Riverine Ecology Scoping Report for the Elandsfontein Mining Project

Riverine Ecology Scoping Assessment

Emalahleni, Mpumalanga

November 2019

CLIENT

Prepared by:

The Biodiversity Company

Cell: +27 81 319 1225

Fax: +27 86 527 1965

info@thebiodiversitycompany.com

www.thebiodiversitycompany

Report Name	Riverine Ecology Scoping Report for the Elandsfontein Mining Project
Submitted to	
Report Compiler	**Russell Tate**
	Russell Tate was the lead specialist for this freshwater ecology assessment. Russell is a water resource scientist with a Master of Science Degree (MSc) in aquatic health, specializing in aquatic ecotoxicology. He is a registered professional scientist with the South African Council for Natural Scientific Professions (SACNASP). Russell Tate has eight years working experience and has completed aquatic assessments in over 20 countries.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

DECLARATION

I, Russell Tate, 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the 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; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Russell Tate

Aquatic Ecologist

The Biodiversity Company

November 2019

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1 Introduction

Elandsfontein Colliery Pty Ltd (hereafter referred to as Elandsfontein Colliery) has appointed Geo Soil and Water cc (GSW) as the Environmental Assessment Practitioner (EAP) to assist with undertaking the necessary Environmental Authorisation and amendment processes for Elandsfontein Colliery. The Biodiversity Company (TBC) was appointed to conduct specialist studies to support the proposed authorisation and amendment processes.

The Integrated Environmental Impact Assessment (EIA) process shall be undertaken in terms of Chapters 4 and 6 of the EIA Regulations, 2014 (GNR 982) promulgated under the NEMA (as amended). A full EIA process will be followed which involves a Scoping phase which is the 'feasibility' and largely desk-top assessment stage of the project, followed by more detailed assessments in the Environmental Impact Assessment (EIA) phase.

The Elandsfontein Colliery comprises of 2 distinct mining rights (MR314 and MR63). The Elandsfontein Colliery plans to consolidate the two mining right areas into a single mining right. In addition, the applicant wishes to expand their existing mining operations to include additional mineral resource areas.

The aim of this report is to present the available desktop information pertaining to the riverine resources associated with the Elandsfontein Colliery Mining Right area, hereafter referred to as the project area. Following the establishment of desktop ecological condition, an impact assessment will be completed based on the anticipated activities that will take place at the proposed project area. Following the completion of the impact assessment, general mitigation actions will be recommended and the proposed methodology for the detailed site investigation will be presented.

The location of the proposed project is presented in Figure 1. The proposed project is located on a portion of the remaining extent of portion 8; remaining extent of portion 1; a portion of the remaining extent of portion 6; portion 44; portion 14 and the remaining extent of portion 7 of the Farm Elandsfontein 309 JS, located in Emalahleni Local Municipality, Nkangala District Municipality, Mpumalanga Province. The site is ~4km south of Kwa-Guqa and ~16k west of Emalahleni. The centre point of the site is 25°53'05.01"S and 29°05'36.57"E.

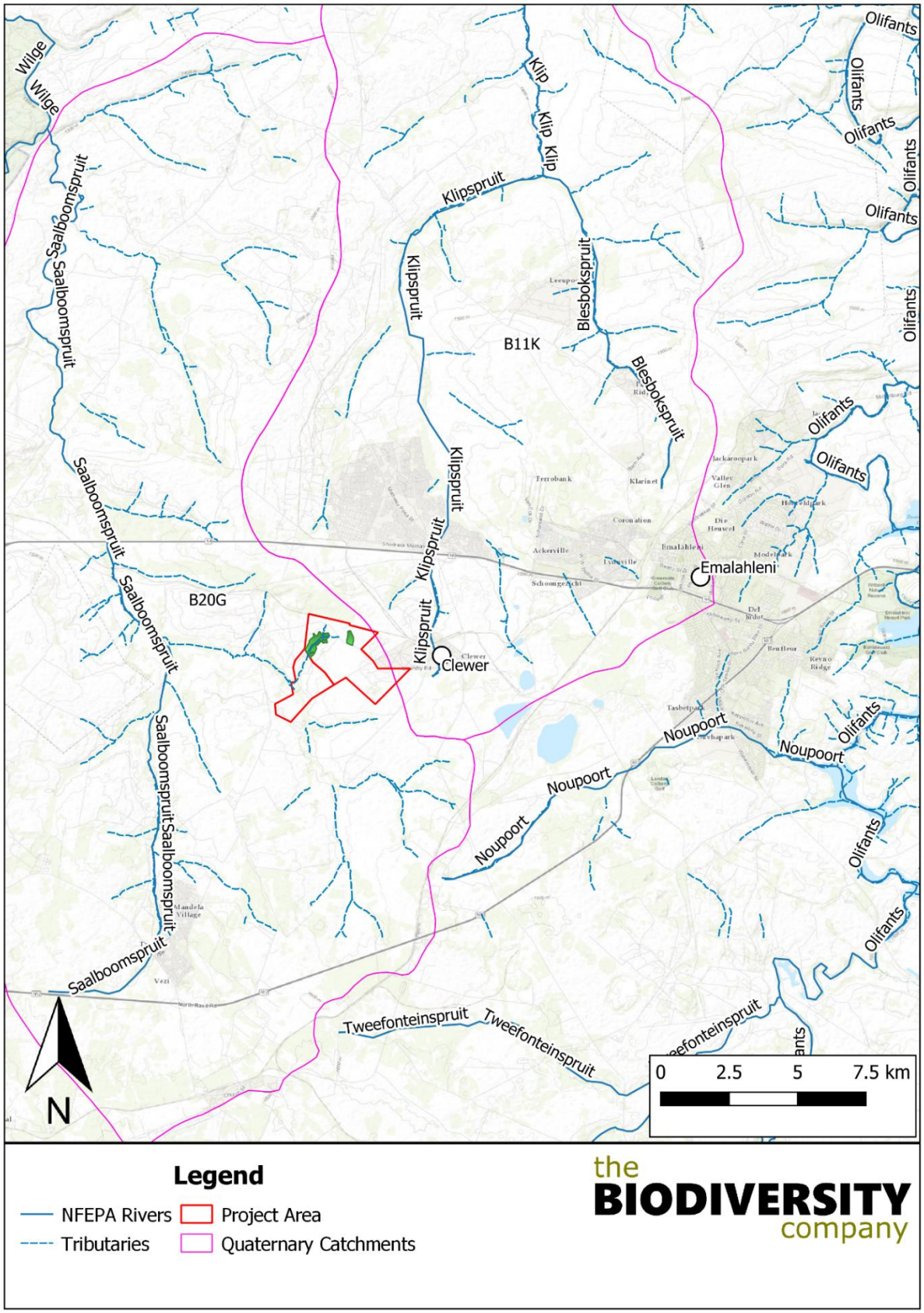

Figure 1: The project area and watercourses associated with the Elandsfontein Colliery

2 Document Structure

This report has been compiled in accordance with the EIA Regulations, 2014 (Government Notice (GN) R982). A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 1 below.

Table 1: Report Structure

Environmental Regulation	Description	Section in Report
NEMA EIA Regulations 2014 (as amended)		
Appendix 6 (1)(a):	Details of – (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 3 and Appendix B
Appendix 6 (1)(b):	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix A
Appendix 6 (1)(c):	an indication of the scope of, and the purpose for which, the report was prepared;	Section 4
Appendix 6 (1)(ca):	an indication of the quality and age of base data used for the specialist report;	Section 9
Appendix 6 (1)(cb):	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 9
Appendix 6 (1)(d):	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
Appendix 6 (1)(e):	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 9
Appendix 6(1)(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;	N/A
Appendix 6(1)(g):	an identification of any areas to be avoided, including buffers;	N/A
Appendix 6(1)(h):	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 10
Appendix 6(1)(i):	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 6
Appendix 6(1)(j):	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 10
Appendix 6(1)(k):	any mitigation measures for inclusion in the EMPr;	Section 10
Appendix 6(1)(l):	any conditions for inclusion in the environmental authorisation;	N/A
Appendix 6(1)(m):	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A
Appendix 6(1)(n):	a reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (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;	N/A
Appendix 6(1)(o):	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
Appendix 6(1)(p):	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
Appendix 6(1)(q):	any other information requested by the competent authority.	N/A

3 Specialist Details

Report Name	**Riverine Ecology Scoping Report for the Elandsfontein Mining Project**
Submitted to	
Client	
	Russell Tate
Report Writer	Russell Tate was the lead specialist for this freshwater ecology assessment. Russell is a water resource scientist with a Master of Science Degree (MSc) in aquatic health, specializing in aquatic ecotoxicology. He is a registered professional scientist with the South African Council for Natural Scientific Professions (SACNASP). Russell Tate has eight years working experience and has completed aquatic assessments in over 20 countries.
	Andrew Husted
Report Reviewer	Andrew Husted is Pr Sci Nat registered (400213/11) in the following fields of practice: Ecological Science, Environmental Science and Aquatic Science. Andrew is an Aquatic, Wetland and Biodiversity Specialist with more than 12 years' experience in the environmental consulting field. Andrew has completed numerous wetland training courses, and is an accredited wetland practitioner, recognised by the DWS, and also the Mondi Wetlands programme as a competent wetland consultant.
Declaration	The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.

4 Terms of Reference

The following Terms of Reference (ToR) were defined for this scoping study:

- Delineation of sensitive watercourses associated with the project area;
- Identification of desktop ecological status and existing impacts;
- Identification of potential impacts arising from the proposed project; and
- Provide recommendations for the final study.

5 Project Description

The Elandsfontein Colliery is located in the Witbank Coal Field on the farm Elandsfontein 309 JS. The property is approximately 16 km west of the town of Witbank in the Mpumalanga Province, South Africa. The centre point of the site is 25°53'05.01"S and 29°05'36.57"E. The Elandsfontein Colliery comprises of 2 distinct mining rights (MR314 and MR63). The applicant plans to consolidate the two mining right areas into a single mining right with associated consolidated Environmental Management Programme (EMPr). In addition, the applicant wishes to expand their existing mining operations to include additional mineral resource areas (i.e. new opencast & underground areas within the consolidated mining right boundary) (GSW, 2019). The area surrounding the project area consists predominantly of mining activities, secondary roads and agricultural areas.

6 Limitations

The following limitations were noted for the study:

- This assessment represents the Scoping Phase of the project only;
- A detailed riverine ecology baseline and impact assessment report will be submitted for the EIA phase of the project;
- The impact assessment has only been conducted for the proposed opencast and underground mining areas. The construction phase activities have assumed that access roads and topsoil stripping for the initialisation of the open cast activities will form a component of the construction phase;
- The impact assessment assumes that no discard dumps or processing facilities will form part of this application;
- No alternatives have been provided; and
- No infrastructure or activities such as abstraction, discharge, processing plants, Run-of-Mine storage, discard dumps or overburden stockpiles have been included in this impact assessment. Considering this, only the operation phase of the project will be considered.

7 Key Legislative Requirements

7.1 National Water Act (NWA, 1998)

The Department of Water and Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (Act No. 36 of 1998 – NWA) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means;

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; 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.

The NWA recognises that the entire ecosystem and not just the water itself, and 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 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) and (i).

7.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (Act No. 107 of 1998 – NEMA) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation application process needs to be followed. This could follow either the Basic Assessment (BA) process or the Environmental Impact Assessment (EIA) process depending on the scale of the impact.

8 Project Area

The watercourses associated with Elandsfontein Colliery are presented in Figure 1. The watercourses are located in the B20G quaternary catchment and to a lesser extent the B11K quaternary catchment, within the Olifants Water Management Area (WMA) (NWA, 2016) and the Highveld - Lower ecoregion (Dallas, 2007). The relevant Sub-Quaternary Reach (SQR) is the B20G-1099, which is a reach of the Saalboomspruit, which flows north and eventuates in the Wilge River (Figure 2 1). The reach assessed represents a tributary of the headwaters of the Saalboomspruit. The area is marked by extensive agricultural and mining activities. The project area of the B11K quaternary catchment is drained by the Klipspruit which is classified as the B11K-1127. Considering the location of the proposed activities, limited impacts can be anticipated in the B11L-1127 SQR.

9 Receiving Environment

9.1 Climate

The climate of the area is temperate, with cold winters and warm summer periods (Figure 5). The flooding regime is unimodal occurring between October and March annually (Figure 6). As can be observed in Figure 6, the region has experienced a drought for the last 3-4 years, with precipitation rates increases in 2019.

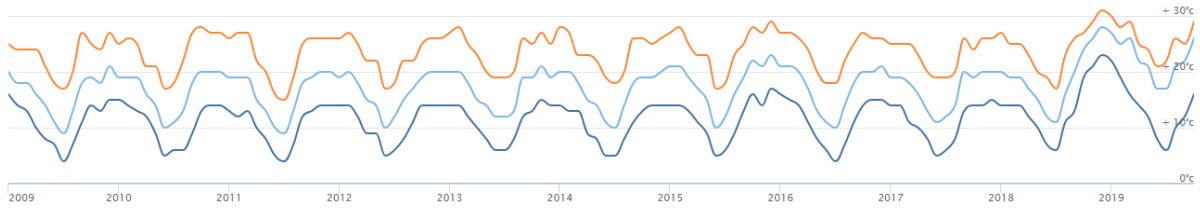

Figure 2: Temperature in eMalahelni (World Weather Online 2019; bottom line min temperatures, middle line average temperatures, top line maximum temperatures in degrees Celsius))

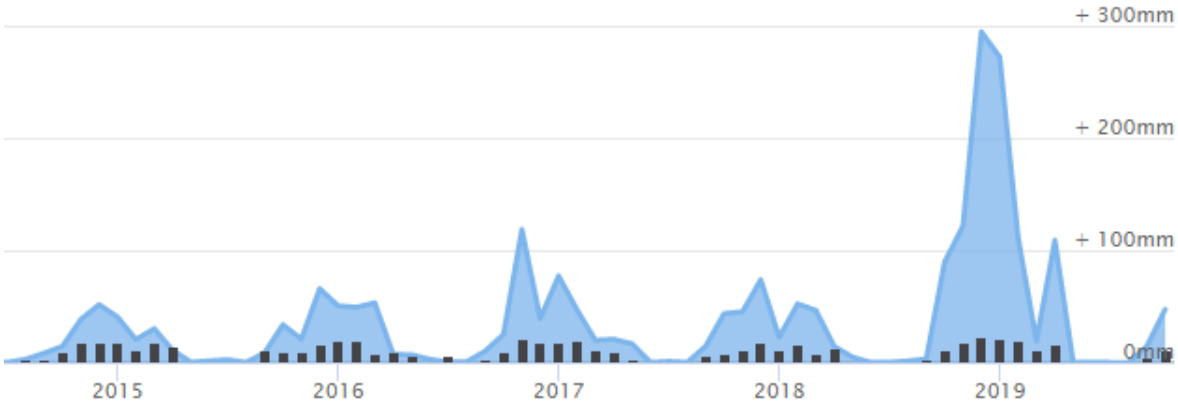

Figure 3: Precipitation in eMalahleni (World Weather Online 2019)

9.2 Freshwater Ecoregion

The study area considered in this assessment is located within the Southern Temperate Highveld Freshwater Ecoregion (Abel et al., 2008). In comparison to northern African river systems, the aquatic fauna of the considered ecoregion is “lacking in diversity” (Abel et al., 2008). This ecoregion is known to contain approximately 67-101 freshwater fish species of which 1-11 are known to be endemic (Figure 4). The ecoregion is known to have increased flow rates during the spring and summer seasons (October to March) and the indigenous fish species breed during this period.

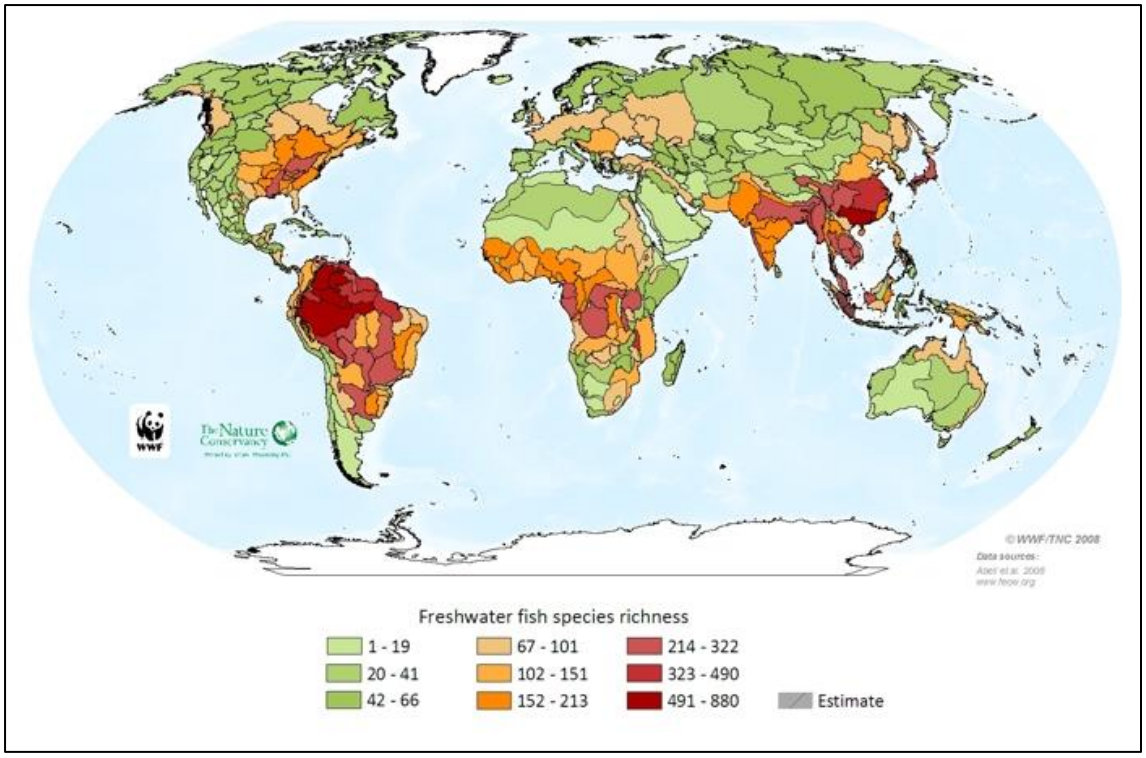

Figure 4: Freshwater Fish Species Richness of the Freshwater Ecoregions of the World (Abel et al., 2008)

9.3 National Freshwater Ecological Priority Area

The National Freshwater Ecosystem Priority Areas (NFEPA) database forms part of a comprehensive approach for the sustainable and equitable development of South Africa's scarce water resources. This database provides guidance on how many rivers, wetlands and estuaries, and which ones, should remain in a natural or near-natural condition to support the water resource protection goals of the NWA. This directly applies to the NWA, which feeds into Catchment Management Strategies, water resource classification, reserve determination, and the setting and monitoring of resource quality objectives (Nel *et al*. 2011). The NFEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act's biodiversity goals (Act No.10 of 2004) (NEM:BA), informing both the listing of threatened freshwater ecosystems and the process of bioregional planning provided for by this Act (Nel *et al*., 2011). According to Nel *et al.* (2011), no river FEPAs are listed for the B20G-1099 SQR (Figure 5). However, as presented in Table 2, numerous NFEPA wetlands are present within the reach.

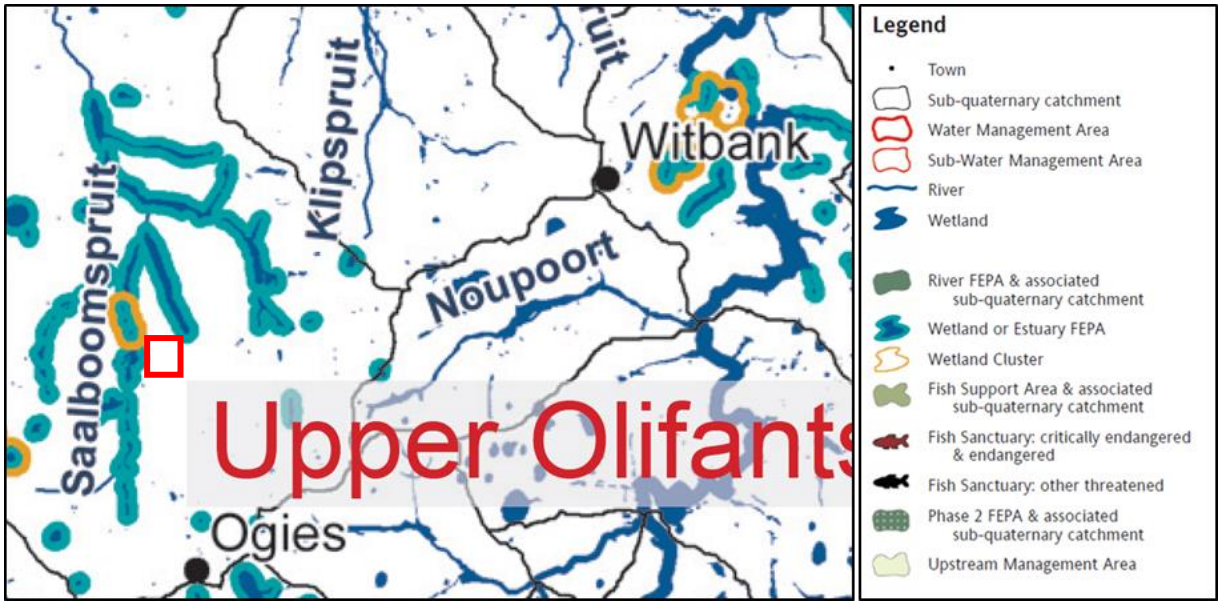

Figure 5: Illustration of absence of NFEPAs within the project area (indicated by a red square)

Table 2: NFEPAs listed for the B20G-1099 SQR

Type of FEPA map category	Biodiversity features
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Channelled valley-bottom wetland
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Depression
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Flat
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Seep
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Unchannelled valley-bottom wetland
Wetland ecosystem type	Mesic Highveld Grassland Group 4_Valleyhead seep

9.4 Land Use and Historical Impacts

The land cover consists of a mixture of grassland, mining, woodland (invasive *Eucalyptus* or Black Wattle), wetlands, cultivated lands and other agricultural activities. Adjacent to the proposed mining right the grassland vegetation type is classified as the Amersfoort Highveld Clay Grassland (Mucina and Rutherford, 2008).

9.5 Ecological Status and Composition

Desktop information was obtained from DWS (2019) for the Saalboomspruit SQR and is summarised in Table 3. The desktop PES of the reach of the Saalboomspruit associated with the Elandsfontein Coal Mine area is a class C or moderately modified. The confidence in this classification is low due to the long distance of the considered SQR (42 km). The ecological importance and sensitivity of the river reach was rated as high. The defined Default Ecological Category for the river was class B or largely natural, and according to the RQOs for the reach, the Ecological Category to be maintained is a class C. The gradient of the considered river reach in proximity to the project area was found to be a class E geoclass. This places the river as a lowland river reach.

Table 3: The desktop information pertaining to the B20G-1099 Sub Quaternary Reach

Component/Catchment	Saalboomspruit

Present Ecological Status	Moderately Modified (class C)
Ecological Importance Class	High
Ecological Sensitivity	High
Default Ecological Category (DWS, 2019)	Largely Natural (class B)
Resource Quality Objectives (DWS, 2016)	Moderately Modified (class C)

The expected fish species for the river reach are provided in Table 2.

Table 4: Expected fish species in the B20G-1099 Sub Quaternary Reach

Species	Common Name	IUCN Status (IUCN, 2019)
Enteromius anoplus	Chubby Head Barb	LC
Enteromius paludinosus	Straightfin Barb	LC
Enterormius cf. brevipinnis	Steelpoort Barb	NE
Clarias gariepinus	Sharptooth Catfish	LC
Psuedocrenilabrus philander	Southern Mouth-Brooder	LC
Tilapia sparmanii	Banded Tilapia	LC
LC: Least Concern, NE: Not Evaluated		

A total of nine fish species are expected in the study area. The majority of the fish species were listed as Least Concern (IUCN, 2019). However, as noted in the freshwater ecoregion setting, the species *Enteromius cf. brevipinnis* is expected in the project area and is regarded as a Species of Conservation Concern.

9.6 Resource Quality Objectives

Based on the established Resource Quality Objectives (RQO) for the watercourse (DWS, 2016), the B20G quaternary catchment does not form part of any established Integrated Units of Analysis (UA). Considering this, the downstream river reach in the Wilge River quaternary catchment was considered (Table 3).

Table 5: Relevant Resource Quality Objective Information pertaining to IUA 2 (DWS, 2016)

RQO	Indicator	Numerical Limit
Overall salt and sulphate concentrations need to be improved so that they do not threaten the ecosystem or agricultural activities	Sulphates	<200 mg/l
Toxics should not be allowed to negatively impact on the ecosystem or agricultural users	Al	<0.105 mg/l
	Cd	<3.0 µg/l
	Cr (IV)	<121 µg/l
	Cu	<6.0 µg/l
	Mn	<0.990 mg/l
	Zn	<25.2 µg/l
Instream habitat must be in a moderately modified or better condition. Instream biota must be in a moderately modified condition and at sustainable levels Low and high flows must be suitable to maintain river habitat for ecosystem	Instream Habitat Category > C Fish Ecological Category > C Macroinvertebrate Ecological Category > C Instream Ecostatus > C	
The riparian zone must be in a largely natural condition or better	Riparian zone habitat integrity category > C Riparian ecostatus category > 82	

10 Impact Assessment

This impact assessment has been separated into the various expected phases of the proposed project. The write up provided below indicates the anticipated ratings of the impacts, however the various ratings of the impacts can be found in the associated excel scoring sheet submitted to the client.

The 1: 50 000 river reaches were derived from relevant topographical data and overlaid onto the proposed mining activities to provide a general definition of habitat sensitivity (Figure 6). As indicated in the map there will be undermining of the watercourses as well as the opencast mining activities within the proximity of the river reach.

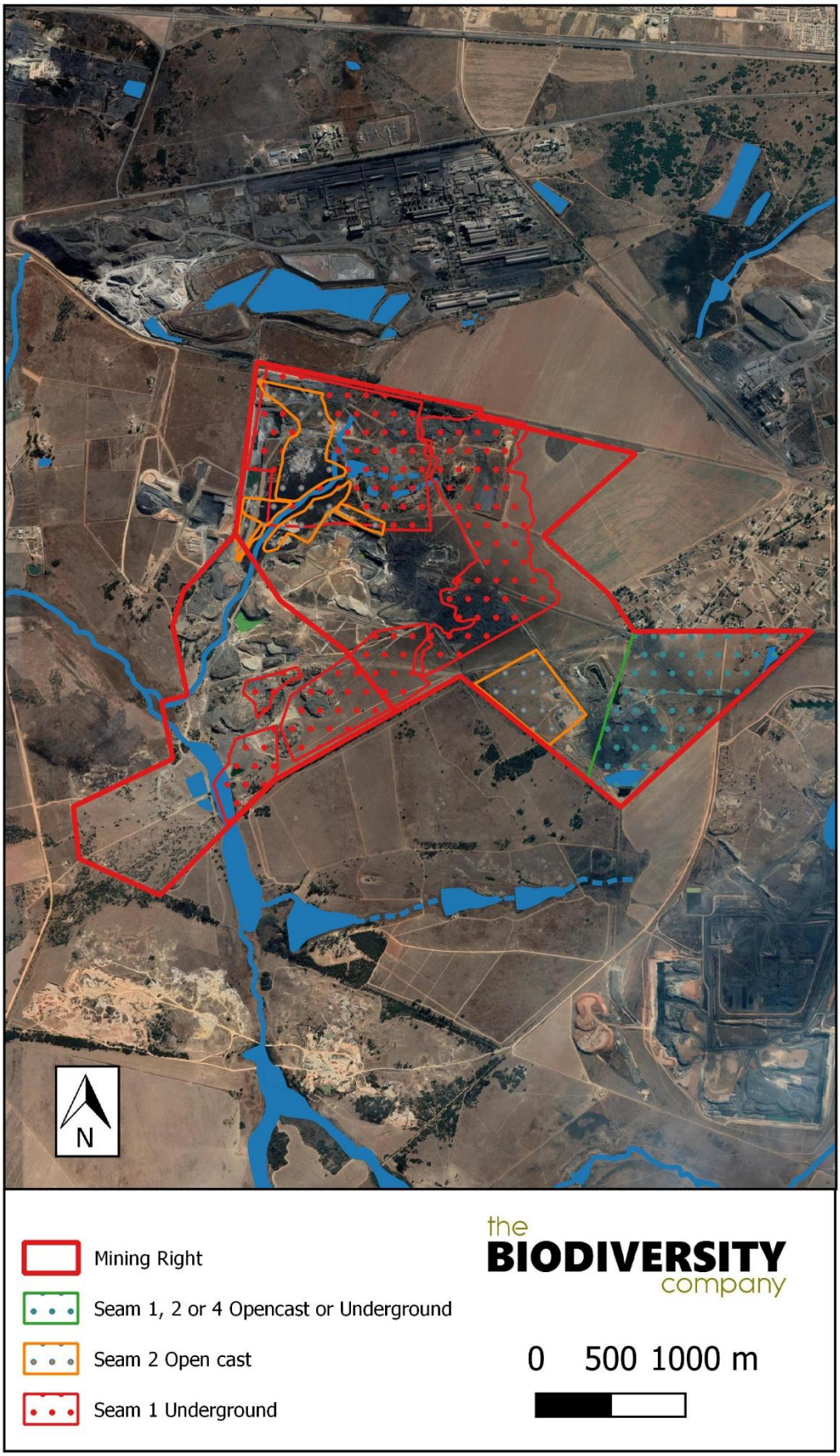

Figure 6: Sensitive riverine areas and proposed mining activities

10.1 Planning Phase

10.1.1 Opencast and Underground Mining

No activities which may disturb the environment area expected during the planning phase.

10.1.1.1 Mitigation

No mitigation required for this phase.

10.1.1.2 Cumulative Impacts

No Cumulative impacts are anticipated in this phase.

10.1.1.3 Irreplaceable Loss

No irreplaceable loss is expected in this phase.

10.2 Construction Phase

10.2.1 Haul Roads

The proposed project will construct haul road infrastructure to gain access to and transport materials throughout the life of the project. Impacts typically associated with haul road infrastructure include altered surface drainage and resultant habitat and water quality impacts to downstream watercourses.

10.2.1.1 Mitigation

- The project must make use of existing mining infrastructure and access routes;
- Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated;
- General stormwater management practices should be included in the design phase and implemented during the life of the project.

10.2.1.2 Cumulative Impacts

Low cumulative impacts are anticipated as a result of the limited extent of the activities.

10.2.1.3 Irreplaceable Loss

No irreplaceable loss is anticipated during this activity.

10.2.2 Opencast and Underground Mining

The stripping of overburden material will take place within the construction phase. The stripped material will then be deposited on a stockpile until such a time comes that rehabilitation begins. As indicated above, these activities will take place within proximity to watercourses. Thus, impacts related to a change in landuse within a delineated catchment can be anticipated within the directly associated watercourses.

10.2.2.1 Mitigation

- The project must make use of existing mining infrastructure and access routes;

- Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated;
- No mining must occur under rivers, wetland or drainage lines should there be a high risk for subsidence where engineering controls will not suffice to reduce the risk to a suitable rating;
- Appropriate recommendations from the rock engineering study regarding pillar size. must be implemented to reduce the overall risk for subsidence, particularly in regions where watercourses are undermined;
- Groundwater models of the mining activities must be completed updated following the completion of the mining activities, this will allow for the identification of areas where mine-water decant may occur;
- Standard surface water management must be in place, this includes clean and dirty water separation;
- An alien vegetation removal and management plan must be implemented for the from the onset of the opencast mining phase of the project.

10.2.2.2 Cumulative Impacts

Low cumulative impacts are anticipated as a result of the limited extent of the activities.

10.2.2.3 Irreplaceable Loss

No irreplaceable loss is anticipated during this activity.

10.3 Operational Phase

10.3.1 Opencast and Underground Mining

The proposed layout (Figure 6) was considered for this impact assessment. As observed there is proposed opencast activities in proximity to the watercourses. The following impacts can be therefore be anticipated for the open cast activities. The alteration of surface topography will have an impact on established hydrological dynamics. Direct loss of catchment area and the attenuation of water in the pit and pollution control facilities will reduce water volume in the associated watercourses. In addition, the change in topography will result in groundwater drawdown, whereby the surface water volumes may be reduced further. Considering these anticipated impacts water volume in the associated watercourses will be affected which in-turn has a negative effect on local habitat quality, the impact is thereby rated as an impact to riverine habitat quality. In addition, fine un-weathered materials exposed during the mining process will accumulate in runoff during rainfall events and can result in sedimentation further exacerbating habitat quality impacts.

Open cast activities in proximity to a watercourse expose un-weathered materials which readily leach dissolved substances via seepage and direct runoff. The seepage and runoff emanating from these areas will typically have increased levels of dissolved solids in the form of sulphate and potentially sulphide bound metals such as manganese, lead and copper. Fine particulate matter as mentioned above, increases the concentration of suspended solids in the waterbody which may impact water quality and clarity. These impacts effect the quality of

water in the riverine ecosystem and therefore are assessed as water quality impacts in this study.

The undermining of a watercourse (wetland, drainage line or river) usually requires groundwater dewatering to facilitate access. This may lead to surface water drawdown and the subsequent reduction in water volumes of associated surface watercourses. The effects of undermining on surface topography has shown to often result in ground subsidence. Ground subsidence can have an impact on local drainage which typically impacts on surface water volumes and associated habitat quality.

As will likely be stipulated in the wetland component of the overall study (TBC, 2019), impacts to wetlands can affect associated surface waters via reducing their respective water sources and thereby serve to exacerbate overall water volume modification and habitat quality.

10.3.1.1 Mitigation

- The project must make use of existing mining infrastructure and access routes;
- Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated;
- No mining must occur under rivers, wetland or drainage lines should there be a high risk for subsidence where engineering controls will not suffice to reduce the risk to a suitable rating;
- Appropriate recommendations from the rock engineering study regarding pillar size. must be implemented to reduce the overall risk for subsidence, particularly in regions where watercourses are undermined;
- Groundwater models of the mining activities must be completed updated following the completion of the mining activities, this will allow for the identification of areas where mine-water decant may occur
- Should groundwater decant occur, the quality of the water should be determined and the effect upon the surface water determined, and managed accordingly;
- Standard surface water management must be in place, this includes clean and dirty water separation.
- An alien vegetation removal and management plan must be implemented for the from the onset of the opencast mining phase of the project.

10.3.1.2 Cumulative Impacts

A moderate cumulative impact can be anticipated. The proposed project will cumulatively alter that nature of drainage in the catchment of the considered watercourse thereby resulting in an impact to the watercourse.

10.3.1.3 Irreplaceable Loss

No irreplaceable loss is anticipated from this anticity.

10.4 Decommissioning

10.4.1 Opencast and Underground Mining

The rehabilitation phase of the proposed project will involve the backfilling and contouring of the open pit. Thus, earthworks will take place during this phase. The disturbance of surface topography can again result in water and habitat quality degradation in associated riverine environments.

10.4.1.1 Mitigation

- The project must make use of existing mining infrastructure and access routes;
- Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated;
- Standard surface water management must be in place, this includes clean and dirty water separation.
- An alien vegetation removal and management plan must be implemented for the from the onset of the opencast mining phase of the project.

10.4.1.2 Cumulative Impacts

A low cumulative impact can be anticipated from this activity.

10.4.1.3 Irreplaceable Loss

No irreplaceable loss is anticipated during this phase.

10.5 Closure Phase

10.5.1 Opencast and Underground Mining

The largest anticipated impact for the proposed project will be the decant of groundwater which has been exposed to the carboniferous mine workings and oxygen. This water is anticipated to contain elevated levels of dissolved solids and may potentially be acidic. Information on the status of potential mine water decant would be provided in the groundwater specialist study. In addition, underground mine subsidence will occur during the closure phase, this may alter surface topography and thus negatively affect natural drainage patterns.

For the purposes of this assessment, it is assumed that both subsidence and contaminated groundwater decant will occur during the closure phase of the proposed project.

10.5.1.1 Mitigation

- The project must make use of existing mining infrastructure and access routes;
- Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated;
- No mining must occur under rivers, wetland or drainage lines should there be a high risk for subsidence where engineering controls will not suffice to reduce the risk to a suitable rating;

- Appropriate recommendations from the rock engineering study regarding pillar size. must be implemented to reduce the overall risk for subsidence, particularly in regions where watercourses are undermined;
- Groundwater models of the mining activities must be completed updated following the completion of the mining activities, this will allow for the identification of areas where mine-water decant may occur
- Should groundwater decant occur, the quality of the water should be determined and the effect upon the surface water determined, and managed accordingly;
- Standard surface water management must be in place, this includes clean and dirty water separation.
- An alien vegetation removal and management plan must be implemented for the from the onset of the opencast mining phase of the project.

10.5.1.2 Cumulative Impacts

A high cumulative impact can be anticipated from the decant of contaminated water should it be allowed to occur.

10.5.1.3 Irreplaceable Loss

No irreplaceable loss is anticipated from the completion of this activity.

10.6 Unplanned Events

The planned activities will have anticipated impacts as discussed above; however, unplanned events may occur on any project and may have potential impacts which will need management. Table 6 is a summary of the findings of an unplanned event assessment from a wetland perspective.

Table 6: Summary of potential unplanned events

Unplanned Event	Potential Impact	Mitigation
Uncontrolled erosion	Sedimentation of wetland systems.	Erosion control measures and monitoring programme must be put in place.
Subsidence	Surface topography and subsequent hydrological modifications.	Subsidence risk assessment, avoidance of high-risk areas, post closure subsidence monitoring. Should subsidence occur a suitable management plan must be investigated, this may include the construction of water diversion around subsidence areas to avoid surface water loss. The required mitigation would however be site specific.
Acid Mine Drainage	Severe water quality degradation	Water treatment, post closure water monitoring and water level management.

10.7 Recommendations

The following recommendations are likely to be applicable for this project:

- As part of the delineation of the watercourse extents, a floodline determination procedure is recommended for the 1:100 and 1:50 return periods.

- Annual subsidence monitoring should take place throughout the project area. Should subsidence develop, a scenario specific remedy to avoid further and more extensive subsidence must be put in place within 6 months of the findings. It is further noted that suitable site-specific subsidence monitoring must be conducted, this could be through the use of satellite imagery or physical surveying techniques;
- A closure and rehabilitation plan must be compiled and implemented for the project, taking into account the local water resources and the associated requirements; and

11 Scoping Phase Conclusion

The results of the desktop analysis indicate the presence of several watercourses in direct association with the proposed project. Available information on the waterbodies indicates that the ecological condition of these systems is modified. The ecological classification of these systems will take place during the next phase of the overall project.

The results of the preliminary risk assessment indicate that open cast mining activities will be in proximity to a watercourse, and that several watercourses are proposed to be undermined. Impacts to these watercourses are likely to occur should the proposed project go-ahead.

A detailed risk and impact assessment will be completed in the final reports to fully determine the significance and likelihood of all associated impacts.

12 Terms of Reference for Final Study

A single survey is proposed for this study. Standard methods utilised in the River Ecosystem Monitoring Programme (REMP) will be used to establish the baseline PES of the considered river reaches. Details pertaining to the specific methodologies applied are provided in the relevant sections below.

To enable the replication of the methods applied in this study a specific spatial PES framework is applicable.

12.1 Water Quality

Water quality will be measured in situ using a calibrated handheld Extech ExStik II meter. The following constituents were measured: pH, conductivity (µS/cm), temperature (°C) and dissolved oxygen (DO) in mg/l.

12.2 Aquatic Habitat Integrity and Riparian Assessment

The Intermediate Habitat Assessment Index (IHIA) as described in the Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999 will be used to define the ecological status of the river reach.

The IHIA model will be used to assess the integrity of the habitats from a riparian and in-stream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale which are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

This model compares current conditions with reference conditions that are expected to have been present. Specification of the reference condition follows an impact-based approach

where the intensity and extent of anthropogenic changes are used to interpret the impact on the habitat integrity of the system. To accomplish this, information on abiotic changes that can potentially influence river habitat integrity are obtained from surveys or available data sources. These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology and physico-chemical conditions and how these changes would impact on the natural riverine habitats.

The riparian delineation will be completed according to DWAF (2005). Indicators such as topography and vegetation were the primary indicators used to define the riparian zone. Contour data obtained from topography spatial data was also utilised to support the infield assessment.

12.3 Aquatic Macroinvertebrate Assessment

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

12.3.1 South African Scoring System

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

Sampled invertebrates will be identified using the “Aquatic Invertebrates of South African Rivers” Illustrations book, by Gerber and Gabriel (2002). Identification of organisms was made to family level (Thirion et al. 1995; Dickens and Graham, 2002; Gerber and Gabriel, 2002).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the relevant ecoregion. This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database.

12.3.2 Macroinvertebrate Response Assessment Index

The Macroinvertebrate Response Assessment Index (MIRAI) was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the SQR. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;

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

The results of the MIRAI will provide an indication of the current ecological category and therefore assist in the determination of the PES.

12.4 Fish Community

A standard qualitative fish assessment was completed for this assessment. Fish sampling was completed through electroshocking techniques. A total of 15 minutes effort will be applied at each sampling point.

12.5 Present Ecological Status

Ecological classification refers to the determination and categorisation of the integrity of the various selected biophysical attributes of ecosystems compared to the natural or close to natural reference conditions (Kleynhans and Louw, 2007). For this study ecological classifications have been determined for biophysical attributes for the associated water course. This was completed using the river ecoclassification manual by Kleynhans and Louw (2007).

13 References

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