measures have been implemented where necessary. Areas have been monitored for sediment build-up in the river. All topsoil stockpiles are managed according to the management measures as per an Environmental Management Programme. The river condition and function have been assessed and monitored annually to note any deterioration or improvement in the system.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
9	Prevention of pollution/effective waste management	<ul style="list-style-type: none"> All dirty water diversion trenches and containment structures should be lined with an impermeable liner (such as concrete and/or soilcrete), which will limit any possible leachate from these structures entering the clean water area; Dirty water containment structures should be regular monitored, and specifically checked after a rainfall event, so as for it to not exceed its capacity and prevent any contamination 	<ul style="list-style-type: none"> All dirty water infrastructure is lined and regularly monitored
10	Control of alien and invasive plant species	<ul style="list-style-type: none"> The removal of the alien and weed species encountered within the zone of influence of the proposed crossing prior to any construction-taking place, 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). The appointed environmental manager should advise on plant identification and invasive categories, should there be any queries on species during the alien vegetation control process, and develop an alien and invasive species control program incorporating the recommendations in Annexure C; Proliferation of alien and invasive species is expected within any disturbed areas, and the vegetation component within the riparian zone in the vicinity of the proposed development is already transformed as a result of alien plant invasion; therefore, these species should be eradicated and controlled to prevent their spread beyond the subject property; Alien vegetation should be manually removed and chemical control is not recommended in order to prevent chemical contamination of the watercourse; No alien plants may be introduced to the subject property and surrounding areas during the construction phases of the project and particular attention must be paid to ensure that any imported material, such as topsoil used for rehabilitation purposes, is certified weed-free; In the removal of smaller alien shrubs and groundcovers, Category 1b, 2 and 3 alien species are to be prioritised in eradication. Non-listed alien species may also be hand-pulled. It is important that the guidelines as outlined in Annexure C of this document be followed in terms of eradication methods and integrated into an alien and invasive plant species control program. In all instances, physical/ manual eradication techniques must be preferred over chemical treatment; All removed alien plant species must be disposed of at a registered garden refuse site and may not be burned on site; Should any alien invasive plants existent on site be trees or bushes greater than 1.5m tall they should be very carefully removed and the ground immediately reseeded and covered with a biodegradable hessian curtain in order to reduce erosion. 	<ul style="list-style-type: none"> An Alien vegetation control program has been developed by a qualified specialist and a suitably qualified and experienced contractor has been appointed for the alien vegetation control.
11	Retain faunal and floral diversity of the Kuruman River.	<ul style="list-style-type: none"> It must be ensured that no additional impacts such as vegetation clearing are allowed to occur in the Kuruman River or the area below its 1:100 year floodline, except for those absolutely essential or planned during the rehabilitation activities. If vegetation is cleared, the soil must be reprofiled and infilled with topsoil to the same level as the surrounding area to ensure that the entire area is free draining. Regular monitoring should however be undertaken, to ensure no erosion or incision is taking place, until such time as the vegetation within the affected portion of the river has been able to re-establish itself; Areas within the Kuruman river where there is no planned development, should not be fragmented or reduced in extent. All of the activities within this zone should be kept to a minimum; 	<ul style="list-style-type: none"> A qualified specialist has developed an Alien vegetation control program and a suitably qualified and experienced contractor has been appointed for the alien vegetation control.



	Objective requirements	Protective measures	Key Performance Indicator (KPI)
		<ul style="list-style-type: none">• Trapping, hunting or collection of faunal species must be prohibited;• Should any other faunal or floral SCC be encountered within the zone of rehabilitation, effective relocation of individuals to suitable offset areas must occur;• All rescue and relocation plans should be overseen by a suitably qualified specialist.	



6.3.2 Management measures pertaining to the operational phase of the proposed activities

Table 8: Control and mitigation measures for the duration of the operational phase of the use of the river crossing

	Objective requirements	Protective measures	KPI
1	General	<ul style="list-style-type: none"> • Ensure that all parties involved with the development are aware of the importance of maintaining the ecological integrity of the Kuruman River and that the SWRMP principles are implemented on an on-going basis by the relevant managing agent; • Ensure that consultation and stakeholder engagement takes place if any future developments take place on surrounding properties; 	<ul style="list-style-type: none"> • All involved parties understand the importance of the surrounding Kuruman River and the SWRMP principles are continuous.
2	Stormwater Management	<ul style="list-style-type: none"> • Stormwater management infrastructure (i.e. clean and dirty water diversion structures) are monitored on a regular basis and desilting of the containment structures must occur – and silt must not be allowed to compromise its surge capacity during heavy rainfall events; • All removed sediment from the river road crossing (i.e. collected in the culvert crossing) should be dispersed into the surrounding area of the river (outside the delineated extent of the river) as part of the natural reclamation process. All other foreign material noted in the river (such as debris and litter) must be suitably disposed of at a registered waste site; • The edge of the rehabilitated Kuruman River is monitored on a regular basis for erosion and incision. In the event that the erosion control measures fail to prevent further erosion, immediate action should be taken to stabilize the slope. A suitably qualified specialist should be informed and the erosion control plan must be amended in accordance to the mitigation measures provided and initiated; and • Edge effects of activities within the Kuruman River (i.e. maintenance of the culverts), including erosion and alien/weed control, need to be strictly managed and continued for at least three months post construction, and should be inspected during maintenance activities. 	<ul style="list-style-type: none"> • Erosion control measures are effective, preventing any erosion, sedimentation or incision of the rehabilitated portion of the Kuruman River. • Erosion and alien / weed control occurs for three months post construction and during maintenance activities. • Maintenance of the trenches occur at regular intervals and silt/sediment removal from the clean water storage dams occurs as required.
3	Retaining faunal and floral diversity	<ul style="list-style-type: none"> • It must be ensured that no additional impacts such as indigenous vegetation clearing are allowed to occur in the vicinity of the culvert crossing and the area within the 1:100 year floodline; • No trapping, hunting or collection of faunal species must be allowed during maintenance or monitoring activities; • Disposal of waste or litter must be prohibited within the area below the 1:100 year floodline. Any waste noted must be cleared immediately during maintenance activities; • Monitoring and removal of alien vegetation must be undertaken continuously for three months after the construction of the development has been completed and during the first growing season. 	<ul style="list-style-type: none"> • Only a single access road (the culvert crossing over the Kuruman River) into the subject property is used during maintenance activities. • No additional waste or litter is present within the river habitat after maintenance activities has taken place. • Alien vegetation is monitored and removed for at least three months post construction, as well as during any maintenance activities within the subject property.



6.4 **Action 4: Aftercare and monitoring**

Although the designs of the structures to manage water may have taken the ecological design criteria into account, there is still a risk to the receiving environment and for this reason, a monitoring program is considered essential. Prudent monitoring of the Kuruman River is of utmost importance, as this will ensure a continual flow of data, enabling all parties involved to accurately assess and manage the progress of the rehabilitation interventions and any arising issues. To ensure the accurate gathering of data, the following techniques and guidelines should be followed:

- It is deemed essential that a suitably qualified environmental manager and monitoring functions on site. The environmental manager must ensure that the designs are being followed and that the construction and implementation is being undertaken according to good freshwater resource management principles and that the objectives of the design will be achieved;
- Site walk through surveys should be applied as the preferred method of monitoring with specific focus on:
 - Erosion monitoring;
 - Sedimentation;
 - Alien and invasive vegetation proliferation;
 - Spills events;
 - Surface water monitoring; and
 - Waste and litter problems.
- General habitat unit overviews should also be undertaken;
- Stability and appropriateness of stormwater controls;
- All data gathered should be measurable (qualitative and quantitative);
- Monitoring actions should be repeatable;
- Data should be auditable; and
- Reports should present and interpret the data obtained.

The monitoring plan comprises but is not limited to the following:

- Identification of areas of concern. These are areas that are affected by disturbances such as:
 - Erosion;
 - Waste dumping;
 - Alien vegetation species encroachment;
 - Soil compaction; and



- Ensuring that the management/rehabilitation measures as stipulated in Section 6 of this report are adhered to;
- Gathering all equipment required for the monitoring process;
- Compiling a monitoring report; and
- A list of all alien vegetation species must be compiled as well as possible control methods such as manual, chemical or mechanical.

This monitoring plan must be implemented by a competent person and submit the findings to the responsible authority for evaluation. The following table illustrates data capturing for the monitoring plan.



Table 9: Monitoring actions for the proposed development.

Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting	Report Content	Equipment
Erosion					
Construction Phase	The portion of the Kuruman river within the subject property, but with specific reference to those areas directly impacted by the culvert crossing	Monitoring of erosion should occur on a regular basis during construction by the contractor, and after every rainfall event. Any evidence of erosion should be recorded photographically /diagrammatically and reported during the environmental manager site visit	1. After every major rainstorm and / flood. 2. Monthly monitoring report compiled by the appointed environmental manager during the construction phase.	1. Brief indication of the method of assessment; 2. Assumptions and Limitations must be listed; 3. Photos and GPS point locations taken of existing erosion in the Kuruman River and adjacent banks must be incorporated into the report. 4. Any erosion observed must be discussed in detail and management recommendations made; and 5. Map indicating where erosion is present. 6. Recommended and undertaken control measures.	1.GPS 2. Camera 3. Field Form 4. Measuring Tape
Operational Phase		Monitoring of erosion should occur after every rainfall and/or following any period of surface flow in the system.	1. After every major rainfall event and / flood for the first wet season post construction. 2. Monthly monitoring report compiled by the appointed environmental manager.	1. Brief indication of the method of assessment; 2. Assumptions and Limitations must be listed; 3. Photos and GPS point locations taken of existing erosion in the Kuruman River and adjacent banks must be incorporated into the report. 4. Any erosion observed must be discussed in detail and management recommendations made (such as revegetation etc.); and 5. Map indicating where erosion is present. 6. Control measures undertaken to be reported.	1.GPS 2. Camera 3. Field Form 4. Measuring Tape
Surface Water Quality(if and when surface water is present)					
Construction	Monitoring must be undertaken at precisely the same locality as the rehabilitation phase monitoring.	Water monitoring must be undertaken on a weekly basis when there is surface water present in the system.	Report must be compiled on a monthly basis for all data collected.	Compare results to rehabilitation phase assessments and aspects as listed in rehabilitation phase report content.	As listed in Rehabilitation phase Equipment
Post Construction	Monitoring must be undertaken at precisely the same locality as the rehabilitation phase monitoring.	Once a month weekly intervals when there is surface water present in the system.	Report must be compiled on a monthly basis for all data collected as required.	Compare results of rehabilitation phase, construction and post construction assessments and aspects as listed in rehabilitation phase report content.	As listed in Rehabilitation phase Equipment
Rehabilitation	Immediately upstream and downstream of the culvert crossing. GPS co-ordinates of the monitoring locality to be recorded.	Water must be tested at weekly intervals when there is surface water present in the system during the rehabilitation phase. GPS co-ordinate of the monitoring point must be recorded so that monitoring	Report must be compiled following completion of fieldwork.	Results of the following must be discussed in detail: Physico-Chemical Water Quality including pH, electrical conductivity, dissolved oxygen content as well as turbidity. data must be compared both spatially and temporally	1.GPS 2. Camera 3. Field Form 4. Handheld multi probe 5. Clarity tube 6. DO Probe (only essential if high



Aspect	Monitoring Location	Frequency of sampling	Frequency of Reporting	Report Content	Equipment
		takes place consistently at the same point.			turbidity is apparent).
Spillage events					
Concurrently	Roads and areas where vehicles commute and areas where chemical storage containers are located.	1. Monitoring of any spillage events should occur monthly during the rehabilitation and construction phase, or 2. Directly after a spill event; and 3. For the operational phase, during maintenance activities	1. Monthly monitoring report compiled by the appointed environmental manager during the rehabilitation and construction phase; and 2. incident reporting must take place during the operational and closure phases of the mining operation.	1. Brief indication of the method of assessment; 2. Discuss type and extent of spill; 3. Photos and GPS point locations taken of the spills in the Kuruman River; 4. Map indicating where the spills has occurred; and 6. Recommended mitigation should be presented. 7. Once an incident has been resolved a close out report or statement should be developed.	1. GPS; 2. Field Form; and 3. Camera
Alien Vegetation Control					
Rehabilitation, Construction and post-Construction	The portion of the Kuruman river within the study area, but with specific focus on those areas directly impacted by the culvert crossing	Regrowth of alien vegetation should be monitored monthly during the first growing season.	At the end of the first growing season following the completion of construction.	1. Provide a list of species occurring within the subject property; 2. Discuss the density of species 3. Kuruman River integrity and risk to be discussed; 4. Fixed point photo (Taking photo at specific point within priority area to show effect of alien vegetation control); 5. Control measures undertaken to be recorded, and; 6. Assess the necessity of further alien and invasive vegetation control. 7. The VEGRAI method should be utilised at each assessment, both upstream and downstream of the disturbed areas, in order to provide an auditable result of the riparian habitat "health".	1. GPS; 2. Field Form; and 3. Camera



7. CONCLUSION

SAS was appointed to develop SWRMP as part of the water management system for the proposed Mn48 Mine. The proposed mining project entails the construction of an access road, which will cross over a portion of the Kuruman River. This will result in some loss of riparian habitat, and increased risk of modifications to the characteristics of the river. Other stormwater management infrastructure includes the construction of separate clean and dirty separation trenches.

With the implementation of the SWRMP procedures outlined in this document, the potential negative impacts of the unauthorised activities which have occurred within the Kuruman River associated with the study area should be reduced and rehabilitated to an acceptable level. If all mitigation measures as stipulated in this plan, along with those stipulated in the Freshwater Ecological Assessment report (SAS, 2014) are adhered to, the freshwater environment is likely to be reinstated to acceptable ecological conditions and ensures that adequate regional and local conservation of the Kuruman River takes place while allowing for economic development to take place.

The SWRMP further assists in the adequate protection of the downstream reach of the Kuruman River and maintenance and enhancement of the PES and function of the river. The information gathered through monitoring programs will assist in a better understanding of the ecology of the area in the vicinity of the rehabilitation activities and ensure proactive management of risks to the receiving environment associated with the proposed activities.



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ANNEXURE A – RECEIVING ENVIRONMENT

BACKGROUND CHARACTERISATION

The table provides background information on the freshwater ecological aspects pertaining to the Mn48 Mine as reported by SAS (2014).

Table A1: Background information on the freshwater ecological aspects pertaining to the Mn48 Mine

- The study area falls within quaternary catchment D41M;
- The study area falls within the Lower Vaal (WMA);
- The sub-Water Management Area (sub-WMA) is the Molopo subWMA;
- The study area falls within the Southern Kalahari Ecoregion;
- A National Freshwater Ecosystem Priority Area (NFEPA) river, the Kuruman River is located on the southern boundary of the study area, and is proposed to be traversed by the access road. According to the NFEPA database and the PES 1999 Classification the river is largely natural (Class B).
- According to the NFEPA database, a single natural floodplain wetland is located outside the south western boundary of the study area. According to the NFEPA database this floodplain wetland is considered in a natural or good condition (WETCON = Class AB); and
- According to the NFEPA database, the study area falls within the Eastern Kalahari Bushveld Group 1 considered Least Threatened by Mbona *et al.* (2015).



ANNEXURE B – LEGAL REQUIREMENTS

Table B1 presents each legislative document and the aspects, which are pertinent to water resource management, including the rehabilitation of disturbed areas to a level that will promote improved water quality and aquatic ecology. Please refer to Table 1 for those specifically applicable to this project report.

Table B1: Legal Requirements

The Constitution of the Republic of South Africa, 1996	<p>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.</p>
The National Environmental Management Act, 1998 (Act No. 107 of 1998)	<p>The National Environmental Management Act, 1998 (Act No. 107 of 1998) and the associated Regulations as amended in 2017, refer specifically to biodiversity management in the following Clause: (4) (a) <i>Sustainable</i> development requires the consideration of all relevant factors including, (i) that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.</p> <p>This Maintenance and Management Plan has been developed in fulfilment of the requirements as defined in the Environmental Impact Assessments EIA Regulations, 2014 (as amended) (No. R. 327) where a "maintenance management plan" is defined as a management plan maintenance purposes defined or adopted by the competent authority.</p>
The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)	<p>The objectives of this act are (within the framework of the National Environmental Management Act) to provide for:</p> <ul style="list-style-type: none"> ➤ the management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity; ➤ the use of indigenous biological resources in a sustainable manner; ➤ the fair and equitable sharing among stakeholders of benefits arising from bio prospecting involving indigenous biological resources; ➤ to give effect to 'ratified international agreements' relating to biodiversity which are binding to the Republic; ➤ to provide for co-operative governance in biodiversity management and conservation; and ➤ to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act. <p>This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of benefits arising from indigenous biological resources.</p> <p>Furthermore, a person may not carry out a restricted activity involving either:</p> <ol style="list-style-type: none"> a) a specimen of a listed threatened or protected species; b) specimen of an alien species; or c) a specimen of a listed invasive species without a permit.



	<p>Permits for the above may only be issued after an assessment of risks and potential impacts on biodiversity is carried out. Before issuing a permit, the issuing authority may in writing require the applicant to furnish it, at the applicant's expense, with such independent risk assessment or expert evidence as the issuing authority may determine. The Minister may also prohibit the carrying out of any activity, which may negatively impact on the survival of a listed threatened or protected species or prohibit the carrying out of such activity without a permit. Provision is made for appeals against the decision to issue/refuse/cancel a permit or conditions thereof.</p> <p>National Environmental Management: Biodiversity Act (NEMBA) (Alien and Invasive Species Regulations, 2014):</p> <p>NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aim to:</p> <ul style="list-style-type: none"> ➤ Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur, ➤ Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and ➤ Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats. <p>Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) as:</p> <ul style="list-style-type: none"> (a) a species that is not an indigenous species; or (b) an indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention. <p>Categories according to NEMBA (Alien and Invasive Species Regulations, 2014):</p> <ul style="list-style-type: none"> ➤ Category 1a: Invasive species that require compulsory control. ➤ Category 1b: Invasive species that require control by means of an invasive species management programme. ➤ Category 2: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread. ➤ Category 3: Ornamentally used plants that may no longer be planted.
<p>The National Water Act, 1998 (Act No. 36 of 1998)</p>	<p>The purpose of the National Water Act, 1998 (Act 36 of 1998) (NWA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled.</p> <p>The NWA, 1998 also provides for water use licenses which an operation will have to apply for, before commencing with any Section 21 water use activity. Various conditions may be attached to these licenses and a breach thereof will result in criminal and civil liability. The conditions attached to water use licenses will function alongside the additional protective measures, duty of care and statutory liability provisions provided by the NWA and other legislation to regulate a whole array of water issues.</p> <p>Accordingly, and in terms of the <i>Guide to the National Water Act</i>, "water use" refers to doing something that has an impact on the water resource, for example:</p> <ul style="list-style-type: none"> ➤ The amount of water in the resource; ➤ The quality of water in the resource; and ➤ The environment surrounding the resource. <p>Section 4 governs the entitlement to use water and states that water may only be used if it is a Schedule 1 use, a continuance of an existing lawful use (ELU), or authorised in terms of a general authorisation (GA) or license. A water use may therefore not be implemented unless it is properly authorised through one of these types of authorisations.</p>



	<p>The National Water Act, 1998 (Act No. 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 Human Settlements, Water and Sanitation (DHSWS). Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from the DHSWS in terms of Section 21 (c) & (i).</p> <p>A watercourse is defined as:</p> <ul style="list-style-type: none"> a) A river or spring; b) A natural channel in which water flows regularly or intermittently; c) A wetland, lake or dam into which, or from which water flows; and d) Any collection of water which the minister may, by notice in the Gazette, declare a watercourse.
<p>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)</p>	<p>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:</p> <ul style="list-style-type: none"> 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. <p>This notice replaces GN1199 and may be exercised as follows:</p> <ul style="list-style-type: none"> 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 storm water management activities as contained in a river management plan; v) Conduct rehabilitation of wetlands or rivers where such rehabilitation activities have 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. <p>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.</p>
<p>Mineral and Petroleum Resources Development Act (MPRDA) (Act 28 of 2002)</p>	<p>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 Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP), and a Public Participation Process (PPP). The primary environmental objective of the MPRDA is to give effect to the 'environmental right'¹⁰ contained in the South African Constitution. The MPRDA further requires the Minister to ensure the sustainable development of South Africa's mineral resources, within the framework of national environmental policies, norms and standards, while promoting economic and social development. With regard to the environment, Section 37(1) of the MPRDA provides that the environmental management principles listed in Section 2 of the National Environmental Management Act (No. 107 of 1998) (NEMA) must guide the interpretation, administration and implementation of the environmental requirements of the MPRDA, and makes those principles applicable to all prospecting and mining operations. Furthermore, Section 37(2) of the MPRDA states that "any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into</p>



	the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations”.
Government Notice 704 as promulgated in Government Gazette 20119 of 1999 as it relates to the National Water Act, 1998 (Act No. 36 of 1998)	<p>These regulations, forming part of the National Water Act, 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.</p> <p>It is recommended that the project complies with Government Notice 704 as promulgated in Government Gazette 20119 of 1999 as it relates to 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:</p> <p><i>No person in control of a mine or activity may:</i></p> <p>(b) <i>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 (m) 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;</i></p> <p>According to the above, the activity footprint must fall outside of the 1:100 year floodline of the riparian feature or 100m from the edge of the feature, whichever distance is the greatest, unless authorised by DHSWS.</p>



ANNEXURE C – ALIEN FLORAL SPECIES CONTROL

The dominant alien floral species are predominantly associated with agricultural activities and should be identified by the ECO prior to the commencement of construction. An Alien and Invasive Plant (AIP) species control program should be developed for control of these species. The basic principles of a control program are presented below.

AIP control programs must include the following three phases (Campbell, 2000):

- Initial Control Phase: The existing population must be drastically reduced.
- Follow-up Control Phase: Control of coppice regrowth, root suckers and seedlings.
- Maintenance Phase: Low AIP density and numbers with a low annual control cost. During this phase, AIP is no longer considered a problem. It is important to monitor the situation of infestation during the growing season of the plants as to avoid re-infestation and to keep the control cost at a minimum.

Control Methods

To control AIP successfully, one must use a number of control methods. When using herbicides, the recommendations that are stated on the label of the specific product must be adhered to (Campbell, 2000).

Integrated Control Strategies

A combination of the most suitable and effective methods should be used to control a specific species in a particular situation. The following selection of appropriate control methods should take into account the following (Campbell, 2000):

- Species of alien and invasive weeds;
- The type of growth form (i.e. seedling, sapling, shrub or tree);
- The density of infestation;
- The terrain where the infestation is present;
- Rehabilitation requirements
- What resources are available;
- Speed or urgency that the control of the infestation requires – physical removal and biological control will take longer than chemical control.
- **Initial control phase**
 - **Hand pull:** saplings and seedlings must be pulled out by hand and regrowth must be controlled with herbicide (Campbell, 2000). All guidelines for the application of herbicide listed in this Rehabilitation Plan must be adhered to;
 - **Frill:** a cane knife is used to cut frills into the stem. Herbicide must be applied (1-2 mm per frill) and must be done in 30min after frilling;
 - **Soil application:** herbicide is applied to the soil and taken up by the plants roots

Methods for controlling Coppice, saplings and seedlings:

AIP infestation can comprise different growth forms, and some of the growth forms cannot be utilised. These plants need to be cut with a brush cutter and the stumps treated with herbicide that was mixed with a dye to show where treatment was done (however stumps must not be removed as they significantly contribute to soil stability).



Integrated strategies to control alien shrubs	Alien shrubs that are less than 1 m in height: <ul style="list-style-type: none"> • A foliar application must be used in the general control of alien shrubs that are less than 1 m in height. • Registered herbicide must be used and where grass is present, selective broadleaf herbicide that will not impact on the grass. When grass is not present, a selective or non-selective registered herbicide must be used. • For dense seedling growth that is of uniform height a flat fan nozzle with knapsack must be used. • For seedling growth that is of uneven height, root suckers, short saplings, and coppice growth a cone nozzle must be used.
	Alien shrubs that are taller than 1 m (Campbell, 2000): <ul style="list-style-type: none"> • Shrubs that are taller than 1 m must be reduced cutting using brush cutter or cane knives. • When large areas with dense growth are present a tractor mounted gyro-motor must be used. • For low – medium density infestation a cut stump treatment must be used. Stumps that are must be treated immediately. The best time to treat is during the active growing season. • Medium – High-density infestations must be slashed to knee height so that the plants can coppice. The best time to do this is during the winter months as the plants are dormant and the coppice will come out during the active growing period after good rain. The coppice must be sprayed when enough leaves are present to absorb the herbicide, and a dye must also be used to indicate treated areas. • Pathways must be cut to increase exposed areas so that a foliar spray treatment is more effective without compromising the indigenous vegetation. • Mechanical uprooting of shrubs is not always a preferred method because the soil is disturbed and this increases the risk of alien vegetation infestation. This activity also promotes erosion, and soil loss will occur. Mechanical uprooting can be done in areas that have a dense grass cover, as the roots of the grass will keep the soil intact. After uprooting the soil must be levelled and if grass seeds are present, some grass seeds must be placed on these areas to promote grass regrowth.
Integrated strategies to control alien herbs (Campbell, 2000)	Chemical Control: <ul style="list-style-type: none"> ➤ Alien herbs are soft non-woody species. ➤ Some of the alien herbs have registered herbicides to control them and are either pre- or post-emergent herbicides. ➤ When alien herbs are associated with woody alien plant, herbicides that are registered to control woody alien species are often used to control alien herbs. Alternatively, glyphosate can be used as it is often registered for both alien herb and alien woody species.

Follow up control (Campbell, 2000)

Introduction

Follow-up control is essential to control alien saplings, seedlings and coppice regrowth to achieve and sustain the progress that was made with the initial control work in the initial phase. If the follow-up control phase is neglected, the alien infestation will become worse and denser than before the eradication process started. It is essential to sustain the follow-up phase because it will prevent the suppression of alien seedlings on planted grasses.

Follow up treatment control must use the following methods:

- Chemical control methods: Only use registered herbicides to control any alien species. Instruction on the herbicide labels must be followed carefully.
- Mechanical control methods
- Biological control methods that are available.



Control methods for dense regrowth: After initial control operations dense regrowth may arise as new regrowth will sprout in the form of stump coppice, seedlings and root suckers.	
Chemical control / foliar application:	<ul style="list-style-type: none"> Plants that are less than 1 m in height must be controlled by foliar application. Dense seedling growth must be controlled with knapsack sprayers with a flat fan nozzle. If grass is present, the use of a registered selective herbicide must be used so as not to harm the grass, and if grass is not present a registered non-selective or selective herbicide can be used. Suitable dye must be used at all times to limit over- or under spray of areas.
Mechanical control:	<ul style="list-style-type: none"> Areas with dense seedlings should not be uprooted or hoed out, as these areas will result in soil disturbance and will in return promote flushes and germination of alien seedling growth. When stump density is high, plants should not be cut. This is impractical, and there will be many untreated stumps. Instead cut the stumps in dense areas with brush cutters and remove the top growth. Stumps will start to coppice, and foliar spray must be used to control the coppice regrowth.
Control methods for low-medium density regrowth: Neglecting to control low-medium density regrowth will result in densification and spreading as well as additional control costs.	
Chemical control:	<ul style="list-style-type: none"> Cut stump method must be used and stumps must be cut up to a height of 15 cm and must be sprayed within an hour of cutting the plant with a registered herbicide. Herbicide must be applied with knapsack sprayers set to low pressure, using cone nozzles, e.g. TG1 or CE1. Hand sprayers can also be used to apply herbicide. A suitable dye must be used to ensure all stumps are treated. Only the cut surface must be treated with herbicide, and the side of the stumps must not be treated. Foliar spray can be applied to regrowth that is up to the height of 1m. Herbicide must be applied using knapsacks with solid cone nozzle and must be mixed with a suitable dye to prevent over- or under spraying of treated areas.
Mechanical control:	<ul style="list-style-type: none"> Seedlings can be removed from wet soil by hand pulling. Gloves can be used for hand protection during the operation.



ANNEXURE D – RECOMMENDED SPECIES FOR USE IN THE REHABILITATION OF THE AFFECTED PORTION OF THE KURUMAN RIVER

The plant species that are recommended for use as part of the rehabilitation plan described above are listed below.

Table D1: Recommended plant species for use in the Mn48 Mine SWRMP.

Trees	Forbs
<ul style="list-style-type: none"> • <i>Asparagus laricinus</i> • <i>Diospyros lycioides</i> • <i>Grewia flava</i> • <i>Senegalia mellifera</i> subsp. <i>Detinens</i> 	<ul style="list-style-type: none"> • <i>*Chenopodium album</i> • <i>*Echinopsis schickendantzii</i> • <i>Abutilon</i> sp. • <i>Aptosimum elongatum</i> • <i>Berkeya</i> sp. • <i>Crotalaria orientalis</i> • <i>Chrycosoma ciliata</i> • <i>Cucumis zeyheri</i> • <i>Dicoma capensis</i> • <i>Dimorpotheca zeyheri</i> • <i>Felicia muricata</i> • <i>Gnidia polycephala</i> • <i>Helichrysum cerastioides</i> • <i>Hermannia comosa</i> • <i>Hirpidium</i> sp. • <i>Hoffmannreggia burchellii</i> • <i>Lycium hirsutum</i> • <i>Lycium</i> sp. • <i>Melolobium candicans</i> • <i>Monechma distichotrichum</i> • <i>Pentzia globosa</i> • <i>Pollicha campestris</i> • <i>Pteronia glauca</i> • <i>Senna italica</i> subsp. <i>arachoides</i> • <i>Tribulus zeyheri</i>
<p><i>Riparian shrubs and trees</i></p> <ul style="list-style-type: none"> • <i>Asparagus laricinus</i> • <i>Diospyros lycioides</i> • <i>Grewia flava</i> • <i>Gymnosporia buxifolia</i> • <i>Lycium hirsutum</i> • <i>Rhigozum trichotomum</i> • <i>Talium caffrum</i> 	
<p>Grasses</p> <ul style="list-style-type: none"> • <i>Aristida bipartita</i> • <i>Aristida congesta</i> • <i>Aristida meridionalis</i> • <i>Aristida stipitata</i> • <i>Cenchrus ciliaris</i> • <i>Digitaria eriantha</i> • <i>Enneapogon cenchroides</i> • <i>Eragrostis lehmanniana</i> • <i>Eragrostis pallens</i> • <i>Fingerhuthia afriacana</i> • <i>Heteropogon contortus</i> • <i>Schmidtia kalahariensis</i> • <i>Schmidtia pappophoroides</i> • <i>Stipagrostis zeyheri</i> 	
<p><i>Riparian sedges and grasses</i></p> <ul style="list-style-type: none"> • <i>Aristida congesta</i> • <i>Aristida meridionalis</i> • <i>Aristida stipitata</i> • <i>Cymbopogon excavates</i> • <i>Schmidtia kalahariensis</i> • <i>Setaria sphacelata</i> var. <i>sphacelata</i> • <i>Stipagrostis zeyheri</i> 	



ANNEXURE E - TRAINING AND AWARENESS

Training of Construction Workers

Construction workers must receive basic training in environmental awareness, including minimisation of disturbance to all of the freshwater resources and in particular those of increased ecological Importance and sensitivity and the area below the GN509/704 zone of regulation. Construction workers must also be made aware of impacts upon fauna and flora through implementation of a no poaching and collection policy, management of waste and prevention of water pollution.

Contractor Performance

The Contractor must ensure that the conditions of the SWRMP are adhered to. Should the Contractor require clarity on any aspect of the SWRMP the Contractor must contact the environmental manager for advice.

The environmental manager must regularly audit the operation, and as deemed necessary on a proactive basis, to establish whether the measures in the SWRMP were applied and adhered to. The audit report of the environmental manager must be submitted to the lead project manager immediately upon completion. The lead project manager must ensure that the SWRMP is implemented and that suitable penalties are in place for non-conformance to the SWRMP by contractors. The environmental manager should be the designated authority to issue a stop work order if severe non-compliance is taking place by the contractor.



ANNEXURE F – PROJECT TEAM

SAS Consulting Team (a member of the SAS Group of Companies)

Stephen van Staden

SACNASP REG.NO: 400134/05

Stephen van Staden is an environmental practitioner with over 18 years of experience in the water compliance, water monitoring and environmental management fields. He started and has grown a multi-disciplinary environmental consultancy firm since 2003 and has become a forerunner in the environmental consultancy industry. He holds a master's degree in environmental management, which focussed on aquatic resource management. Stephen is accomplished in various freshwater disciplines including both aquatic and wetland fields of science. Stephen has become recognised as a national expert combining science, engineering principles and an in-depth understanding of the legislative framework to provide turnkey advisory services. Stephen is registered by the SA RHP as an accredited biomonitoring specialist and is SACNASP registered in ecology. Stephen is a member of the Gauteng Wetland Forum, SASSO, LARSA and IAIA.

Christel du Preez

SACNASP REG.NO: 120240

Christel holds a Masters degree in Environmental Sciences with a focus on urban wetlands and ecological processes. During her employment at Scientific Aquatic Services since 2016, she has been involved in a variety of projects, primarily focussing on the assessment of freshwater systems (wetland and riparian) within South Africa. Additionally, Christel has also attended a variety of recognised freshwater related training courses presented by a variety of universities in order to further her knowledge of current best practise as accepted by the relevant authorities. As a freshwater ecological consultant, she is involved in the compilation of ecological assessment studies, undertaking risk and impact assessments and mitigation measure development, client liaison and advising in terms of relevant legislation, and also contributes to GIS map development and analysis and the development of Landscape Plans. Christel is registered as a Professional Natural Scientist with SACNASP in the field of Ecological Science.

Christel is based in the Cape Town office but has undertaken freshwater ecological studies associated with a variety of assessment spheres, within a variety of provinces in South Africa.



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

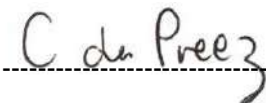
I, Stephen van Staden, declare that -

- 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


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

I, Christel du Preez, 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





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Date: 22 August 2017
(Amended May 2020)

Ref: SAS 217053

SLR Consulting (Africa) (Pty) Ltd

Email: chird@slrconsulting.com

SLR Consulting (Johannesburg office)

Suite1 – Building D, Monte Circle

178 Montecasino Boulevard

Fourways

Johannesburg

2191

Attention: Ms Caitlin Hird

Dear Madam,

**RE: MEMORANDUM CONSIDERING THE FRESHWATER RESOURCE
ECOLOGICAL CONSIDERATIONS FOR THE DESIGN OF THE STORM WATER
SYSTEM FOR THE Mn48 (PTY) LTD MINING PROJECT.**

1. INTRODUCTION AND CONSIDERATION OF DATA

Scientific Aquatic Services (SAS) was requested to assist with reviewing the draft water management systems associated with the Mn48 (Pty) Ltd mining project and providing a set of design criteria, by means of a workshop with the design engineers, specifically focusing on ecological requirements and the requirements for management of water in the landscape, in support of the Department of Water and Sanitation (DWS) Sub Directorate Instream Water Use requirements. In addition, it was deemed necessary to consider the impact, from an aquatic ecological point of view, that reduced catchment yield would have on the Kuruman River located adjacent to the proposed mining project.

SAS previously conducted a freshwater ecological assessment as part of the environmental assessment and authorisation process for the Mn48 Mine¹, in order to inform the Water Use Licence Application (WULA) and specifically the requirements of the mandatory supplementary information required for Section 21 (c) & (i) licence Form *DW781 supp²*. At that time, the characteristics of the identified reach of the Kuruman River were defined, including definition of the Present Ecological State (PES), the Ecological Importance and Sensitivity (EIS) and the ecoservices provided by the river. The results of that study were used to inform the design criteria and considerations of impact for the stormwater management system at the current time.

The proposed Mn48 (Pty) Ltd mining project (the footprint area thereof hereafter referred to as the “study area”) is located 18km north of the town Hotazel, with the R380 passing along the south-western boundary of the study area. The Kuruman River is located on the south-western boundary of the study area, which will also be traversed by the proposed access road.

Overall, the surrounding environment to the Kuruman River were found to be dominated by livestock farming and are mostly overgrazed. The Kuruman River within the area of the study area are considered to be largely natural with only a few modifications (PES Category B), with intermediate levels of ecological and socio-cultural service provision. The overall riparian vegetation is considered to be in a relatively natural condition in terms of species composition, however evidence of alien invasive floral species (*Prosopis glandulosa*) was apparent towards the southern portion of the river, ultimately to such an extent that the extreme southern portion of the river was dominated by this alien species. The Kuruman River is considered to be of high ecological importance (EIS Category B).

The following points summarise the risk to the Kuruman River arising from the water management infrastructure required for the access road crossing of the Kuruman River which forms part of the Mn48 mining project.

- The local area can be considered water stressed and loss of catchment yield has the potential to impact on the ecology and integrity of the affected portion of the Kuruman River;
- A loss of Aquifer Dependent Ecosystems (ADE) may result in a loss of sensitive species, specifically *Vachellia erioloba* and *V. haematoxylon*, which are protected under the National Forest Act, 1998 (Act No. 48 of 1998). However, according to the Groundwater Flow and Contaminate Transport Modelling report³, no significant groundwater contribution to baseflow of the Kuruman River is evident and no significant impact on the shallow Kalahari Aquifer is likely. Thus, any impact on ADE is highly unlikely due to dewatering effects. However, although no impact from the mining activities on ADE is anticipated, severe invasion by

¹ Freshwater ecological assessment as part of the environmental assessment and authorisation process for the proposed Mn48 (Pty) Ltd mining project near Hotazel, Northern Cape Province. Prepared by Scientific Aquatic Services for SLR Consulting. March 2014 (Amended May 2020).

²Compilation of freshwater motivations in support of a stream crossing near Hotazel, Northern Cape Province. Prepared by Scientific Aquatic Services for SLR Africa. August 2017 (Amended May 2020).

³ SLR. 2013. Lehating Mine Groundwater Flow and Contaminate Transport Modelling. August 2013

Prosopis glandulosa is likely to affect ADE and control and eradication of this species is recommended in order to protect any possible ADE within the area of influence of the mine;

- Potential edge effects of mining related activities and the access road construction activities through the Kuruman River will result in the loss or transformation of riparian habitat and ecology. The Kuruman river is considered a sensitive system (EIS: Category B) and the loss of riparian habitat, which is already considered scarce within the region, is considered to be of a very high significance;
- Construction activities across the Kuruman River may result in the loss of stream flow regulation, sediment trapping and erosion control abilities, whilst also lowering the ability to support biodiversity. This would also be of negative impact to the down stream areas of the Kuruman river; and
- The impact on the hydrological functioning of the section of the Kuruman River proposed to be crossed, as well as the edge effects of mining activities, would be of high significance. Since the soils within the study area are considered dispersive and naturally susceptible to erosion, disturbances relating to construction activities are considered highly likely to result in further erosion and sedimentation of the river, with associated alteration of flow patterns.

LOSS OF CATCHMENT YIELD

The study area of the Lehating Mine project is located within the D41M quaternary catchment, which has a catchment area of 2628 km² and a Mean Annual Runoff (MAR) of 2.05 million m³ (WR, 2012⁴).

From the proposed stormwater management infrastructure layout provided, several berm and channel clean and dirty water diversion channels will limit catchment runoff from entering the Kuruman River. Although the size of the contained dirty water area was not available at the time of composing this report, it is not considered to equate to a significant reduction of catchment yield into the Kuruman River.

Based on the design of the stormwater management system produced by the design engineers, the layout (especially that of the clean water cut off channel) is considered optimized and loss of catchment yield minimised. Containment of dirty stormwater within the mining area will make negligible difference to flows of the Kuruman River.

DESIGN CRITERIA

During the consideration of the design of the proposed river access road crossing and the overall stormwater management, the key objectives as mentioned above were used to guide the design of the crossing to minimise the impact on the Kuruman River system and to adhere to the resource

⁴ Water Resources of South Africa, 2012 study. Water Research Commission Report Number TT 380/08, Water Research Commission, Pretoria, South Africa

quality objectives of the river. The table below presents the objectives along with the design criteria to meet these objectives.

From the above assessment, some guidelines for the river crossing design are proposed. The design should ensure that the following criteria are met to ensure the ongoing functioning of the various zones of the river in the vicinity of the crossing. The table below presents the objectives for conservation of the river as well as the areas upstream and downstream of the crossing. The table also presents the design criteria required in order to meet these requirements:

Table 1: Key objectives and design criteria

OBJECTIVE	DESIGN CRITERIA
Ensure that hydraulic connectivity of the river is maintained between the areas upstream and downstream of the crossing	<p>The design must ensure that the active river channel remains inundated with water after heavy rainfall events but without causing artificial ponding or concentration of flow. In order to achieve this the following should be implemented</p> <ul style="list-style-type: none"> • The pioneer layer should be constructed out of a porous material or from material which is coarse enough to assist with the movement of water through the structure to allow wetting of the soils to occur on the downstream side of the crossing. • Ensure that the concrete base slab and culvert invert is embedded below the natural ground level of the Kuruman River, allowing for water flow. This foundation should be buried deep enough to allow for scour during high flows. • The extent to which culverts are used in the system should reach as far as possible (over the streambed and banks) to ensure that during freshets the broadest possible area becomes inundated allowing for recharge of the marginal soils, and minimise or prevent the need for bed and bank reinforcement, reduces the risk of creating a barrier to faunal species and allows small faunal species passage under the structure. • The design of the culverts should have a cross fall (be slightly sloped) in order to accommodate the directional flow of the river. The inlet side of the crossing should be at a slightly higher elevation than that of the downstream outlet side, in order to facilitate the natural flow and velocity of water through the culverts.
Ensure that the river functionality is maintained through provision of measures to ensure that soil wetting conditions are maintained during a rainfall event	<ul style="list-style-type: none"> • The pioneer layer should ensure that soil wetness is maintained in the upper 300mm throughout the extent of the river channel on the downstream side in order to ensure that facultative and obligate wetland vegetation species can still be supported. • Therefore, the pioneer layer should be constructed out of a porous material or from material which is coarse enough to assist with the movement of water through the structure to ensure that soil wetness is maintained. • The culvert crossing design must limit the degree of upstream ponding which occurs. Ponding should only occur for a very short period (a few hours) after heavy rainfall events.
Ensure ongoing functioning of the river system in the vicinity of the crossing	<ul style="list-style-type: none"> • All effort to prevent contamination of the river system must occur. In this regard, special mention is made of the need to service and refuel all vehicles off site. • The footprint of the crossing structure should remain as small as possible. • All materials used to construct the crossing structure should not generate toxic leachates or lead to significant changes in pH or dissolved salt concentrations. In this regard pH should not change by more than 5% between upstream and downstream areas and the TDS value should not increase by more than 10%. • As far as possible, all construction activities should occur in the low flow season. • All rock and rubble which remains after the construction needs to be removed from the river system prior to the contractors leaving site.

OBJECTIVE	DESIGN CRITERIA
Ensure that the design of the river crossing allows for river soil conditions to be maintained both upstream and downstream of the bridge to such a degree that vegetation community structures upstream and downstream of the crossing are maintained	<ul style="list-style-type: none"> • The design should ensure that the seasonal river zone should have water logged soils within 300mm of the soil surface after heavy rainfall events • Temporary river zone areas should have waterlogged soil conditions occurring to within 300m of the land surface during after heavy rainfall events.
Ensure that no incision and canalisation of the river system takes place as a result of the construction of the river crossing	<ul style="list-style-type: none"> • The crossing structure must allow for sufficient dispersion of water through the river system to prevent the concentration of flow in the active channel which could lead to scouring and incision of the system. • During construction, the footprint areas of the construction activities must be kept to a minimum. All vehicles must use one single designated track and turn-around areas should be located outside of the river boundary. • Any areas of disturbed soils where vegetation removal has occurred need to be revegetated to prevent erosion and sedimentation.
Ensure that no erosion or sedimentation occurs	<ul style="list-style-type: none"> • The bridge walls are to be clad with rock to prevent erosion. • Any areas of disturbed soils where vegetation removal has occurred need to be revegetated to prevent erosion and sedimentation. • The pioneer layer used to construct the bridge will be extended in a downstream direction which will ensure protection of the stream from erosion.
Ensure that migratory connectivity for more mobile faunal species is facilitated to allow movement of these species between areas upstream and downstream of the crossing.	<ul style="list-style-type: none"> • The design must ensure that free movement of all species (with specific mention of reptiles and small mammals) is afforded through the crossing • The culverts to be used for the crossing should be spaced across the river system in such a way as to ensure that no changes to the natural wetting patterns occur.

CONSIDERATION OF DESIGN DRAWINGS

The design drawings of the proposed river crossing and stormwater management system were reviewed, following the design meeting held with the civil engineers tasked with the design of the structures. The proposed design is considered to be sufficient to adhere to the design criteria presented in this document. If the design criteria recommendations are further implemented, based on the review of the drawings it is the opinion of the freshwater ecologist that the designs will ensure an appropriate level of protection of functionality from a freshwater ecological point of view.

INPUT INTO DESIGN CRITERIA OF WATER CONTROLS ASSOCIATED WITH THE RIVER CROSSING AND THE OVERALL STORMWATER MANAGEMENT SYSTEM

Design criteria and motivation

The following key recommendations were made to ensure that the ecological functionality of the river crossing and the overall stormwater management system is supported and to ensure that impact on the receiving environment was minimised and that the resource quality objectives of the receiving environment could be supported:

- Erosion control mechanisms and scour protection (gabion mattress, rip rap etc.) should be implemented within the design of the culvert crossing;

- Stormwater design should be included in the design of the roadway over the culvert crossing, in order for controlled runoff into the river system;
- All trench slopes forming part of the stormwater management, need to be designed to have a maximum slope of 1:3 to ensure reasonable stability and in order to ensure that revegetation and slope stabilisation will be successful, especially in light of the highly erodible nature of the local soils;
- If any areas of steep slope occur which would create super critical flow, gabions and reno mattresses can be used to protect these vulnerable areas;
- Areas which are to be revegetated should be revegetated as directed by the landscape maintenance and management plan⁵.

MONITORING REQUIREMENTS

Although the designs of the structures to manage water have taken ecological design criteria into account, there is still a risk to the receiving environment and for this reason a monitoring program is considered essential. The following key components should be included in the monitoring plan:

- The stormwater trenches must be inspected for erosion and bank failure after all significant rainfall events;
- Areas where revegetation has taken place must be monitored to ensure vegetation becomes established;
- If any areas of excessive sedimentation are observed, the excess sediment should be carefully removed;
- If any areas of bank failure are observed the banks must be immediately rehabilitated; and
- A Riparian Vegetation Response Assessment Index (VEGRAI) assessment should be conducted every three years in order to evaluate the response of the vegetation to impacts associated with the bridge development.

CONCLUSION

Scientific Aquatic Services (SAS) was requested to assist with reviewing the draft water management systems associated with the Mn48 (Pty) Ltd mining project and providing a set of design criteria, by means of a workshop with the design engineers, specifically focusing on ecological requirements, the resource objective requirements and the requirements for management of water in the landscape in support of the DWS Sub Directorate Instream Water Use requirements. In addition, it was deemed necessary to consider the impact, from an aquatic ecological point of view, that reduced catchment yield would have on the system.

The design criteria provided led to the optimisation of the designs from an ecological perspective. Based on the consideration of the designs the designs are considered suitable to minimise impacts on

⁵ Mn48 (Pty) Ltd Mining Project: Landscape Plan. Prepared by Scientific Aquatic Services for SLR Africa. August 2017 (Amended May 2020)

the receiving environment and support the resource quality objectives for the local systems provided that the structures are well implemented and managed.

Since there is risk to the receiving environment, even with well designed, implemented and managed water management systems, monitoring is considered essential in both the construction and operational phases with specific mention of monitoring of erosion, sedimentation, and proliferation of alien vegetation. Such monitoring should be undertaken using fixed-point photography, at the beginning and end of the summer period (i.e. at the beginning of October, and the end of March annually) as well as after rainfall events, and these records should form part of the overall Environmental Management Programme (EMPr) of the mine. Should problems be identified, measures to minimise erosion and sedimentation should immediately be implemented.

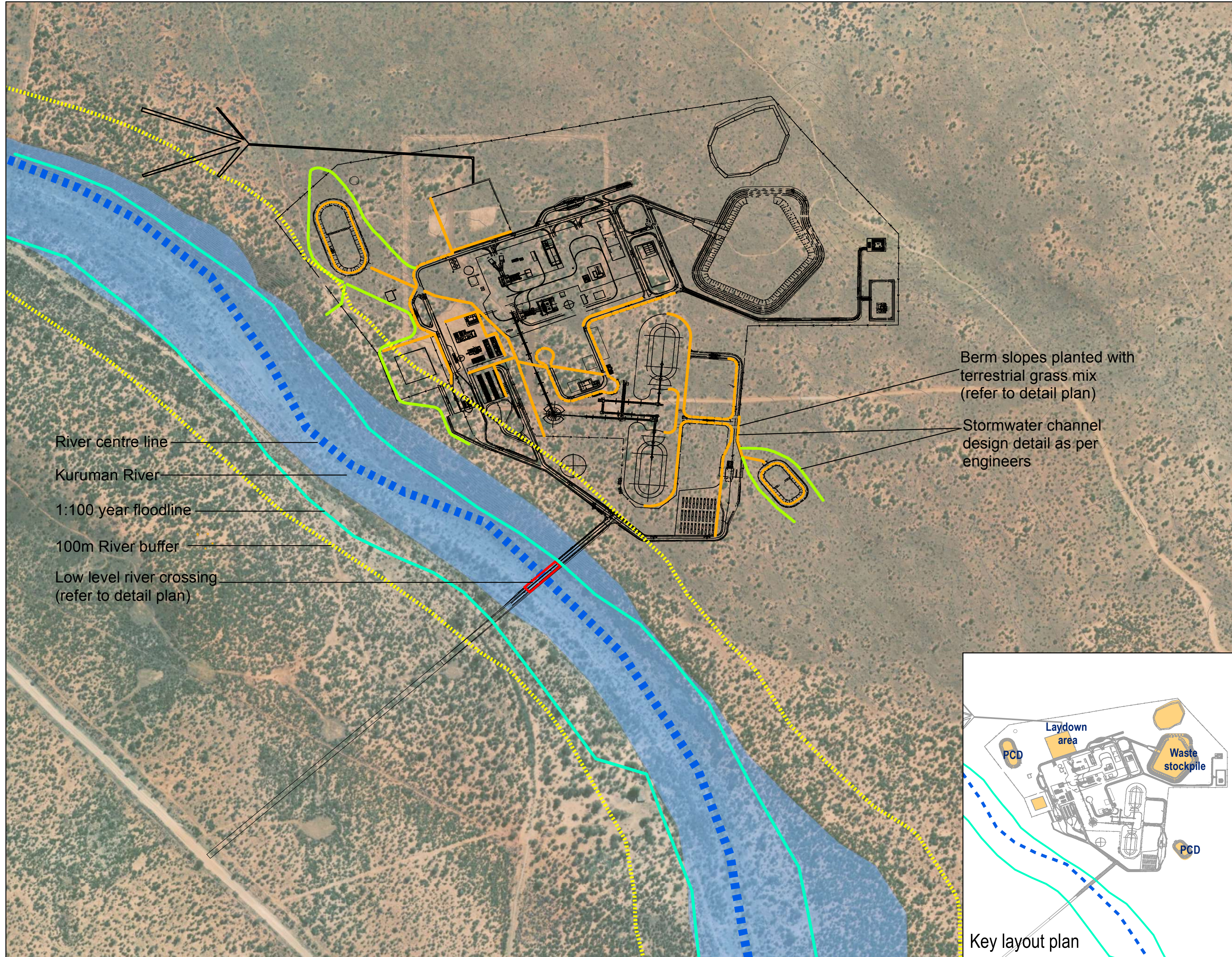
The design drawings of the water control structures were reviewed following the design meeting held with the civil engineers. Based on the review of the drawings, it is the opinion of the freshwater ecologist that the designs, with further adherence to the proposed design criteria, will ensure an appropriate level of functionality from a freshwater ecological point of view.

It is the considered opinion of the aquatic ecologist specialist that, from an aquatic resource conservation point of view, the proposed water management systems and proposed bridge crossing be authorised, by the Department of Water and Sanitation (DWS) as part of the WULA provided that the conditions in this memo are adhered to.

Yours Faithfully,

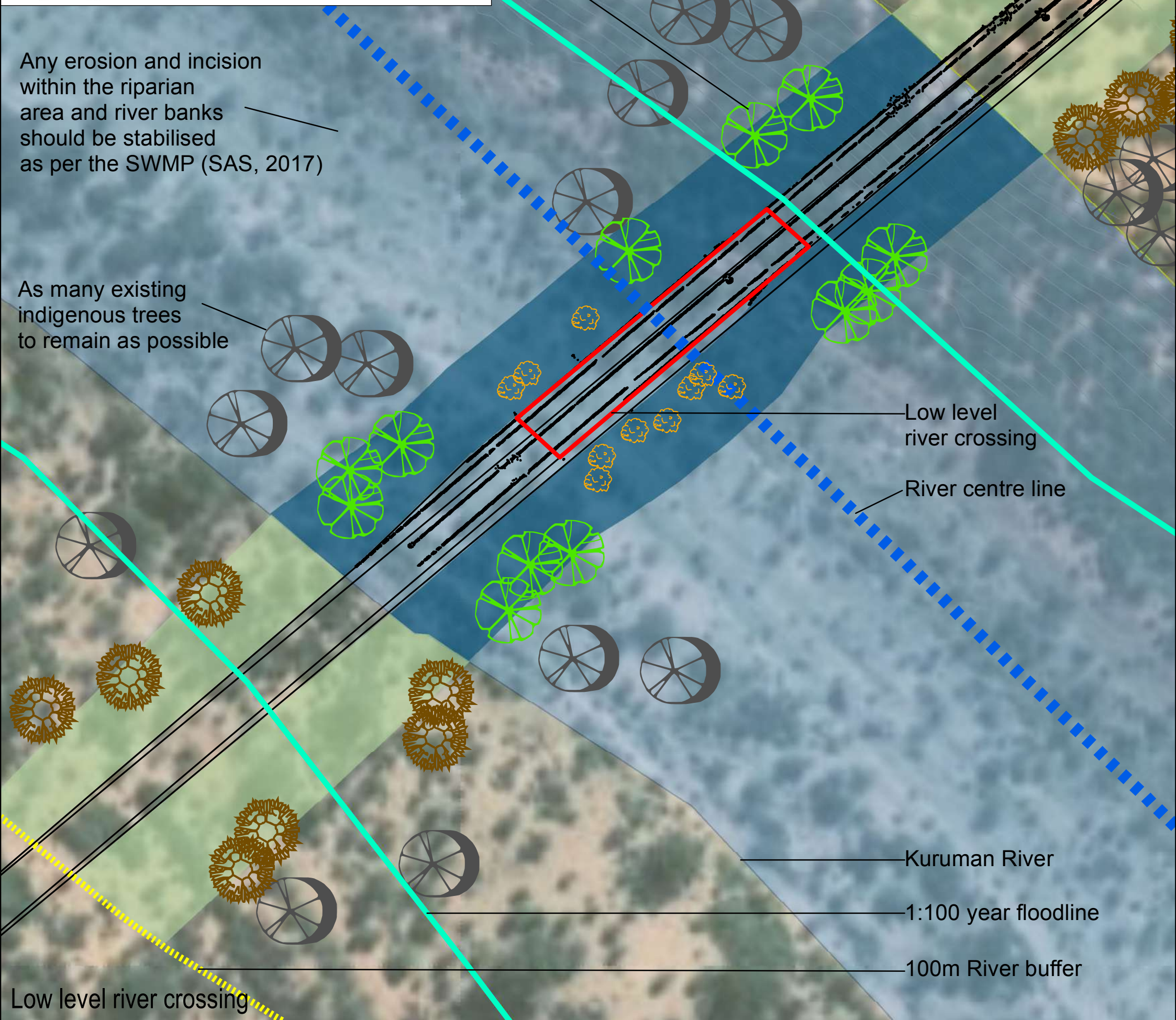


Stephen van Staden
Pr. Sci. Nat.
Managing Member
Scientific Aquatic Services



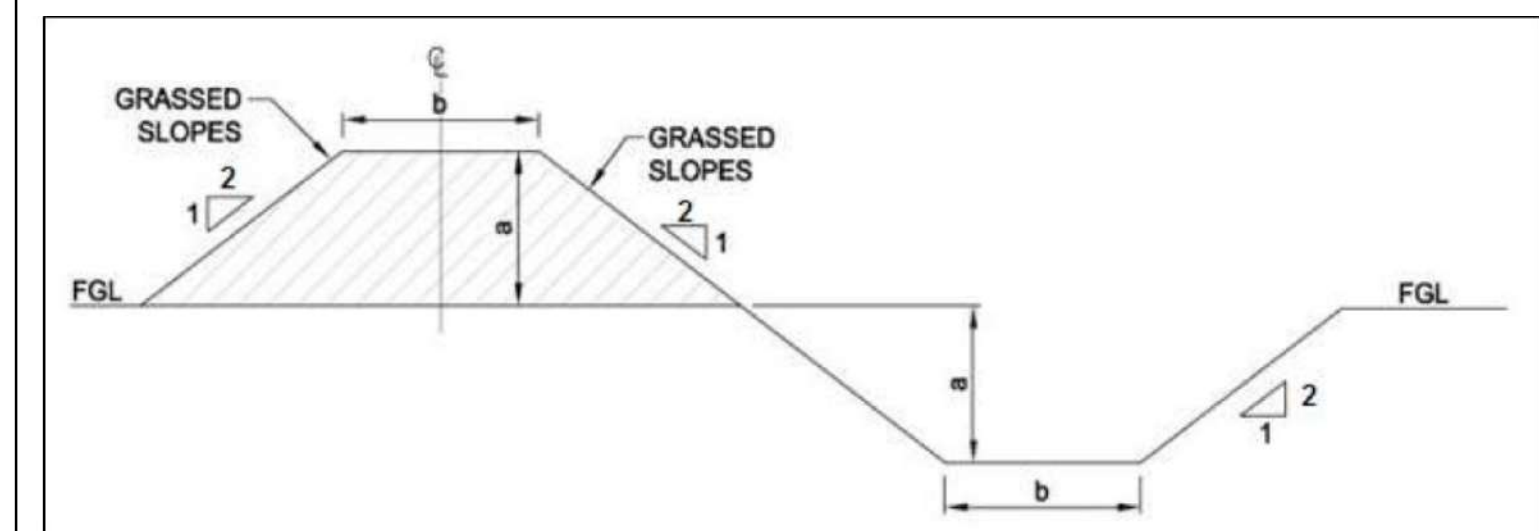
Planting notes:

- All bare areas occurring as a result of construction and related development activities must be revegetated with indigenous vegetation as specified.
- All new planting areas within delineated surface water areas and buffers must be ripped to a depth of approximately 150mm, using hand-held equipment, prior to being rehabilitated with topsoil and revegetated.
- Biodegradable hessian material is to be applied on all steep slopes and areas where erosion is noted.
- A minimum grass cover of 80% to be obtained within all reseeded areas and planted species must be strong and healthy after the first growing season.
- Floral growth and establishment must be monitored as per the rehabilitation plan (SAS, 2017) compiled for the project.
- All alien species are to be removed from the Kuruman River reach associated with the study area, with particular attention paid to eradication of NEMBA Category 1b species, and *Prosopis* spp. specifically.

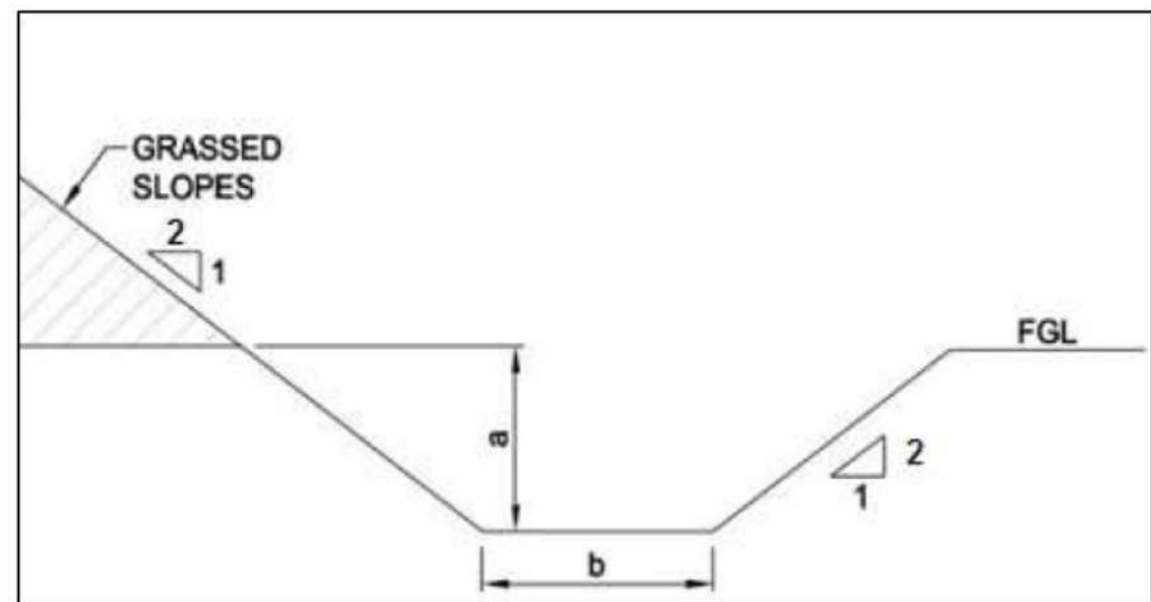


- LEGEND**
- River centre line
 - ▨ 100m Riparian zone
 - 1:100 year floodline
 - ▭ Kuruman River delineation
 - Surface Infrastructure
 - ▭ Clean water diversion structures
 - ▭ Dirty water diversion structures
 - ▭ Low level river crossing
 - Existing indigenous trees
 - New riparian woody mix
 - Trees/ shrubs from minimum 50L containers
 - Diospyros lycioides* 60%
 - Grewia flava* 20%
 - Vachellia karroo* 10%
 - Ziziphus mucronata* 10%
 - New terrestrial woody mix
 - Trees/ shrubs from minimum 50L containers
 - Vachellia erioloba* 40%
 - Grewia flava* 30%
 - Ziziphus mucronata* 10%
 - Searsia erosa* 20%
 - ▭ Riparian grass mix
 - Seeded grass (24kg/ha)
 - Cynodon dactylon* 40%
 - Enneapogon cenchroides* 10%
 - Setaria sphacelata* 20%
 - Eustachys paspaloides* 10%
 - Aristida stipitate* 10%
 - Schmidtia kalahariensis* 10%
 - Forbs (sods@1/m2)
 - Cyperus margaritaceus*
 - ▭ Terrestrial grass mix
 - For use in riparian buffer zone and terrestrial areas requiring revegetation including stormwater infrastructure
 - Seeded grass (40kg/ha)
 - Cynodon dactylon* 20%
 - Eragrostis lehmanniana* 10%
 - Eragrostis curvula* 10%
 - Digitaria eriantha* 10%
 - Aristida adscensionis* 10%
 - Eragrostis curvula* 20%
 - Stipagrostis uniplumis* 10%
 - Schmidtia kalahariensis* 10%

NOTE:
The Landscape Plan pertains to riparian and riparian buffer areas, as well as to the stormwater management structures where applicable only, and does not include detail on the terrestrial landscaping requirements.



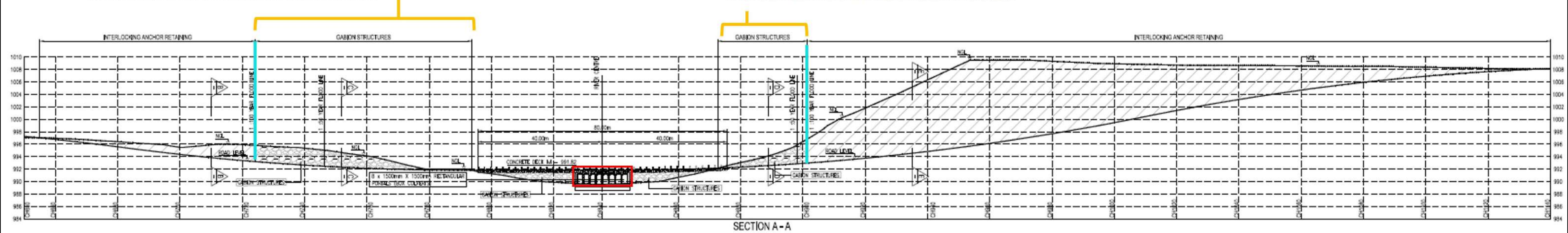
Typical berm and channel for sediment control and dirty stormwater diversion system (SLR, 2013).



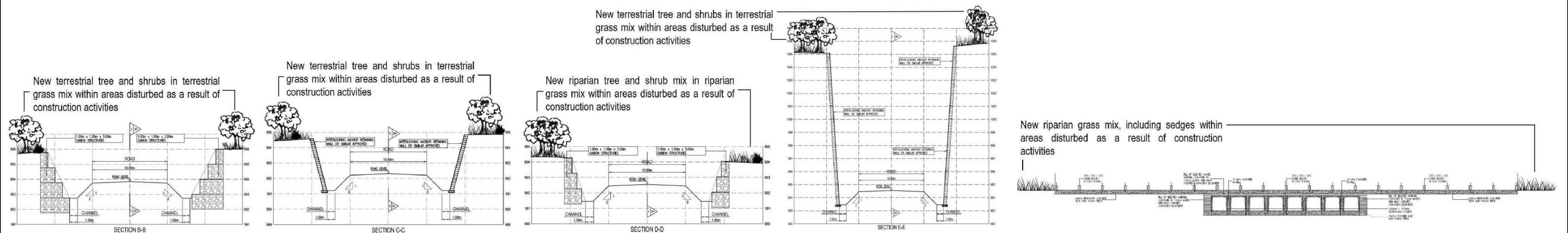
Typical berm and channel for clean stormwater diversion system (SLR, 2013).

New riparian tree and shrub mix in riparian grass mix at top of gabion wall within areas disturbed as a result of construction activities

New riparian tree and shrub mix in riparian grass mix at top of gabion wall within areas disturbed as a result of construction activities



Longitudinal section through the low level crossing



Cross sections through the low level crossing

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NOTES:
The Landscape Plan is to be read with the Surface Water and Management Plan (SAS, 2017) and other supporting documentation.
Engineering drawings not to be used for construction unless signed off by Professional Engineer/Tech.

REVISION: 00

No	DESCRIPTION	DATE

PROJECT: Mn48 (Pty) Ltd
DESCRIPTION:
Landscape Plan (as pertaining to riparian areas and stormwater management infrastructure)
DRAWING NUMBER:
SAS_Mn48_LP_01_R0
DATE: May 2020
SCALE: 1:10000 (A1)
PURPOSE: Information/Approval