ENVIRONMENTAL & ENGINEERING

REPORT

IPP MINING EQUIPMENT (PTY) LTD

NNDANGANENI COLLIERY S102

INTEGRATED ENVIRONMENTAL AUTHORISATIONS

S102 REF: MP-00167-MR/102
CURRENT MINING RIGHT DMRE REF: MP 30/5/1/2/3/2/1 (10134) MR

DRAFT BASIC ASSESSMENT REPORT IN TERMS OF S102 OF THE MPRDA

REPORT REF: (22-1732-AUTH IPP - NNDANGANENI BAR S102)

IN RESPECT OF PORTION 15 OF THE REMAINING EXTENT OF THE FARM HARTOGSHOF 413 JS, STEVE TSHWETE LOCAL MUNICIPALITY, NKANGALA DISTRICT, MPUMALANGA

VERSION BB

11/11/2022

Document and Quality Control:

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BB – draft	10/11/2022	Jane Mahaba		Review
CC– draft		Leoni le Roux		Quality review
DD – draft		Lian Roos		Review
Approved for Distribution:				
0.0		Vernon Siemelink		Technical Review

Quality Control by:

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This is a legally binding document and many of the actions and recommendations remain the responsibility of the client (as the owner/lessee of the property).

EAP - was independent and performed the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the application; have expertise in conducting environmental impact assessments or undertaking specialist work as required, including knowledge of the Act, these Regulations and any guidelines that have relevance to the proposed activity; ensure compliance with these Regulations;

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The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge, as well as available information. Information utilised and contained in this report is based on data/information supplied to Eco E by the client and other external sources (including previous site investigation data and external specialist studies).

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EXECUTIVE SUMMARY

Background

IPP Mining Equipment (Pty) Ltd, hereafter IPP, intends to extend their existing void / opencast pit area around the northern pan on its existing Mining Right (MP30/5/1/2/2/10134MR) at Nndanganeni Colliery. The proposed extension is over portion 15 of the remaining extent of the farm Hartogshof 413 JS. IPP applied for a Section 102 amendment application to amend the existing Mining Right area. The Mining Right (10134MR) covers various portions of the farms Hartogshof 4143 JS and Kopermyn 435 JS, in the Steve Tswete Local Municipality (LM), Nkangala District Municipality (DM), Mpumalanga.

Table 1-1: Basic Assessment Timeline

Date	Aspect
17/10/2022	S102 Application lodged on SAMRAD.
N/A	S102 Acceptance received from DMR.
11/11/2022	Advert Placed in Middleburg Observer.
11/11/2022	Interested and Affected Parties notified via email and SMS.
11/11/2022 to 11/12/2022	30-day Public Participation started for the NEMA Basic Assessment Process.
14/12/2022	Submission of the final Basic Assessment Report.

The obtaining of an amendment to a Mining Right from the Department of Mineral Resources and Energy is governed by the Mineral and Petroleum Resources Development Act (MPRDA, no 28 of 2002). The MPRDA requires compliance with related legislation, specifically the National Environmental Management Act of 1998 (NEMA). This Basic Assessment Report includes, amongst others, the following information as required in terms of the NEMA:

- A description of the environment likely to be affected by the proposed prospecting activities;
- An assessment of potential impacts on the environment, socio-economic conditions, and cultural and heritage aspects;
- A summary of the potential significance of identified impacts;
- Proposed mitigation and management measures to minimise adverse impacts and to optimise benefits; and
- Planned monitoring and performance assessment of the EMP and Rehabilitation measures of areas disturbed during prospecting.

Project Description

Table 1-2: Project description

Farm Name:	Portion 15 of the remaining extent of the farm Hartogshof 413 JS
Application area (Ha)	60 ha. Existing void expansion.
Magisterial district:	Magisterial District of Middelburg Steve Tswete LM Nkangala DM

Distance and direction from nearest town	Located approximately 22km south-east of the town of Middelburg, Mpumalanga.
21 digit Surveyor General Code for each farm portion	T0JS000000000413000015
Description of the overall activity. (Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance permit, Technical co-operation permit, Additional listed activity)	Application for Environmental Authorisation (EA) submitted in support of the application for a Section 102 Mining Right Amendment for the mining of coal. IPP Equipment (Pty) Ltd (hereinafter IPP) holds a Mining Right (MR) (Ref: MP 30/5/1/2/2/10134MR) in terms of the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and a Water Use Licence (03/B12C/CGIJ/4850) in terms of the National Water Act, Act No. 36 of 1998 (NWA). IPP is currently operating Nndanganeni Colliery, a mining operation 22km south-east of the town of Middelburg Mpumalanga Province, South Africa. IPP intends to expand its existing void around the Grootpan on its existing Mining Right MP 30/5/1/2/2/10134MR at Nndanganeni Colliery. This expansion is proposed on Portion 15 of the farm Hartogshof 413 JS. A Section 102 MWP and BA EMPr amendment application is being lodged to amend the existing Mining Right area. Environmental Authorisation Application in terms of the National Environmental Management Act (NEMA), Act No. 107 of 1998, and the 2014 Environmental Impact assessment (EIA) Regulations (as amended) will be required. The intention to mine within 500 m of a watercourse will also require application for an Integrated Water Use Licence (IWUL) Amendment in terms of the NWA and the National Environmental Management: Waste Act, Act No. 59 of 2008 as amended (NEM:WA); read with the requirements of the MPRDA. The resource will be mined via opencast roll over mining. The following activities will be undertaken on site: • Box cut opencast mining with a roll over rehabilitation sequence; • Clean and dirty water separation system (Stormwater management • infrastructure) • Hauling, access road, haul road; A basic assessment process is required in terms of the NEMA 2014 amended regulations for the S102 application.

Project Schedule

The BA process should be undertaken for project activities that are included under Listing Notices 1 and 3. Impacts of these activities are more generally known and can often be mitigated or easily managed. The BA process is generally shorter and less onerous than the S&EIR process. The BA process must follow the procedure as prescribed in Regulations 19 to 20.

Registered Landowner

The registered owners of the farms were listed as follows:

Table 1-3: Landowners

Farm			Ptn	Owner
HARTOGSHOF	413	JS	RE/15	BEESTEPAN BOERDERY PTY LTD

Surrounding landowners are listed below:

Table 1-4: Surrounding landowners

Farm			Ptn	Owner
HARTOGSHOF	413	JS	1	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	RE/3	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	4	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	RE/8	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	9	ZULFADIL INV CC
HARTOGSHOF	413	JS	14	IPP MINING EQUIPMENT PTY LTD
LEMOENFONTEIN	436	JS	2	BIRK STEAD INV HOLDINGS PTY LTD
ELANDSFONTEIN	1204	JS	15	BEESTEPAN BOERDERY PTY LTD
ZEVENFONTEIN	415	JS	1	BEESTEPAN BOERDERY PTY LTD
ZENZELE	986	JS	RE	BEESTEPAN EMPLOYEES' COMMUNITY & HOUSING TRUST

Details of the Public Participation Process followed

Section 41 of NEMA Regulation 982 set out the Legal and Regulatory Requirement for Public Participation. The Public Participation Process (PPP) aims to involve the authorities and I&APs in the project process, and determines their needs, expectations and perceptions which in turn ensures a complete and comprehensive environmental study. An open and transparent process has and been followed at all times and is based on reciprocal dissemination of information. The following will be undertaken during the PPP:

1. Identification of Interested and Affected Parties (IAPs);
2. Notification of IAPs regarding the proposed project;
3. A public information meeting, should there be interest;
4. Gathering comments, issues and concerns from IAPs;
5. Responding to IAP comments, issues and concerns;
6. Compilation and submission of results of consultation report to the DMR; and
7. Providing IAPs with the opportunity to review and comment on the basic assessment report.

Location

The study area is located 23 km southeast of Middelburg, while Pullens Hope is located 24 km to the southwest, and Belfast / eMakhazeni 40 km to the east-northeast. The study area falls within the Nkangala District Municipality and the Steve Tshwete Local Municipality in the Mpumalanga Province. In terms of vegetation, the study area falls within the Grassland Biome, which is typically associated with summer rainfall regions. This Biome covers approximately 28% of South Africa. According to the vegetation classification by Mucina & Rutherfords (2006), the eastern half of the study area falls within the Eastern Highveld Grassland vegetation unit, while the western half is classified as Rand Highveld Grassland.

Impacts

The impacts were assessed, and impacts rated as Moderate to High after mitigation or as a cumulative impact are summarised below:

Table 1-5: Moderate to High Impact Summary

Activity	Aspect	Impact	Phase	+/-	SU	+/-	SM
Groundwater							
Opencast mining	Dewatering	The water infiltrating the voids will be removed for safe mining, causing a decrease in the water level. The drawdown will decrease the groundwater contribution volume to the Northern pan.	Operational Phase	Negative	High	Negative	High
Surface Water							
Pit extension	Flow drivers cut-off	Impact on pan catchment	Construction & Operational Phase	Negative	Med	Negative	Low - Med
Construction activities	Vegetation clearance and site establishment	Sedimentation and pollution of the watercourse	Construction Phase	Negative	Med - High	Negative	Med
Dewatering	Water level drawdown	Reduction in Baseflow	Operational Phase	Negative	Med - High	Negative	Med - High
Operational Activities	Hydrocarbon spills Dirty Water release Sediment runoff	Water quality deterioration	Operational Phase	Negative	High	Negative	Med
Ecological (Wetland, Aquatic Terrestrial)							
Operational Activities	Increased traffic Use of heavy machinery Bank Erosion	Flow alterations due to erosion and sedimentation	Operational Phase	Negative	High	Negative	High
Operational Activities	Increased traffic leading to potential accidental spills of hydrocarbon materials Hazardous materials entering the watercourses. Increased road runoff during rainfall events	Pollution of watercourse	Operational Phase	Negative	High	Negative	High
Operational Activities	Increased runoff from hardened surfaces Increased traffic	Spread of alien invasive vegetation	Operational Phase	Negative	Med - High	Negative	Med
Social Economic							
Mine establishment	Mining operations	Employment and income opportunity.	Construction and Operation Phase	Positive	Med	Negative	Med
Mining operations	Mine closure	Job losses.	Decommissioning and Closure	Negative	Med - High	Negative	Med
Mining operations	Mine Closure	Decrease/termination of community investment funds and support to local communities.	Decommissioning and Closure	Negative	Med - High	Negative	Med
Soil, Lands use							

Site Preparation	Soil stripping	Loss of soil	Construction	Negative	High	Negative	Med - High
Site Preparation	Earthworks	Change in Surface Profile	Construction	Negative	High	Negative	Med - High
Site Preparation	Vegetation Removal	Change in Land Use	Construction	Negative	High	Negative	Med - High
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Change in Land Capability	Construction	Negative	High	Negative	Med - High
Site Preparation	Earthworks	Change in Surface Profile	Construction	Negative	High	Negative	Med - High
Ongoing mine management	Continued soil stripping	Loss of Topsoil	Operation	Negative	High	Negative	Med
Ongoing mine management	Bare soil	Erosion and Sedimentation	Operation	Negative	High	Negative	Med
Air Quality							
Mining	Haul trucks moving on the Haul Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Haul road	Operational Phase	Negative	Med - High	Negative	Med - High
Mining	Commercial trucks moving on the Access Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Access road	Operational Phase	Negative	Med - High	Negative	Med - High

Reasoned opinion

The EAP believes that the authorisation for the void extension on portion 15 of the remaining extent of the farm Hartogshof 413 JS should be granted provided that IPP Mining Equipment (Pty) Ltd strictly adhere to their existing water use licence conditions, specifically the conditions relating to the Northern Pan (Licence no: 03/B12C/CGIJ/4850 File no: 27/2/2/B412/10/4).

- Mining within 500m of the Northern Pan (mining will however not take place within 200m of the Northern Pan).
- Further mining of the Northern Pan's sub catchment should be avoided to prevent the pan's degradations. Refer to Figure 1-1. A 10m buffer around the pan sub catchment should be implemented.

Taking the status quo of Northern Pan into consdeiration, the risks of the proposed mining activity is minimal and can be mitigated by following the mitigation measures stipulated in the EMPr, which will reduce impacts significantly to acceptable levels.

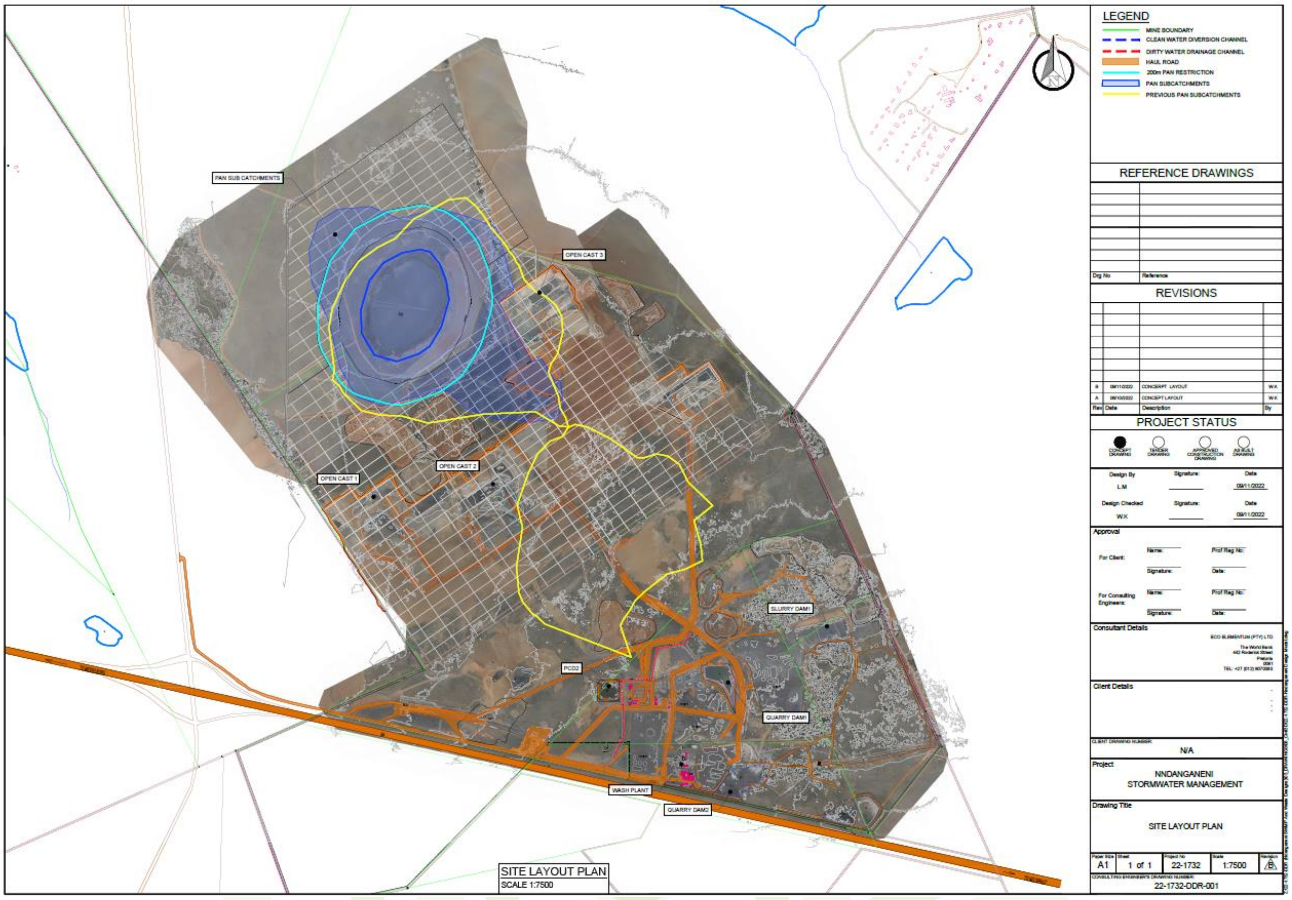

Figure 1-1: Northern Pan sub catchment

Conditions that must be included in the authorisation

- Adhere to all recommendation and management measures contained in the EMP.
- All relevant permits and authorisation must be obtained prior to construction commencing.
- Adhere to all monitoring requirements.
- Adhere to the existing water use licence conditions
- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended, and the relevant heritage resources authority contacted.
- From a palaeontological perspective – the possibility exists that fossiliferous significant material (plants, insects, bone, coal) may be exposed during the development (construction & operational phase). These materials generally occur below the surface and is of palaeontologic significance. In cases where such material is found, all activities must be suspended pending further palaeontological investigations by a qualified palaeontological scientist.
- Methods of handling the potential decant should be investigated, approved, and set in place prior to mine closure.
- All acoustic screening measures must be in place before commissioning the mining activities.
- No off-road driving, hunting, poaching, or fires should be permitted on the property.
- An incident and complaints register must be present on site and submitted to the Municipality on quarterly basis.
- The applicant must have dust fallout monitoring points around the proposed mining area and have the monitoring reports submitted to the Municipality on quarterly basis.

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Definition of Terms

Audit	a systematic, independent and documented review of operations and practises to ensure that relevant requirements are met. Qualified professionals with relevant auditing experience should conduct audits and, where possible, independent external auditors should also be used.
Borehole	is a narrow shaft bored in the ground, either vertically or horizontally. A borehole may be constructed for many different purposes, including the extraction of water or other liquid (such as petroleum) or gases (such as natural gas), as part of a geotechnical investigation, environmental site assessment, mineral exploration, temperature measurement, as a pilot hole for installing piers or underground utilities, for geothermal installations, or for underground storage of unwanted substances, e.g. in Carbon capture and storage.
Clean Water	clean water is any water that has maintained the chemical, physical, and biological integrity of the waters by preventing point and nonpoint pollution sources.
Compliant	a full achievement of the performance requirement of a particular condition of the license or programme
Conservation	in relation to a water resource means the efficient use and saving of water, achieved through measures such as water saving devices, water-efficient processes, water demand management and water rationing;
Construction	the time period that corresponds to any event, process, or activity that occurs during the Construction phase (e.g., building of site, buildings, and processing units) of the proposed project. This phase terminates when the project goes into full operation or use.
Corrective Action Plan	an action plan developed by the proponent, contractor, or facility owner and approved by the external auditor that describes how the contractor or facility owner intends to resolve the non-conforming item. The Corrective Action Plan should be specific, measurable, achievable, realistic, and timely.
Director-General	means the Director-General of the Department;
Effluent	is defined by the United States Environmental Protection Agency as "wastewater - treated or untreated - that flows out of a treatment plant, sewer, or industrial outfall. Generally, refers to wastes discharged into surface waters". The Compact Oxford English Dictionary defines effluent as "liquid waste or sewage discharged into a river or the sea". Effluent in the artificial sense is in general considered to be water pollution.
Environmental Audit Report	a summary report prepared after an environmental audit that describes the attributes of the audit and the audit findings and conclusions.
Environmental Authorisation	is an environmental authorisation issued by a state department.
Environmental Component	an attribute or constituent of the environment (i.e., air quality; marine water; waste management; geology, seismicity, soil, and groundwater; marine ecology; terrestrial ecology, noise, traffic, socio-economic) that may be impacted by the proposed project.
Environmental Impact	a positive or negative condition that occurs to an environmental component as a result of the activity of a project or facility. This impact can be directly or indirectly caused by the project's different phases (i.e., Construction, Operation, and Decommissioning).
Groundwater	is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps, and can form oases or wetlands
Non-conformance	constitutes a non-compliance or an action plan or initial actions taken without tangible deliverables. Non-conformance may also be associated with activities breaching legislation. Non-Conformance findings therefore have a high priority and mitigation measures are mandatory.
Operation	the time period that corresponds to any event, process, or activity that occurs during the Operation (i.e., fully functioning) phase of the proposed project or development. (The Operation phase follows the Construction phase, and then terminates when the project or development goes into the Decommissioning phase.)
Partially Compliant	achievement with shortcomings (such as documented proof and or work in progress) and achievement where there is an obvious shortcoming in the delivery of the performance requirement.
Pollution	is the introduction of contaminants into the natural environment that cause adverse change. Pollution can take the form of chemical substances or energy, such as noise, heat or light. Pollutants, the components of pollution, can be either foreign substances/energies or naturally occurring contaminants. Pollution is often classed as point source or nonpoint source pollution.
Protection	in relation to a water resource, means - (a) Maintenance of the quality of the water resource to the extent that the water resource may be used in an ecologically sustainable way; (b) Prevention of the degradation of the water resource; and (c) the rehabilitation of the water resource;
Proponent	the person, company, or agency that is the primary responsible party for a development project and that is the permit applicant/holder for the project.
Rehabilitation	is the act of restoring something to its original state;
Responsible Authority	in relation to a specific power or duty in respect of water uses, means - (a) if that power or duty has been assigned by the Minister to a catchment management agency, that catchment management agency; or (b) if that power or duty has not been so assigned, the Minister;
Water Resource	includes a watercourse, surface water, estuary, or aquifer;

Wetland	means 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.

Abbreviations

CARA: Conservation of Agricultural Resources Act, 43 of 1983
DEA: Department of Environmental Affairs (The former Department of Environmental Affairs and Tourism)
DMR: The Department of Mineral Resources (The former Department of Minerals and Energy)
DWA: Department of Water Affairs (Is now referred to the Department of Water and Sanitation – DWS)
EA : Environmental Authorisation
ECO: Environmental Control Officer
EIA : Environmental Impact Assessment
ELCA : Environmental Legal Compliance Assessment
EMP : Environmental Management Plan
EMPPA: Environmental Management Programme Performance Assessment
EMPR : Environmental Management Programme
EMS: Environmental Management System
GM: General Manager
GN: Government Notice
I&AP: Interested & Affected Parties
IEM: Integrated Environmental Management Series
ISO: International Standards Organisation
IWULA: Integrated Water Use Licence Application
IWUL: Integrated Water Use License
IWWMP: Integrated Water and Waste Management Plan
KG: Knowledge Gap
MOC: Management of Change
MPRDA: Mineral and Petroleum Resources Development Act, 28 of 2002
MR: Mining Right
N/R: Applicable, but not required at the time of the audit
NEMA: National Environmental Management Act, 107 of 1998
NEMAQA: National Environmental Management: Air Quality Act, 39 of 2004
NEMBA: National Environmental Management: Biodiversity Act, 10 of 2004
NEMWA: National Environmental Management: Waste Act, 59 of 2008
NC: Non-conformance
NHRA: National Heritage Resources Act, 25 of 1999
NWA: National Water Act, 36 of 1998
RWD: Return Water Dam
ROM: Run of Mine
SAHRA: South African Heritage Resources Authority
SHEQ: Safety, Health, Environment and Quality
SLP: Social and Labour Plan
SOP: Standard Operating Procedure
SWMP: Strategic Water Management Plan
WSA: Water Services Act, 108 of 1997
WUL*:* Water Use Licence

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT BASIC ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT:	**IPP Mining Equipment (Pty) Ltd**
TEL NO:	013 656 0191
FAX NO:	
POSTAL ADDRESS:	PO Box 8283, Die Heuwel, Witbank
PHYSICAL ADDRESS:	Plot 54 Prinsberg Road, Seekoeiwater AH, Emalahleni, 1035

FILE REFERENCE NUMBER SAMRAD: MP-00167-MR/102

CURRENT MR REF: MP 30/5/1/2/3/2/1 (10134) MR

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore, please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

2. OBJECTIVE OF THE BASIC ASSESSMENT PROCESS

The objective of the basic assessment process is to, through a consultative process—

a. determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context.
b. identify the alternatives considered, including the activity, location, and technology alternatives.
c. describe the need and desirability of the proposed alternatives,
d. through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage, and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on these aspects to determine:
   i. the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and
   ii. the degree to which these impacts—

aa. can be reversed.
bb. may cause irreplaceable loss of resources; and
cc. can be managed, avoided or mitigated.

e. through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—
   i. identify and motivate a preferred site, activity and technology alternative;
   ii. identify suitable measures to manage, avoid or mitigate identified impacts; and
   iii. identify residual risks that need to be managed and monitored.

PART A

BASIC ASSESSMENT REPORT

3. CONTACT PERSON AND CORRESPONDENCE ADDRESS

3.1 Details of

3.1.1 Details of the EAP

Name of The Practitioner: Lian Roos - Candidate EAP (2022/4550)

Tel No.: 012 807 0383

Fax No. :

e-mail address: lian@ecoe.co.za

3.1.2 Expertise of the EAP.

3.1.2.1 The qualifications of the EAP

Name	Lian
Surname	Roos
Company	Eco Elementum (Pty) Ltd
Position	Environmental Consultant
Location	Glenfield Office Park, 361 Oberon Avenue, Faerie Glen, Pretoria
Email	lian@ecoe.co.za
Telephone Number	012 807 0383
Education	BSc Hons (App Sci) Water Utilisation, University of Pretoria BSc Environmental Science, University of Pretoria
Professional registration	EAPASA - Candidate EAP (2022/4550) SACNASP – Pr.Sci.Nat (Pending application)
Professional skills	Specialist Co-ordination. Project Management. Monitoring and Compliance. Compilation of Environmental Management. Compilation of Environmental Impact Assessment. Government Department Liaison.

Please refer to the CV attached in Appendix A.

3.1.2.2 Summary of the EAP's past experience.

Table 3-1: Qualifications of EAP

Name	Lian Roos
Skills	- Environmental Impact Assessments. - Basic assessments & EMP, WULA reports. - Environmental Compliance Monitoring. - Environmental Monitoring: Water Quality (Surface & Ground), Air Quality (Dust, PM2.5, PM10, SO_2, NO_2, HF), Noise (Ambient & Environmental) - Environmental Control Officer.

	- Environmental Awareness. - External & Internal Auditing - Public consultation & Stakeholder engagement - Specialist coordination
Experience	As an environmental consultant, Lian has attained a variety of environmental related skills and experiences in the broader industry. He is a driven individual and prides himself in his integral responsibilities regarding the supporting role he fulfils. His responsibilities range from environmental investigation and environmental monitoring to auditing and authorisation related engagements. His duties extend to advising clients in aligning with relevant legislation and policy requirements as part of the on-going environmental compliance process. Lian also engages with stakeholders for newly proposed projects.

3.2 Location of the Overall Activity.

Table 3-2: Location of the activity

Farm Name:	Portion 15 of the remaining extent of the farm Hartogshof 413 JS
Application area (Ha)	60 ha. Existing void expansion.
Magisterial district:	Magisterial District of Middelburg Steve Tswete LM Nkangala DM
Distance and direction from nearest town	Located approximately 22km south-east of the town of Middelburg, Mpumalanga.
21 digit Surveyor General Code for each farm portion	T0JS000000000413000015
Description of the overall activity. **(Indicate Mining Right, Mining Permit, Prospecting right, Bulk Sampling, Production Right, Exploration Right, Reconnaissance permit, Technical co-operation permit, Additional listed activity)**	Application for Environmental Authorisation (EA) submitted in support of the application for a Section 102 Mining Right Amendment for the mining of coal. IPP Equipment (Pty) Ltd (hereinafter IPP) holds a Mining Right (MR) (Ref: MP 30/5/1/2/2/10134MR) in terms of the Minerals and Petroleum Resources Development Act, Act No. 28 of 2002 (MPRDA) and a Water Use Licence (03/B12C/CGIJ/4850) in terms of the National Water Act, Act No. 36 of 1998 (NWA). IPP is currently operating Nndanganeni Colliery, a mining operation 22km south-east of the town of Middelburg Mpumalanga Province, South Africa. IPP intends to expand its existing void around the Grootpan on its existing Mining Right MP 30/5/1/2/2/10134MR at Nndanganeni Colliery. This expansion is proposed on Portion 15 of the farm Hartogshof 413 JS. A Section 102 MWP and BA EMPr amendment application is being lodged to amend the existing Mining Right area. Environmental Authorisation Application in terms of the National Environmental Management Act (NEMA), Act No. 107 of 1998, and the 2014 Environmental Impact assessment (EIA) Regulations (as amended) will be required. The intention to mine within 500 m of a watercourse will also require application for an Integrated Water Use Licence (IWUL) Amendment in terms of the NWA and the National Environmental Management: Waste Act, Act No. 59 of 2008 as amended (NEM:WA); read with the requirements of the MPRDA. The resource will be mined via opencast roll over mining. The following activities will be undertaken on site:

	• Box cut opencast mining with a roll over rehabilitation sequence; • Clean and dirty water separation system (Stormwater management • infrastructure) • Hauling, access road, haul road; A basic assessment process is required in terms of the NEMA 2014 amended regulations for the S102 application.

3.3 Locality Map

(show nearest town, scale not smaller than 1:250000)

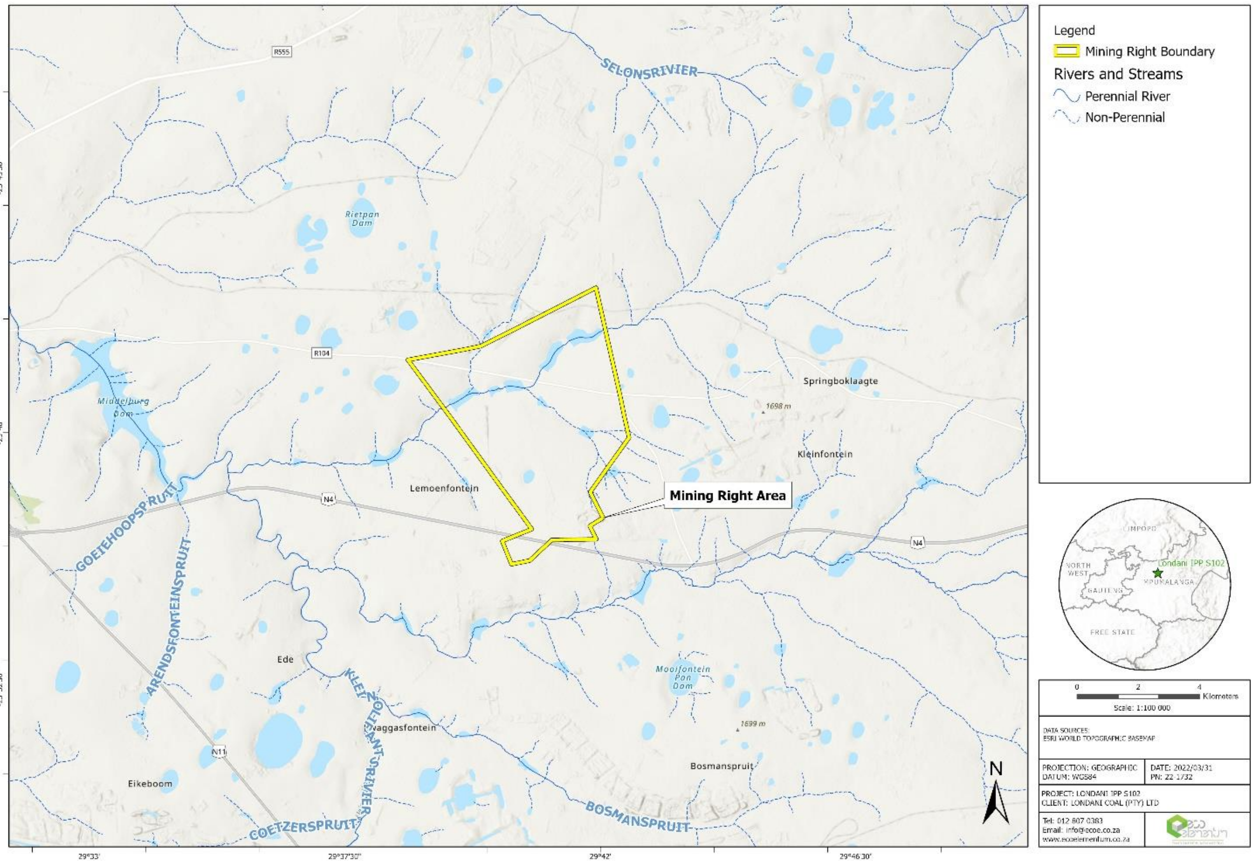


Figure 3-1: Locality Map

3.4 DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY.

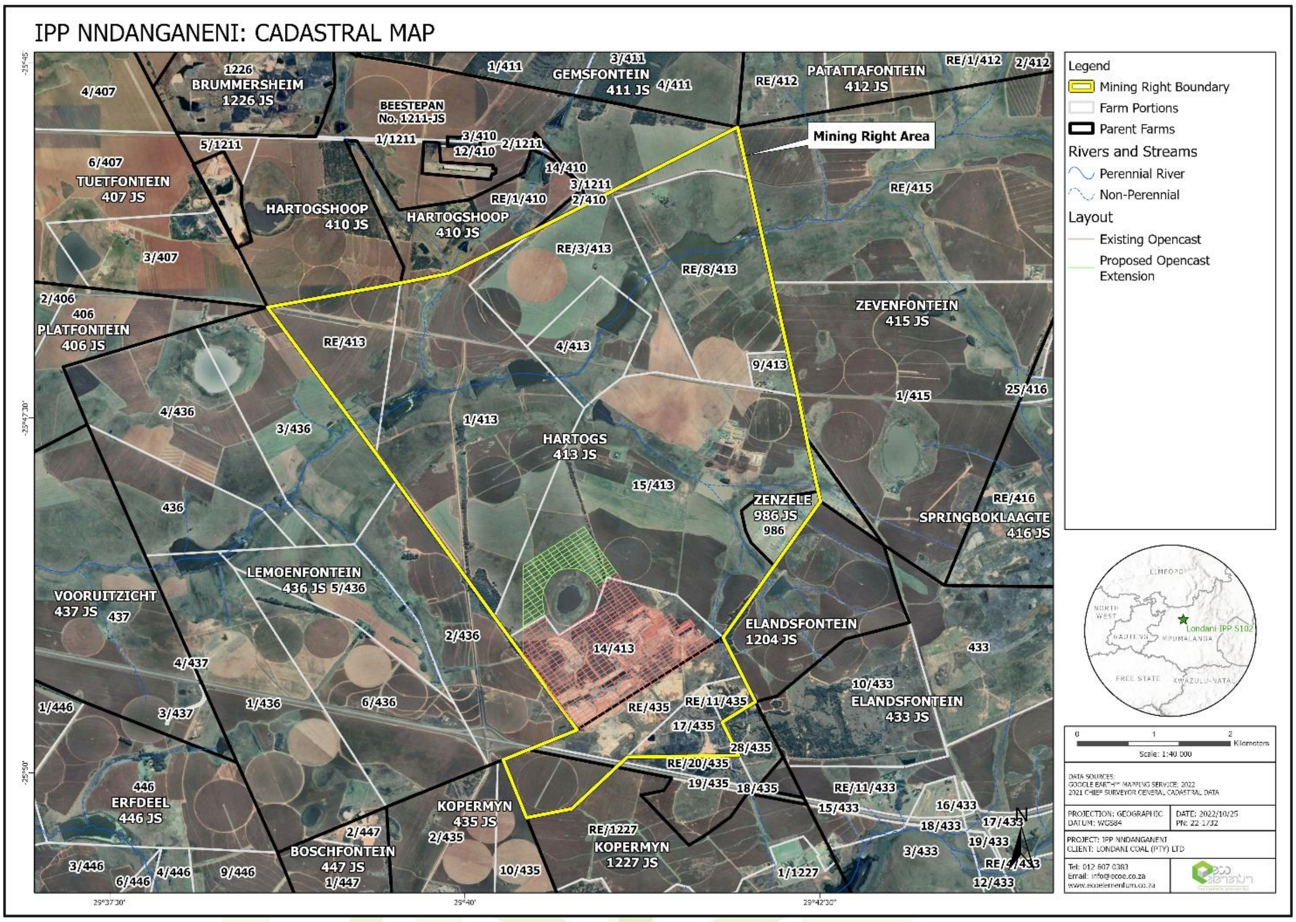


Figure 3-2: Activities Map (see next page for enlarged view)

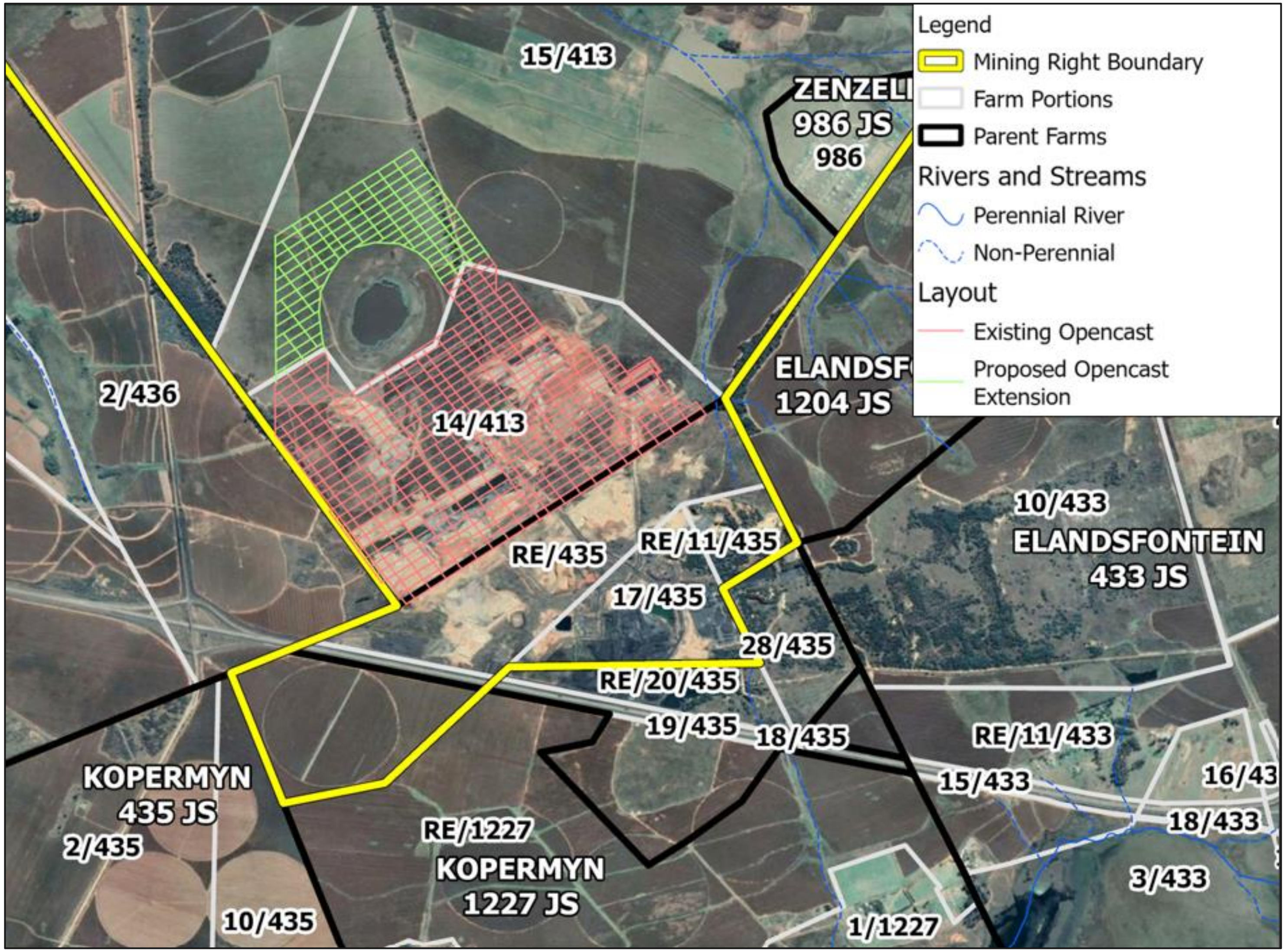


Figure 3-3: Activities Map (enlarged view)

3.4.1 Listed and specified activities

Section 16 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) requires, upon request by the Minister that an Environmental Management Plan be submitted, and that the applicant must notify and consult with Interested and Affected Parties (I&APs). Section 24 of the NEMA requires that activities, which may impact on the environment must obtain an environmental authorisation from a relevant authority before commencing with the activities. Such activities are listed under Regulations Listing Notice 1. Please refer to the following table for the details in terms of the listed activities.

Table 3-3: Listed and specific activities

APPLICABLE LISTING NOTICE (GNR 983, GNR 984 or GNR 985; as amended).		NAME OF ACTIVITY	Aerial extent of the Activity Ha or m^2	WASTE MANAGEMENT AUTHORISATION
Listing Notice 1 (GNR 983)				
9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where— (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	Stormwater management structures.	>1000 m	No
10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where— (a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	Process / Waste / Return Water pipeline infrastructure.	> 1000 m	No
21D	Any activity including the operation that activity which requires an amendment or variation to a right or a permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such an amendment.	Mining right amendment	60 ha	No

3.4.2 Description of Activities to be Undertaken

Nndanganeni Colliery has existing and fully functioning infrastructure (PCD, stormwater infrastructure, offices, workshop, stockpiles, etc). The activities associated with the void extension therefore, are somewhat limited to only the following: Opencast Mining with a Roll-over Rehabilitation Sequence. Clean and dirty water separation system (Stormwater management infrastructure) and Hauling, access road.

Site Preparation

Site preparation mainly deals with the stripping and stockpiling of topsoil prior to the mining activities commencing as this might affect the quality and quantity of available valuable topsoil resources. The main objectives of soil management are to:

- Soil removal and stockpiling will be done progressively in line with the roll over method of opencast mining to ensure minimal areas required for stockpiling topsoil.
- optimise the preservation and recovery of topsoil for rehabilitation;
- identify soil resources and stripping guidelines;
- identify surface areas requiring stripping (to minimise over clearing);
- manage topsoil reserves to not degrade the resource;
- identify stockpile locations and dimensions; and
- identify soil movements for rehabilitation use.

In accordance with the objective of providing sufficient stable soil material for rehabilitation and to optimise soil recovery, the following strategies have been adopted:

- stockpiles to be located outside proposed mine disturbance areas;
- construction of stockpiles by dozers rather than scrapers to minimise structural degradation;
- construction of stockpiles with a “rough” surface condition to reduce erosion hazard, improve drainage and promote revegetation; and
- revegetation of stockpiles with appropriate fertiliser and seed to minimise weed infestation, maintain soil organic matter levels, soil structure and microbial activity and maximise the vegetative cover of the stockpile depending on the exposure timeframes.

Disturbance areas will be stripped progressively (i.e. only as required) to reduce erosion and sediment generation, to reduce the extent of topsoil stockpiles and to utilise stripped topsoil as soon as possible for rehabilitation. Rehabilitation of disturbed areas (i.e. roads, embankments and stripped mining footprint) will be undertaken as practicable after these structures are completed or as areas are no longer required. Soil surveys over the open cut area, beneath proposed mine waste emplacements and other infrastructure areas will determine the depth of topsoil. It should be noted that it is important that for topsoil recovered from the areas it is required that underlying material is not inadvertently collected since it is unsuitable for reuse in rehabilitation.

A general protocol for soil handling is presented below and includes soil handling measures which optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth:

- The surface of the completed stockpiles will be left in a “rough” condition to help promote water infiltration and minimise erosion prior to vegetation establishment;
- Topsoil stockpiles to have a maximum height of 3 m to limit the potential for anaerobic conditions to develop within the soil pile;

- Topsoil stockpiles to have an embankment grade of approximately 1V:4H (to limit the potential for erosion of the outer pile face);
- Topsoil stockpiles will be seeded and fertilised; and
- Soil rejuvenation practices will be undertaken if required prior to re-spreading as part of rehabilitation works.

Box Cut Opencast Mining with a Roll-over Rehabilitation Sequence

Opencast mining using the truck and shovel lateral sequential rollover mining method will be undertaken. Mining will commence from the initial box cut. A haul road that will be extended from the nearby existing road will be used as access to the mining area.

The soft overburden will be removed by mechanical methods. The hard overburden will be drilled and blasted and then removed by mechanical methods. The coal will be drilled and blasted prior to removal.

Replacement of overburden materials into the mining pit will be according to the following sequence:

1. Placement of hard overburden at base of pit;
2. Placement of soft overburden; and
3. Final cover of topsoil (minimum 500 mm).

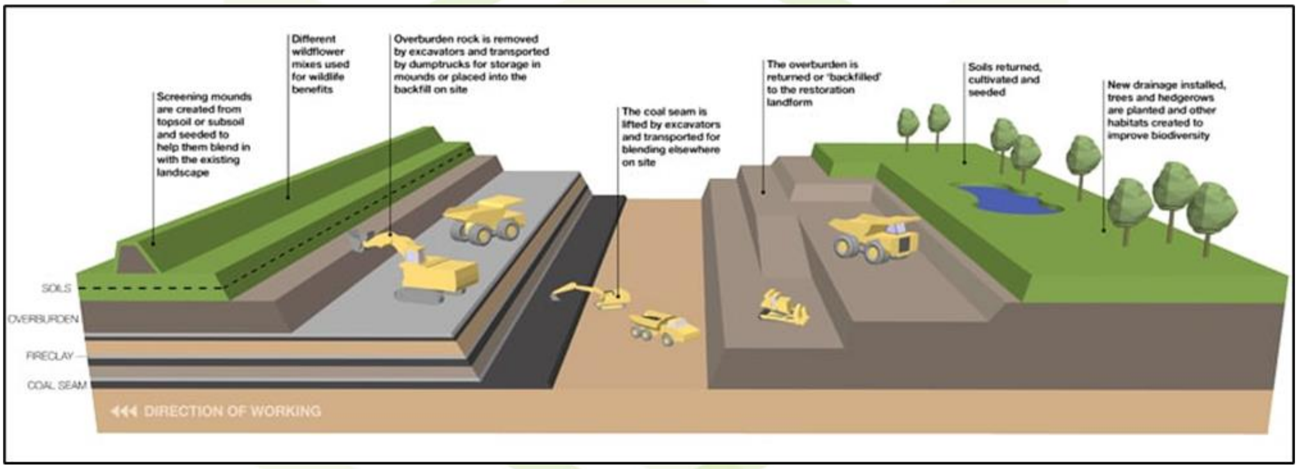


Figure 3-4: Typical Opencast Concurrent Roll Over Rehabilitation Mining Technique

Access and Haul Roads Construction

The mine access road will lead off one a dirt road serving the purpose as a farm road. The dirt road will be upgraded to the applicable standards which includes a gravel road leading into the mine. The road will be used to access the mine offices, workshop complex, and mining area. Coal transportation trucks will also use this road to enter and exit the mine premises, including travelling to the weighbridge.

Clean and Dirty Water Separation

A detailed surface water management plan will be drawn up as part of the Water Use License Application including the determination of flood lines, identification of sensitive receptors and existing surface water systems and flow paths, and civil engineering design reports for the required trenches and water management facilities. The Geohydrological investigation will also feed into these designs as the anticipated pollution will be modelled. Trenching around the mining area forms part of the clean and dirty water separation and is to a large extent based on the water balance as calculated by the civil engineering team. The image below is a typical illustration of aspects to consider during the calculation of the opencast mining area water balance.

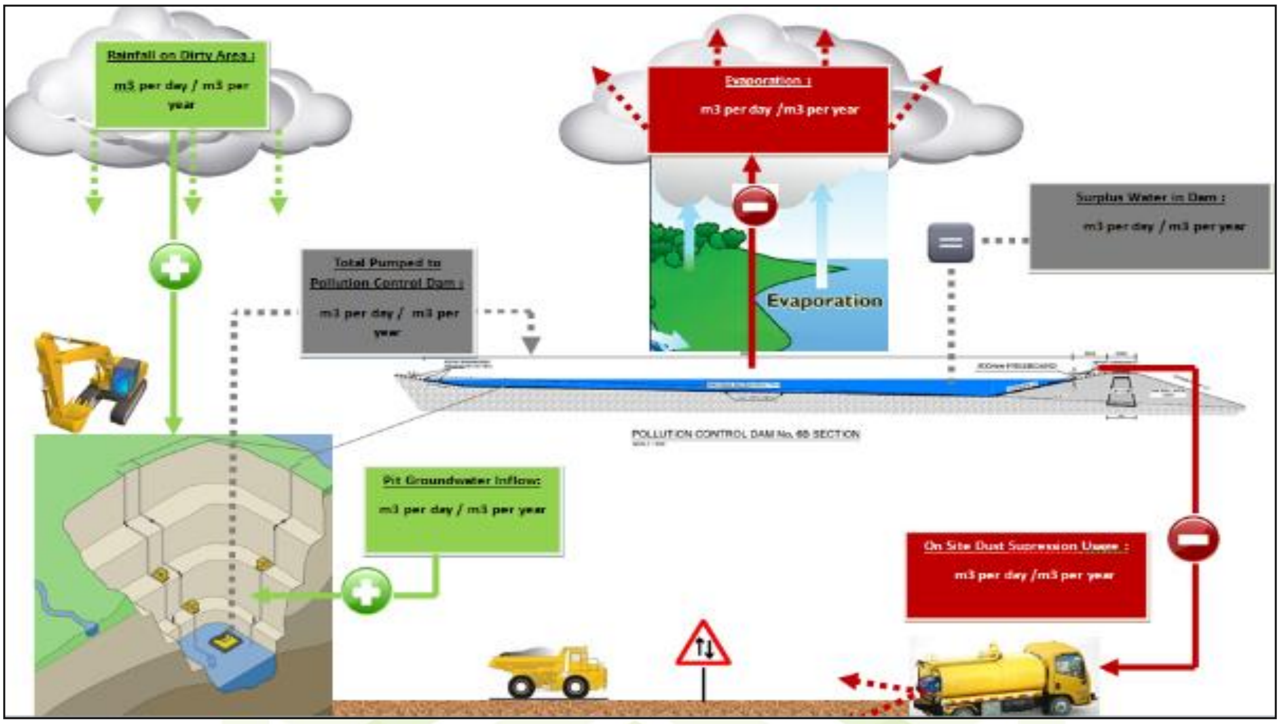


Figure 3-5: Typical water balance considerations during the design of a clean and dirty water separation system

Further images for clarification purposes have been provided below to indicating cross sections of both the dirty water and clean water diversion trenches which will be constructed around the mining area. These designs will also form part of the final master plan to be implemented during the Water Use License Application.

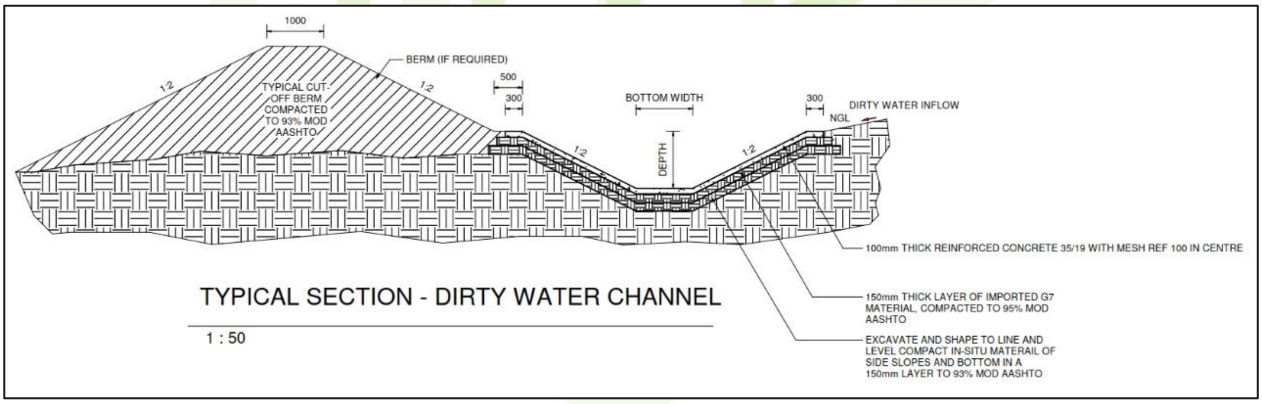


Figure 3-6: Typical Channel / Berm Cross Section For Polluted Water Diversion

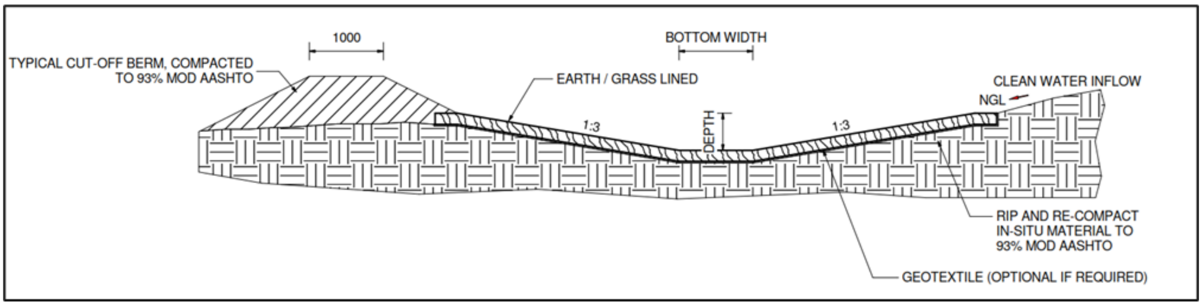


Figure 3-7: Typical channel/berm cross section for Clean water diversion

Fencing

Fencing of the entire mining area will be required as a means of ensuring safety and also keeping trespassers at bay. Fences will be clearly demarcated, and appropriate signage will be displayed, similar to the signs in the images below. Fencing of the sensitive receptors such as wetlands will also take place ensuring no mining personnel will enter these areas and that it will remain protected for the duration of the project. Sites of archaeological and heritage importance will also need to be fenced off while safe access to these sites will be provided. The necessary signage will also be erected at sites of archaeological and/or heritage importance to ensure visitors can easily and safely access the premises.

Figure 3-8: Typical mine fence signage

Drilling and Blasting

Blasting of mine overburden to allow efficient recovery of the underlying coal can have impacts on the surrounding community. These impacts mainly include vibration through the air (overpressure) and earth (ground vibration) along with the generation of dust and fume. Overpressure and ground vibration limits in place for private residences and heritage structures are prescribed by government based on standards. Blasts are designed and managed to minimise the risk of exceeding these limits, and to minimise impacts they have on the community, surrounding structures and environment.

Due to the nature of the activities associated with open cast activities, blasting might occur during the construction phase of the initial box cut, however, subsequent blasting to remove overburden and gain access to the mineral reserve will also take place during the life of mine. A suitably qualified blasting contractor will be appointed to construct a blasting design and conduct blasting activities. There will be no explosives magazine on site and the blasting contractor will be required to supply the explosives and consumables required to blast if blasting is required.

Topsoil, Subsoil, Overburden Stockpiles

All topsoil, subsoil and overburden material will be removed during the mining operation and stockpiled separately for the purpose of backfill rehabilitation.

3.5 Policy and Legislative Context

Table 3-4: Policy and legislative table

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.	**REFERENCE WHERE APPLIED**	**HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT?** (E.g., In terms of the National Water Act a Water Use License has/ has not been applied for.)
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)	The project requires a Mining Right authorisation from the Department of Mineral Resources and Energy.	A Section 102 application acceptance is still pending. Awaiting acceptance from the DMRE.
NEMA Environmental Impact Assessment (EIA) Regulations, as Amended	This Basic Assessment and Environmental Management Plan to be conducted. Specialist environmental information of the project area will be assessed. Mitigation measures and recommendations where provided according to best practice standards.	An Application for Environmental Authorisation will be submitted to the Mpumalanga DMRE with the mining right application lodgement on SAMRAD. S102 Ref: MP-00167-MR/102 Current Mining Right DMRE Ref: MP 30/5/1/2/3/2/1 (10134) MR
The South African Constitution **The South African Constitution (Act 108 of 1996) constitutes the supreme law of the country and guarantee the rights of all people in South Africa**	Applied at potential impacts identification as well as mitigation measures and public participation.	A public participation process is followed, and consultations are accordingly undertaken. An EMPr and awareness plan will be designed according to the issues raised during this process.
National Environmental Management: Waste Act	Provisions of the waste act were consulted to determine whether a waste license was required for any aspect of the proposed development.	The mine does not plan to store general or hazardous waste on site.
Section 38 of the National Heritage Resources Act (Act No. 25 of 1999)	Legislation consulted during the impact assessment process, to determine what legal requirements with regards to the management of national heritage resources were relevant to this application.	An upload of the BAR will be done on the SAHRIS online system for comment.
National Environmental Biodiversity Act The National Environmental Management Biodiversity Act (NEM:BA), 2004 (Act No.10 of 2004), provides for:	Baseline review of the biodiversity on the site	SANBI database will be used to determine conservancy status as well as mitigation measures for alien invasive species encroaching the project area.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT? (E.g., In terms of the National Water Act a Water Use License has/ has not been applied for.)
(i) the management and conservation of South Africa`s biodiversity within the framework of the National Environmental Management Act, 1998; (ii) the protection of species and ecosystems that warrant national protection; (iii) the sustainable use of indigenous biological resources; (iv) the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources; (v) the establishment and functions of a South African National Biodiversity Institute;		
National Water Act The NWA (Act No. 36 of 1998)	The proposed activities may require a water use license, consultation. The existing activities on Nndanganeni Colliery are subject to the existing water use licence held by IPP.	The department has been notified of the proposed project and comments will be addressed. Adhere to the existing water use licence conditions.
National Environmental Management: Air Quality Act, 2004 (Act no.39 of 2004);	Dust monitoring on site during the operation.	As part of the EMPr dust suppression methods will be used.
Mine Health and Safety Act, 1996 (Act No. 29 of 1996);	Health and Safety Policy.	Risk Impact Assessment to be conducted.
National Development Plan (2012) **The National Development Plan outlines what we should do to eradicate poverty, increase employment and reduce inequality by 2030. The Plan has the target of developing people's capabilities to be to improve their lives through education and skills development, health care, better access to public transport, jobs, social protection, rising income, housing and basic services, and safety.**	Used to identify project Need and Desirability and alignment with National Policy.	To form part of the project background and socio-economic evaluation.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT (a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process.	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE LEGISLATION AND POLICY CONTEXT? (E.g., In terms of the National Water Act a Water Use License has/ has not been applied for.)
Municipal Systems Act, 2000 (Act No. 32 of 2000) **Section 100 of the Mineral and Petroleum Resources Development Act (MPRDA) tasks the Minister to establish, assess and where necessary, revise the framework and targets for the entry and ongoing participation of historically disadvantaged South Africans into the sector**	The project must be tested against the local and district IDP and SDF.	Used to assess the need and desirability.
Mining Charter **Section 100 of the Mineral and Petroleum Resources Development Act (MPRDA) tasks the Minister to establish, assess and where necessary, revise the framework and targets for the entry and ongoing participation of historically disadvantaged South Africans into the sector**	The project must align itself with the principles of the Charter.	Included in a Social Development Plan or similar document.
Mpumalanga SDF	Used in the BAR to identify Need and Desirability.	Guideline considered during the assessment of the need and desirability of the proposed development, at the provincial scale.
Nkangala District Municipality IDP and SDF	Source of background demographic and socio-economic information.	Utilized as a source of demographic and socio-economic information for the Nkangala District.

3.6 NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES.

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

The mining sector has been described as the "Continuous Sunrise Sector" by President Cyril Ramaphosa at the 'Investing in African Mining Indaba' in Cape Town during May 2022, this due to the significant contribution which the sector continues to have on the country's economy. Despite the many challenges created by the Covid-19 Pandemic, the mining sector continues to contribute substantially to export earnings, is a critical source of foreign direct investment and provides employment for a considerable number of people.

As the economic effects of the Covid-19 Pandemic begin to subside, the mining sector has significantly contributed to the recuperation of South Africa's economy. In 2021, the mining sector registered a growth of 11.8%, the largest growth seen across all the industries in the economy. The sector was able to recover production close to pre-covid conditions.

In 2019 StatSA provided a report detailing the mineral production, finances, employment, exports and imports statistics for South Africa. The results of the census conducted confirmed that the South African Mining Industry is a critical pillar of our economy, with R527,5 billion in total sales generated in 2019. Of this R527,5 billion, 61% (R323,8 billion) was sourced from outside the country through exports. Coal dominates production in South African, covering about 75% of the total mass of all minerals produced. In 2019, 306 million metric tons of coal was produced. Almost two-thirds of mining sales are from abroad, with 39% of coal produced being exported.

The extracting and processing of minerals requires a great deal of machinery and workforce. The South African mining industry employed 514 859 individuals in 2019, with 39% employed in the platinum group metals sector, 21% in the coal sector and 20% employed in the gold sector. Recent statistics note that mining in South Africa still directly employs over half a million people post-covid.

At the 4th South African Investment Conference in 2022, investments of approximately R46 billion was pledged towards mining and mineral beneficiation, showing investor confidence in South Africa's mining potential and operations.

The mining industry is identified as one of the key components toward Rapid Economic Growth in order to reduce poverty and minimise unemployment Growth (State of the Nation Address, 2019). The key issues include:

- The need for a strong capable state;
- Cost reduction for businesses and consumers;
- The need for reindustrialisation and a revitalised mining sector;
- Faster growth in tourism;
- Improved infrastructure;
- Better support for small businesses; and
- Marked reduction in unemployment.

Mining's contribution to provincial GDP (2020) is 25.9% and the sector employs 53 000 people. The activity of mining has numerous social and economic benefits in local, regional and national context. These include:

- Job creation.
- Skills development.
- SMME development.
- Local economic development.

- Contribution to local and national tax income (royalties, companies' tax etc.).
- Contribution to the national gross domestic product, and
- Future business opportunities.

The production of goods, supply of services or construction of infrastructure results in expenditure within a regional economy which has knock-on effects and results in additional expenditure which contributes to the regional economy.

3.7 Motivation for the overall preferred site, activities and technology alternative.

Nndanganeni Colliery already has an existing opencast pit with associated mining infrastructure. The proposed void / pit extension will allow for the continuation of the box cut opencast mining with a roll-over rehabilitation sequence.

The area is located in the Witbank Coal Field. This extension area is preferred due to the shallow nature of the coal reserve and its accessibility via the existing highwall in the opencast where mining is currently taking place.

In terms of the technologies and activities proposed, roll-over mining is seen as the most efficient way to undertake concurrent rehabilitation as mining progresses, therefore also reducing the cost required for rehabilitation after cessation of mining activities. Location of infrastructure on site will be based on the most effective way to handle clean and dirty water separation.

3.8 Full description of the process followed to reach the proposed preferred alternatives within the site.

GIS and spatial analysis will be used to determine the location of the mining infrastructure by considering environmental sensitivities. Furthermore, the resource location was determined through drilling exercises in order to locate the areas that will be most economical to mine, and the extent of the resource that will be mined.

3.8.1 Details of the development footprint alternatives considered.

With reference to the site plan provided in Appendix C and the location of the individual activities on site, provide details of the alternatives considered with respect to:

a) the property on which or location where it is proposed to undertake the activity;

Portions 15 of the farm Hartogshof 413 JS is located in the Witbank Coal Field. This extension area is preferred due to the shallow nature of the coal reserve and its accessibility via the existing highwall in the opencast where mining is currently taking place. The extension area is bound to the current location due to the underlying geology and surrounding wetlands.

b) the type of activity to be undertaken;

Opencast roll-over mining is seen as the most efficient way to undertake concurrent rehabilitation as mining progresses, therefore also reducing the cost required for rehabilitation after cessation of mining activities. Underground mining was not considered due to the small nature of the mining area and the extremely shallow nature of the coal reserve.

c) the design or layout of the activity;

Location of infrastructure on site will be based on the most effective and cost sensitive way to handle clean and dirty water separation as well as the location of the coal resource and surrounding wetlands.

d) The technology to be used in the activity

The technology proposed will be the most economically viable technology for the proposed operation.

e) the operational aspects of the activity; and

No feasible alternative technologies are available to conduct the rollover mining. Alternative technologies to the management of water, dust, and noise will be considered as mitigation measures in this report.

f) the option of not implementing the activity.

Should the applicant not have the opportunity to mine a very viable coal reserve, the opportunity for job creation and resource utilisation will be lost. The alternative activity that is most likely to take place when the option of not implementing the mining activity is exercised will be of an agricultural or natural nature (grazing and/or wilderness).

3.8.2 Details of the Public Participation Process Followed

(Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land.)

Section 41 of NEMA Regulation 982 (as amended) set out the Legal and Regulatory Requirement for Public Participation. The Public Participation Process (PPP) aims to involve the authorities and I&APs in the project process, and determines their needs, expectations and perceptions which in turn ensures a complete and comprehensive environmental study. An open and transparent process has and been followed at all times and is based on reciprocal dissemination of information. The following will be undertaken during the PPP:

1. Identification of Interested and Affected Parties (IAPs);
2. Notification of IAPs regarding the proposed project;
3. A public information meeting, should there be interest;
4. Gathering comments, issues and concerns from IAPs;
5. Responding to IAP comments, issues and concerns;
6. Compilation and submission of results of consultation report to the DMRE; and
7. Providing IAPs with the opportunity to review and comment on the basic assessment report.

Landowner and property detail

The registered owners of the farms were listed as follows:

Table 3-5: Directly affected landowners

Farm			Ptn	Owner
HARTOGSHOF	413	JS	RE/15	BEESTEPAN BOERDERY PTY LTD

Surrounding landowners are listed below:

Table 3-6: Surrounding Landowners

Farm			Ptn	Owner
HARTOGSHOF	413	JS	1	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	RE/3	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	4	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	RE/8	BEESTEPAN BOERDERY PTY LTD
HARTOGSHOF	413	JS	9	ZULFADIL INV CC

HARTOGSHOF	413	JS	14	IPP EQUIPMENT PTY LTD
LEMOENFONTEIN	436	JS	2	BIRK STEAD INV HOLDINGS PTY LTD
ELANDSFONTEIN	1204	JS	15	BEESTEPAN BOERDERY PTY LTD
ZEVENFONTEIN	415	JS	1	BEESTEPAN BOERDERY PTY LTD
ZENZELE	986	JS	RE	BEESTEPAN EMPLOYEES' COMMUNITY & HOUSING TRUST

Site Notices

Site notices were placed around the proposed mining site in accordance with Regulation 41(2)(a), (3) and (4) of the Environmental Impact Assessment Regulations Published under Government Notice R982 in *Government Gazette* 38282 of 4 December 2014 (as amended).

PUBLIC PARTICIPATION NOTICE FOR INTEGRATED ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED IPP EQUIPMENT (PTY) LTD MINING RIGHT AMENDMENT APPLICATION

DMR REF: MP 30/5/1/2/3/2/1 (10134) MR | ECO ELEMENTUM REF: 22-1732-AUTH | S102 REF: MP-00167-MR/102 DATE OF PUBLICATION OF THIS NOTICE: 11 NOV 2022

NOTICE AND INVITATION TO PARTICIPATE IN A PUBLIC PARTICIPATION PROCESS FOR THE INTEGRATED ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED IPP EQUIPMENT (PTY) LTD MINING RIGHT AMENDMENT APPLICATION IN TERMS OF SECTION 102 OF THE MPRDA, ON PORTION 15 OF THE REMAINING EXTENT OF THE FARM HARTOGSHOF 413 JS, STEVE TSHWETE LOCAL MUNICIPALITY, NKANGALA DISTRICT, MPUMALANGA PROVINCE OF SOUTH AFRICA.

Notice is hereby given in terms of the Minerals and Petroleum Resources Development Act (Act No.28 of 2002) (MPRDA), together with Regulation 3 (6) of the National Environmental Management Act (Act No 107 Of 1998): Environmental Impact Assessment Regulations 2014 (As Amended) (NEMA) and the National Water Act,1998 (Act No. 36 of 1998) (NWA), that IPP Equipment (Pty) Ltd applied for a mining right (MP 30/5/1/2/3/2/1 (10134) MR) amendment in terms of Section 102 of the MPRDA. Eco Elementum has been appointed to undertake the Environmental Authorisations, and would like to engage the local property owners, Interested and Affected Parties in respect of activities proposed.

PROPOSED PROJECT:

Nndanganeni Coal is planning to expand its existing void around the northern grootpan on its existing Mining Right 10134MR, on portion 15 of the remaining extent of the farm Hartogshof 413 JS, Steve Tshwete Local Municipality, Nkangala District, Mpumalanga Province of South Africa. The resource will be mined via opencast roll over mining. The following activities will be undertaken on site:

- Box cut opencast mining with a roll over rehabilitation sequence
- Clean and dirty water separation system (Stormwater management infrastructure)
- Access and haulage roads

The intent to mine requires the following applications and subsequent approvals prior to commencement:

- Mining Right (MPRDA): Section 102
- Environmental Authorisation - GNR 983. Activities 9, 10 and 21D

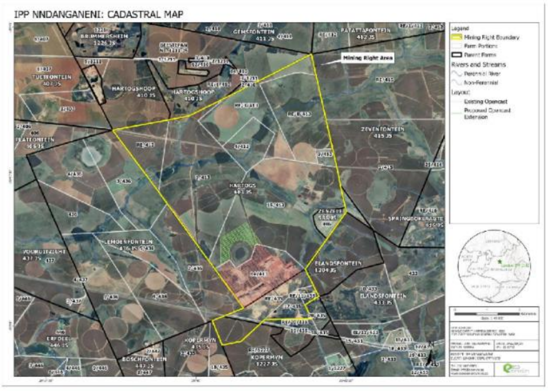
An integrated environmental application process will be followed for the mining permit by means of a Basic Assessment Process. A Basic Assessment Report (BAR) for the mining permit will be available for review for 30 days from **11 November 2022 – 12 December 2022**; through electronic copies sent (upon request) and on Eco Elementum's website (http://ecoelementum.co.za/downloads). **Interested and affected parties (I&APs) are invited to register and provide written comments. I&APs should refer to the relevant reference number(s), and must provide their comments together with their name, contact details and an indication of any direct business, financial, personal or other interest which they have in the application to the contact person indicated below by latest 12 December 2022.**

Queries regarding this matter should be referred to:

Ulane Albrecht
Office: 012 807 0383
Email: ulane@ecoe.co.za
Project ref: 22-1732-AUTH IPP Nndanganeni

In order to ensure that you are identified and registered as an interested and/or affected party, please submit your name, contact information and interest in the matter to the contact person by latest **12 December 2022.**

IPP NNDANGANENI: CADASTRAL MAP



ENVIRONMENTAL & ENGINEERING

When registering as an I&AP a person consents to the lawful processing of personal information for the intended purposes, as described by the Protection of Personal Information Act. 2013 (Act no.4 of 2013). Your information will be used for this project, including the application as well as subsequent related appeals, amendments, or audits where you are registered as an I&AP. By registering, a person agrees that by submitting comment to inform this profess, your contact details will where be required by a public body, be reflected in regulated reports that must be compiled and submitted to the public, registered stakeholder, organs of state, as well as the competent authority for consideration and decision making.

Figure 3-9: Site Notice

Background Information Document

A Background Information Document (BID) was compiled and sent to interested and affected Parties (I&APs) in accordance with Regulation 41(2)(b) and (3) of the Environmental Impact Assessment Regulations Published under Government Notice R982 in *Government Gazette* 38282 of 4 December 2014 (as amended).

Advert placement

An Advert was placed in the Middelburg Observer on Friday 11 November 2022 in accordance with Regulation 41(2)(c) and (3) of the Environmental Impact Assessment Regulations Published under Government Notice R982 in *Government Gazette* 38282 of 4 December 2014 (as amended).

Proof of notification

Email

An email notifying the I&APs of the proposed project, the public participation process, draft report review and how to comment, was sent to all identified I&APs.

SMS

A SMS notifying the I&APs of the proposed project, the public participation process, draft report review and how to comment, was sent to all identified I&APs.

Submission of Draft Basic Assessment Report

The Draft Report was submitted to the following Commenting Authorities for comment:

Table 3-7: Commenting authorities

Department	Attention to
Mpumalanga Provincial Government DARDLEA.	Pamela Ntuli / Dineo Tswai
Nkangala District Municipality.	Charles Makula
Steve Tswete Municipality	Ms. D Lambrecht
Mpumalanga Tourism and Park Agency.	Phumla Nkosi / Komilla Narasoo
Department of Agriculture forestry and fisheries.	Doreen Sithole
Department of Mineral Resources.	Registry (No acceptance letter received yet)
Department of Water and Sanitation	Adivhaho Rambuda
South African Heritage Resources Agency.	Online submission

3.8.3 Summary of issues raised by I&APs

(Complete the table summarising comments and issues raised, and reaction to those responses)

The section, summarising comments and issues raised by I&APs, and the reaction to those responses will be completed after the initial 30-day commenting period.

3.8.4 The Environmental attributes associated with the alternatives. (The environmental attributed described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

3.8.4.1 Baseline Environment

3.8.4.1.1 Type of environment affected by the proposed activity.

(its current geographical, physical, biological, socio- economic, and cultural character).

CLIMATE

The Nndaganeni area falls within a climate region with warm summers and cold winters with sharp frost. Average daily maximum temperatures are approximately 27°C in January and 17°C in July, but in extreme cases, these may rise to 38°C and 26°C respectively. Average minimum range from about 13°C in January to 0°C in July, whereas extremes can sink to 1°C and -13°C respectively. Rain in this area occurs almost exclusively as showers (mild to heavy) and thunderstorms mainly in summer (October/March), with the maximum in December to February. The winter months are normally dry.

Historical rainfall record, kept by Optimum Colliery and the South African Weather Services (SAWS) were used to determine the monthly precipitation rates. The vicinity of the Optimum Colliery comprises of rainfall gauging station from the SAWS with a record in excess of 60 years. The MAP for the Nndaganeni area is approximately 680 mm.

The Nndaganeni area falls within a region where evaporation is estimated to be between 2 000 and 2 200 mm/a.

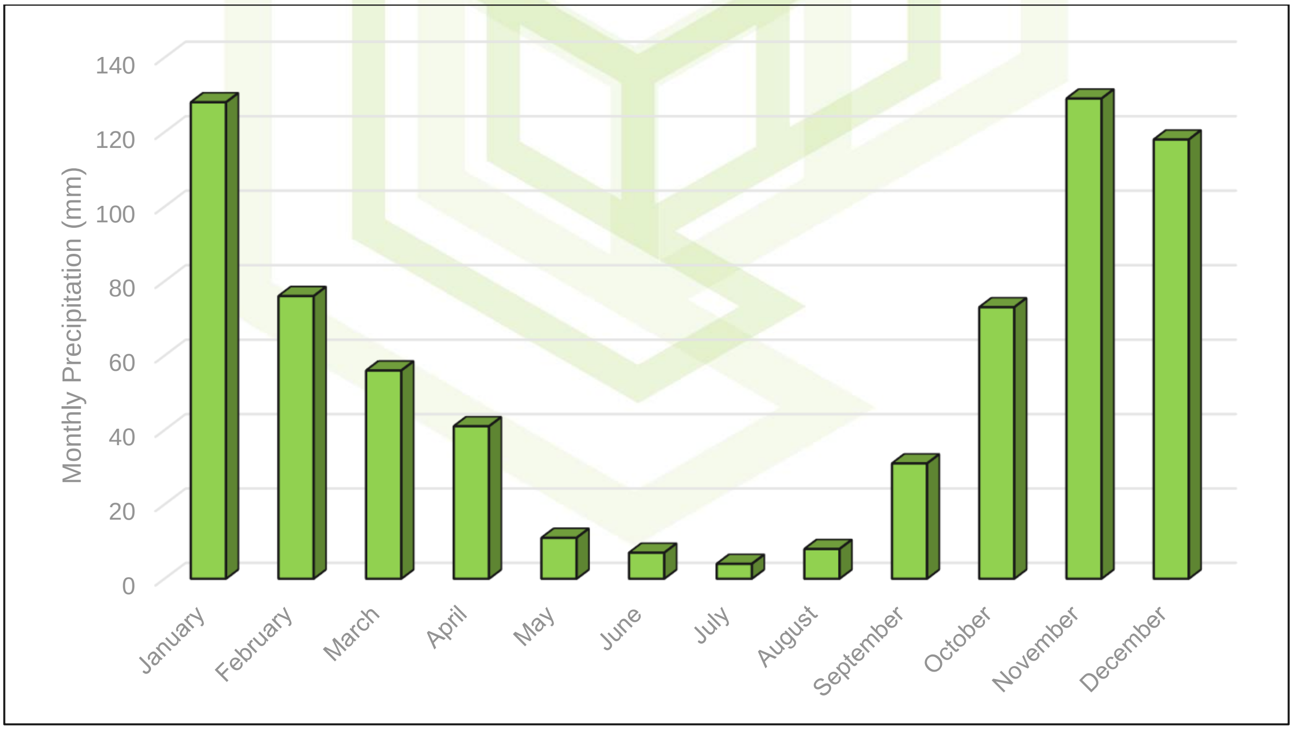


Figure 3-10: Monthly precipitation in the proposed Nndaganeni area (Magalela Associates, 2014)

TOPOGRAPHY & DRAINAGE

The Nndaganeni area is located on a tributary of the Klein Olifants River. Drainage is from the site towards the west and north-west. The site is located in the B12C quaternary catchment which falls within the Klein Olifants Resource of the Olifants Water Management Area (WMA).

The area is located in the Eastern Highveld with gently rolling hills and shallow valleys. The natural topography of the area has generally been disturbed by several mining activities in the region which have been conducted over the past several decades. Typically, opencast mining and rehabilitation activities affect the natural topography. The Optimum Pit is situated approximately 5.5 km south of the proposed mining site partially in the same catchment area that has been left un-rehabilitated. The topography within the mining area ranges between 1 710 metres above mean sea level (mamsl) in the east to 1 530 mamsl in the west. The topography in the Nndaganeni area generally dips towards the west at a gradient of 0.01.

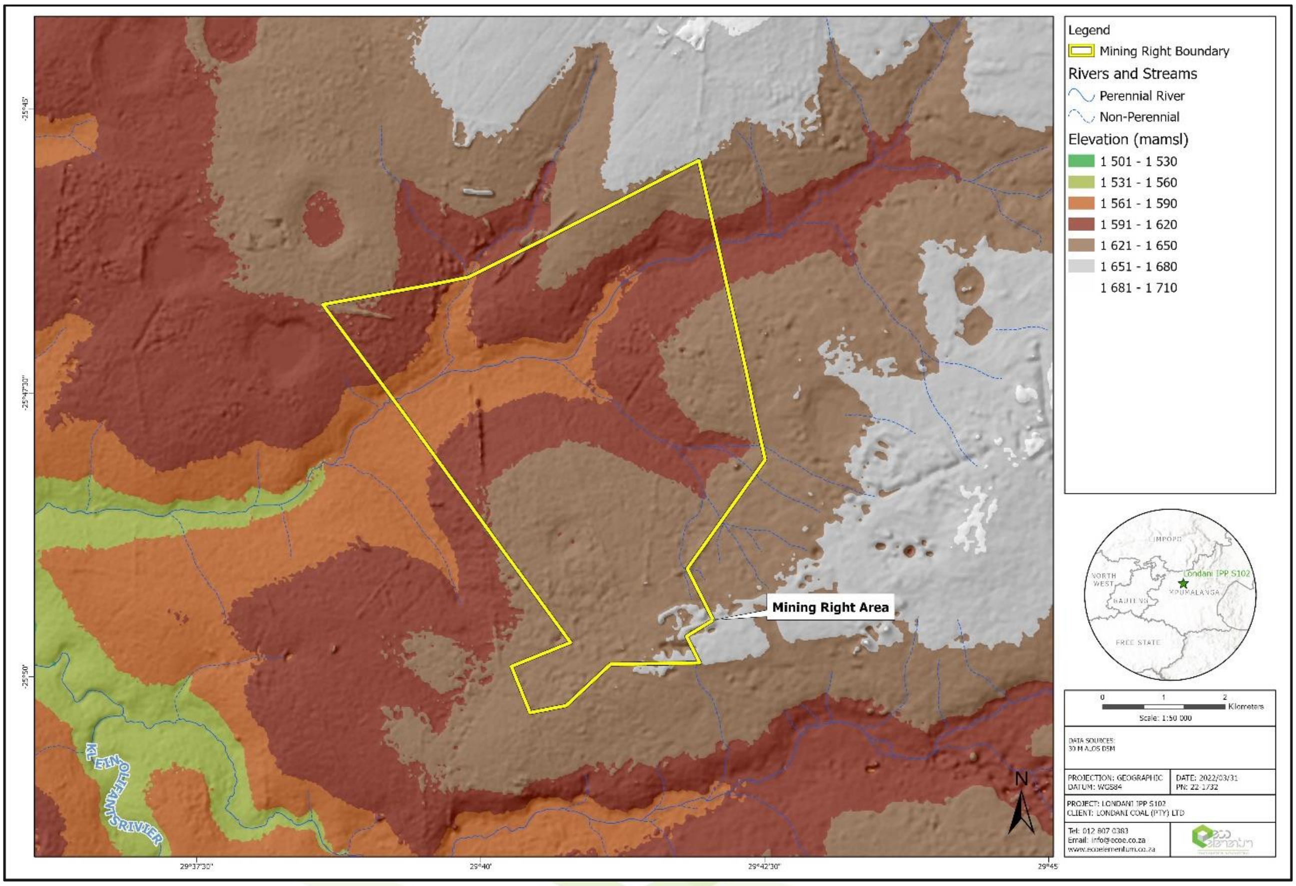


Figure 3-11: Topographical map for the Nndaganeni area

GEOLOGY

Regional Geology

The Nndanganeni extension is underlain by rocks from the Karoo Supergroup. The site is also situated in the Witbank Coalfields which is the most important coal-producing coalfields in South Africa. Five coal seams exist in the coalfield, but not all are economically viable. These coal seams are hosted in Vryheid Formation the middle Ecca Group sediments. The number 1 seam is the lowest or deepest while the 5 seam is the uppermost coal seam. The number 2 and 4 seams are the most exploited throughout the Witbank Coalfields.

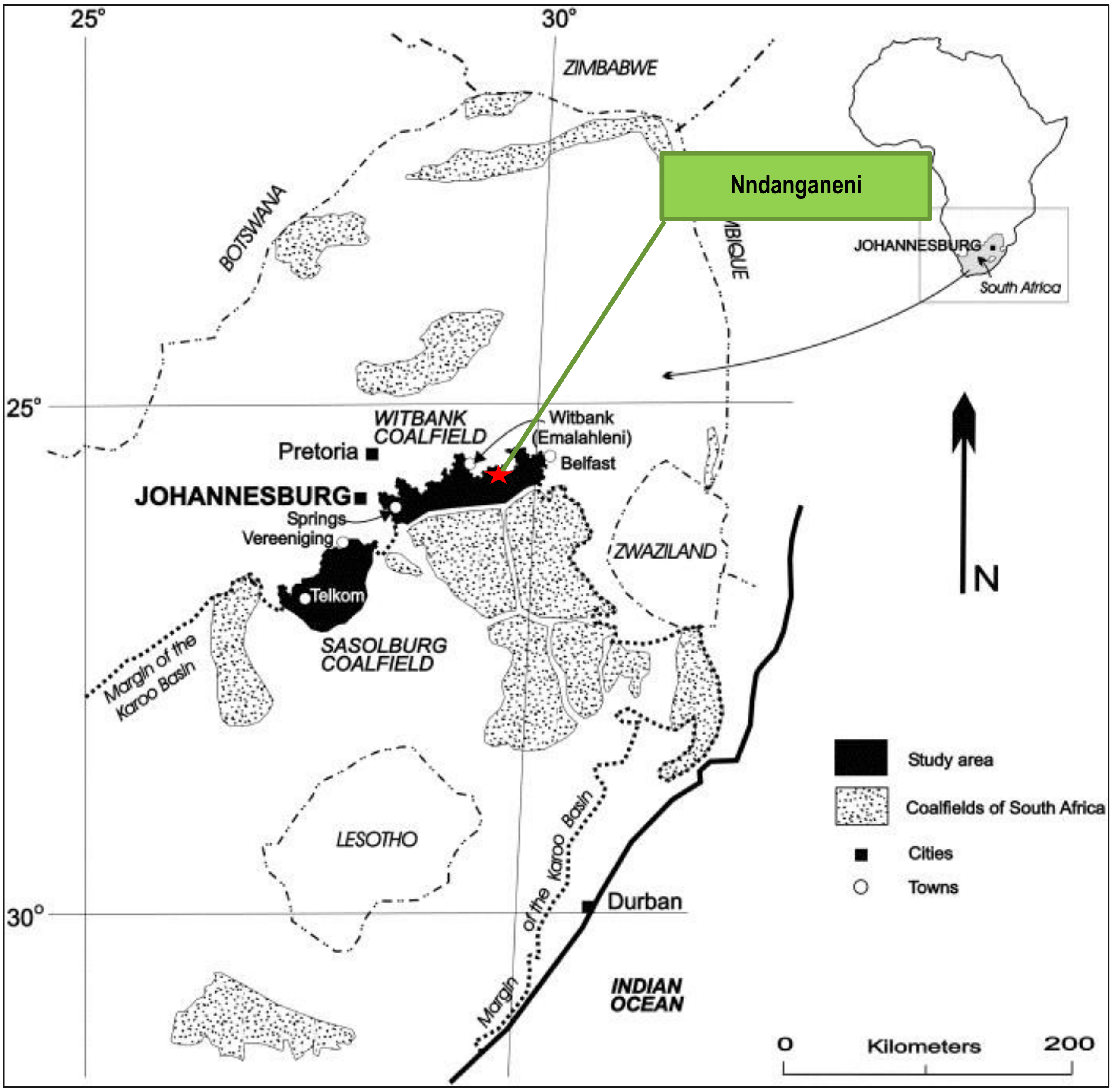


Figure 3-12: Witbank Coalfields and the position of Nndaganeni area in relation to it (Denis et.al., 2007).

The Karoo Supergroup mainly consists of sedimentary successions of sandstone, shale and coal. The Ecca Group is underlain by the Dwyka Formation which consists of tillites and diamictites. Geological features such as dykes (dolerite intrusions) and faults are commonly found in the coalfield. The dolerite intrusions typically act as groundwater flow barriers due to their low permeability, while the contact zone of the intrusions acts as flow pathways due to cracks and faults leading to higher flow rates along these contact zones.

Local Geology

In the Nndanganeni project area, the Vryheid Formation directly overlies the Damwal Formation of the Rooiberg Group (Bushveld Complex). The Dwyka Group is absent or not well developed. As the Vryheid Formation pinches out in the study area, the thickness of the formation is only several tens of meters. Felsitic rocks of the Damwal Formation are present at surface where the Vryheid Formation has been eroded by local streams. Coal seams are strongly influenced by varied depositional environments and / or the present day erosional surfaces. The coal seams (and strata) are generally flat-lying to gently undulating with a regional dip to the south southeast. Due to the varied depositional environments (e.g. basement topography) and the present-day erosional surface, not all of the seams are present at any one locality. (GCS, 2015)

Table 3-8: Overburden and Seam Thickness Summary (GCS, 2015)

Description	Thickness (m)			Seam 1 and Seam 2 Separation Thickness (m)		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Overburden (above Seam 2)	-7.2	-18.7	-15.8	na	na	na
Seam 1	-0.4	-2.8	-1	-1.8	-11.3	-4.5
Seam 2	-0.4	-4	-2			

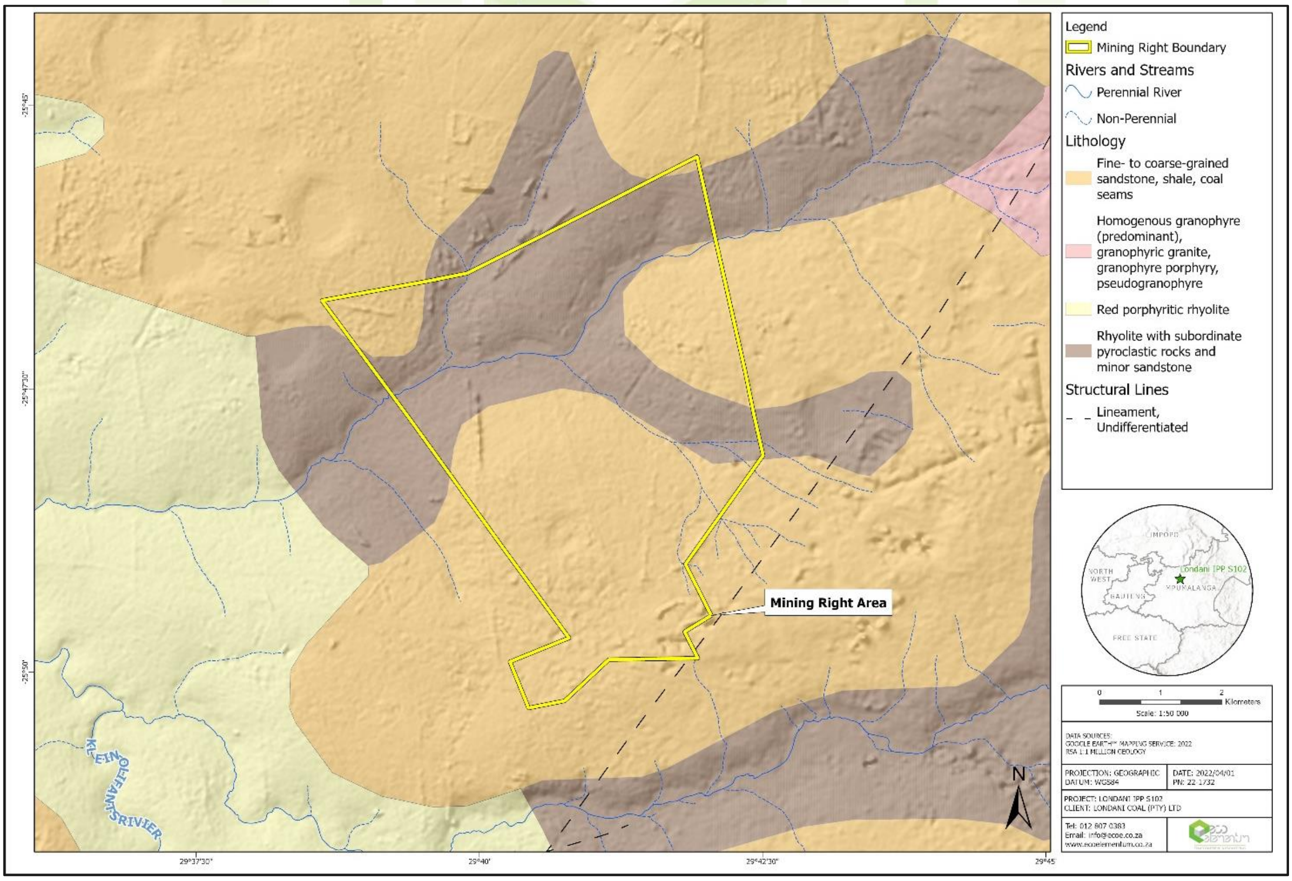


Figure 3-13: Ndaganeni simplified geology

The project area is located within the Witbank Coalfield. The coalfield in the Kriel locality is underlain by a sequence of Dwyka and Middle Ecca strata which rests on an undulating floor composed of felsite's, granites and diabase associated with pre-Karoo depositional activities. The stratigraphy throughout the Kriel area is uniform and the coal seams are generally flat and gently undulating. However, there is evidence of some dolerite intrusions that result in coal seams that are faulted or burnt along the margin areas.

Typical sedimentary sequences are present in the project target area. The No. 2 Seam, the No. 3 Seam, and the No. 4 Seam, which is subdivided into the 4-Upper and 4-Lower Seam in the area and the No. 5 Seam occurs in the area. A parting layer separates the 4-Upper and 4-Lower Seams in most cases. However, this was not evident in the drilling that took place in the area. The overburden mainly consists of sandstone with some areas including thin layers of clay in the lithology. The project area has a thin dolerite intrusion (sill) present. The sequence is underlain by the lithologies of the Dwyka Group as indicated by historical data acquired for the area.

HYDROGEOLOGY

Unsaturated zone

The unsaturated zone is the zone between the ground surface and the static water table. In the unsaturated zone the pores between the ground particles are filled with air and water- thus below saturation. Static water levels in the region of the Nndaganeni mining area as obtained from the hydrocensus boreholes, range between 0.2 and 17 mbs. The thickness of the unsaturated zone in the area of the Nndaganeni can therefore also vary from 0.2 to 17 m in depth. The unsaturated zone may consist of soil, weathered bedrock, and even solid bedrock from the sandstone and shale of the Ecca Group.

Saturated zone

The saturated zone is that part of the aquifer below the regional static water level where all pores and fractures are filled with water at a pressure greater than atmospheric pressure. The depth of the saturated zone in the Nndaganeni mining area is therefore, more than 0.2 to 17 mbs. From studies compiled in the larger region of Nndaganeni area, the saturated zone mainly consists of two aquifer systems.

- Firstly, the weathered, unconfined aquifer that typically occurs on the transition between soil and weathered bedrock (typically sandstone and shale). The groundwater flow closely mimics the surface topography. Groundwater levels are usually shallow in the low-lying topographical regions and may even daylight on a surface which is referred to as springs. The weathered aquifer is more prominent in the wet season because it is located on top of solid bedrock or clayey layers. This aquifer normally has a low yield.
- The second aquifer is known as the deeper, confined aquifer. Flow in this aquifer mainly occurs along fractures, bedding planes and other groundwater flow paths. The presence of fractures generally decreases with depth in this aquifer. The secondary aquifer, due to its heterogeneous nature, maybe higher yielding than the weathered aquifer. Due to the longer residence time of the groundwater in this aquifer, the salt load may be higher than that of the weather aquifer.

The third aquifer at great depth may occur within the pre-Karoo geology (Transvaal Group), underlying the Dwyka-tillites. Very little information of this aquifer in the area is available since very few boreholes have been drilled to this great depth. The water quality in quantity in this aquifer may be inferior to that of the overlying Karoo aquifers. Where dolomite underlays the Karoo geology, the yields of this aquifer may be significantly higher.

Hydraulic conductivity

Hydraulic conductivity refers to the ease with which water passes through a porous medium at a certain time under a hydraulic gradient (m/d). Hydraulic Conductivity (K) can be determined as:

$$K = \frac{\text{Transmissivity (T)}}{\text{Aquifer thickness (d)}}$$

The aquifer characteristics in the area are expected to correspond with other similar Karoo Aquifers. The hydraulic conductivity range can vary anywhere between 10^{-4} to 10^{-2}. It is expected that:

- The hydraulic conductivity will decrease with depth.
- That the fracture zones, also along the dykes, will have a higher hydraulic conductivity than the surrounding rock matrix. These zones will act as preferred groundwater flow paths along which potential contamination will migrate at a higher rate than in the surrounding rock matrix.
- The dykes are expected to have a significantly lower hydraulic conductivity and will therefore in most cases act as groundwater flow barriers.
- The coal seams can also have a higher hydraulic conductivity than the surrounding rock matrix.

Aquifer tests were conducted on thirteen monitoring boreholes by GCS in 2015. Two constant rate discharge tests and thirteen rising head tests were conducted. The hydraulic conductivity statistics for the weathered and fractured aquifers are indicated in **Table 3-9**

Table 3-9: Hydraulic Conductivity Statistics (GCS, 2015).

Description	Weathered Aquifer (m/d)	Fractured Aquifer (m/d)
Average	0.17	0.002
Geometric Mean	0.013	0.0007
Harmonic Mean	0.004	0.0002

Groundwater Levels

Water level trends in the IPP Nndanganeni monitoring boreholes over the period from March 2017 to March 2022 are presented in Figure 3-14 of this report. Increasing water level trends from 2017 to 2022 are observed in BH2, BH3, BH5, BH10 and KM4. No impacts in terms of dewatering on the pan from the mining activities is currently observed since the water levels in BH10 has increased over the monitoring period.

Water levels in the monitoring boreholes varied between 0.2 and 17 mbs for the 2021/2022 monitoring period. BH2 is situated in a rehabilitated opencast area. It is expected that the deeper levels in this borehole may be due to the fact that the water level has not yet recovered post-mining and may also be as a result of the very high permeability of this rehabilitated area.

Future and continuous time-series water level monitoring will result in the numerical model being a more accurate tool for predicting future groundwater level behaviour.

The water levels recorded during the hydrocensus varied between 2 and 4.6 mbs. The water level in the boreholes closest to the Northern pan varied between 2 and 4.6. The water level elevation is close to the water level elevation in the pan which indicates that groundwater contributes to the water make of the pan. Drawdown in the shallow aquifer in the new mining are will therefore have an impact on the pan in terms of the groundwater contribution.

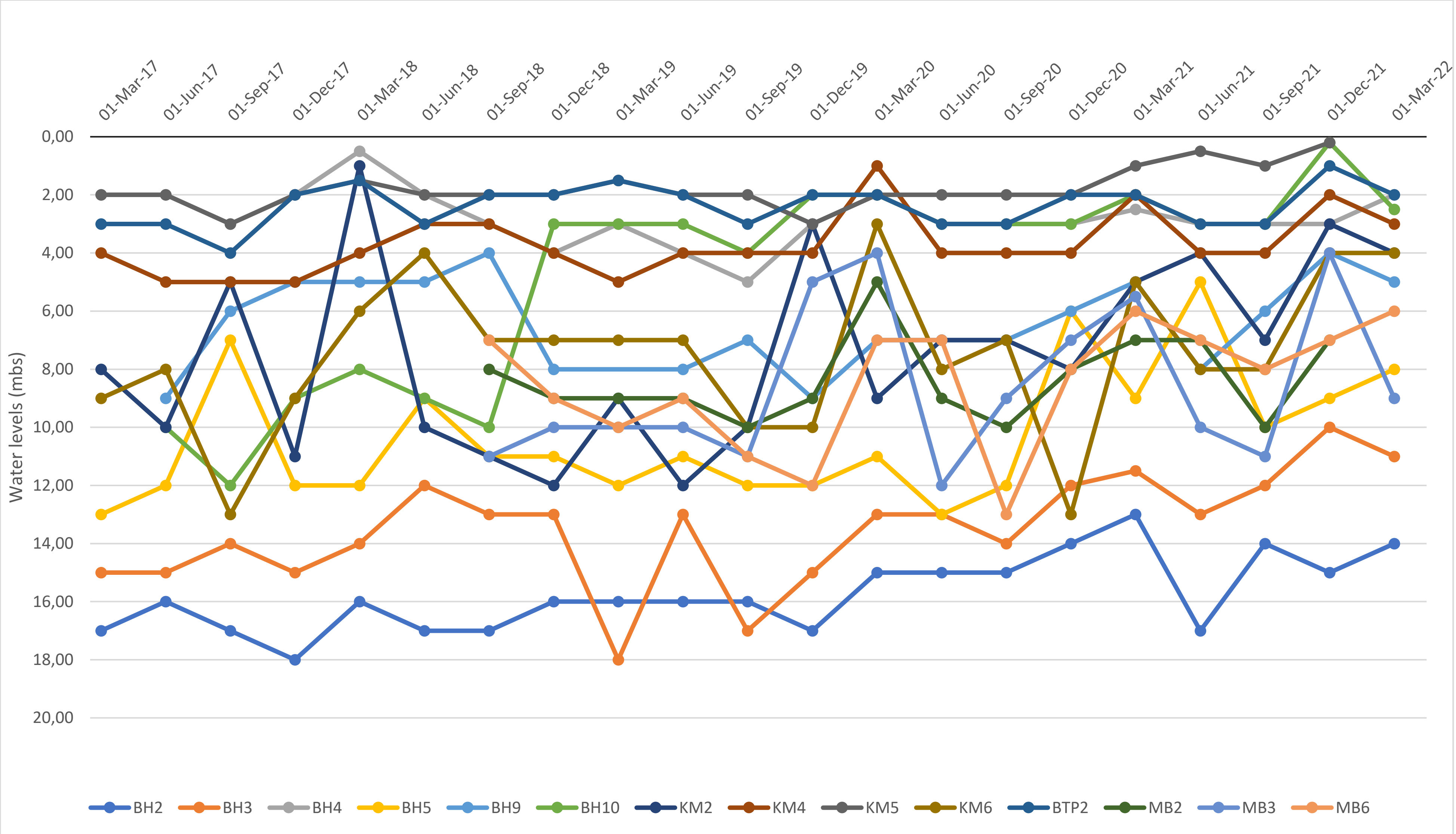


Figure 3-14: Water Level trends in the IPP Nndanganeni monitoring boreholes from March 2017 to March 2022.

Table 3-10: Measured groundwater levels for 2017 to 2022 (uKhozi Environmentalists, 2022)

Sample no.	Groundwater Level																								
	Mar 2017	**Jun 2017**	**Sep 2017**	**Dec 2017**	**Annual Average (2017)**	**Mar 2018**	**Jun 2018**	**Sep 2018**	**Dec 2018**	**Annual Average (2018)**	**Mar 2019**	**Jun 2019**	**Sep 2019**	**Dec 2019**	**Annual Average (2019)**	**Mar 2020**	**Jun 2020**	**Sep 2020**	**Dec 2020**	**Annual Average (2020)**	**Mar 2021**	**Jun 2021**	**Sep 2021**	**Dec 2021**	**Annual Average (2021)**	**Mar 2022**
BH 2	17m	16m	17m	18m	**17m**	16m	17m	17m	16m	**16.5m**	16m	16m	16m	17m	**16.25m**	15m	15m	15m	14m	**14.75m**	13m	17m	14m	15m	**14.75**	14m
BH 3	15m	15m	14m	15m	**14.75m**	14m	12m	13m	13m	**13m**	18m	13m	17m	15m	**15.75m**	13m	13m	14m	12m	**13m**	11.5m	13m	12m	10m	**11.63**	11m
BH 4	2m	2m	3m	2m	**2.25m**	0.5m	2m	3m	4m	**2.37m**	3m	4m	5m	3m	**3.75m**	2m	3m	3m	3m	**2.75m**	2.5m	3m	3m	3m	**2.88**	2m
BH 5	13m	12m	7m	12m	**12m**	12m	9m	11m	11m	**10.75m**	12m	11m	12m	12m	**11.75m**	11m	13m	12m	6m	**10.5m**	9m	5m	10m	9m	**8.25**	8m
BH 9	Not sampled	9m	6m	5m	**6.66m**	5m	5m	4m	8m	**5.5m**	N/A	8m	7m	9m	**8m**	**7m**	**7m**	**7m**	**6m**	**6.75**	5m	8m	6m	4m	**5.75**	5m
BH 10	Not sampled	10m	12m	9m	**10.33m**	8m	9m	10m	3m	**7.5m**	3m	3m	4m	2m	**3m**	**2m**	**3m**	**3m**	**3m**	**2.75**	2m	3m	3m	0.2m	**2.05**	2.5m
KM 2	8m	10m	5m	11m	**8.5m**	1m	10m	11m	12m	**8.5m**	9m	12m	10m	3m	**8.5m**	**9m**	**7m**	**7m**	**8m**	**7.75**	5m	4m	7m	3m	**4.75**	4m
KM 3	Infested by Bees	Infested by Bees	5m	4m	**4.5m**	N/A	3m	4m	N/A	**3.5m**	N/A	Dry	Dry	N/A	**N/A**	N/A	N/A	4m	N/A	**4m**	N/A	4m	Dry	Dry	**4m**	N/A
KM 4	4m	5m	5m	5m	**4.75m**	4m	3m	3m	4m	**3.5m**	5m	4m	4m	4m	**4.25m**	1m	4m	4m	4m	**3.25m**	2m	4m	4m	2m	**3m**	3m
KM 5	2m	2m	3m	2m	**2.25m**	1.5m	2m	2m	2m	**1.87**	1.5m	2m	2m	3m	**2.12m**	2m	2m	2m	2m	**2m**	1m	0.5m	1m	0.2m	**0.68**	Bees
KM 6	9m	8m	13m	9m	**9.75m**	6m	4m	7m	7m	**6m**	7m	7m	10m	10m	**8.5m**	3m	8m	7m	13m	**7.75m**	5m	8m	8m	4m	**6.25**	4m
BTP2	3m	3m	4m	2m	**3m**	1.5m	3m	2m	2m	**2.12**	1.5m	2m	3m	2m	**2.12m**	2m	3m	3m	2m	**2.5m**	2m	3m	3m	1m	**2.25**	2m
BTP3	Taken from tap	Taken from tap	Taken from tap	Taken from tap	**N/A**	Taken from tap	Taken from tap	Taken from tap	Taken from tap	**N/A**	Taken from tap	Taken from tap	Taken from tap	Taken from tap	**N/A**	Taken from tap	Taken from tap	Taken from tap	Taken from tap	**N/A**	N/A (Taken from tap)	N/A (Taken from tap)	N/A (Taken from tap)	N/A (Taken from tap)	**N/A (Taken from tap)**	N/A (Taken from tap)
MB 2	**Sampling started in March 2018**							8m	9m	**8.5m**	9m	9m	10m	9m	**9.25m**	5m	9m	10m	8m	**8m**	7m	7m	10m	7m	**7.75**	Bees
MB 3								11m	10m	**10.5m**	10m	10m	11m	5m	**9m**	4m	12m	9m	7m	**8m**	5.5m	10m	11m	4m	**7.63**	9m
MB 6								7m	9m	**8m**	10m	9m	11M	12m	**10.50**	7m	7m	13m	8m	**8.75**	6m	7m	8m	7m	**7m**	6m

Groundwater Potential Contaminants

Acid generation is a common response to the coal mining environment. Coal and carbonaceous material contain a mineral known as pyrite, an iron-sulphide mineral, which is the main contributor to acid rock drainage (ARD). After being exposed to oxygen and water the sulphide minerals react to form an acid. Bacteria, which increase with exposure to water and oxygen often accelerates the acidification process. The reaction can however also occur abiotically.

The general equation of pyrite oxidation is as follows:

$$2FeS_2 + 7O_2 + 2H_2O \rightarrow 2Fe^{2+} + 4SO_4^{2-} + 4H^+$$

Ferrous iron is oxidised to ferric iron:

$$4Fe^{2+} + O_2 + 4H^+ \rightarrow 4Fe^{3+} + 2H_2O$$

As mentioned previously these two reactions can occur abiotically or with the catalisation by micro-organisms. These organisms arise from the oxidation reactions. The ferric cations reduce to ferrous ions:

$$FeS_2 + 14Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^{2-} + 16H^+$$

The release of H+ lowers the pH. At the lower pH the solubility of the ferric ion continuous which increases the acid generation.

Acid Generation Capacity

ABA tests were not conducted in 2015 by GCS. A total of 23 samples were collected for geochemical testing which included discard, tailings, coal and waste rock. The following conclusions have been made in terms of acid mine drainage from the tests results:

- The degree to which AMD will occur in the Hartoghof pit will depend on the amount of pyrite present with respect to carbonate minerals. Waste rock does not have significant potential to generate acid mine drainage but also does not have significant potential to neutralise acid drainage. Acid-mine drainage will occur in parts (hotspots) in the backfill;
- According to the ABA test results the discard has some potential to generate acid mine drainage. Paste pH tests show that most of the discard is already acidic which explains the formation of jarosite in the one discard sample; and
- According to the NAG test results the tailings has no potential to generate acid mine drainage but saline drainage will still occur from the tailings because of the high pyrite content.

Waste Classification

A waste classification should be conducted in accordance with the National Environmental Management: Waste Act (NEM: WA) Regulations (2013). The assessment is undertaken by comparing the samples' leachate concentration (LC) to the leachable concentration threshold (LCT), and the total concentration (TC) to the total concentration thresholds (TCT). The results will indicate the type of waste and the type of liner, if any, required for the potential source.

Table 3-11: Waste Classification Criteria

Waste Type	Disposal
0	Not allowed
1	Class A or Hh:HH landfill
2	Class B or GLB+ landfill

3	Class C or GLB- landfill
4	Class D or GLB- landfill

A waste classification was not conducted for the proposed Nndaganeni mining area. Generally, the results below are expected for the coal mining environment. Please note that these are only indicative and may differ from site to site.

Coal material:

- The coal samples are generally classed as Type 3 waste and according to the NEM: WA guidelines should be followed as indicated in the figure below; and
- The short-term storage of the coal material on stockpiles and good storm water management should ensure that environmental impacts are kept to a minimum and contained to the stockpile sites. Based on these management protocols the liner illustrated in the figure below should be sufficient, however, the decision lies with the Department of Environmental Affairs.

Overburden material:

- Overburden is generally also classed as Type 3 waste and should be disposed of at Class C landfill sites or sites designed with liner requirements illustrated below.

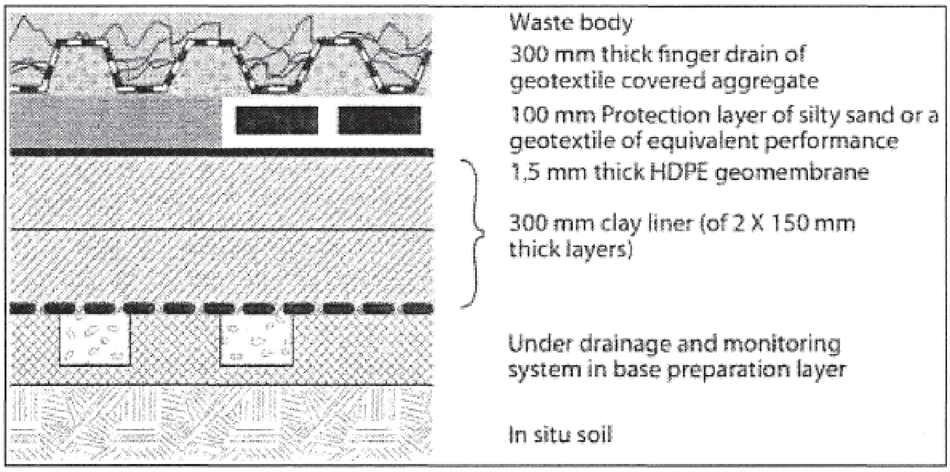


Figure 3-15: Class C landfill site liner requirements.

Groundwater Quality

Geochemical information was available from June 2018 to June 2022 for the monitoring boreholes at IPP Nndanganeni. The trends of Sulphate, TDS and pH over the period from 2018 and 2022 have been presented in Figure 3-17 and Figure 3-18.

Significant increasing sulphate concentration trends have been observed in BH2, BH3 and KM6 over the monitoring period. Increases over this period has also been observed in KM2. The increasing sulphate concentrations is evident of increasing impacts from the coal mining activities. In BH4 the sulphate concentrations have decreased from 1 830 mg/l in June 2021 to 1 070 mg/l in March 2022. Continuous monitoring will indicate whether this decrease will continue.

Acid generation is a common response to the coal mining environment. Coal and carbonaceous material contain a mineral known as pyrite, an iron-sulphide mineral, which is the main contributor to acid rock drainage (ARD). After being exposed to oxygen and water the sulphide minerals react to form an acid bacteria, which increases with the exposure to water and oxygen often accelerating the acidification process. The reaction can however also occur abiotically.

The general equation of pyrite oxidation is as follows:

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As mentioned previously these two reactions can occur abiotically or with the catalisation by micro-organisms. These organisms arise from the oxidation reactions. The ferric cations reduce to ferrous ions:

$$FeS_2 + 14Fe^{3+} + 8H_2O \rightarrow 15Fe^{2+} + 2SO_4^{2-} + 16H^+$$

The release of H+ lowers the pH. At the lower pH, the solubility of the ferric ion continuous, which increases the acid generation.

The pH in KM2 indicated a fluctuating concentration trend with pH in March 2020, March 2021 and September 2021 below the permissible SANS241:2915 limits. The pH in MB2 was also acidic at 4.7 and below the permissible SANS limits in December 2020.

The geochemistry for 2022 was discussed in detail in the Groundwater Monitoring Report by uKhosi Environmentalists in June 2022. The following summary have been extracted from the March 2022 report.

- The following was observed after assessing the water quality of the groundwater samples taken around the Nndanganeni Colliery Kopermyn, Nndanganeni Colliery Hartogshof Extension (NCHE):
    - The pH level of BTP3 exceeds the SANS Limits.
    - The manganese concentration of BH 2, BH 4 and KM 4 exceed the SANS Limits.
    - The sulphate concentration of BH 2, BH 3 and BH 4 exceed the SANS Limits.
    - The TDS concentration of BH 2, BH 3 and BH 4 exceed the SANS Limits.
    - BH10, KM2, KM4, BTP 3, MB3 and MB6 display corrosive characteristics.
    - BH3 and BH4 display scaling characteristics.

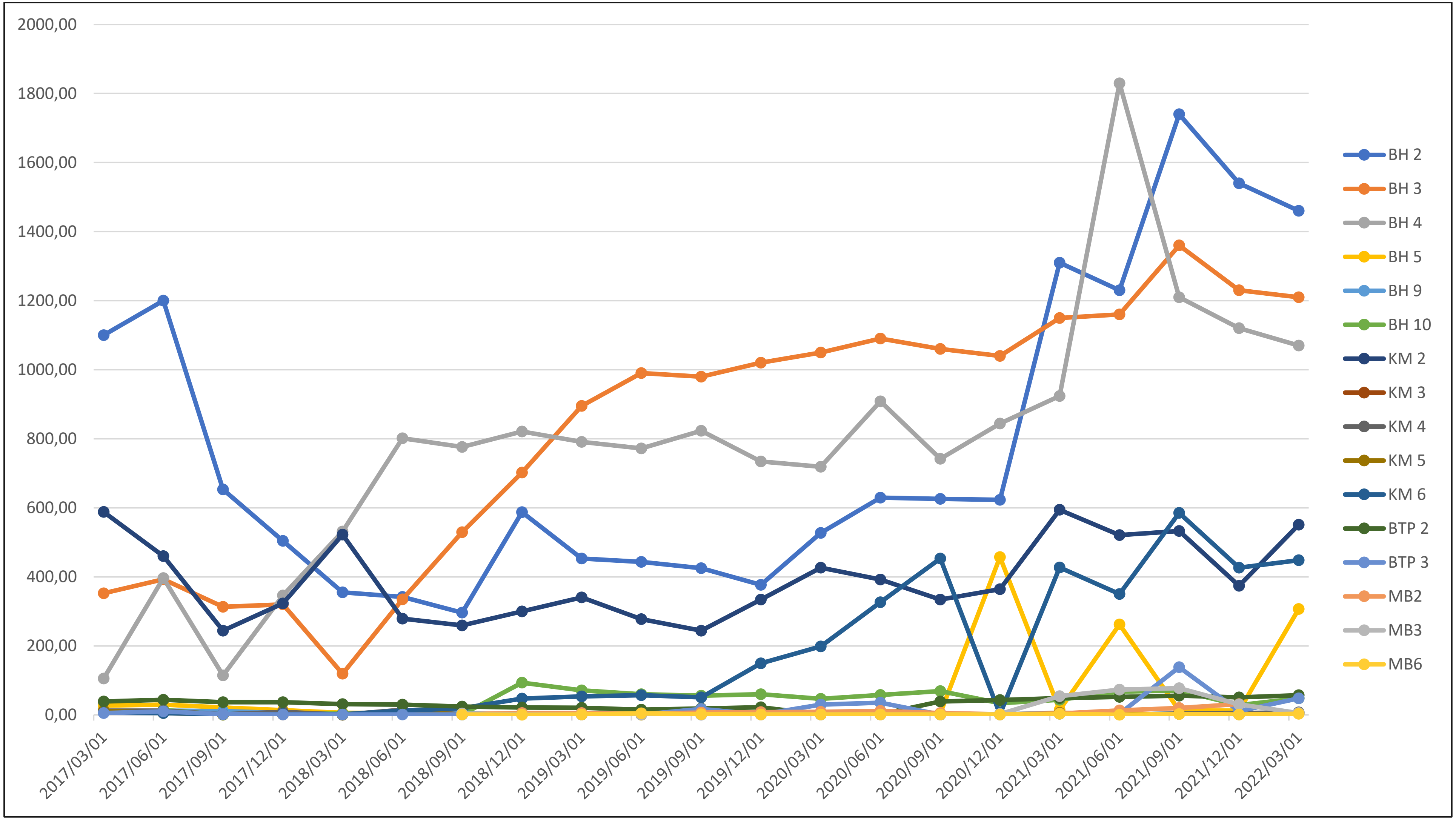

Figure 3-16: Sulphate concentration trends from 2018 to 2022 at IPP Nndanganeni Coal

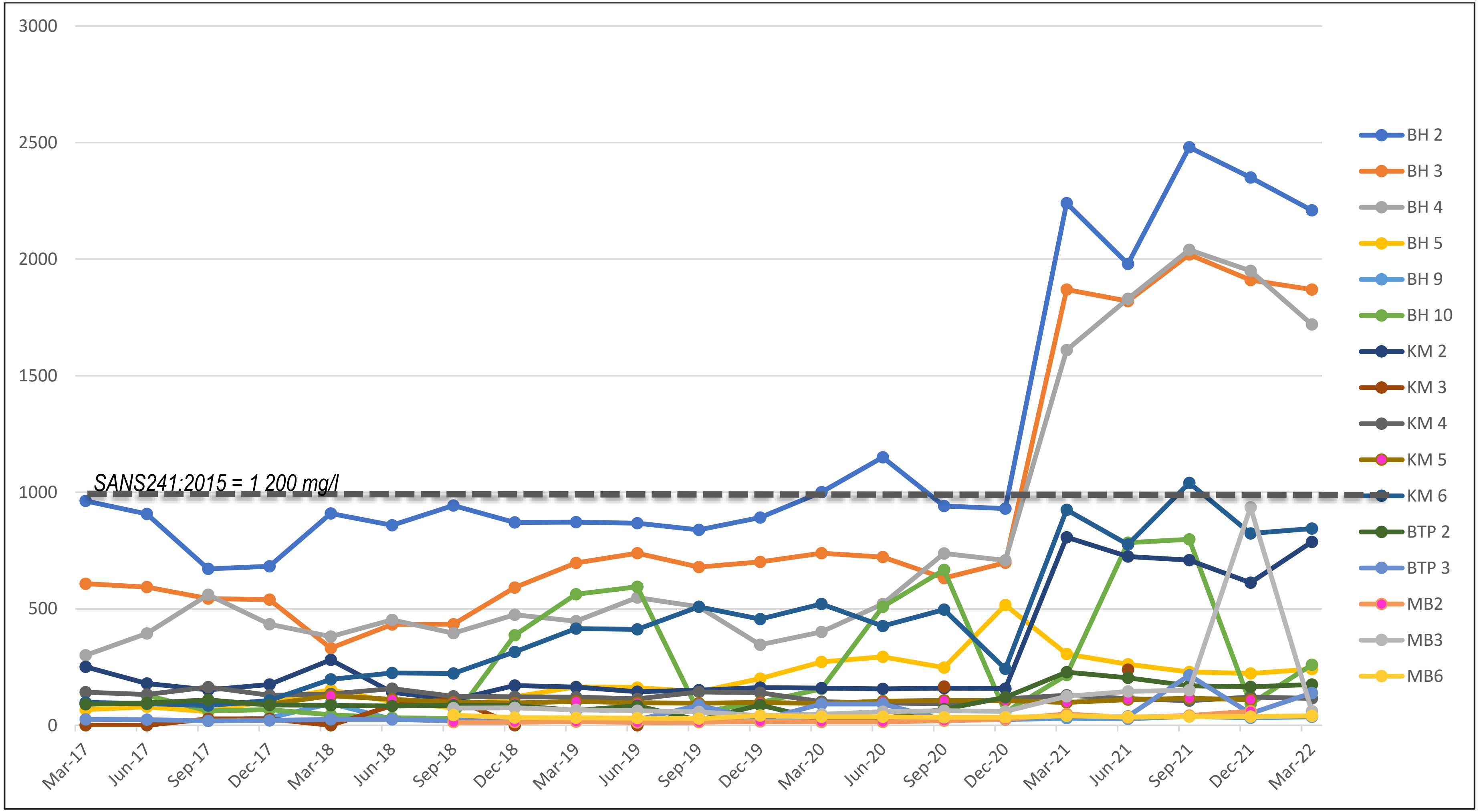

Figure 3-17: TDS concentration trends from 2018 to 2022 at IPP Nndanganeni Coal.

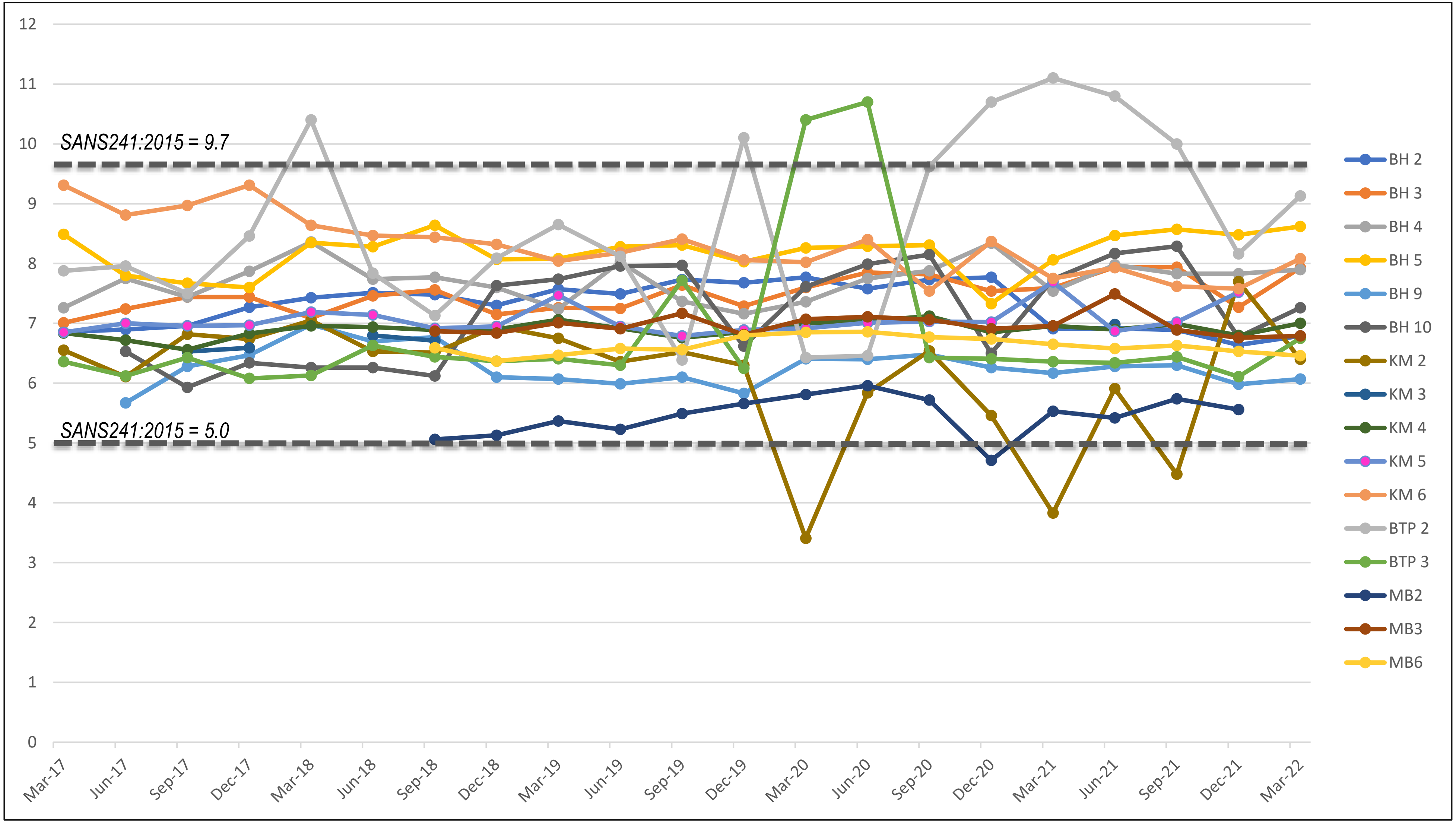

Figure 3-18: pH trends from 2018 to 2022 at IPP Nndanganeni Coal.

Groundwater Vulnerability

Groundwater vulnerability refers to the likelihood of contamination reaching a certain area/receptor after it has been introduced to the surface. For the Nndanganeni area, the vulnerability was estimated from the Aquifer Vulnerability map of South Africa (DWA, 2013) and by the Groundwater Vulnerability Classification System. According to the Aquifer Vulnerability map the Nndanganeni area is located in the least to moderate vulnerability rating area.

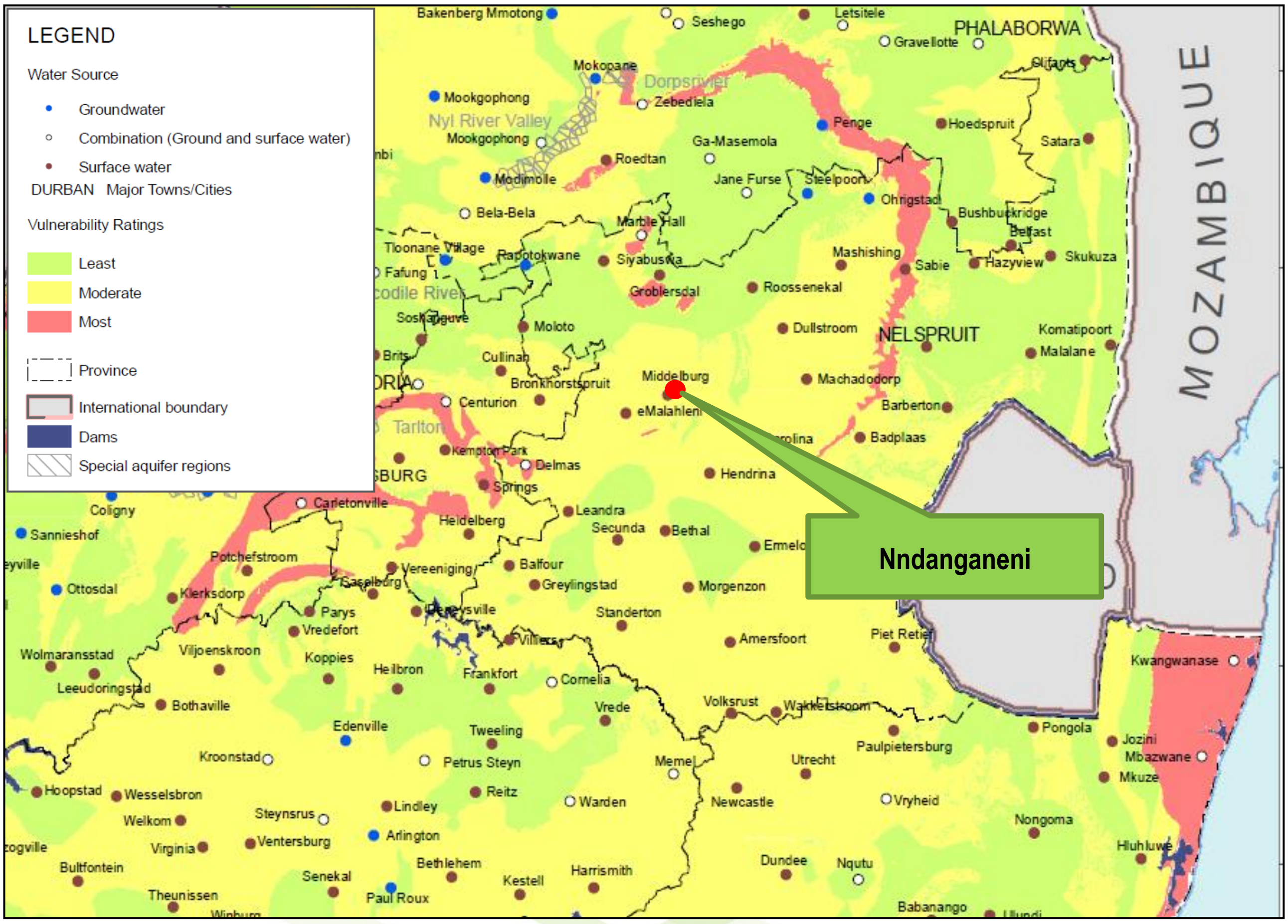

Figure 3-19: Aquifer vulnerability rating of the proposed Nndanganeni area (DWA, 2013)

Table 3-12: Groundwater Vulnerability Classification System

Rating	Depth to Water Level	Groundwater Quality	Aquifer Type- Parsons
1	> 10 m	Poor (TDS > 2 400 mg/l)	Non-Aquifer System
2	6 – 10 m	Marginal (TDS > 1 000 < 2 400 mg/l)	Minor Aquifer System
3	3 – 6 m	Good (TDS > 450 < 1 000 mg/l)	Major Aquifer System
4	0 – 3 m	Excellent (TDS < 450 mg/l)	Sole Aquifer System

Table 3-13: Groundwater Vulnerability Rating

Rating	Vulnerability
≤ 4	Low
> 4 ≤ 8	Medium
≥ 9	High

Table 3-14: Groundwater Vulnerability for Nndanganeni area

Rating	
Depth to water level	3
Groundwater quality	2
Aquifer Type	2
Total Score	**7**

According to the Groundwater Vulnerability Classification System, the Nndaganeni aquifer scored a rating of 7 which is indicative of a medium vulnerable aquifer.

Aquifer Classification

According to the Aquifer Classification map (DWA, 2012), the Nndaganeni area is situated in a minor aquifer classification area. Aquifer classification is based on the Parsons System (1995). Qualities in these aquifers can vary and are typically moderately yielding aquifers.

Table 3-15: Aquifer System Management Classes.

Sole Aquifer System	An aquifer that is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
Major Aquifer System	Highly permeable formation, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (less than 150 mS/m).
Minor Aquifer System	These can be fractured or potentially fractured rocks that do not have a primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large volumes of water, they are important both for local suppliers and in supplying base flow for rivers.
Non-Aquifer System	These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although impermeable, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Special Aquifer System	An aquifer designated as such by the Minister of Water Affairs, after due process.

Two main aquifer systems exist in the Nndanganeni area. Firstly, is a swallow, weathered aquifer which is found in the transitional soil and weathered bedrock zone. Due to direct recharge and dynamic groundwater flow through the weathered sediments, the natural groundwater qualities are often good. The direct recharge and dynamic groundwater flow are also the reason why this aquifer is vulnerable to pollution. Water levels in this aquifer are often shallow (few meters below ground level) and follow the surface topography.

Secondly is a deeper semi-confined to confined fractured aquifer where groundwater flow is predominantly fractured flow. The fractured Karoo aquifer consists of sedimentary successions of siltstone, shale, sandstone and the coal seams. Groundwater flow is dominated by secondary porosities like faults, fractures, joints, bedding planes, or other geological contacts. Yields can be higher in this aquifer along these geological structures. The rock matrix is characterised by low permeability. Borehole yields in the Ecca aquifers are generally low and can be expected to be less than 2 l/s.

Aquifer Protection Classification

As part of policy and regulation development and implementation, the aquifer classification alone is not sufficient. To minimise misinterpretation, the decision support tool is also needs to be incorporated as part of aquifer classification (Parsons, 1995). The combination of the Aquifer System Management Classification and the Aquifer Vulnerability Classification rating is referred to as the Groundwater Quality Management (GQM) classification, which provide a level of aquifer protection.

GQM = Aquifer System Management x Aquifer Vulnerability

Table 3-16: GQM Classification for the proposed Nndanganeni Area.

Aquifer System Management Classification		Aquifer Vulnerability Classification		GQM		GQM
Class	**Points**	**Class**	**Points**	**Index**	**Level of protection**	**Nndanganeni**
Sole Source Aquifer System	6	High	3	<1	Limited	
Major Aquifer System	4			1 - 3	Low	
Minor Aquifer System	2	Medium	2	3 - 6	Medium	4
Non-aquifer System	0			6 - 10	High	
Special Aquifer System	0-6	Low	1	>10	Strictly non-degradation	

The level of protection for the Nndaganeni according to the GQM Index is 4. This indicates a medium level of protection. Based on the findings of the geohydrological study it is very important that a monitoring protocol should be in place for the proposed project area.

The DWS (previously DWA – Department of Water Affairs) has also compiled a susceptibility map for South Africa (2013). This map indicates the qualitative measure of the relative ease with which an aquifer can potentially be contaminated. According to the aquifer susceptibility map, the Nndaganeni area is also classified as medium susceptible to contamination.

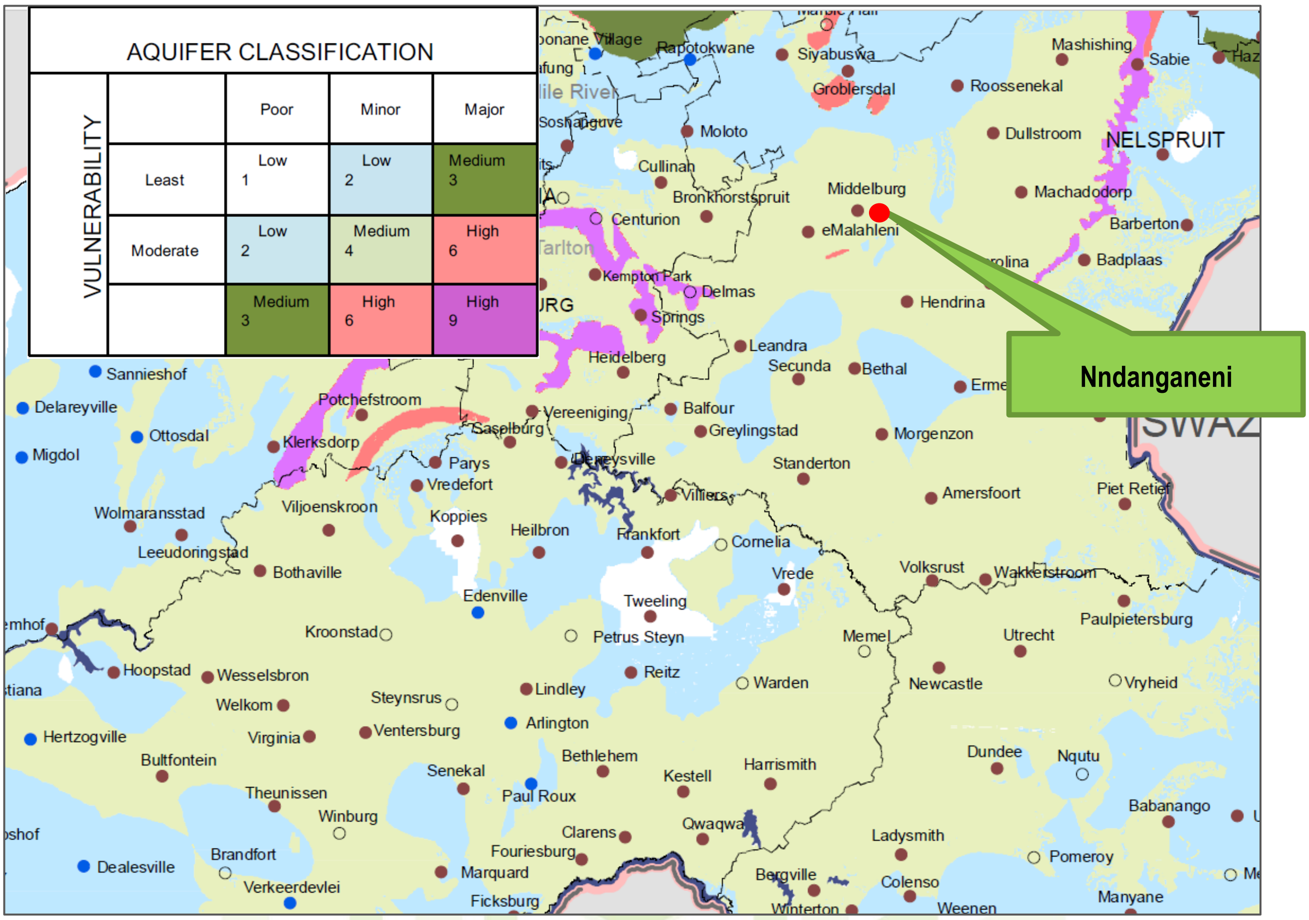

Figure 3-20: Aquifer susceptibility map for the Ndanganeni mining area.

Groundwater Moddeling

Model Set-Up And Boundaries

The numerical model grid indicating the model boundaries are presented in the figure below. The model dimensions used for the IPP Nndanganeni numerical groundwater model is summarised in the table below.

The following model boundaries have been used in the IPP Nndanganeni numerical model:

- No-flow boundaries: These are typically the topographical high or low regions in the model area. As the name suggests no groundwater flow occurs over these boundaries. These boundaries are found at the edge between the active and inactive cells in the model.
- River nodes were used in the northern, western and southern region of the model and act as constant head boundaries. The river node will add or remove water from the aquifer as the water level increases or decreases. The water level at the river nodes therefore remain relatively constant.

Table 3-17: Model extent and aquifer parameters

Model Grid Size	Easting = 17 740 Northing = 11 240
Rows	562
Columns	887
Cell Size	20 x 20 m
Layer Thickness	Layer 1 = 15 m Layer 2 = 200 m
Layers	Layer 1 = Confined / Unconfined Layer 2 = Confined
Transmissivity	Shallow weathered aquifer = 1.5 m^2/day Deep, secondary aquifer = 0.2 m^2/day
Recharge	1.4%

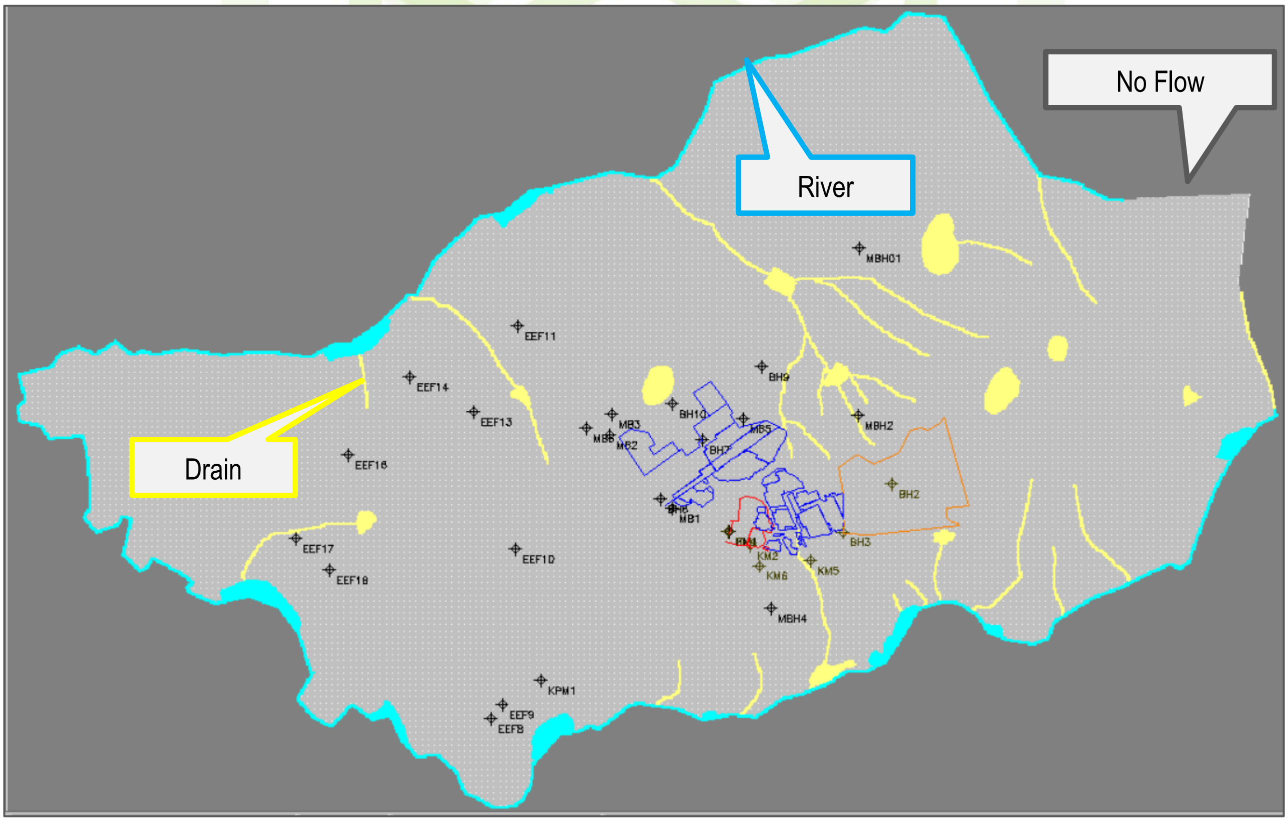

Figure 3-21: IPP Nndanganeni model domain and boundaries.

Groundwater Elevation And Gradient

Steady state flow model calibration involves the varying of aquifer parameters in the model until the observed water levels correlates well with the measured water levels. The measured water levels must represent the levels prior to any impacts from mining activities. Steady state water levels therefore represent "reality" prior to changes caused by mining activities.

Water level elevations used for steady state model calibration was obtained from hydrocensus information as well as some mine monitoring borehole information (GPT, 2017). Only water level information for the shallow aquifer was available for model calibration. By adjusting the aquifer parameters in the model to the values indicated in (Table 3-17), a very good correlation of 96% were obtained (Figure 3-22).

The IPP Nndanganeni mining area is situated on a groundwater divide area. Groundwater from the area will flow towards the north-north-west, and south- south-west. Groundwater within the IPP Nndanganeni model area decrease from approximately 1 635 mamsl (on highest elevation in mining area) to 1 580 mamsl in both the flow directions. Groundwater gradients over the area is approximately 1.3% (north-north-west) and 1.8% south-south-west.

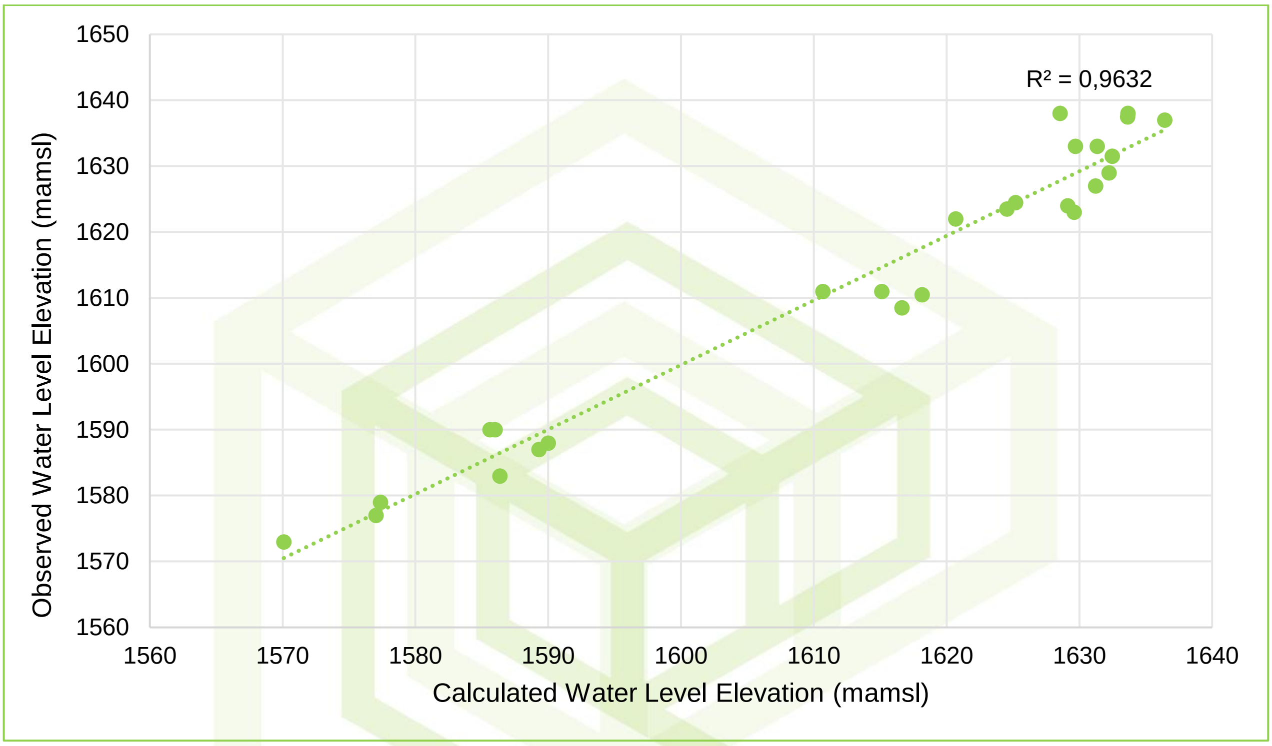

Figure 3-22: Model calculated water level elevations vs observed water level elevations correlation.

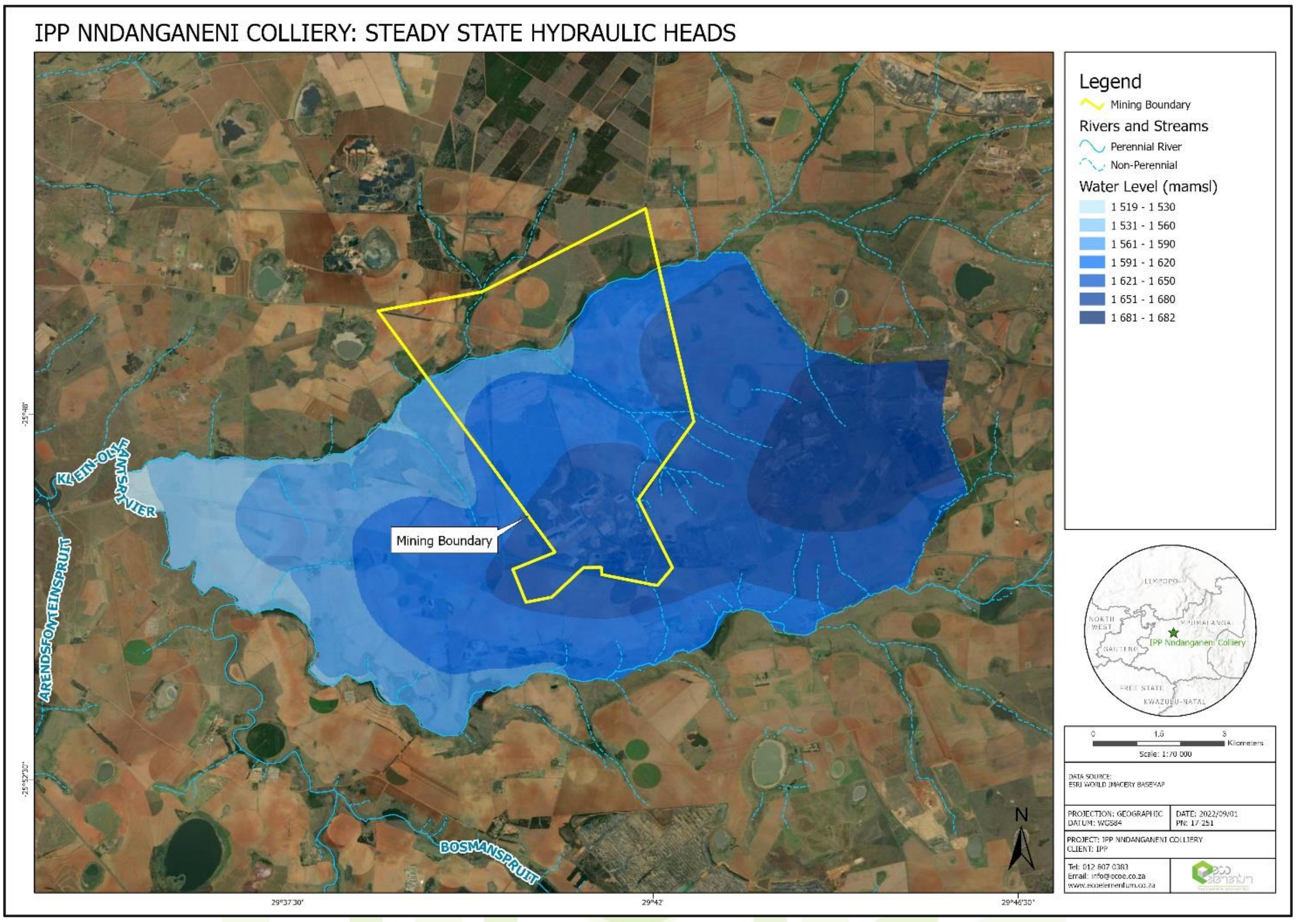

Figure 3-23: Steady state water level elevation contours

Geometric Structure Of The Model

The model grid simulates an area of almost 200 km² (17.7 km E and 11.2 km N). The grid cells are squares with a dimension of 20 x20 m. The model grid therefore consists off 498 494 cells. Two layers were simulated in the model. Layer 1 represents the shallow, weathered aquifer and was assigned a thickness of 15 m. The deep, secondary aquifer were simulated with Layer 2 with a thickness of 200 m.

Groundwater Sources And Sinks

Groundwater sources and sinks are features that either add (source) or remove (sink) water from the aquifer. During the steady state model calibration river nodes representing the streams to the northern, eastern and southern boundary of the model can act as either a sink or a source. Drain nodes were used to represent less prominent streams, which is not perennial and therefore mostly act as a sink. Recharge also act as a source since it contributes to the water make in the model. A recharge of 1.4% were used for the IPP Nndanganeni model area. During the transient model simulations, the different activities of the mine will act as sources and sinks. Sources will typically include PCD's, return water dams and other "wet" sources that add to the water make of the model (artificial recharge). The opencast mining operations will act as groundwater sinks, since groundwater flow will be towards the pits / voids due to dewatering and therefore remove water from the model.

Conceptual Model

A conceptual model involves the construction of a simplified version of the real world. All the geohydrological information gathered by different means including during the hydrocensus, aquifer tests, chemical analysis etc. are used to construct this simplified model. The conceptual model forms the basis of the numerical model and aids in understanding the geohydrological characteristics of the model area. The conceptual model was mainly summarised from the study compile for IPP Nndanganeni by GPT in 2017.

The basis of the conceptual model can be summarised as follows:

- The IPP Nndanganeni mining area is located in the highveld region of Mpumalanga and in a summer rainfall region;
- The mean annual precipitation is ± 680 mm/annum, while the evaporation is estimated at 1 797 mm/annum;
- The recharge can be up to 3 to 5% of the mean annual precipitation;
- The IPP Nndanganeni mining area is situated on a groundwater divide area. Groundwater from the area will flow towards the north-west and west;
- A large portion of the project site is covered with unconsolidated sediments. The encountered lithology's were generally similar in each hydrogeological exploration hole consisting of:
    - Weathered sandstone and / or shale – weathering is relatively shallow ranging between ~1 m (bgl) and ~6 m (bgl);
    - Coal seam – coal seams interlayered with sandstone, shale and siltstone of various thickness;
    - Interlayered Sandstone and Shale – fresh sandstone and shale; and
    - In addition to the above, rhyolite was also encountered in some boreholes.
- Geological structures such as dykes and faults are known to exist in the region of the IPP Nndanganeni mining area. These structures and the weathered zone are possible pathways of elevated groundwater flow and contamination migration;
- Two main aquifer systems are found in the IPP Nndanganeni mining region. Firstly, the shallow weathered aquifer and secondly, the deeper, secondary aquifer;
- Water levels in the monitoring and hydrocensus boreholes varied between 0.2 and 17 mbs.
- The cone of depression due to dewatering is not expected to extent more 450 400 m from the pit areas;
- Significantly elevated sulphate concentrations have been observed in BH2, BH3, BH4, KM2 and KM6 over the 2022 monitoring period. Increasing trends over this period has also been observed in these boreholes. The increasing sulphate concentrations in evident of increasing impacts from the coal mining activities;
- The following was observed after assessing the water quality of the groundwater samples taken around the Nndanganeni Colliery Kopermyn, Nndanganeni Colliery Hartogshof Extension (NCHE):
    - The pH level of BTP3 exceeds the SANS Limits.
    - The manganese concentration of BH 2, BH 4 and KM 4 exceed the SANS Limits.
    - The sulphate concentration of BH 2, BH 3 and BH 4 exceed the SANS Limits.
    - The TDS concentration of BH 2, BH 3 and BH 4 exceed the SANS Limits.
    - BH10, KM2, KM4, BTP 3, MB3 and MB6 display corrosive characteristics.
    - BH3 and BH4 display scaling characteristics.

For the risk of groundwater impacts to occur three factors should be present:

- Source – Generates and emits contamination.
  - The area at which a groundwater contaminant is released as seepage or leachate.
  - Point source can be traced to the exact location of the source. Can include PCDs, Discard dumps, Tailings Facilities, etc.
  - Diffuse source's origin is unknown.
- Pathway – the path along which the contaminant is transported.
  - For a contaminant to reach a receptor it has to move along a pathway. Aquifer characteristics such as hydraulic conductivity, and hydraulic gradient play an important role. Contamination will flow faster in the weathered zone aquifer and along the fractures and fissures in the secondary aquifer.
- Receptor – Receives the contamination.

Groundwater Sources:

- Recharge:
  - Natural recharge: in the region of the proposed project the natural recharge is estimated between 1 and 3% of the MAP. Rivers and drainage systems can also be seen as potential recharge sources. Gaining or losing streams play a role here. Losing streams "lose" their water to the aquifer, making it a natural recharge source.
- Contamination Sources: At the proposed Mining the potential contamination sources include the opencast pit itself and the ROM pad.

Groundwater pathways:

- Fault zones and dykes surrounding the proposed project area may be potential pathways for groundwater contamination migration. No site-specific geological structures were recorded during the geophysical survey. Where these features are present contamination may flow further in a shorter period of time.
- The weathered zone aquifer is a major pathway for contamination transport. The aquifer parameters in this aquifer allow for greater mass transport rates.

Groundwater receptors:

- River Systems: any contamination from potential sources may be discharged in terms of baseflow into the receiving river or surface water systems in the area. The Northern pan is located 100 m from the Nndaganeni pit and is expected to be impacted on in terms of the Nndaganeni Mining activities.

- Potential groundwater users: In the area of the proposed mining operation's impact zone no known groundwater users exist. The impact zone may increase if pathways such as geological structures are present, and the activities may also impact the groundwater users within this increased impact zone.

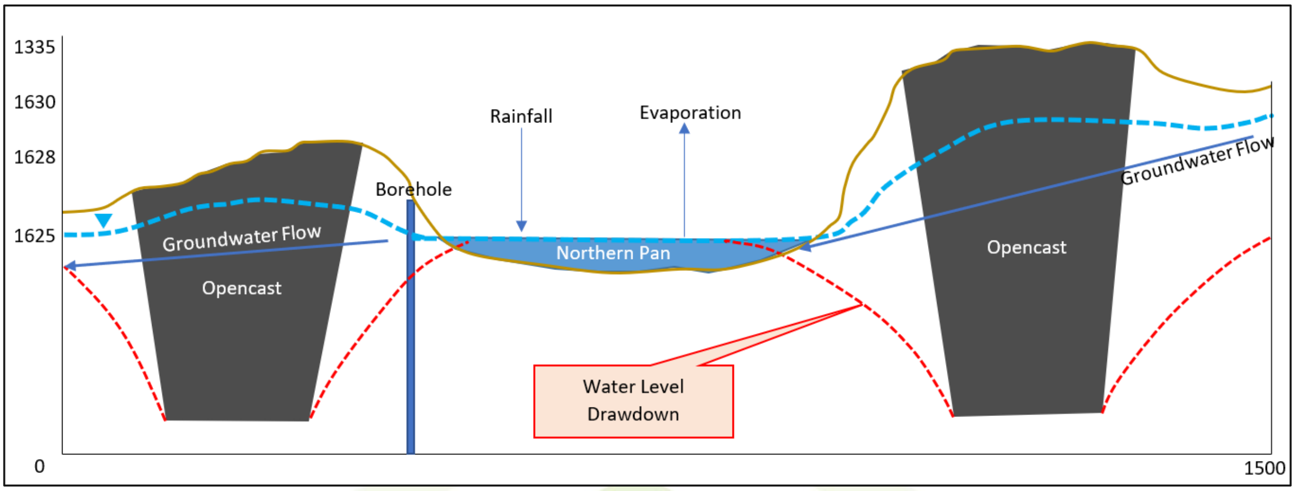

Figure 3-24: Conceptual model of the Nndaganeni mining operation indicating impacts on the Northern pan-West to East cross section

Numerical Model

The numerical groundwater model is used to represent both the flow and contamination/pollution migration of the groundwater regime. The numerical model consists of:

1. Groundwater Flow model; and
2. Mass Transport Model.

Numerical Model

After the steady state calibration have been obtained, the model is set-up for transient state simulations. The boundaries, mesh size, layer type, top and bottom of the layers and aquifer transmissivity of the model remain as defined in the steady state model. The transient state model consists of several stress periods which represents different time frames of the mining activities. The groundwater flow and mass transport conditions remain the same during a stress period. Sources and sinks can change between stress periods but not within a stress period. The groundwater low model for the IPP Nndanganeni mining area consist of 11 stress periods.

Table 3-18: The groundwater low model for the IPP Nndanganeni mining area

Stress Period	Duration (Years)	Description
1 - 2	1 year each	Simulates the historic opencast mining and mining during 2012.
3	3 years	Simulates the opencast mining from 2014 to 2016 in addition to potential pollution sources.
4 - 10	1 year each	Simulates opencast mining from 2017 up to 2022.
11	1 Year	Simulates the mining up to the end of the operational phase.

Mass Transport Model

The mass transport model is used to simulate contamination migration in the aquifer. The main contaminant and a major concern in the coal mining environment is sulphate. Sulphate contamination was simulated for the IPP Nndanganeni mining area. Available monitoring information from IPP Nndanganeni monitoring program was used to mimic the current sulphate contamination at the mine. The boreholes mostly affected is situated in rehabilitated mining areas (KM6, BH2 and BH3) and downgradient of the plant area (KM2, BH4 and KM5).

No life of mine and coal floor contour information for the southern rehabilitated opencast pit was available at the time of this study. Boreholes KM6, BH5 and KM4 are situated in this area. Sulphate concentrations in these boreholes indicate impacts from this rehabilitated opencast area.

Table 3-19: Average observed sulphate concentrations in 2022 versus model calibrated concentrations (mg/l)

Borehole	Model Calculated SO_4 (mg/l)	2022 Observed SO_4 (mg/l)
BH2	1458	1460
BH3	1233	1210
BH4	1077	1070
BH5	312	307
KM2	542	551
KM6	454	448

Mass Transport Model Results of the Model

Pre-facility

The pre-facility or steady-state water level elevations were discussed in above. These elevations represent the conditions before any impacts from the Nndaganeni activities.

During-facility

The main aim of this geohydrological report is to investigate the expected impacts of the planned activities at Nndaganeni. The following activities are planned to take place at the Nndaganeni area and were also simulated in the model:

1. Opencast Pit.

The client provided information on the pit floor elevation which varied between 1 608 to 1 615 mamsl. The Life of Mine period is also simulated at 8 years.

The table below represents the total estimated groundwater inflow to the opencast mining void during mining. The total inflows are estimated to range between 20 and 160 m^3/day during the life of mining. The estimated groundwater inflows to the pit are presented in the table below.

Table 3-20: Estimated groundwater inflows over the mining period (m3/day).

Period	Estimated Average Groundwater Inflows (m^3/day)
Year 1	160
Year 2	70

Year 3	80
Year 4	100
Year 5	100
Year 6	30
Year 7	20
Year 8	20

The simulated maximum drawdown cone in the shallow aquifer as a result of the opencast mining activities is presented in the figure below. The maximum extent of the drawdown cone is not expected to exceed 450 m from the opencast boundaries. The maximum depth of drawdown to the opencast is expected to be less than 11 meters towards the eastern boundary.

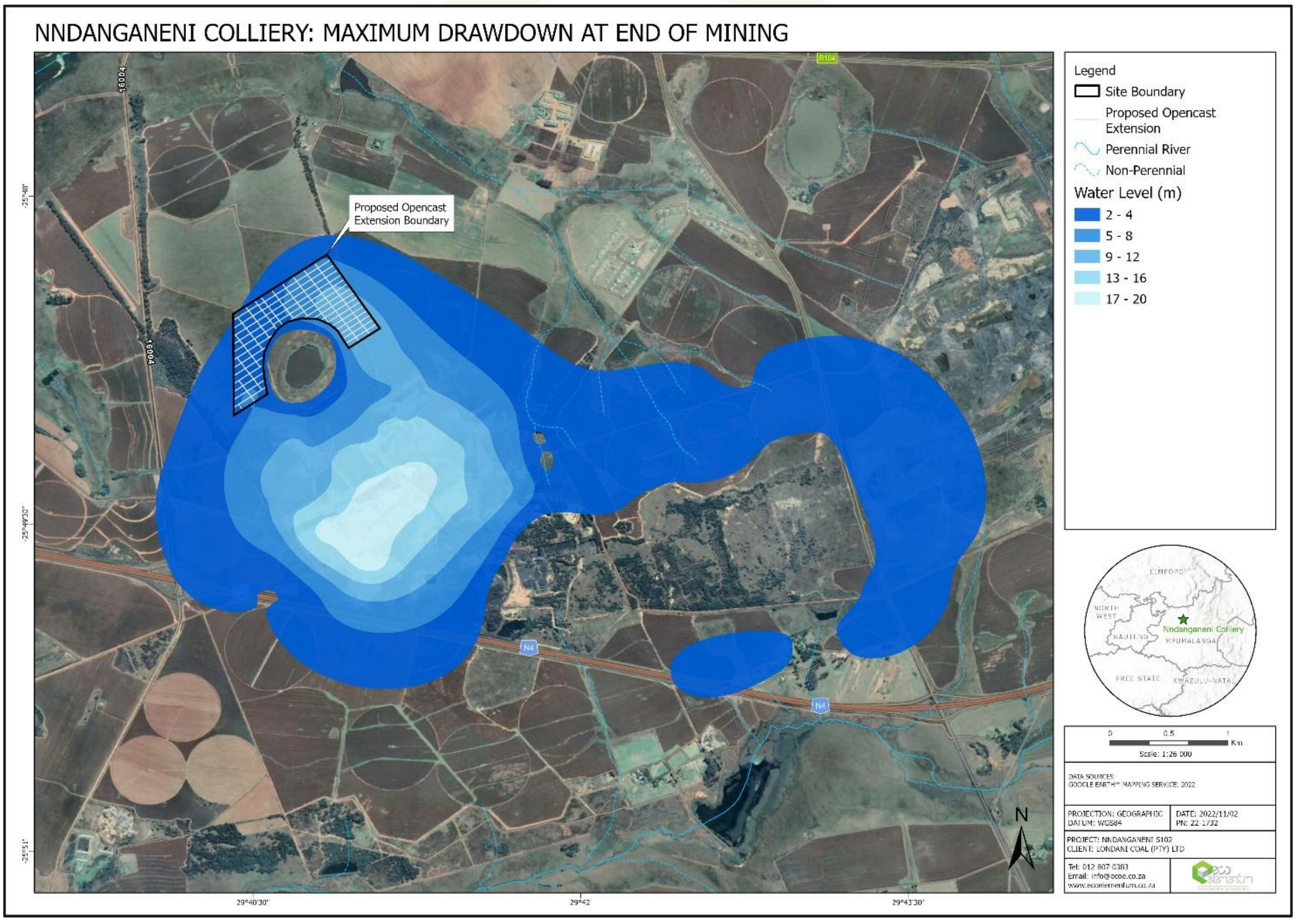

Figure 3-25: The simulated maximum drawdown cone in the shallow aquifer for the Nndaganeni area.

During the operational phase and for a period after, until the water level has reached equilibrium, a contamination plume will not migrate away from the opencast pit. This is because the opencast void act as a groundwater sink. Contaminated groundwater, as a result of acid mine drainage, will be contained within the opencast area. The maximum extent of the mass transport plume at the end of the operational phase is not expected to exceed 30 m from the mine boundary. The maximum simulated sulphate concentration in the pit area at the end of mining is 790 mg/l. The mass transport simulations for the shallow aquifer at the end of the proposed mining operations are presented in the figure below.

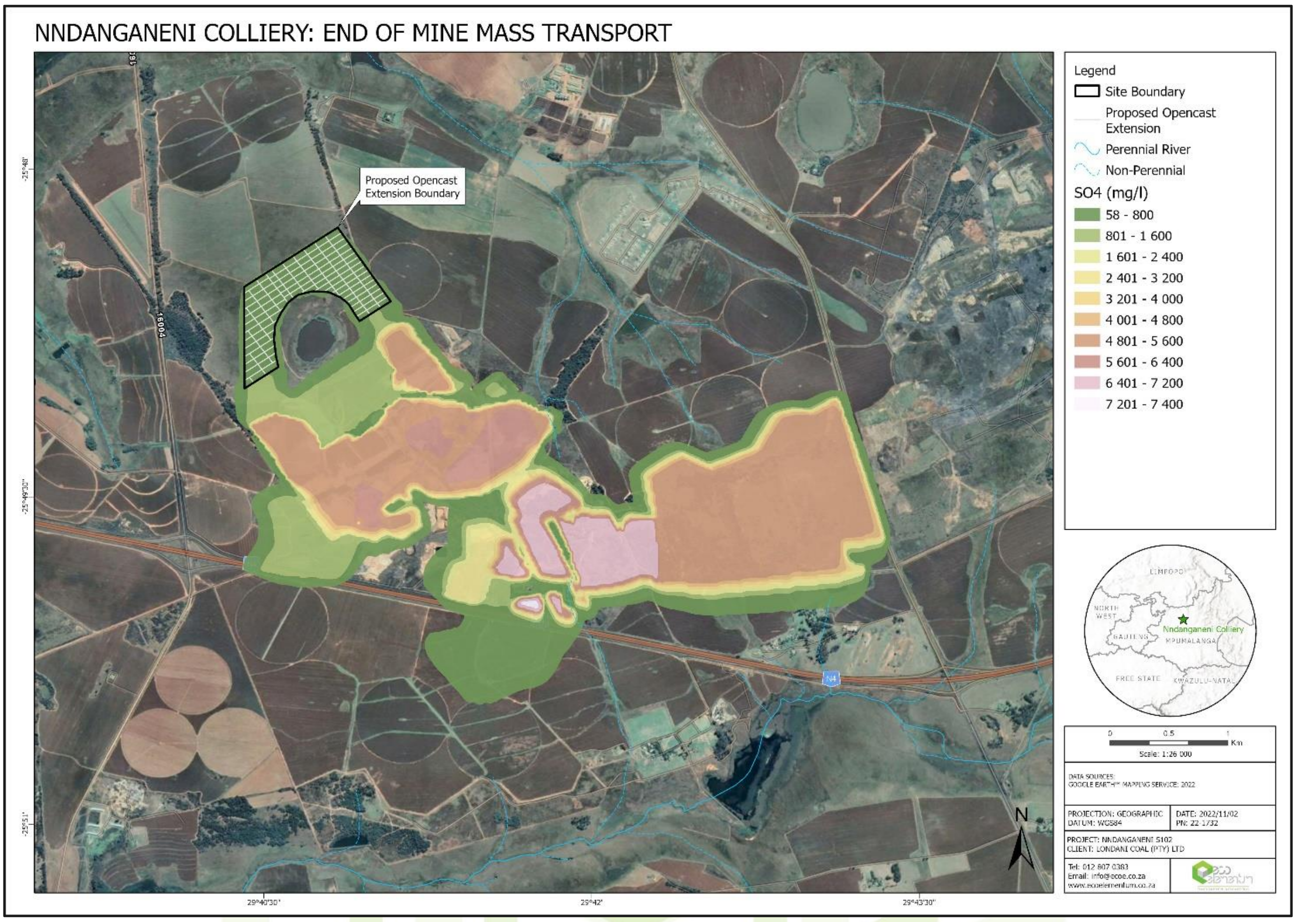

Figure 3-26: Simulated mass transport at end of the operational phase in the shallow aquifer at Nndaganeni area

Post-facility

For the post-facility model simulations, the model was run an additional 100 years for both the flow and mass transport models. The mass transport contours for the shallow aquifer are represented in the figure below.

The most common/possible effects of a coal mining operation post-facility are:

- Decanting of the opencast into the shallow aquifer and on the surface.
- Acid generation and therefore decrease in groundwater qualities in the opencast.
- Down-gradient movement of a contamination plume.

In the case where carbonaceous material is placed at the base of the pit, the material will be covered by water at the decant elevation which leads to it not being exposed to oxygen. The exposure of carbonaceous material to oxygen will result in redox reactions and continuous potential for acid generation of exposed material.

According to GCS, 2015 the existing pit will fill to decant at 11 to 18 years with a total decant volume varying between 150 and 290 m^3/day. The estimated filling time of the new opencast mine extension void is presented in Table 3-21Table 3-21. The estimated filling time of the proposed pit is 35 years. The decant elevation of the pit is approximately 1 625 mamsl and is above the highest elevation of the pit floor. The pit floor will be completely covered by water at the decant elevation in the pit. The decant volume can be as high as 130 m^3/day. Decant is expected on the western boundary of the old opencast area.

Table 3-21: Estimated fill time of the Nndaganeni pit.

	Nndanganeni
Annual Rainfall (m/a)	0,68
Decant Elevation (mamsl)	1625
Mined Area (m2)	562900
Mined Volume Below Decant Elevation (m3)	6754800
Annual Recharge to Rehab Pit area (m3/y):	
10%	38277
12,50%	47847
15%	57416
Voids (m3):	
20% porosity	1350960
25% porosity	1688700
30% porosity	2026440
Average Time to Decant (years)	**35**
Average expected decant rate (m3/d)	**131**

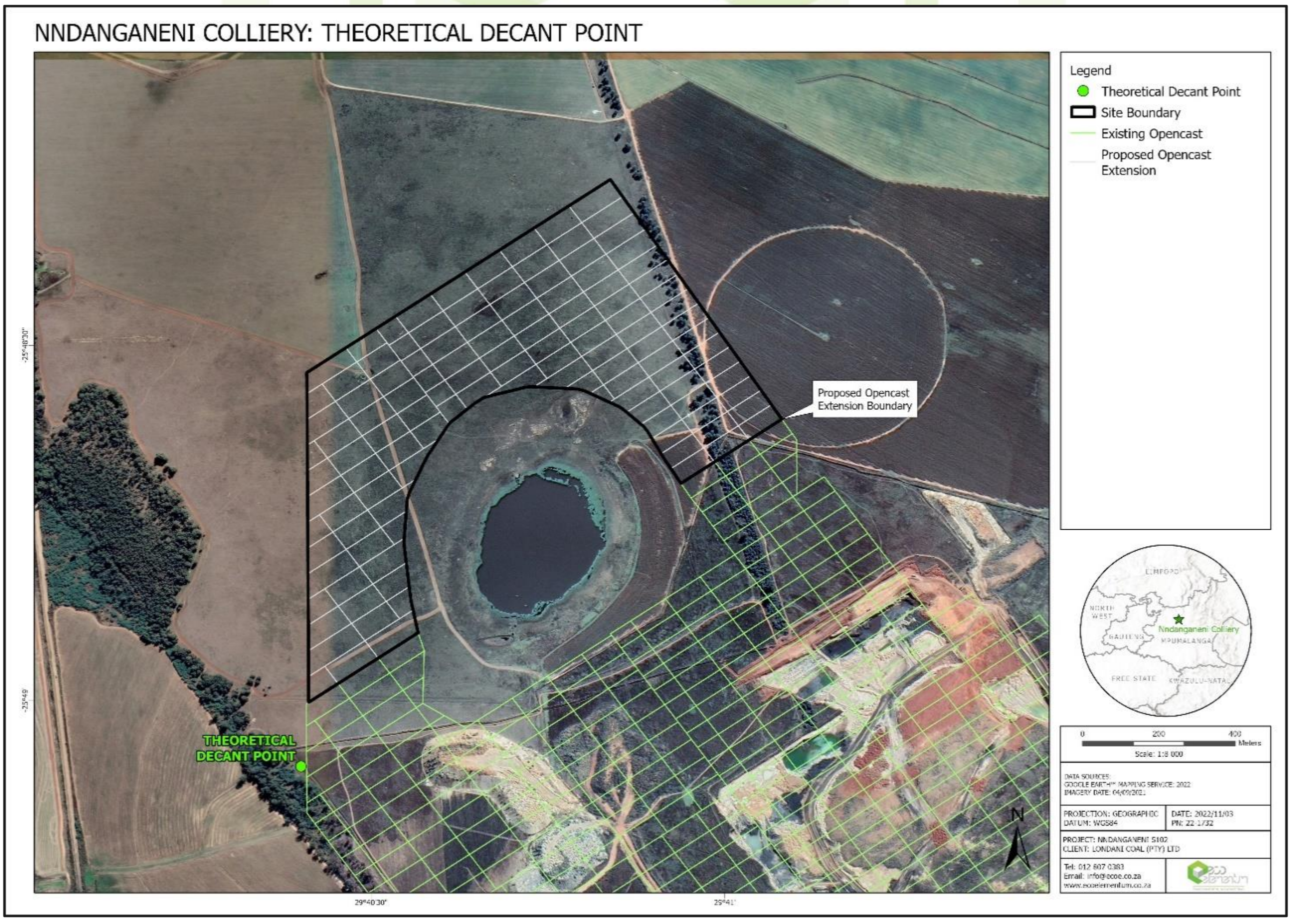

Figure 3-27: The potential theoretical decant point position.

The simulated groundwater contamination plume at 100 years post-facility in the shallow aquifer is presented in Figure 3-28. The plume will migrate away from the opencast area in a predominantly western, northern and north-eastern direction similar to the groundwater flow directions. The sulphate concentrations in the opencast area increase as a result of acid generation to a concentration over 2 700 mg/l. The contamination plume from the opencast is not expected to an extent more than 850 m over the period of 100 years post-mining. The sulphate concentration reaching the Northern Pan can be as high as 5 850 mg/l but also emanating from the existing mining area.

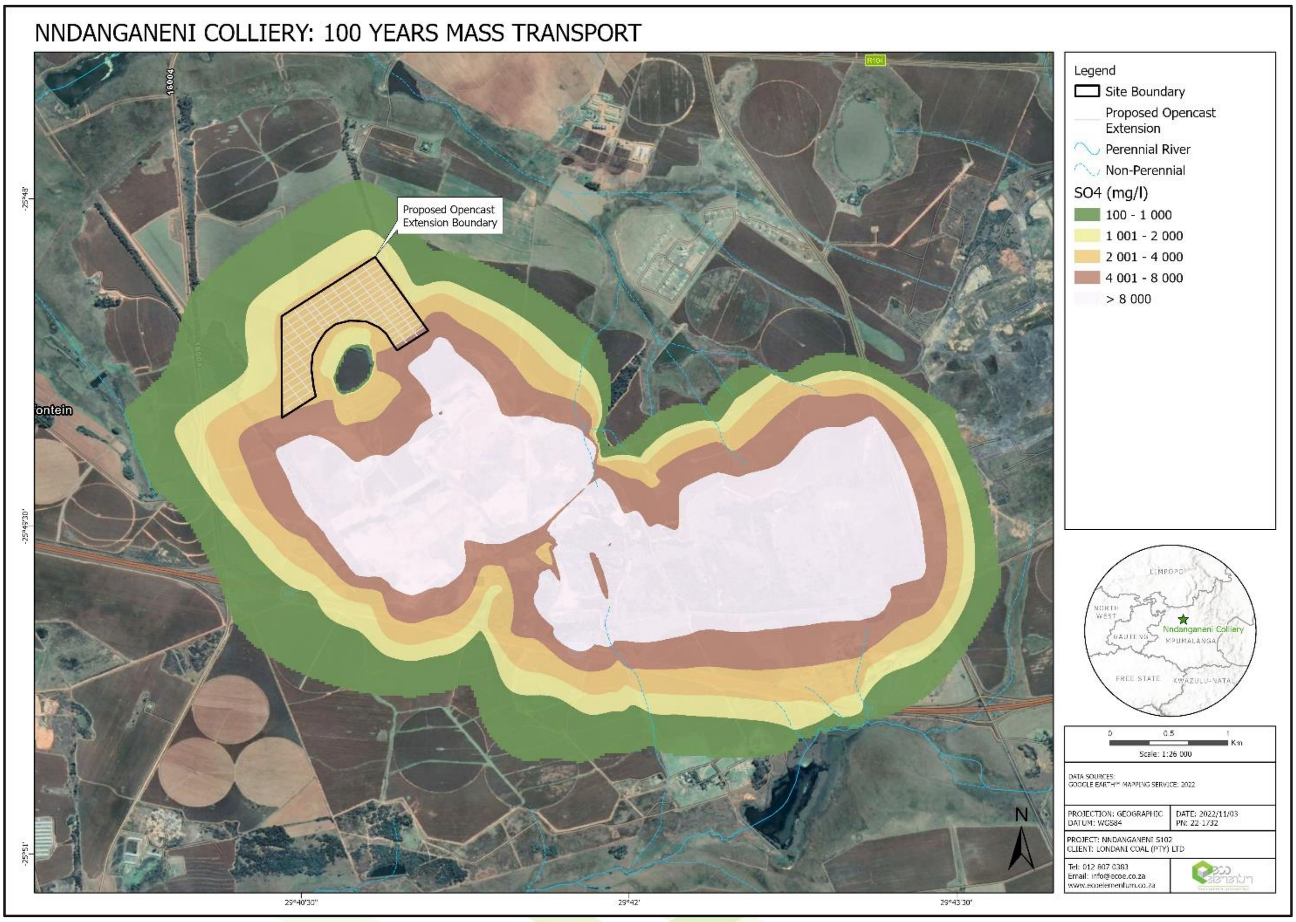

Figure 3-28: Model Simulated groundwater contamination plume in the shallow aquifer at 100 years post facility.

Wetlands / Watercourses

Examination of the National Freshwater Ecosystem Priority Areas (NFEPA)'s databases were undertaken for the project. The NFEPA project aims to produce maps which provide strategic spatial priorities for conserving South Africa's freshwater ecosystems and supporting sustainable use of water resources. These strategic spatial priorities are known as Freshwater Ecosystem Priority Areas, or FEPAs. FEPAs are determined through a process of systematic biodiversity planning and involved collaboration of over 100 freshwater researchers and practitioners. They are identified based on a range of criteria dealing with the maintenance of key ecological processes and the conservation of ecosystem types and species associated with rivers, wetlands and estuaries (MacFarlane et al., 2009).

The assessment of the study site involved the investigation of aerial photography, GIS databases including the NFEPA and South African National Wetland maps as well as literature reviews of the study site in order to determine the likelihood of wetland areas within this site.

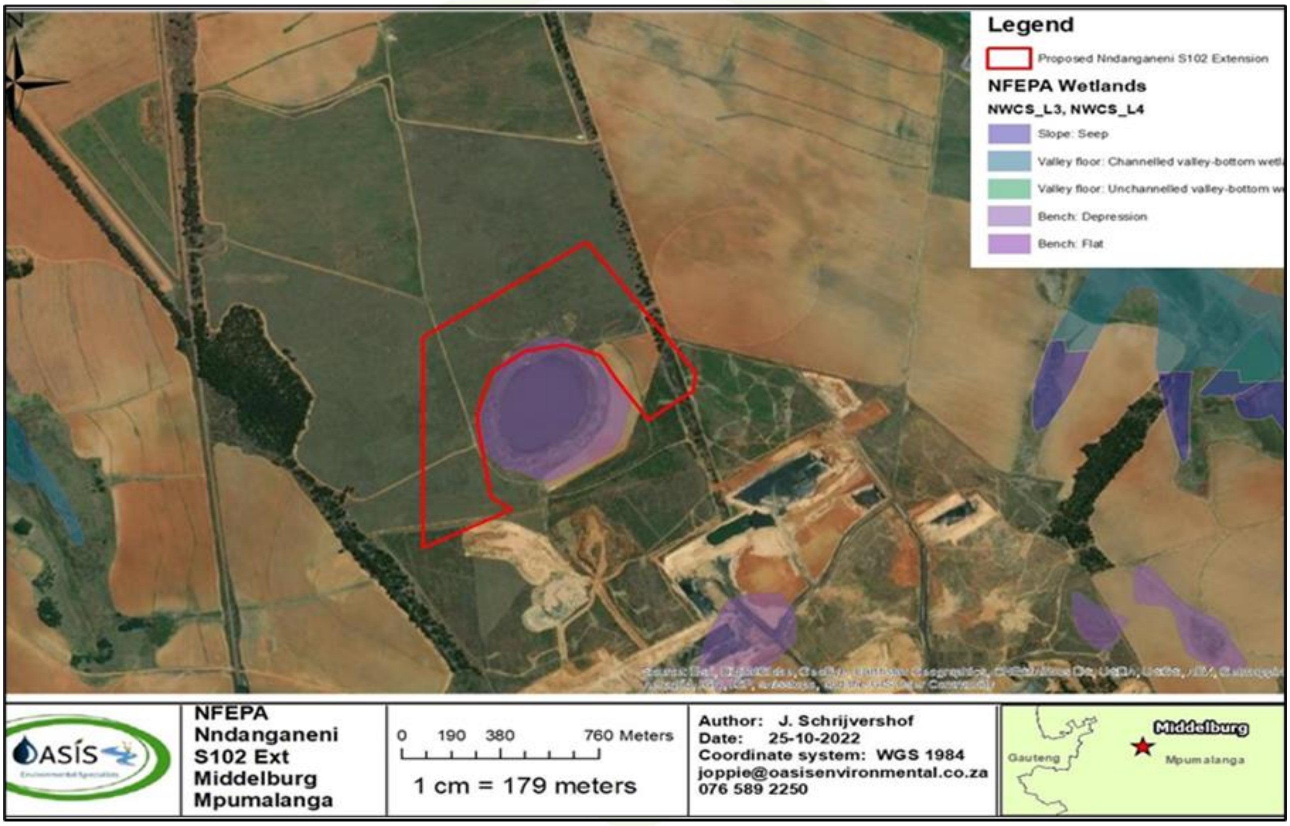

Figure 3-29: Proposed Nndanganeni Extension - NFEPA Wetland map

Wetland terrain indicator

The topography of an area is generally a good practical indicator for identifying those parts in the landscape where wetlands are likely to occur. Generally, wetlands occur as a valley bottom unit however wetlands can also occur on steep to mid slopes where groundwater discharge is taking place through seeps (DWAF, 2005). In order to classify a wetland system, the localised landscape setting must be taken into consideration through ground-truthing of the study site after initial desktop investigations (Ollis et al., 2014).

The study site can be characterised as having a relatively flat topography. The site ranges in altitude from 1585 m to 1676 m above sea level. A Digital Elevation Model (DEM) of the aerial photography of the site revealed depression in landscape west of the proposed mining boundary. These areas identified during the desktop assessment where then assessed in more detail during the field investigation and confirmed to be a valley bottom system.

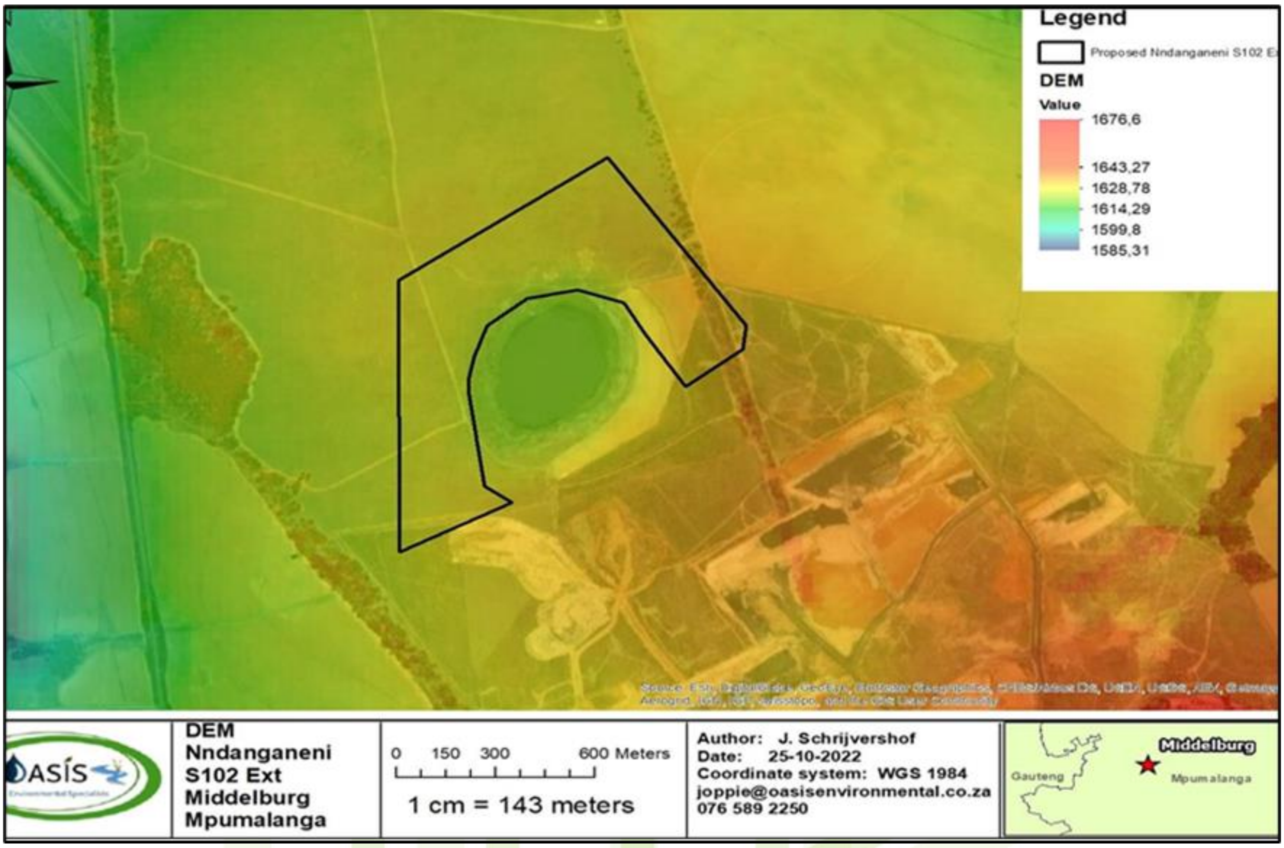

Figure 3-30: Proposed Nndanganeni Extension - Digital Elevation Model map

Wetland soil wetness and soil form indicator

Wetland areas were identified and mainly delineated according to the presence of hydric (wetland) soil types. Hydric soils are defined as those which show characteristics (redoximorphic features) resulting from prolonged and repeated saturation. Characteristics include the presence of mottling (i.e., bright insoluble manganese and iron compounds) a gleyed matrix and/or Mn/Fe concretions.

The presence of redoximorphic features are the most important indicator of wetland occurrence, as these soil wetness indicators remain in wetland soils, even if they are degraded or desiccated (DWAF, 2005). Redoximorphic features are soil characteristics which develop as a result of prolonged and repeated saturation. It is important to note that the presence or absence of redoximorphic features within the upper 500 mm of the soil profile alone is sufficient to identify the soil as being hydric, or non-hydric (Collins, 2005).

Hydric soils identified within the site were classified as a sandy clay loam with mottling. This is a widely encountered wetland soil in South Africa associated with wetland systems (Fey, 2010). Terrestrial soils sampled were dominated by Clovelly and Hutton soils. Soil properties identified on site are shown below.

Table 3-22: Information used to inform the wetland delineation for the wetlands identified within the pan area adjacent the proposed Nndanganeni boundary.

Soil Form and Horizons		Soil	Zone of wetness	Observations
Hydric Soil				
Sandy Clay Loam	Orthic A	Sandy Clay	Permanent, Seasonal and Temporary zone	Gleyed matrix, sandy-clay soil identified. No mottling was found
	Unspecified with signs of wetness			
Terrestrial Soil				
Clovelly	Orthic A	Sandy	None	Yellow structureless soil with no signs of saturation observed. No mottling was observed in the profiles examined
	Hard Rock			
Hutton	Orthic A	Sandy	None	Terrestrial soil identified outside of wetland areas. Red apedal soils identified on the tops of hills. No mottling was identified in these soils as the sandy nature of the soils ensures a quick infiltration of surface water.
	Red Apedal			

Wetland vegetation indicator

According to DWAF (2005), vegetation is regarded as a key component to be used in the delineation procedure for wetlands. Vegetation also forms a central part of the wetland definition in the National Water Act, Act 36 of 1998. However, using vegetation as a primary wetland indicator requires an undisturbed condition (DWAF, 2005). **Minor disturbances were however noted in the wetland systems making it difficult to rely solely on vegetation as a wetland indicator.** Disturbances included the presence of alien invasive species, damming, surrounding mining activities and erosion within the area. **Hydrophytic wetland vegetation included Imperata cylindrica, Cyperus spp. and Typha capensis were dominant** (Figure 3-31). Dominant wetland sedges included **Juncus spp.**

Figure 3-31: Hydrophytic plants identified in wetland system included Juncus spp.

Wetland delineation

The northern pan consisted of associated with a few hillslope seepages situated on the edge of the pan (lateral foot-slope seepages) Refer to Figure 3-32.

Historic imagery indicates that the pan is a perennial pan with mostly open water dominating the basin. According to the baseline wetland assessment conducted by GCS (2015), the pan is fed by surface run-off from the pan catchment and subsurface water inputs which the pan receives through sub-surface interflow from the surrounding sub- catchment. GCS (2015) further states that the GCS groundwater assessment indicated that the northern pan only receives a small percentage of water for recharge from groundwater. If this is indeed the case, opencast activities to the south should not have a major impact on the pans hydroperiod and water quality is expected to remain fairly stable along with normal environmental fluctuations. However, following a preliminary hydropedological approach, there seems to be potential for the pan to receive sub-surface water from the mining area.

Upon further investigation it came to light that there are historic underground mine workings located between the mine and HGM 1 which could highly likely be responsible for the poor water qualities observed within HGM 1. Monitoring of the pans water level and water quality are thus two important components to be incorporated into the pan’s wetland monitoring program.

The associated Hydro-geomorphic (HGM) unit is discussed on the following pages in more detail in terms of the functional integrity, Present Ecological Score and the impacts which affect wetland functionality.

Table 3-23: Wetland hydrogeomorphic (HGM) types (Kotze et al., 2008)

HGM Unit	Description	Source of water maintaining the	
		Surface	Subsurface
Depressions/Pans 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/*** Contribution may be small or important depending on the local circumstances	*/*** Contribution may be small or important depending on the local circumstances
Precipitation is an important water source and evapotranspiration an important output in all of the above settings water source:			

*Contribution usually small
*** Contribution usually large
*/ *** Contribution may be small or important depending on the local circumstances

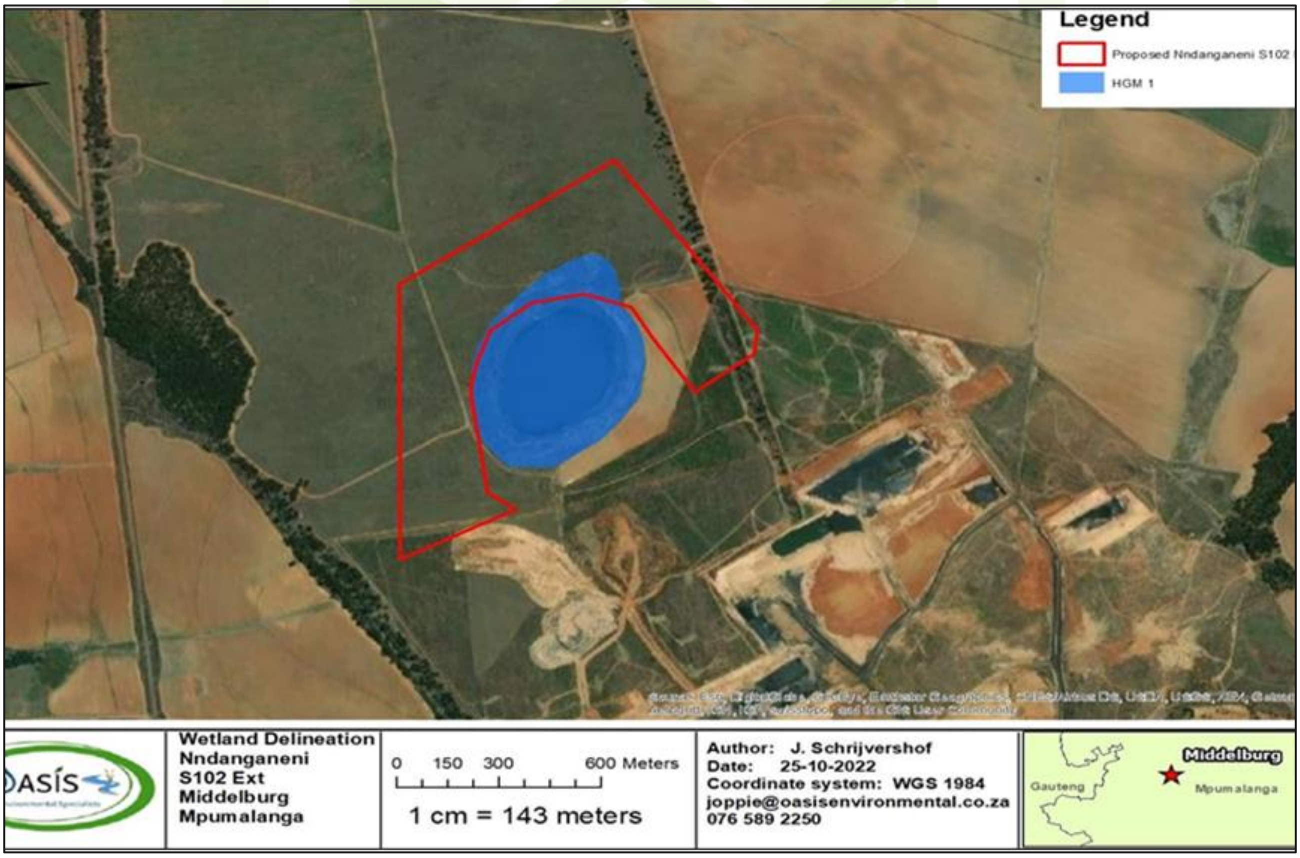

Figure 3-32: Wetland delineation

Wetland Ecological Importance and Sensitivity

According to the functional assessment flood attenuation; sediment trapping; erosion control and the maintenance of biodiversity are the predominant attributes provided by these wetlands to the surrounding landscapes.

HGM 1, the endorheic depression wetland (northern pan), received its highest ecosystem services scores for flood attenuation, sediment trapping, phosphate trapping, erosion control and biodiversity maintenance. Depressions can receive both surface and groundwater flows, which accumulate in the depression owing to a generally impervious underlying layer which prevents the water draining away (Kotze et al., 2005). Pans capture runoff because of their inward draining nature, and thus they reduce the volume of surface water which would otherwise reach the stream system during storm events (Kotze et al., 2005). This also adds to the erosion control benefits performed by these wetlands. Photodegradation of toxicants are expected to take place with the large shallow open water environment provided by the pan. Further, in terms of biodiversity maintenance, several avifaunal species were observed to use the pan regularly with a large portion of the pan's catchment still consisting of grassland. From a direct use perspective, the grasslands within the pans temporary and seasonal zonation is utilised for grazing of livestock, especially during the winter months. The pan is also potentially intermittently utilised for irrigation of pivot farming as indicated by the large sump constructed on the pan's southern end.

An assessment of the wetland's functional ecosystem services indicated that ecosystem services provided by the pan and associated hillslope seepages likely remained the same as during the 2015 baseline survey as well as the 2018 and 2019 surveys.

The Ecological Importance and Sensitivity of HGM 1 during previous wetland studies remained in the moderate category, similar to the 2015 baseline, 2018, 2019, 2020 and 2021 monitoring assessments with no discernible changes detected. Hydrological and Functional Importance for HGM 1 were considered to be moderate as a result of the important biogeochemical processes that the wetland renders. Several direct human benefits were also associated with the pan including possible use for irrigation as well as grazing of livestock. During the current 2022 Wetland Assessment, the Ecological Sensitivity and Importance (EIS) of the wetlands has generally been recorded as moderate and the Ecological Services as intermediate, with slightly increased scores with the pan system being filled with water from heavy rains (Figure 3-33) (Table 3-24 & Table 3-25). Although no red-data species were identified during the site investigation, the majority of pan systems usually, provide habitat for a number of floral and faunal species, especially as nesting areas on the edge for avifauna. A trench can be observed from the mine leading to the wetland. Sulphate accumulation was observed on the soils from the pan in a white to yellowish coloration at the time of the assessment.

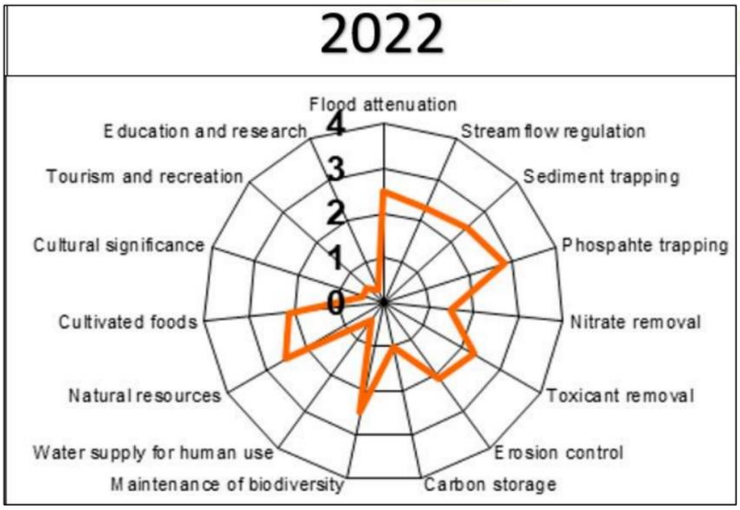

Figure 3-33: WET-Eco Services results for HGM 1 during 2022

Table 3-24: Summary of the Ecological Services of the northern pan (HGM 1)

Condensed summary sheet	HGM 1	
	Overall score	Confidence rating
Flood attenuation	2,5	4
Streamflow regulation	2,3	4
Sediment trapping	2,5	2,1
Phosphate trapping	2,8	3
Nitrate removal	1,5	1
Toxicant removal	2,3	1
Erosion control	2,1	3
Carbon storage	1	3
Maintenance of biodiversity	2,5	2
Water supply for human use	0,5	3
Natural resources	2,5	3
Cultivated foods	2,1	4
Cultural significance	0,5	3
Tourism and recreation	0,5	3
Education and research	0,3	3
Threats	3	3
Opportunities	1,9	3
Overall	**1,93**	**3,01**

Note: <0.5 Low; 0.5-1.5 Moderately low; 1.5-2.5 Intermediate; 2.5-3.5 Moderately high; and >3.5 High

Table 3-25: Summary of the Ecological Importance and Sensitivity of the wetland system associated with the pan (HGM 1)

ECOLOGICAL IMPORTANCE AND SENSITIVITY:		
Ecological Importance	Score (0-4)	*Confidence (1-5)*

Biodiversity support	1,93	2,67
Presence of Red Data species	2,10	2,00
Populations of unique species	1,80	2,00
Migration/breeding/feeding sites	1,90	4,00
Landscape scale	1,90	3,00
Protection status of the wetland	1,50	2,00
Protection status of the vegetation type	1,70	2,00
Regional context of the ecological integrity	2,10	2,00
Size and rarity of the wetland type/s present	2,50	2,00
Diversity of habitat types	1,70	2,00
Sensitivity of the wetland	2,73	2,33
Sensitivity to changes in floods	2,50	3,00
Sensitivity to changes in low flows/dry season	2,70	2,00
Sensitivity to changes in water quality	3,00	2,00
ECOLOGICAL IMPORTANCE & SENSITIVITY	2,19	2,67
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	2,41	2,41
DIRECT HUMAN BENEFITS	1,58	4,00
OVERALL	2,06	3,03

None, Rating = 0 rarely sensitive to changes in water quality/hydrological regime; Low, Rating =1 One or a few elements sensitive to changes in water quality/hydrological regime; Moderate, Rating =2 some elements sensitive to changes in water quality/hydrological regime; High, Rating =3 Many elements sensitive to changes in water quality/ hydrological regime; Very high, Rating =4 Very many elements sensitive to changes in water quality/ hydrological regime

Wetland functional and health assessment

The Wet-Health assessment, historic imagery and previous studies indicated that the pan is permanently inundated, however, after a poor rainy season the pan dried up towards the end of winter, August/September 2019 (Watermakers, 2020). Subsequently the pan has filled to previous years water levels with vegetation mosaic's surrounding the pan in similar pattern as during wet months of previous years. It is still not clear at this stage whether the drying up of the pan was caused as a result of mining activities in the catchment or due to climatic conditions. Otherwise, no major changes have taken place since the baseline assessment was completed, with the wetland complex mostly effected through ongoing cultivation practices within the wetland's catchment as well as within the wetland's temporary zonation (especially within the associated hillslope seepages). The wetlands hydrology and geomorphology were still considered intact (albeit the potential impact of opencast mining situated to the south). The most prominent impact was the excavation of a small farm dam (sump for irrigation) within the temporary zone on the southern side of the pan. Following application of the WET-Health approach, the wetland complex was determined and a PES Category of C (Moderately Modified) was found by all the previous studies since 2018 to 2020 by Watermakers and the initial 2015 baseline study by GCS. The pan system was assessed in terms of health and was found to be categorised as moderately modified (Category C) (Table 3-26) but with slightly improved scores as a result of rains filling the pan and with a better establishment of wetland vegetation since 2021 to 2022. The impacts on the health of the wetlands is predominantly related to the mining pits, extensive alien invasive vegetation and erosion.

Extensive Acacia mearnsii and Eucalyptus infestation surrounding the pan in the terrestrial zones, mining and sedimentation have had a negative impact on the basal cover of vegetation within the catchments associated with the pan (Figure 3-34), leading to an increase in velocity entering the wetlands and the formation of erosion gullies in the majority of these systems. This results in a negative impact on the wetlands ability to maintain biodiversity.

Table 3-26: Summary of PES scores for HGM 1 in October 2022

HGM 1 October 2022			
Module	**Impact Score**	**Category**	**Trajectory**
Hydrology	2,7	C	↓
Geomorphology	2,2	C	↓
Vegetation	3,5	C	↓
Overall Score	**2,79**	**C**	↓

Figure 3-34: Overall view of the pan (HGM 1) in October 2022.

Hydropedology (Wetland Flow Driver)

Hydropedological rationale

A wetland flow driver (hydropedological) assessment is based on the **guideline** for hydro pedological assessments and minimum requirements - Van Tol, J.J., Bouwer, D. & Le Roux, P.A.L., 2021. **A Hydropedological surveys aim to characterise dominant surface and sub-surface flow paths of water through the landscape to wetlands and streams or groundwater.**

The objective of these **guidelines** is to **standardise hydropedological survey methodology** to **identify dominant hydrological drivers and responses of landscapes in order to quantify the impact of new development on water resources.** This will assist decision makers to understand the hydrological system and thereby make sensible decisions with regards to sustainable water management. These guidelines were developed from numerous scientific and consultancy projects (van Tol, 2020) and are divided into four steps:

1. Identification of dominant hillslopes.
2. Conceptualising hillslope hydro pedological responses.
3. Quantification of hydraulic properties and flowrates.
4. Quantification of hydro pedological fluxes.

Hydropedological environment

Identification of dominant hillslopes

Infiltration is the movement of water into the soil, and the hydrology and water quality of a watershed is controlled to a large degree by the infiltration characteristics of the surface soils. Although infiltration rates in wetlands themselves are typically low, infiltration rates across the landscapes surrounding wetlands can have a strong effect on the routing of water to the wetlands.

The physics of infiltration are very complicated. Infiltration rates in soils are affected by soil physical properties (porosity, structure, and texture, discussed above), antecedent moisture content, the amount of `vegetative detritus on the soil surface, vegetation, layering of soils, vertebrate and invertebrate activity in the topsoil, landscape position, groundwater dynamics, and even air temperature. For given soil conditions, the potential infiltration rate decreases asymptotically over time during a wetting event thus only indicative modelling can be done.

Surface runoff

The surface water features of interest within the study area are the pan (Northern Pan) based on the literature study the southern pan has been mined out. No streams traverse the site. Pans are well defined, natural, shallow and circular to oval depressions with no outlet, which are permanently or periodically filled with water. Typically, many pans dry up seasonally, mainly through loss of water by evaporation and they often have a highly saline content and contain high concentrations of sodium chloride, sodium, calcium and magnesium. **No runoff from this site flows overland in a north westerly direction towards the nonperennial tributary (Klein Olifants Tributary 1) of the Klein Olifants River.** This tributary discharges into the Klein Olifants River approximately 5 km downstream of the study area.

The Goldsim model was used for the Water Balance calculations, a dynamic system modelling package, which is a graphical object-oriented modelling environment with an in-built capacity to carry out dynamic probabilistic simulations (Goldsim Technology Group, 2015). Goldsim uses equations and rules to simulate a system quantitatively in order to identify and understand the factors that control a system or to predict the future behaviour of the system. The model was based on the mine's operational philosophy, and, wherever assumptions were made, these were documented.

The following parameters were obtained for the pan catchment:

- The median annual simulated runoff from natural (unmodified) catchments in this area is simulated in WR2015 as being equivalent to 22 millimetres per year over the surface area and is equal to approximately 3 to 4 % of the Mean Annual Rainfall.
- Groundwater recharge was calculated as 35 mm per year or 5%.
- Baseflow was calculated as 110 mm per year or 16%.

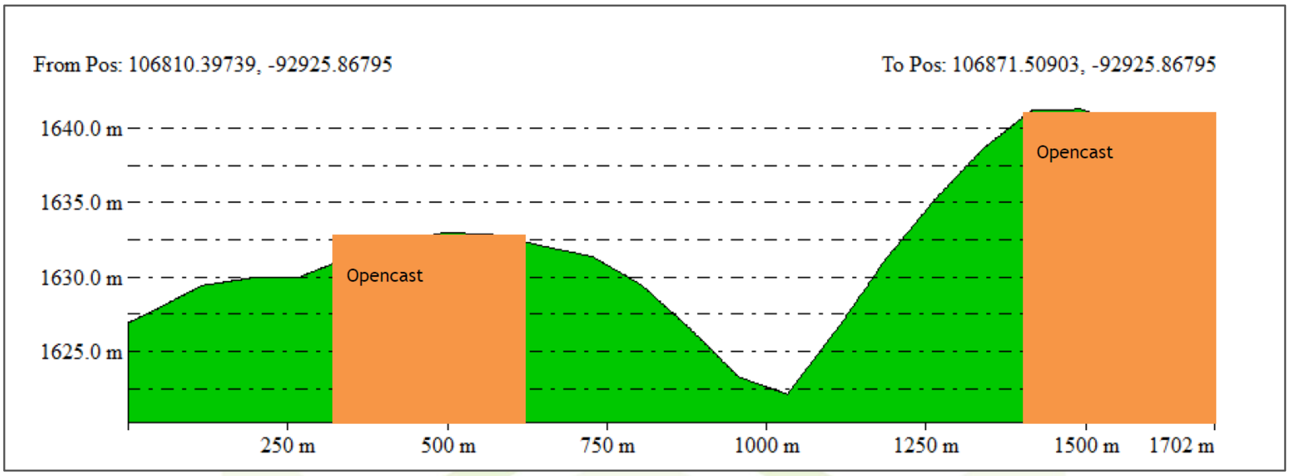

Figure 3-35: Site drainage and topography – Cross section (west to east)

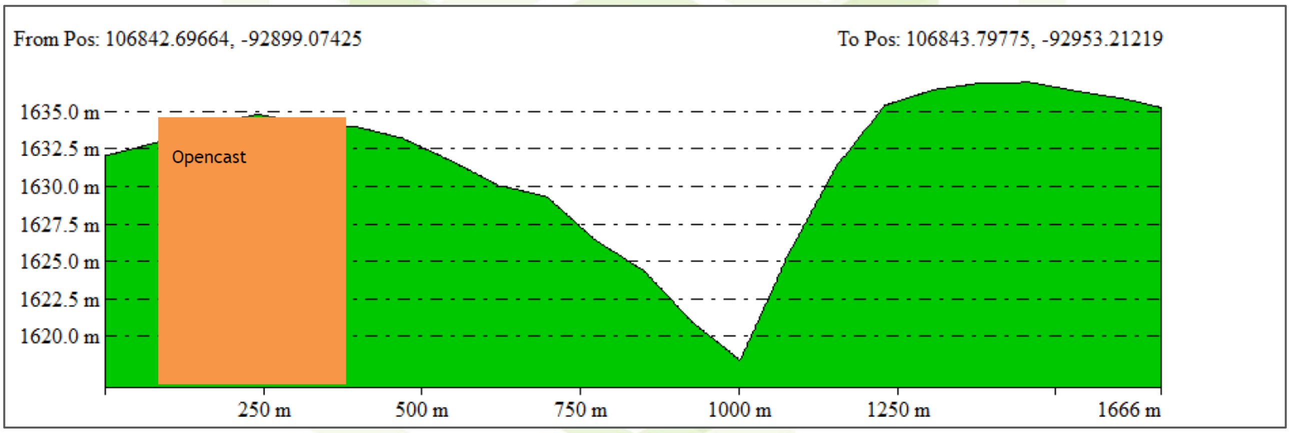

Figure 3-36: Site drainage and topography – Cross section (north to south)

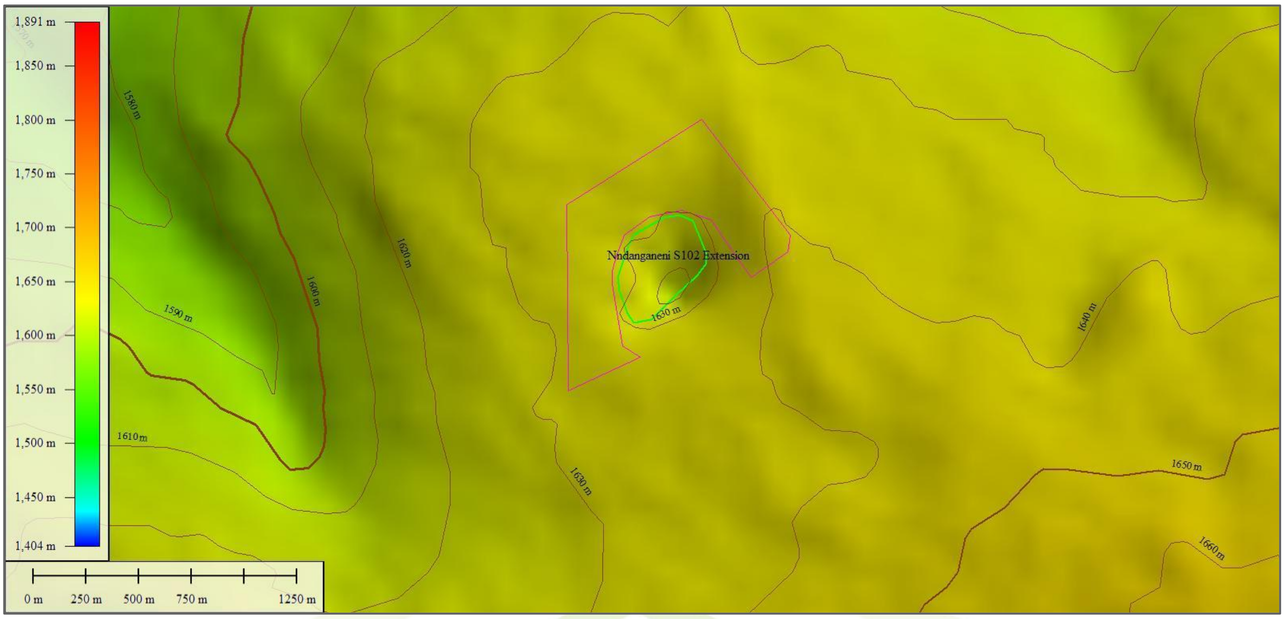

Figure 3-37: Site drainage and topography – Digital elevation model

Conceptualize hillslope hydro-pedological responses

The soil survey done by GCS (2015) followed a zig-zagged transects across the project site in question, according to a free format. A total of 12 points where surveyed and of these 6 were sampled. Two samples (A-Horizon and B-Horizon) were collected for each of the 6 points, bringing the total of samples to 12. Sample collection points were based on the major or dominant soil types within the study area, and represent a grouping of similar conditions.

The surveyed points, therefore, were representative of the whole site which has a total area of approximately 2.4 km2. Three (3) survey points were selected for confirmation P9, P11 and P6.

Recharge soils

The rocky soils are generally shallow and overlie an impeding layer such as hard rock or weathering saprolite. The main soil forms found in rocky soils were Hutton and Clovelly. The agricultural soils found on site support an industry of commercial maize production. These soils include Hutton.

Interflow or transitional soils

The transitional soil unit comprises the soils found between clay soils and the agricultural soils. These soils often have signs of clay accumulation or water movement in the lower horizons. These soils are usually indicative of seasonal or temporary wetland conditions. The main soil forms found in transitional soils were Sepane.

Figure 3-38: Responsive soils (within Pan)

Quantification of hydraulic properties and flowrates

Quantification of hydraulic properties was done through the following:

1. In situ field infiltration tests;
2. Falling head permeability tests;
3. Wetland delineation; and,
4. Site observations.

An interpolated map of the hydro pedological soil types based on the above is detailed below in Figure 3-39.

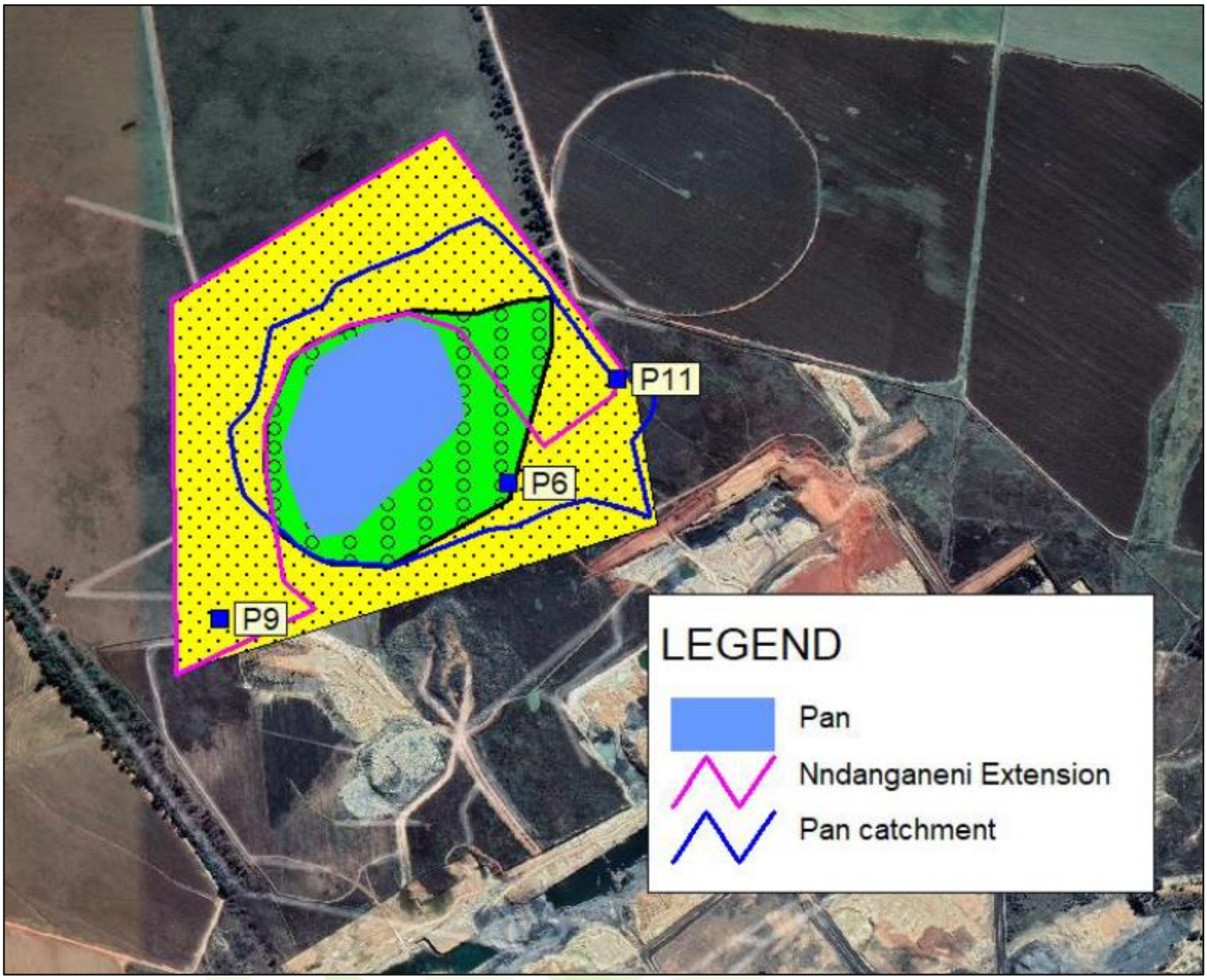

Figure 3-39: Hydropedological interpolation from auger holes

In situ field infiltration tests

In situ infiltration tests (falling head permeability test) to estimate the rate at which runoff will infiltrate, or pass through the soil profile were done as follows:

Step 1: Test hole with the following dimensions Depth 50 cm, Diameter 10 cm
Step 2: Determine soil texture through a ribbon test
Step 3: Fill the hole with water and measure time to drain the hole completely
Step 4: Calculate the infiltration rate using the following formula

$$k = \frac{2.3A}{F(t_2 - t_1)} log \frac{h_1}{h_2}$$

A summary of the falling permeabilities is shown the table below. The following observations can be made regarding the permeabilities:

- The auger holes permeabilities are typical of sandy gravel and can be regarded as responsive soils. These soils 'respond' quickly to rain events and typically generate overland flow. These soils can be shallow and overlie relatively impermeable bedrock, with limited storage capacity that is quickly exceeded following a rain event. Alternatively, they are soils with morphological indications of long periods of saturation. Given that the latter soils are close to saturation during the rainy season, additional precipitation will typically flow overland due to saturation excess.

A summary of the soil results from the test pits are shown in the table below. The following observations can be made regarding the permeabilities:

- The soil outside the pan catchment are typical recharge soils without any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow direction.
- The soils within the pan catchment are typical responsive soils with saturation. Lateral flow is expected to be dominant.

Table 3-27: Auger hole positions and infiltration rates

Label	m/s	% Clay	% Silt	% Sand	% Gravel		Material Description
P6	1.125-06	2	12	78	8	100	SANDY GRAVEL
P11	1.39-06	1	15	75	9	100	SANDY GRAVEL
P9	1.17-06	2	14	76	8	100	SANDY GRAVEL

Quantification of hydropedological fluxes

The proposed extension and associated infrastructure could impact on the flow drivers of the wetland systems through interception systems such as drainage systems, berms, increased/decreased recharge and water quality changes.

Wetland catchment flow reduction

The SANBI Biodiversity Series 22, (2013) Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems was consulted in determining the estimated flow losses to the specific wetland catchment systems due to the proposed opencast.

Many wetlands are hydrologically and ecologically linked to adjacent groundwater bodies, but the degree of interaction can vary greatly. Some wetlands may be completely dependent on groundwater discharge under all climatic conditions, whilst others may have very limited dependence such as only under very dry conditions – and some may have no connection with groundwater at all. The wetlands can characterise as follows:

- Endorheic pan

Assumptions

Wetlands are dependent on rainfall infiltrating the upslope soil, being partitioned by the subsoil and fractured rock, before flowing down slope to return to the soil surface and wetland, sometimes via a river system. A wetland may thus be considered a signature of the hydrological dynamics of its surrounding catchment.

The pan's catchment determines the relative extent of different hydrological response types in the catchment and within specific hillslopes contained within the catchment. The impact on flow drivers of the wetland catchment is detailed below and is based on the following assumptions (status quo). A water balance3 on the wetland catchment is represented by:

- Rainfall 100% of flow input – ±700 mm
- Evapotranspiration is 60 – 70% of rainfall (outflow) - ±470 mm
- Runoff is 4% (outflow)4 – ±22 mm
- Groundwater recharge is 5%5 (outflow) - ± 33 mm
- 20 -30 % of the water being left in or stored the unsaturated zone or interflow zone feeding the wetland

The impact assessment is only valid for the extension. Based on the site visit, historic mining activity and agricultural activities has impacted on the wetland systems. Current flow driver impacts from existing and neighbouring mines/agricultural activities was not part of the impact assessment; however, it was deemed necessary to indicate the impact on the existing seepage wetland. Furthermore, the model should not be seen as exact as there are numerous variables which are impossible to simulate, the model should therefore only be seen as a tool for planning purposes.

Current flow drivers

The flow driver's extension on the pan is expected to be in the order of the following as shown in the figure below. As expected, the water stored in the wetland soils is the dominant wetland flow driver in terms of volume.

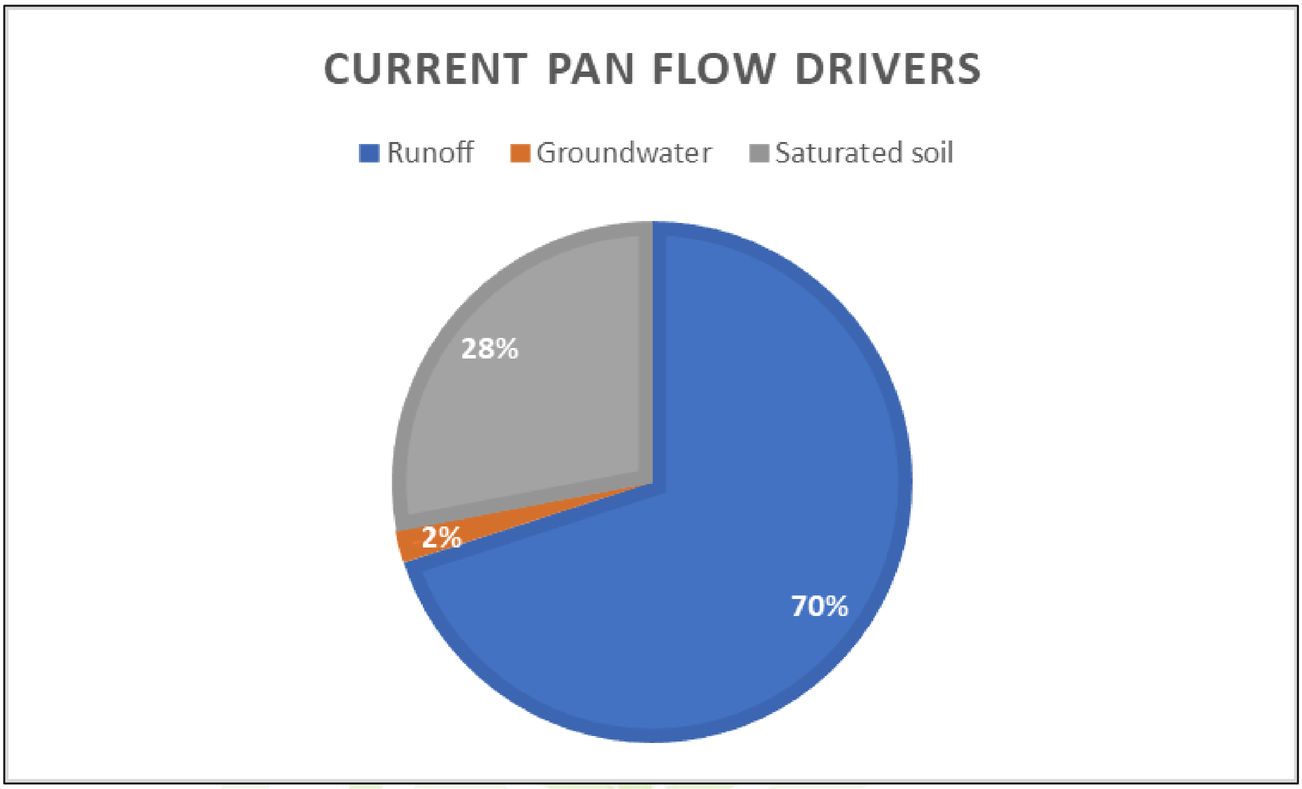

Figure 3-40: Wetland flow drivers pre development

Expected impacts by proposed opencast extension

The impact by the proposed extension is shown in the table below. The biggest impact is on the saturated soils surrounding the pan which stores surface water and groundwater. If the extension remains outside the saturated/responsive soils the impact is reduced from 41% to below 10%.

Table 3-28: Flow driver impacts relative to each other

Flow component	Pre extension flow drivers (m3)	Post extension flow drivers (m3)	Exclusion and 50 m buffer	Impact % (Proposed mining)	Impact % (50 m buffer and exclusion)
Runoff	10714	8026	2640	75%	2%
Groundwater recharge	16071	6039	0	5%	4%
Saturated soil	85225	32025	0	29%	0%
Total	112010	46090	2640	41%	2%

ECOLOGICAL

CBA (Critical Biodiversity Areas)

According to the Critical Biodiversity Areas datasets provided by SANBI (2022), the majority of the application area falls within a **highly or moderately transformed landscape and other natural areas**. These sections were confirmed to be transformed landscape surrounding the wetland area during the site visit.

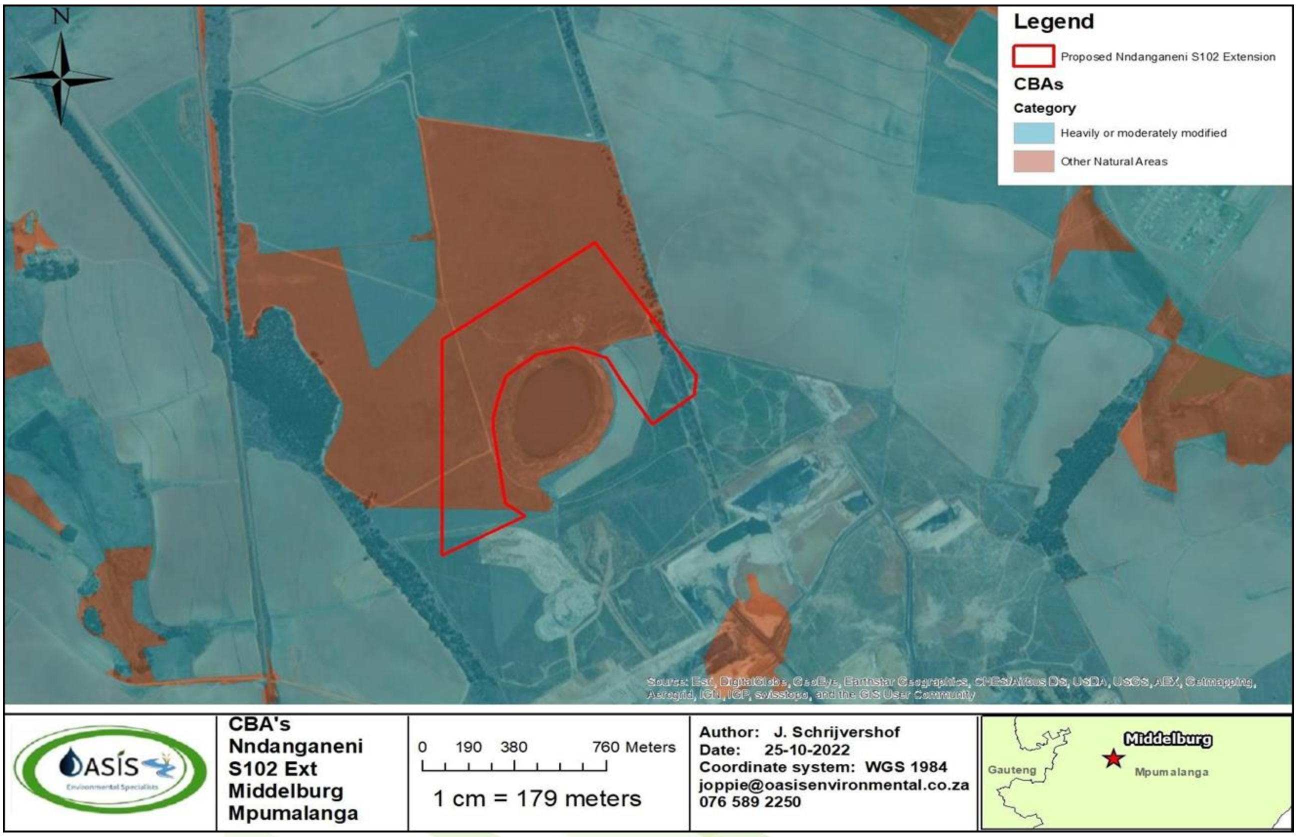

Figure 3-41: The proposed Ndanganeni Extension - Critical Biodiversity Areas map

Threatened Ecosystems and Protected areas

The mining area does not overlap with any threatened ecosystems and/or protected areas.

IBA (Important Bird Areas)

The mining area does not occur within close proximity to any Important Bird Areas.

Fauna

Mammal species that were identified onsite included the yellow mongoose (*Cynictis penicillata*) and ground squirrel (*Xerus spp.*).Bird species included Long-tailed widowbird (*Euplectes progne*); Helmeted guineafowl (*Numida meleagris*), Cattle egret (*Bubulcus ibis*) Red-knobbed coot (*Fulica cristata*), Spur winged goose (*Plectropterus gambensis*), Egyptian goose (*Alopochen aegyptiaca*). Other species included Laughing dove (*Spilopelia senegalensis*), Indian myna (*Acridotheres tristis*), Southern red bishop (*Euplectes orix*), Southern masked weaver (*Ploceus velatus*) and Pied crow (*Corvus albus*).

Red listed species that could possibly occur within the 2529DC QDS include: Giant Bull Frog (*Pyxicephalus adspersus*) listed as Near Threatened, Serval (*Leptailurus serval*) listed as Near Threatened (2016), Brown Hyena (*Hyaena* *brunnea*) listed as Near Threatened (2015), African Clawless Otter (*Aonyx capensis*) listed as Near Threatened (2016), African Striped Weasel (*Poecilogale albinucha*) listed as Near Threatened (2016), Schreibers's Long-fingered Bat (*Miniopterus schreibersii*) listed asNear Threatened, Greater Flamingo (*Phoenicopterus roseus*) (Global: LC; BLSA: NT), Southern Bald Ibis (*Geronticus calvus*) (Global: VU; BLSA: VU).

No red listed faunal species were observed during the site visit. A very low abundance of faunal species were observed as a result this area being blasted during mining activities and faunal species migrating to refuge areas within grasslands and other suitable habitat types.

From an **ecological perspective this pan wetland area** can be regarded as a **highly sensitive area** as it is a nesting and foraging area for a diversity of avifauna and possible Giant African Bullfrog (*Pyxicephalus adspersus*). **A recommended buffer of 110 m is implemented for the protection of the wetland areas.**

Flora

The majority of the study site consisted of alien invasive vegetation and very little indigenous vegetation, however vegetation normally associated with that area is depicted from Mucina and Rutherford (2006) for the Eastern Highveld Grassland and Rand Highveld Grassland. No red listed floral species were observed during the site visit.

Commonly observed grasses (dominant species) within the area of investigation comprised of *Melines repens* (Natal red top) and *Pogonarthria squarrosa* (Herringboe grass) . Beyond the reaches of the grasslands is extensive gumtree and black wattle invasion. Milkweed (*Gomphocarpus physocarpus*) were also dominant on the roadside. Commonly observed grasses (dominant species) within the area of investigation comprised *Imperata cylindrica* (Cogon grass) *Hyparrhenia hirta* (Thatching grass) associate with the wetland areas. Common species observed within grassland habitat includes *Eragrostis curvula, Seriphium plumosum, Eragrostis chloromelas, Helichrysum nudifolium, Tagetes minuta, Bidens pilosa, Hermannia transvaalensis, Dicoma zeyheri, Eragrostis gummiflua* and *Hyparrhenia tamba*. Beyond the reaches of the grasslands is extensive gumtree and black wattle invasion. *Seriphium spp.* encroached certain sections of the grassland areas. Native trees included Leather-leaved fluffbush (*Lopholaena coriifolia)* covering the rocky outcrop area north of the pan.

Alien Invasive Vegetation

National Environmental Management: Biodiversity Act (No. 10 of 2004) categories for invasive species according to Section 21 are as follows:

- Category 1a: Species requiring compulsory control;
- Category 1b: Invasive species controlled by an invasive species management programme;
- Category 2: Invasive species controlled by area, and;
- Category 3: Invasive species controlled by activity.

Certain species have different alien invasive categories for different provinces in South Africa, where lists the alien species identified on site as well as their respective alien categories. The dominant plant species identified was alien invasive *Eucalyptus tereticornis* and *Acacia mearnsii*, other species identified.

Table 3-29: Alien Invasive Plants identified surrounding the mining area

Species Name	Common Name	Category
Acacia mearnsii	Black Wattle	2
Datura ferox	Large thornapple	1b

Datura stramonium	Common thornapple	1b
Eucalyptus tereticornis	Forest red gum	1b
Tagetes minuta	Khaki Weed	-
Verbena bonariensis	Wild verbena	1b

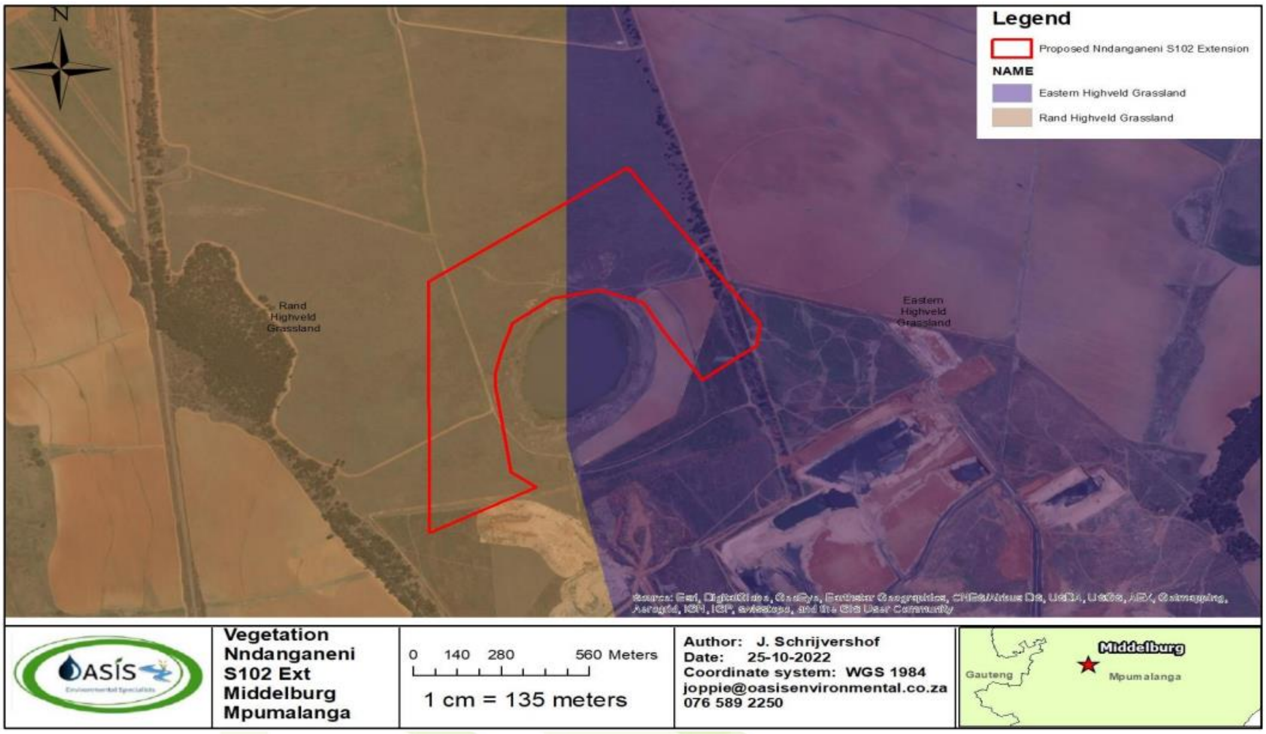

Figure 3-42: Vegetation map in relation to the proposed mining activities

Eastern Higveld Grassland

Stretches over the Mpumalanga and Gauteng Provinces, with plains between Belfast to the east and the eastern side of Johannesburg and extending southwards to Bethal, Ermelo and Piet Retief. Altitude ranges between 1520 to 1780 m, but also as low as 1300 m (Mucina & Rutherford, 2006). Strongly seasonal summer rainfall, with very dry winters. Mean annual precipitation ranges between 650 mm to 900 mm (overall average: 726 mm) and is relatively uniform, but increases significantly in the southeast areas (Mucina & Rutherford, 2006). Incidence of frost from lasts from 13 to 42 days, but is higher at higher elevations (Mucina & Rutherford, 2006).

Slightly too moderately undulating plains, including some low hills and pan depressions (Mucina & Rutherford, 2006). The vegetation is short dense grassland dominated by the usual Highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) with small, scattered rocky outcrops with wiry, sour grasses and some woody species (*Senegalia caffra, Celtis africana, Diospyros lycioides subsp lycioides, Parinari capensis, Protea caffra, P. welwitschii and Rhus magalismontanum*) (Mucina & Rutherford, 2006).

Some 44% transformed primarily by cultivation, plantations, mines, urbanisation and dams. Cultivation may have had a more extensive impact, indicated by land-cover data (Mucina & Rutherford, 2006). No serious alien invasions are reported, but Acacia mearnsii can become dominant in disturbed sites, with very low erosion (Mucina & Rutherford, 2006).

Red to yellow sandy soils of the Ba and Bb land types found on shales and sandstones of the Madzaringwe Formation (Karoo Supergroup). Land types are Bb (65%) and Ba (30%) (Mucina & Rutherford, 2006). Found on younger Pleistocene to recent sediments overlying fine-grained sedimentary rocks of the Karoo Supergroup (on sediments of both Ecca and Beaufort Groups due to the large extent of the area of occurrence) as well as of the much older dolomites of the Malmani Subgroup of the Transvaal Supergroup in the northwest (Mucina & Rutherford, 2006). In the areas built by Karoo Supergroup sediments are associated with the occurrence of Jurassic Karoo dolerite dykes having a profound influence on run-off (Mucina & Rutherford, 2006).

Soils are peaty (Champagne soil form) to vertic (Rensberg soil form) (Mucina & Rutherford, 2006). The pans and wetlands forms where flow of water is impeded by impermeable soils and/or by erosion resistant features, such as dolerite intrusions (Mucina & Rutherford, 2006). Many pans of this type of freshwater wetlands are inundated and/or saturated only during the summer rainfall season, and for some months after this into the middle of the dry winter season, but they may remain saturated all year round (Mucina & Rutherford, 2006). Surface water inundation may be present at any point while the wetland is saturated and some plant species will be present only under inundated conditions, or under permanently saturated conditions (Mucina & Rutherford, 2006). The presence of standing water should not be taken as a sign of permanent wet conditions (Mucina & Rutherford, 2006).

Rand Higveld Grassland

The Rand Highveld Grassland is the dominant vegetation unit in the Tlokwe Municipal area and consists of wide sloping plains and raised rocky outcrops at altitudes ranging from 1300 m to 1635 m (Mucina & Rutherford, 2006). Grasslands in South Africa have always been of great worth for agricultural development (Adamson, 1938), but agricultural activities (cultivation) and ongoing urbanisation is leading to the fragmentation and transformation of the endangered Rand Highveld Grassland (of which a mere 1% is being conserved) (Mucina & Rutherford, 2006).

The North-West Department of Agriculture, Conservation, Environment and Rural Development (NWDACERD, 2009) identifies the Rand Highveld Grassland as being vulnerable, as 49.8% of this vegetation type has been transformed, and 3.2% significantly degraded. Vulnerable ecosystems are defined by the National Environmental Management: Biodiversity Act (No. 10 of 2004) as ecosystems that are at substantial risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, but are not critically endangered or endangered ecosystems.

Climate Annual rainfall for the Rand Highveld Grassland ranges between 570 mm and 730 mm, and the rainy season is predominantly in the summer months (October until March) (Mucina & Rutherford, 2006). The climate of this region is warmtemperate, with cold, dry winters when frost is prevalent (Adamson, 1938; Mucina & Rutherford, 2006). Land type and soil According to O'Connor and Bredenkamp (1997) the Bankenveld false grassveld type (an old classification which includes the Rand Highveld Grassland) is characterised by rocky ridges with shallow rocky soils, this is also confirmed by Mucina and Rutherford (2006) and the Soil Classification Working Group (1991). The Tlokwe Municipal area is mainly situated in the Ba-land type characterised by red or yellow, dystrophic and/or mesotrophic (apedal) soil types (Land Type Survey Staff, 1984). The Rand Highveld Grassland supports shallow Glenrosa and Mispah soil forms (Mucina & Rutherford, 2006). Moderate to high erosion levels has been recorded in 7% of this vegetation unit (Mucina & Rutherford, 2006). Because the vegetation of the Ba-land type has been lost extensively due to agricultural activities, the representative vegetation communities are endangered (Bezuidenhout & Bredenkamp, 1991).

The vegetation type occurs on a highly variable landscape with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains (Mucina & Rutherford, 2006). The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes (Mucina & Rutherford, 2006). There is a high diversity of herbs. Rocky hills and ridges carry sparse (savannoid) woodlands accompanied by a rich suite of shrubs.

Soil and Agricultural Potential

The climatic conditions of the region frequently give rise to chemically weathered red and yellow soils that are typical of subtropical upland areas, as were seen across much of the site. The site geology is dominated by fine- to course-grained sandstone, shale, and coal seams. The sandstone has given rise to sandy soils across much of the site, as expected. The site is not steep but does slope gently toward the pan on all sides. The only low-lying areas where signs of surface wetness are evident is the area immediately around the pan, and this falls just outside of the boundary of the soils study site.

Figure 3-43: Subtropical Weathered Soil (Clovelly) (Left) & Site sloping towards the pan (Right)

Soil Form Identification and Classification

According to the WR90 soils database (WRC, 1996), the site area is underlain by structureless soils with generally favourable physical properties and limitations that could include restricted soil depth, excessive or imperfect drainage and high erodibility. The soil forms identified within the study site included Clovelly soils in the main – which agrees with the WR90 database - as well as Mispahs.

Clovelly

The Clovelly soil form was identified across much of the site. This soil form is characterised by an orthic topsoil over a yellow brown apedal (devoid of macrostructure) B horizon over an unspecified horizon. In the case of the Clovelly soils identified at the study site, this unspecified horizon was sandstone in various states of weathering. The B horizon varied in depth across the site and in all cases was stony.

Mispah

The Mispah soil form was identified in and around a single rocky outcrop area across a portion of the centre of the site. This soil form is characterised by a thin orthic A horizon over hard rock, so is a very shallow soil.

Land Capability Analysis

Land capability is the inherent capacity of land to be productive under sustained use and specific management methods. The land capability of an area is the combination of the inherent soil properties and the climatic conditions as well as other landscape properties, such as slope and drainage patterns.

Using the Hattingh (2019) system, the **majority of the site's land capability is III – Grazing** as the **area is capable of supporting grass species but is too shallow and stony to be considered arable.** The very shallow **Mispah area's land capability is IV – Wilderness as it is too shallow to support grazing.** Using the Scotney et al. (1987) system, the majority of the study site's land capability class is Grazing IV, which means that it has limitations that preclude cultivation but can support natural and perennial vegetation. The very shallow Mispah area's land capability is VIII as it is not suitable for grazing (see Figure 10). **The main limitations in the case of the Clovelly soils identified at the study site are a lack of depth and a stony B horizon. It is apparent that the areas that are currently under cultivation are not deep and are clearly stony throughout, yet mielies are being cultivated there. This does not mean that the land capability in these areas is different, only that the farmer has overcome these limitations.**

Soil Depth

For site rehabilitation purposes it is important to have an understanding of the depths of the topsoil and subsoil across the study site in order to strip and stockpile these correctly (as elaborated upon in Section 4.5 and Appendix B of the Soil and Agricultural Potential Study, attached in Appendix D – Specialist Studies of this BAR).

While the cultivated soil areas appear to be disturbed Clovelly soils, these no longer comprise a topsoil and a subsoil component owing to ploughing practices. The Clovelly soils in the north-eastern portion of the site appear shallower than those across the rest of the site. Their topsoil depths were around 10 cm and (stony) subsoils up to 25cm. Across the rest of the site (except in the Mispah area) roughly the top 10 cm of the Clovelly soil constituted topsoil and the subsoil ranged from 25 cm to 50 cm. Subsoil depths varied from classification point to point with no obvious patterns emerging.

Figure 3-44: Nndanganeni Proposed Extension - Soil Types Map

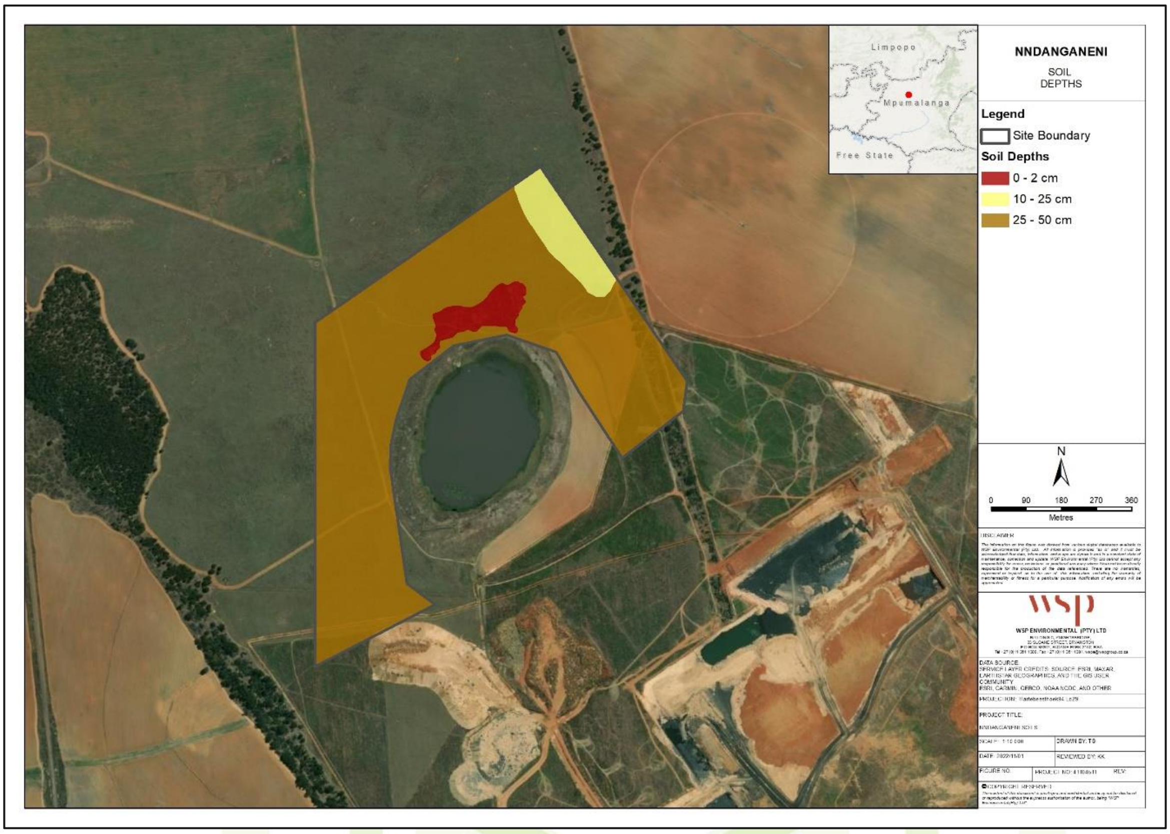

Figure 3-45: Nndanganeni Proposed Extension - Soil Depths Map

Figure 3-46: Nndanganeni Proposed Extension - Land capability Map

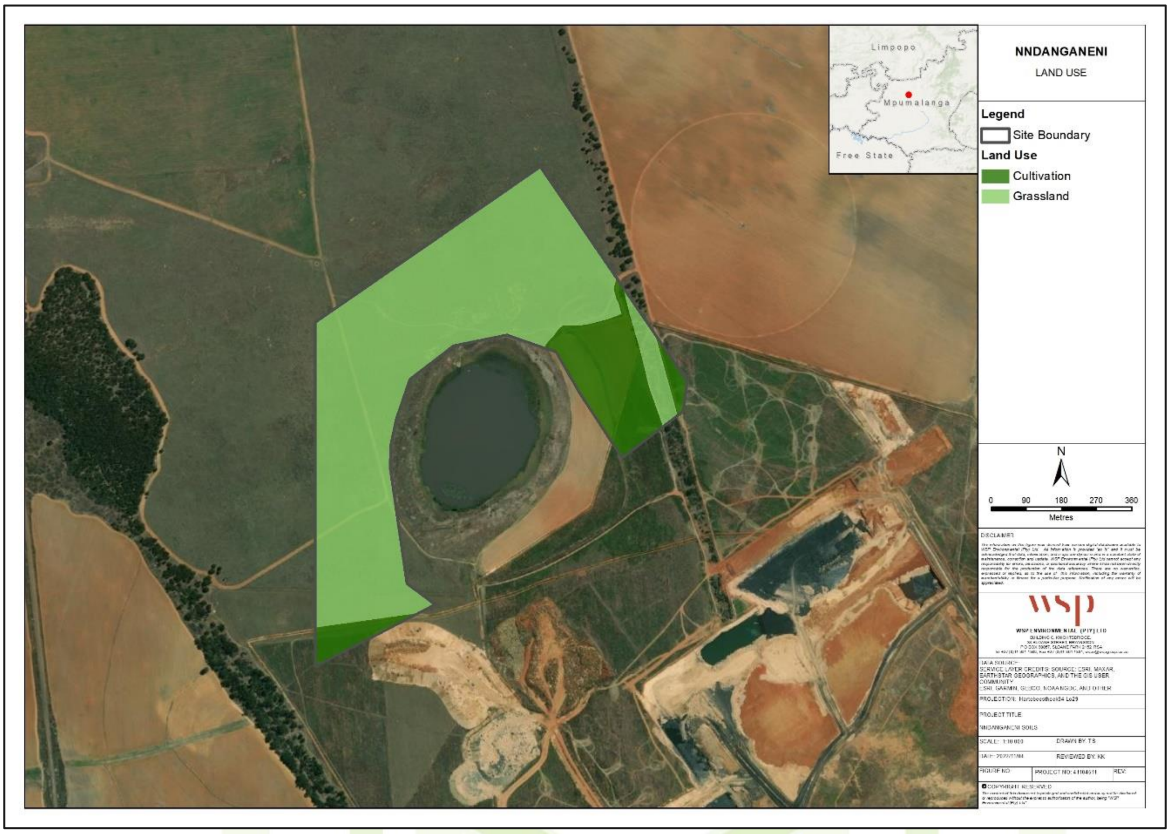

Figure 3-47: Nndanganeni Proposed Extension – Land use Map

HERITAGE / ARCHAEOLOGICAL

Historical topographical maps & aerial images

The historical aerial image dating to 1943 shows the south-eastern corner of the study area to be cultivated, while the remaining area appears to consist of open veldt. Except for a few additional cultivated sections, the 1955 aerial image depicts the same detail. The 1964 aerial image shows the presence of three areas potentially associated with buildings (Sites B01 – B03), while the remaining land use appears to remain the same. When the 1967 topographical map is inspected, the entire demarcated study area is shown as open veldt without any buildings or cultivation. The 1975 aerial image also shows the study area to be absent of buildings, but the entire area appears to be cultivated. The 1984 and 1997 topographical maps, 1997 aerial image and the 2010 topographical map show the two small, cultivated sections and remaining open veldt that is consistent with the field observations. Although most of the data sources indicate that the majority of the study area consisted of open veldt, the 1975 aerial image suggests that the entire area was cultivated. The possibility, however, exists that the markings observed on the image could represent a different activity. It should also be noted that the buildings observed on the 1964 aerial image are not visible/indicated on any of the remaining data sources.

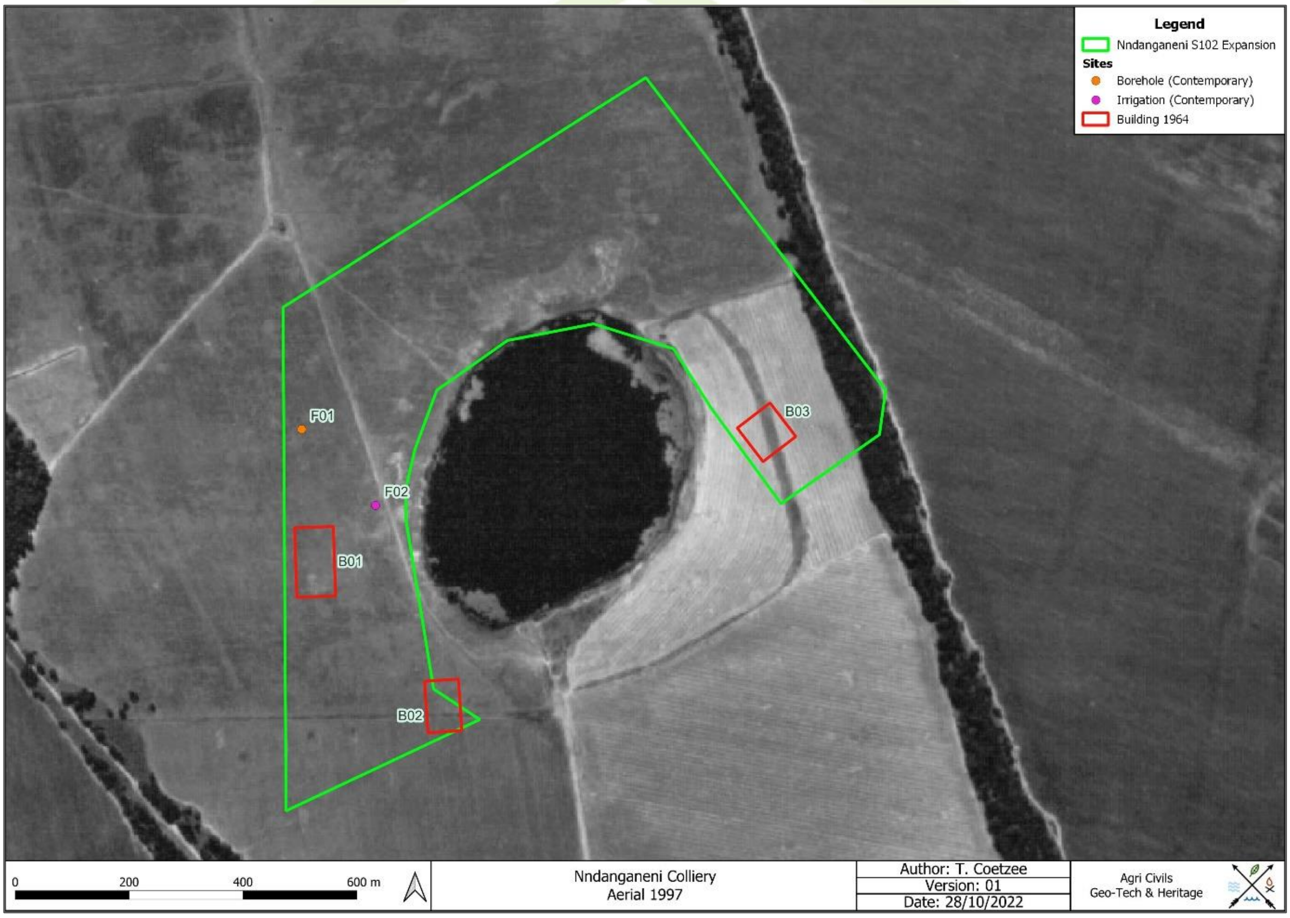

Figure 3-48: Proposed mining area superimposed on a 1997 aerial map

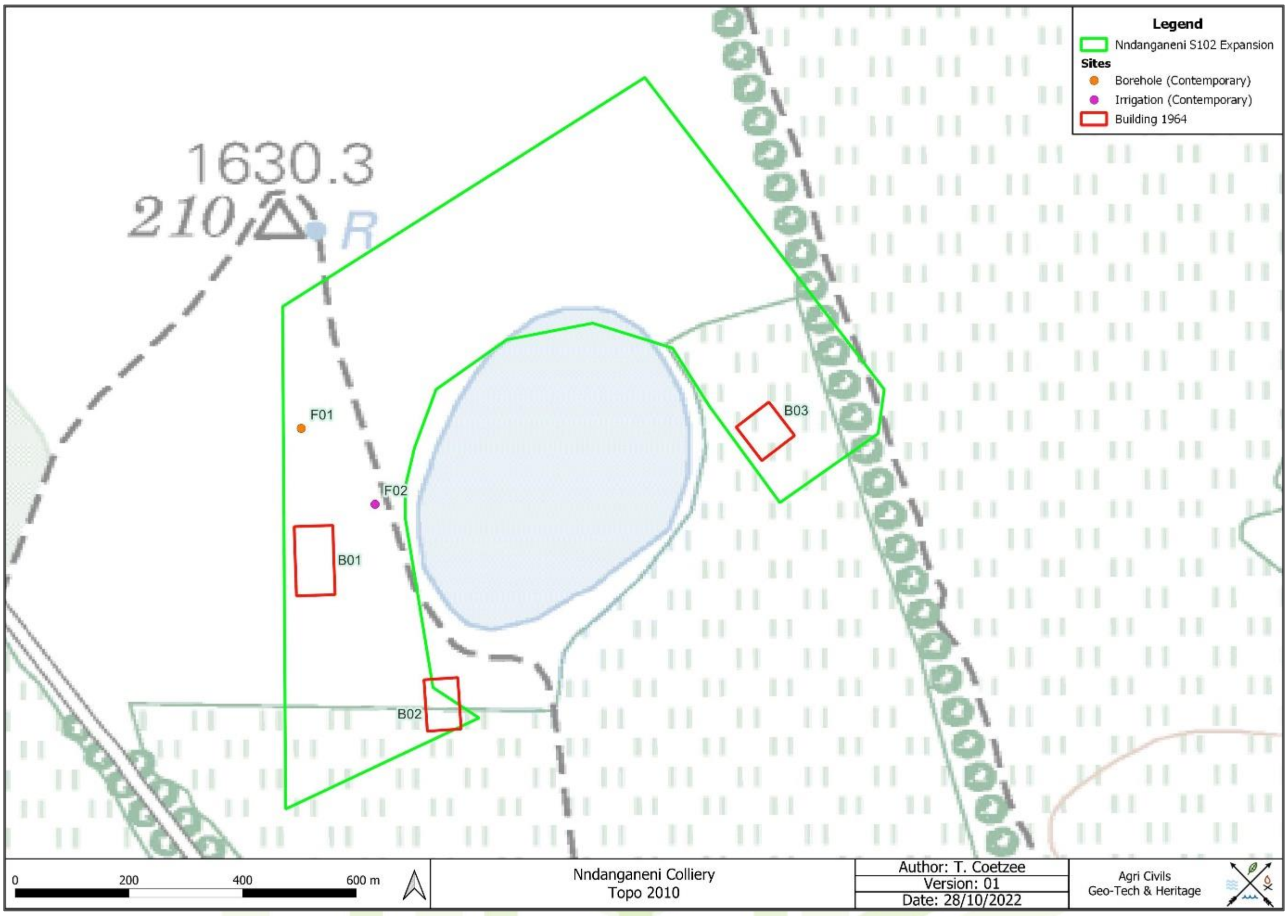

Figure 3-49: Proposed mining area superimposed on a 2010 topographical map

Table 3-30: Sites on and near the proposed mining area

Name	Off. Name	Latitude	Longitude	Description	Age	Current Status	Estimated Extent	ID Source	Farm Portion	Intersecting Development
B01	2529DC-B01	-25.814490	29.675284	Building	Historical	Demolished – No surface remains	0.7 ha	Aerial 1964	15/413	Yes
B02	2529DC-B02	-25.816739	29.677303	Building	Historical	Demolished - Foundation mound	0.5 ha	Aerial 1964	14/413; 15/413	Yes
B03	2529DC-B03	-25.812444	29.682410	Building	Historical	Demolished – No surface remains	0.5 ha	Aerial 1964	14/413; 15/413	Yes
F01	2529DC-F01	-25.812363	29.675090	Borehole	Contemporary	Intact	1 m²	Field	15/413	Yes
F02	2529DC-F02	-25.813562	29.676256	Irrigation	Contemporary	Intact	1 m²	Field	15/413	Yes

The study area: The proposed mining area

The area demarcated for the S102 mining expansion is associated with open veldt and sections of cultivated land. A possibility also exists that the majority of the study area used to be cultivated in the past, indicating a lower sensitivity and potential impact to cultural resources. Three potential buildings (Sites B01 – B03) falling within the demarcated area were noted on the 1964 aerial image, and two contemporary sites consisting of a borehole and what appears to be irrigation equipment (Sites F01 & F02) were noted during the site inspection. The building sites were completely demolished and apart from a foundation mound at Site B02, are not associated with surface remains. Although the buildings were demolished, the possibility exists that potentially sensitive subsurface cultural remains might be located at Sites B01 – B03. Should such remains be discovered, it is recommended that the associated activity be suspended and that a qualified archaeologist be contacted. Contemporary Sites F01 & F02 are not significant from a heritage perspective, have sufficiently been recorded and require no further action.

Archaeological and Historical Remains

Stone Age Remains

No Stone Age archaeological remains were located within the demarcated study area. Although no Stone Age archaeological remains were located, such artefacts may occur in the area. These artefacts are often associated with rocky outcrops or water sources.

Iron Age Farmer Remains

No Iron Age Farmer remains were located within the demarcated study area.

Historical

Three potential sites dating to the Historic Period were noted on the historical aerial imagery dating to 1964. All three sites (B01 – B03) are visible on the 1964 aerial image only, suggesting that the buildings were constructed between 1955 and 1964 but were demolished by 1967 Site B01 is located along the western border of the study area and is not associated with any surface remain. Site B02 is located near the southern-most corner of the study area and a foundation mound was noted during the site inspection. Site B03, located near the eastern border of the study area, is currently associated with cultivated land and no surface remains were observed during the site inspection.

Contemporary Remains/Natural

Two sites dating to contemporary times were noted during the site inspection. Site F01, identified as a ground monitoring borehole, is located along the western border of the study area. An identification plate with the name “Borehole Casing Suppliers” and a telephone number was observed, but no additional information is shown. Site F02, located to the southeast of Site F01, appears to be equipment associated with an irrigation system. The site consists of a metal shaft and an iron peg.

Graves

No burial sites were observed during the pedestrian survey.

Palaeontological

Geological context

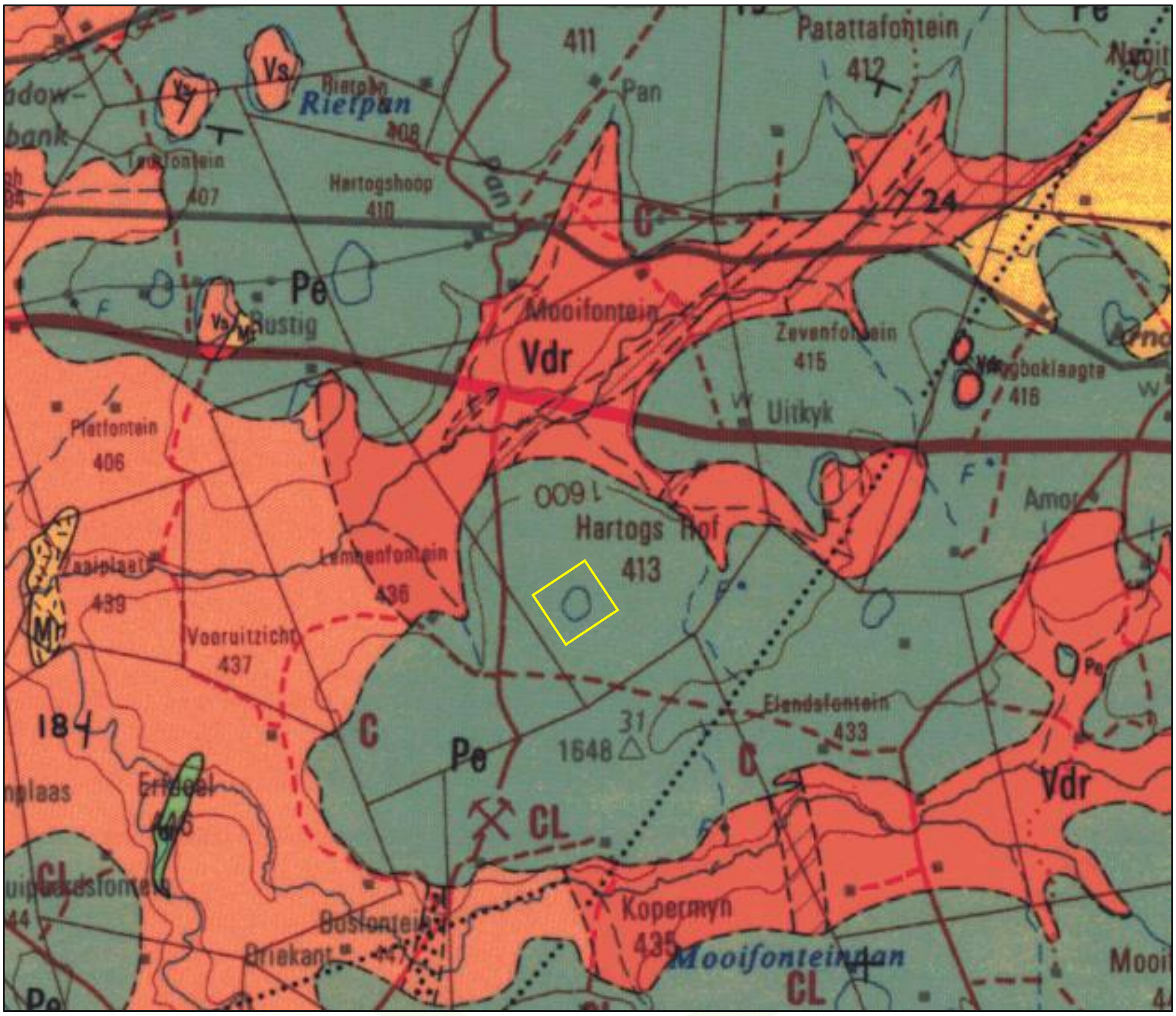

Figure 3-50: Geological map of the area around the Nndanganeni Colliery with the project area within the yellow outline.

The site lies in the north-central part of the Karoo basin where the early Karoo Supergroup strata unconformably overlie the much older quartzites of the Transvaal Supergroup, in the Transvaal Basin. Intruding through the Pretoria Group rocks are sills and dykes composed of diabase, a volcanic and non-fossiliferous rock. The southeastern extension of the Rooiberg Group (Damwal and Schrikkloof Formations) is present around the farm. The volcanic rocks of the Rooiberg Group were intruded by the Rustenburg Layered Suite (Bushveld Igneous Complex) in the Terminal Transvaal Sequence around 2055 million years ago so were partially melted (Buchanan, 2006; Nazari-Dekhordi and Robb, 2022). No fossils would occur in metamorphosed volcanic rocks.

The Karoo Supergroup rocks cover a very large proportion of South Africa and extend from the northeast (east of Pretoria) to the southwest and across to almost the KwaZulu Natal south coast. It is bounded along the southern margin by the Cape Fold Belt and along the northern margin by the much older Transvaal Supergroup rocks. Representing some 120 million years (300 – 183Ma), the Karoo Supergroup rocks have preserved a diversity of fossil plants, insects, vertebrates and invertebrates.

During the Carboniferous Period South Africa was part of the huge continental landmass known as Gondwanaland and it was positioned over the South Pole. As a result, there were several ice sheets that formed and melted, and covered most of South Africa (Visser, 1986, 1989; Isbell et al., 2012). Gradual melting of the ice as the continental mass moved northwards and the earth warmed, formed fine-grained sediments in the large inland sea. These are the oldest rocks in the system and are exposed around the outer part of the ancient Karoo Basin, and are known as the Dwyka Group (Johnson et al., 2006).

Overlying the Dwyka Group rocks are rocks of the Ecca Group that are Early Permian in age. There are eleven formations recognised in this group but they do not all extend throughout the Karoo Basin. In the Free State, Mpumalanga and KwaZulu Natal, from the base upwards are the Pietermaritzburg Formation, Vryheid Formation and the Volksrust Formation. All of these sediments have varying proportions of sandstones, mudstones, shales and siltstones and represent shallow to deep water settings, deltas, rivers, streams and overbank depositional environments.

Palaeontological context

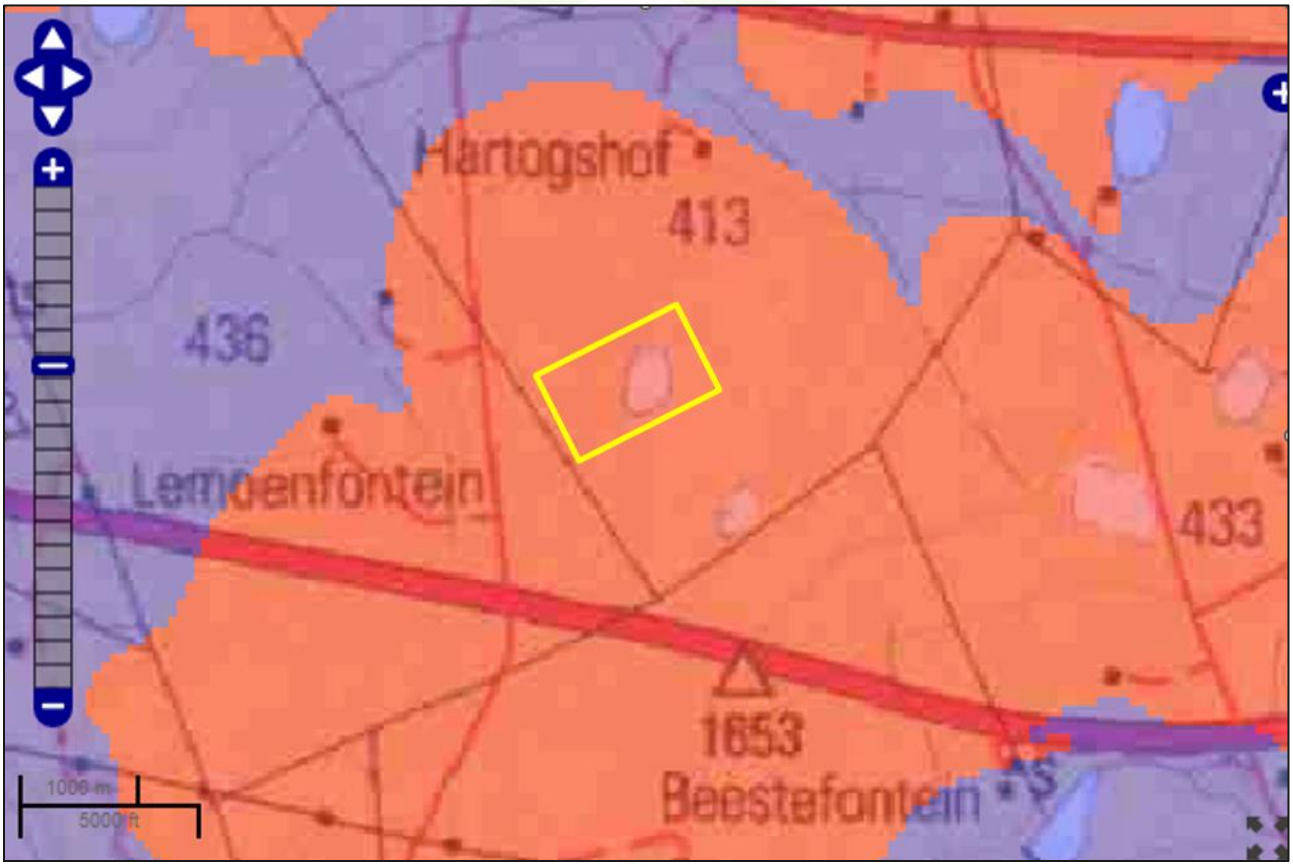

Figure 3-51: SAHRIS palaeosensitivity map for the Nndanganeni shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low

The palaeontological sensitivity of the area under consideration is presented in figure above. The site for development is in the very highly sensitive Vryheid Formation (red) for the whole area. The Vryheid Formation contains the main coal reserves of South Africa. Coals are the product of the alteration of buried peats by heat and pressure to form amorphous organic matter. No fossil plants are visible in the coal itself but can sometimes be found in the carbonaceous lenses between and adjacent to the coal seams. Here the original plants can be seen, the Glossopteris flora. This flora is dominated by the extinct seed fern, Glossopteris, but other plants were also present such as lycopods, sphenophytes, ferns, cordaitaleans and early gymnosperms (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

Vertebrate fossils are seldom found with plant fossils because they require different environments for preservation. Plants require a more reducing environment while bones need a more oxidizing environment (Cowan, 1995).

Although the Glossopteris flora is widespread in Gondwana, the occurrence is sporadic and difficult to predict. In this area, the Witbank Coalfield, there are usually five coal seams, from bottom to top called 1-5 (Snyman, 1988). The uppermost seam is overlain by sandstone in most areas and is 20 or meters below the lands surface (Snyman, 1998; fig 16).

Summary of site observations

No fossils and no rocky outcrops of shales that could preserve fossils were visible in the unmined areas. These fields have been cleared and planted in the past. They have deep sandy soils covering the underground strata so it is unknown at what depth any carbonaceous shales might occur. No shales or carbonaceous shales were evident on the surface in the area, and no fossils were seen.

AIR QUALITY

Sensitive Receptors

Sensitive receptors identified in the immediate vicinity of the study area and proposed mining area have been listed below:

- Various dispersed homesteads / farmsteads

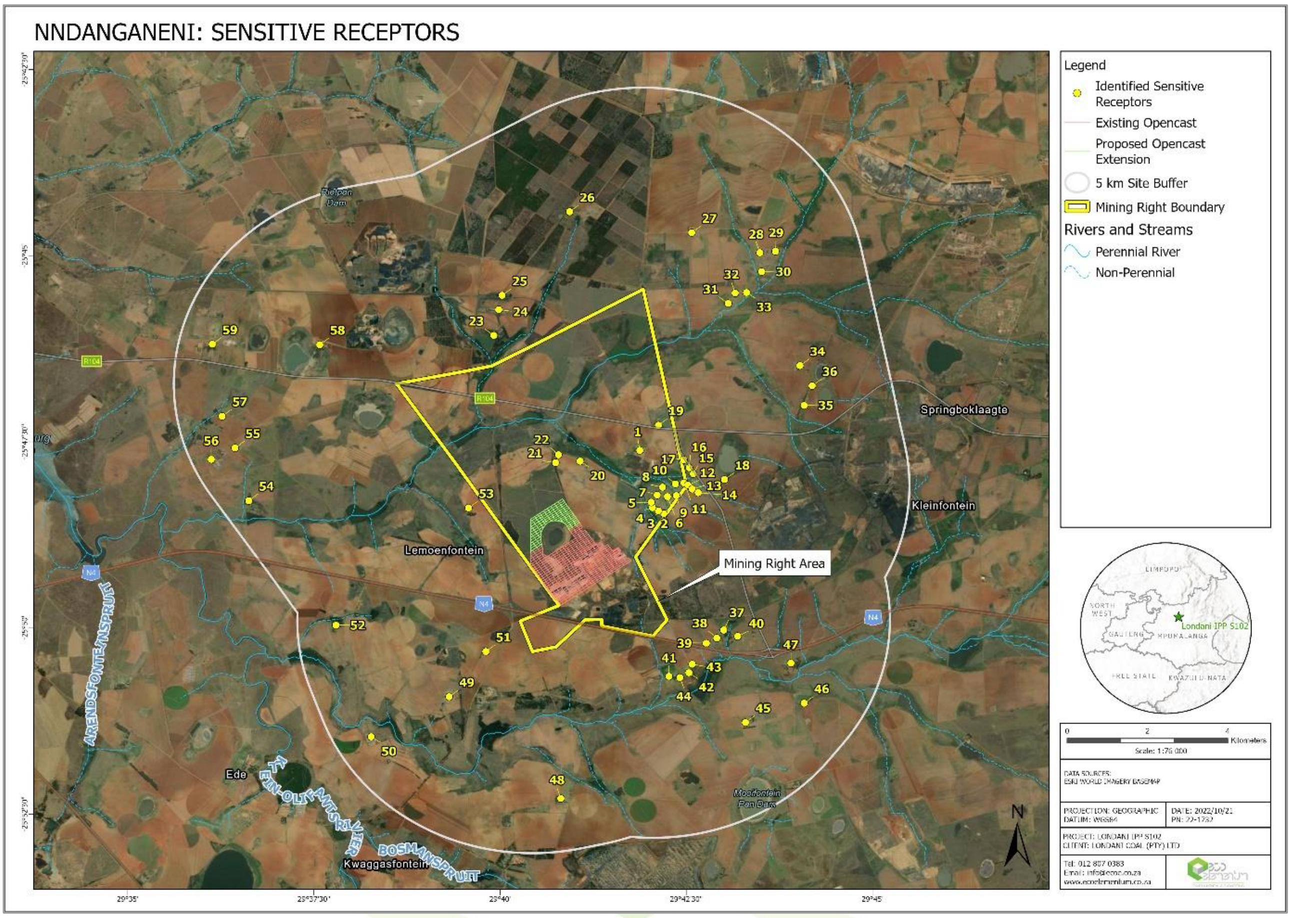

Figure 3-52: Sensitive receptors in the immediate area of the Mafatiki mining permit

Sources of Baseline Emissions

Vehicle Exhaust Gases

Vehicle exhausts contain a number of pollutants including carbon dioxide (CO^2), carbon monoxide (CO), hydrocarbons, oxides of nitrogen (NOx), sulphur and PM10. Tiny amounts of poisonous trace elements such as lead, cadmium and nickel are also present. The quantity of each pollutant emitted depends upon the type and quantity of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the ambient air. Pollutant concentrations in the air can be measured or modelled and then compared with ambient air quality criteria.

Veld Fires

Veld fires are widespread across the world, occurring in autumn, winter and early spring. In addition to controlled burning for fire-breaks and veld management, many fires are set deliberately for mischievous reasons. Some are accidental, notably those started by motorists throwing cigarettes out of car windows. Emissions from veld fires are similar to those generated by coal and wood combustion. Whilst veld fire smoke primarily impacts visibility and landscape aesthetic quality, it also contributes to the degradation of regional scale air quality. Dry combustible material is consumed first when a fire starts. Surrounding live, green material is dried by the large amount of heat that is released when there are veld fires, sometimes this material also burn. The major pollutants from veld burning are particulate matter, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible (USEPA, 1996).

Trucks Passing on the Roads, Loading and Offloading Raw Materials

Dust emissions occur when soil is crushed by a vehicle, as a result of the soil moisture level being low. Vehicles used on the roads will generate PM-10 emissions throughout the area and they carry soils onto the paved roads which would increase entrainment PM-10 emissions. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic.

Wind Erosion as a Result Of ROM Material and Topsoil Stockpiles

The topsoil and waste rock stockpiles generated during the construction phase will be minimal and probably used for construction purposes on site (berm and foundations for buildings), reason being that this will be limited to the mining areas – since the project is mainly an opencast operation. At the ROM stockpile, there will be constant transfer of ore from the opencast to the stockpile.

Material Handling (Loading, Hauling and Tipping)

Material handling during loading, hauling and tipping as mining processes has been known to have influence on dust generation in terms of increasing the fugitive dust emissions being generated. With the different kind of materials – topsoil, soft, and hard, tipping will be negligible. The tipping is mostly associated with the ROM at the processing plant vicinity. During these activities factors such as the surrounding wind regime, the material tipping rate, and the moisture content of the material all have an influence on the dust generation at the tipping transfer points.

Other Mining Activities

Other mining operations in the area contribute to emissions in the project area, the following an be likely sources:

- Particulate emissions generated due to wind erosion from exposed areas;
- Material handling; and
- Vehicle entrained dust on paved and unpaved road surfaces.

VISUAL

Topography

The topography of the area can be described as a gently undulating landscape. The surface elevation varies between 1 468 meters above mean sea level (mamsl) and 1 769 mamsl within 15 km of the proposed mining area.

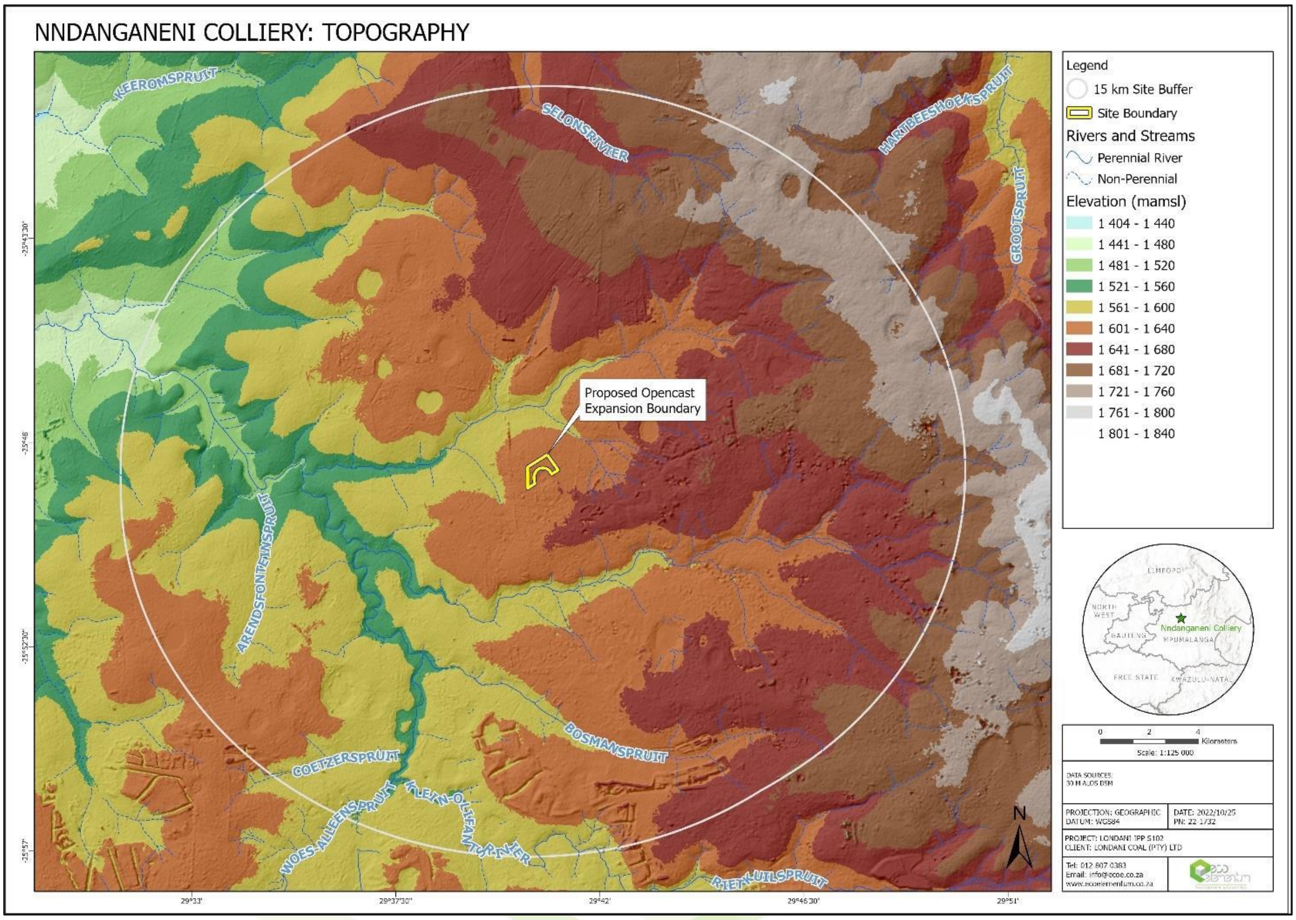

Figure 3-53: Regional Topography

Vegetation

The Visual Absorption Capacity (VAC) is the capacity of the receiving environment to absorb the potential visual impact of the proposed infrastructure. The VAC is primarily a function of the surrounding vegetation, and will be high if the vegetation is tall, dense and continuous.

Conversely, low growing, sparse and patchy vegetation will have a low VAC. The figure below shows the 2018 national vegetation of the study area. The figure indicates that the proposed mining operations is situated within the Eastern Highveld Grassland and the Rand Highveld Grassland vegetation types. The Eastern Highveld Grassland vegetation type is characterised by slightly to moderately undulating plains, including some low hills and pan depressions (Mucina et al., 2006). The vegetation is short, dense grassland dominated by the highveld grass composition with small, scattered rocky outcrops with wiry, sour grasses and some woody species. Mucina et al (2006) describes the Rand Highveld Grassland vegetation type as a highly variable landscape with extensive sloping plains with a series of ridges slightly elevated over undulating surrounding plains. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrubland on rocky outcrops and steeper slopes (Mucina et al., 2006).

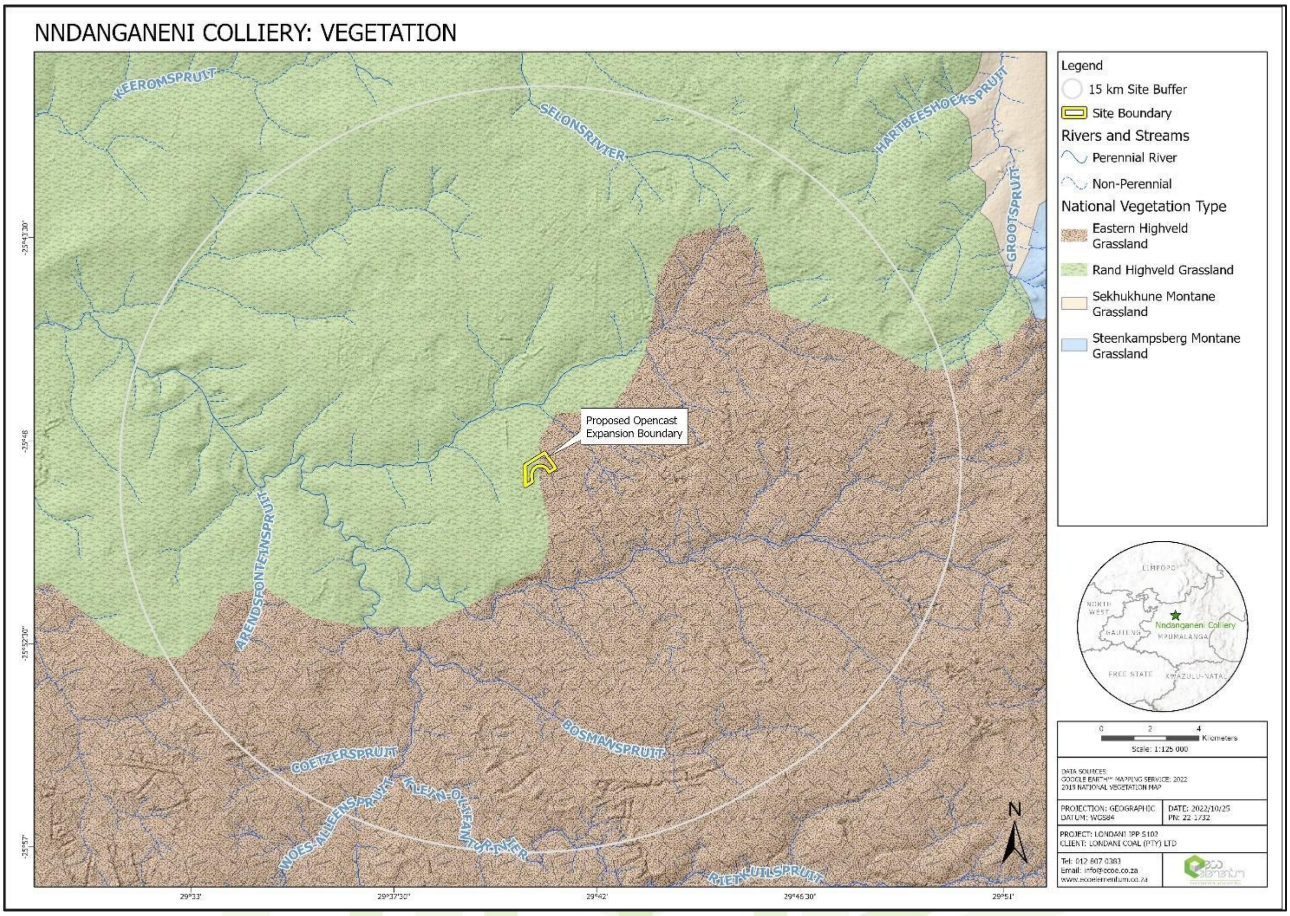

Figure 3-54: Vegetation

From the above descriptions of the vegetation types, it can be inferred that the surrounding vegetation of the area creates a low VAC for the proposed project. However, from a desktop analysis of the areas satellite imagery, it is important to note that the vegetation within the study area has been significantly disturbed by human activities.

Landcover

The figure below indicates the surrounding landcover of the study area. The landcover type within 15 km of the proposed project consists mainly of existing agricultural and mining activities. Patches of fallow land/old fields and natural grassland are also present within the study area. The figure also indicates a few formal residential areas scattered throughout the study area. Overall, the existing landcover creates a high VAC for the study area due to the existing mining and agricultural activities dominating the area.

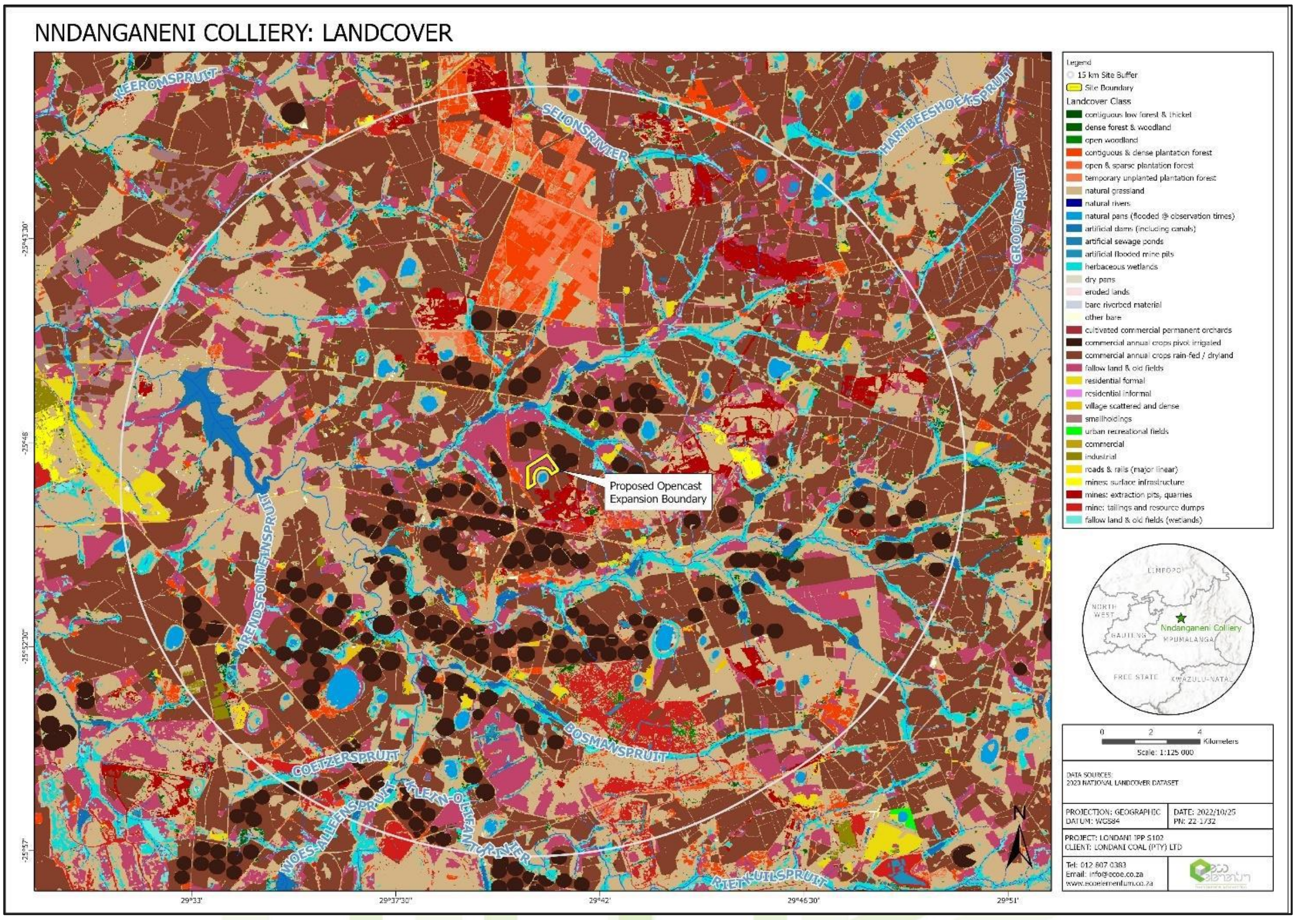

Figure 3-55: Landcover

Sensitive Receptors

From a desktop study of satellite imagery and available national data, potential sensitive receptors were identified within 15 km of the proposed operations and are presented in Figure 4.6 below. Using satellite imagery, homesteads; schools; residential areas and recreational facilities were identified as potential sensitive receptors to the proposed project. It should be noted that the sensitive receptors in the area may differ from those identified as not all areas may have been identified from the imagery successfully

The users on the road networks surrounding the study area are also considered as sensitive receptors due to their potential momentary views of the proposed development. The identified road network includes the R104 main road, the N4 and N11 National Roads and several secondary roads which service the identified homesteads, schools, residential areas and recreational facilities.

The identified homesteads, schools, residential areas and recreational facilities are expected to experience higher levels of visual impacts due to their static views of the proposed development, as compared to travellers using the road networks who are expected to experience lower levels of visual impacts due to their momentary views of the proposed development. However, due to the low density of sensitive receptors, along with the sensitive receptors current exposure to existing agricultural, mining and industrial activities, the identified sensitive receptors are expected to have a low sensitivity towards the proposed opencast pit expansion. Figure 3-57 is an indication of some of the existing mining and industrial areas, within 15 km of the proposed site, in relation to the identified sensitive receptors. The existing mining and industrial areas were delineated using satellite imagery.

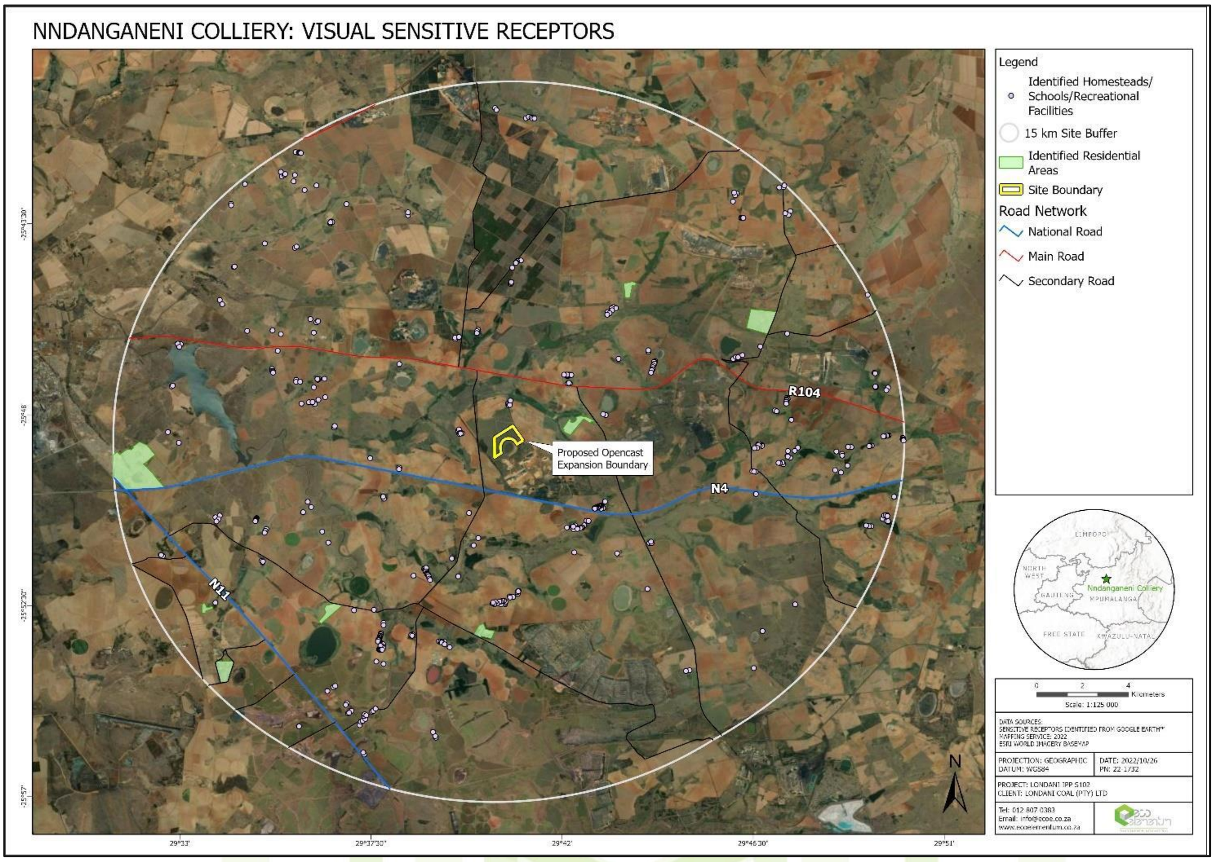

Figure 3-56: Identified Sensitive Receptors

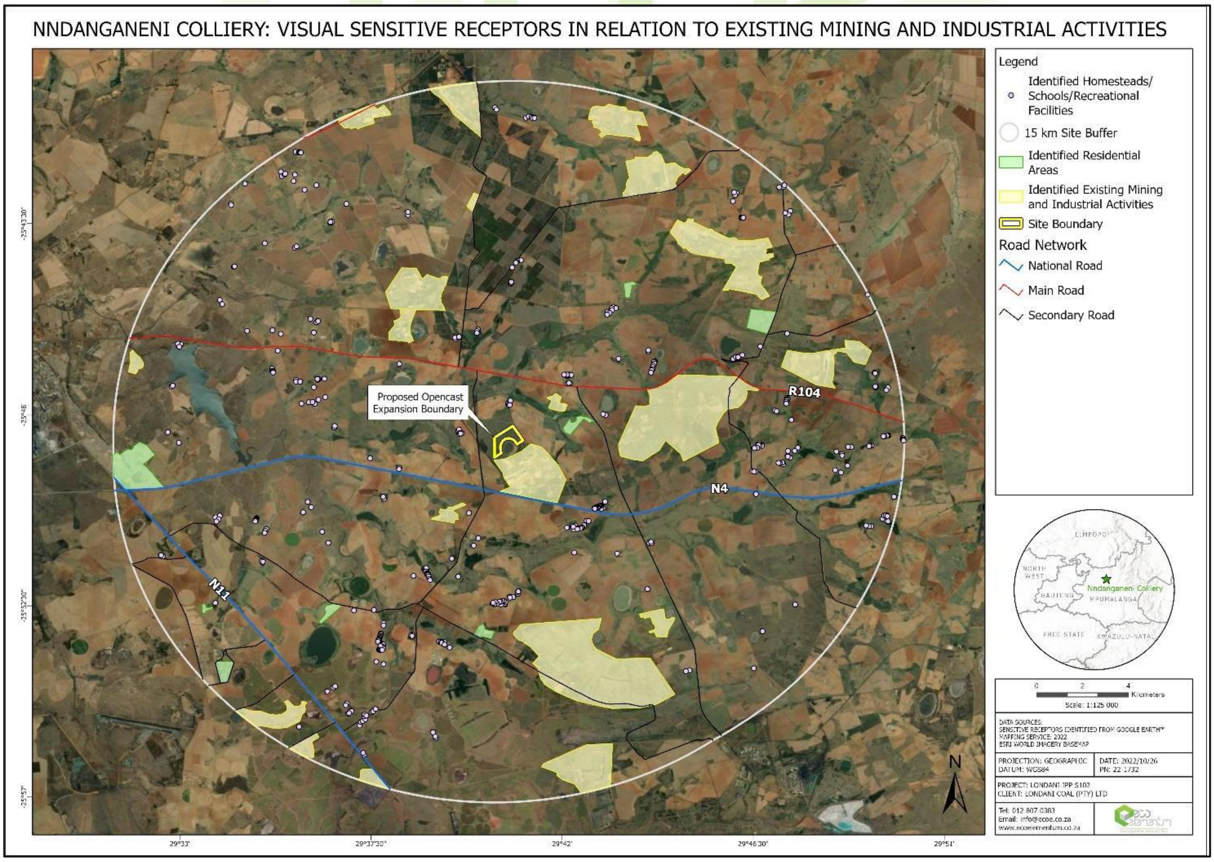

Figure 3-57: Sensitive Receptors in Relation to Existing Mining and Industrial Activities

Sense Of Place

The concept of "a Sense of Place" does not equate simply to the creation of picturesque landscapes or pretty buildings, but to recognize the importance of a sense of belonging. Embracing uniqueness, as opposed to standardization, attains quality of place. In terms of the natural environment, it requires the identification, a response to and the emphasis of the distinguishing features and characteristics of landscapes. Different natural landscapes suggest different responses. The areas current sense of place was extracted mainly from the Steve Tshwete Local Municipality 2022 – 2027 Integrated Development Plan (IDP).

The proposed site is located approximately 20 km southeast of the town of Middelburg, within the Steve Tshwete Local Municipality, which forms part of the Nkangala District Municipality. One of the most important features of the local municipality is the intersection between two national transport corridors, the N4 (Maputo Development Corridor) and the N11 (Middelburg/ Bethal/ Ermelo/ Richards Bay Corridor) (IDP, 2022 – 2027). The local municipality is home to several large industries such as Columbus Steel, Eskom, the Nkangala District Municipality's headquarters, and various government departments (IDP, 2022 – 2027).

The local municipality's contribution to the district economy was 34.4% in 2020, which made it the second largest economy in the district (IDP, 2022 – 2027). The municipality's dominant contribution was to Nkangala's agriculture and manufacturing industries and also contributes significantly in all of the other seven industries (IDP, 2022 – 2027). Furthermore, in 2020, the largest industries were mining, manufacturing, community services and finance, which together contributed 72.9% to the Steve Tshwete's economy (IDP, 2022 – 2027) Steve Tshwete holds comparative advantages in agriculture, mining, manufacturing, and utilities (IDP, 2022 – 2027).

The 2022 – 2027 IDP also indicates that the most prominent development directives emerging from the various developments policy documents, which should inform the development of the Steve Tshwete Municipal Spatial Development Framework (MSDF) includes the Mpumalanga Vision 2030, which states that spatial rationale for future development of Mpumalanga should centre around eight key drivers: nodal development, business, commercial and industrial development, tourism, forestry, agriculture and mining. Another important directive applicable to local municipality is to achieve a sustainable equilibrium between urbanisation, biodiversity conservation, industry, mining, agriculture, forestry, and tourism-related activities within the municipality, by way of effective management of land uses and environmental resources (IDP, 2022 – 2027). This directive should be adhered to should the proposed project go ahead.

The study areas sense of place further interlinks with the level of visual intrusion expected from the proposed project. Visual intrusion refers to the level of compatibility of the project with the particular qualities of the area, which is related to the idea of context and maintaining integrity of the landscape (Oberholzer, 2005). Considering the above description of the study areas sense of place, the proposed project is expected to create a low level of visual intrusion where the proposed expansion is expected to cause minimal change or blends in well with the surroundings. (Oberholzer, 2005).

BLASTING & VIBRATION

Geology

The mining area falls within a sedimentary (Sedimentary rock has the distinct identification characteristic of being bedded) environment of the Witbank Coalfield located in the coal bearing strata hosted in the Vryheid Formation of the Ecca group of the Karoo Supergroup. The Witbank Coalfield has several seams that are available for exploitation. The mining environment generally consists of horizontally stratified sedimentary rocks with occasional igneous (Igneous rocks are rocks that have solidified from molten material known as magma or lava) intrusions.

The site-specific area is characterized by shale, shaley sandstone, grit sandstone, conglomerates and coal. A percussion drill log of borehole GCS16 from the mining area is illustrated in Figure 3-58, illustrating the strata composition of the mining area. The drill log was extracted from the Hydrogeology report of the mining area (GCS Reference number 15-541).

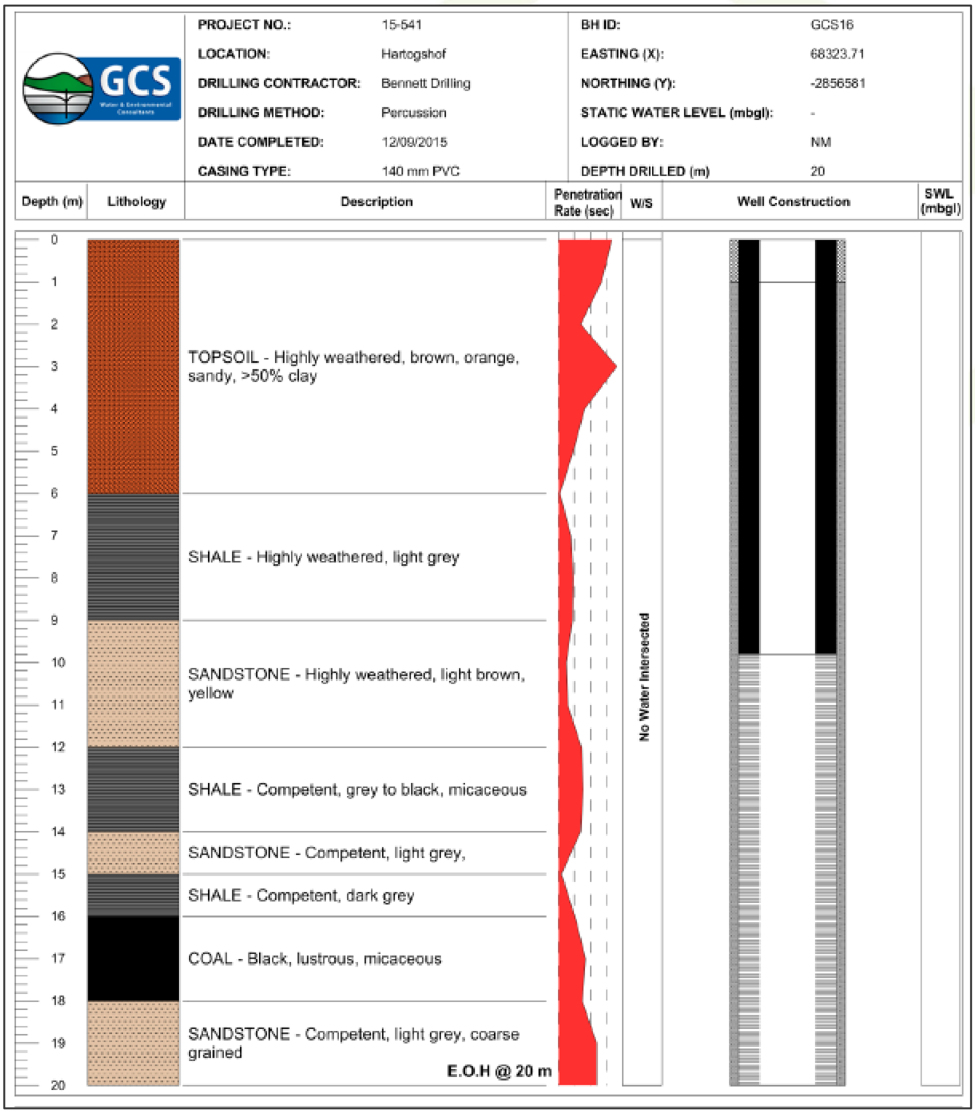

Figure 3-58: Illustration of drill log GCS16

Geotechnical conditions that can be expected in the mining area is:

- Soft overburden consisting of soils and weathered strata material, overlaying the hard rock sedimentary strata material followed by several coal seams and sedimentary partings.

- Frequent horizontal jointing/bedding planes which forms part of the nature of sedimentary rocks. Occasional jointing with irregular dip and strike.
- Occasional igneous intrusions in the form of dykes or sills.

In the opencast mining environment explosives are used to break rock into smaller loads and haulable fragments through the shockwaves and gases generated from the explosion. Ground vibration is a natural result from blasting activities. The far field vibrations (those vibrations felt further away from the blast area) are inevitable, but undesirable by-products of blasting operations. The shockwave energy that travels beyond the zone of rock breakage is wasted and could cause damage and annoyance further on. The magnitude of the shockwave is determined by the following factors (Rangasamy, 2018):

- The charge mass per delay,
- The delay period,
- Distance from the blast,
- Rock mass and
- Geometry of the blast.

Table 3-31: The factors influencing ground vibrations that can be controlled by a planned design and proper blast preparation (Rangasamy, 2018):

The larger the charge mass per delay the greater the vibration energy yielded.	When a number of holes are detonating simultaneously the maximum total explosive mass per such delay will have the greatest influence. In practice, this means that if all holes are detonated individually, the weight of explosives per single hole is considered. Therefore, if more than one hole is detonated simultaneously, the mass per hole for each hole must be added together. Specifically, charges detonated within 15 milliseconds are considered as a single detonation, and delays of more than 15 milliseconds are treated as separate blasts.
The distance between the blast and the point of interest.	The ground vibrations weaken over distance at a rate determined by the mass per delay, timing and geology. Each geological interface (slips, joints, discontinuity planes, etc.) that a shockwave encounter will reduce the vibration energy, due to reflections of the shockwave. In rock such as sedimentary or laminated material with high laminations and with multiple bedding planes the shockwave transfer will be limited.
The geology of the blast medium and surroundings.	Geology influences the magnitude of vibrations. High density materials have high shockwave transferability, whereas low density materials have low transferability of the shockwave. For example, when comparing coal (density of 14-16 kN/m^3) and granite (26 to 27kN/m^3), the denser granite will be the better conductor of the shockwave.

Ground vibrations formula

In order to assess or predict the effect of a blast and the resultant ground vibration in the proposed mining area, the Peak Particle Velocity calculations will be used to determine the effect that it may have on the geology and surrounding surface structures. The most widely accepted measurement of ground vibrations is the Peak Particle Velocity (PPV) during which a standard accepted mathematical process of scaled distance is used:

$$y = a\left(\frac{D}{\sqrt{E}}\right)^{b}$$

Where:

y – Peak particle velocity (PPV)

a – Site constant (1143)

b – Site constant (-1.65)

D – Distance

E – Explosive mass or charge per delay

The PPV is the maximum ground motion amplitude experienced by a particle subjected to ground vibration or is defined as the speed at which a particle of ground/soil vibrates as the wave passes through a particular section. PPV is measured in meters per second (m/s) or millimetres per second (mm/s).

Since site-specific tests have not been conducted for the mining area the following conservative industry accepted constants will be used and is applied for the prediction of ground vibration (Rangasamy, 2018):

Note that site-specific blasting designs have also not yet been conducted, therefore the calculations referred to in this report will serve as a guideline from which site-specific blast designs can be drafted once mining commences.

When considering the PPV values it must be noted that different structures behave differently and therefore the PPV levels are described below for the criteria of the different structures:

- Rock breaking
- Underground workings (if mining will be conducted in close proximity to underground workings)
- Surface structures such as Eskom, Public roads, pipelines and conveyors.
- Different types of buildings

Ground vibrations limiting criteria – Rock breaking

The ground vibration problems developed because of the peak particle velocity which is necessary to break the rock and can be classified in the following broad bands when considering rock breaking.

Table 3-32: Broad bands Rock breaking (Thompson, 2005):

PPV (mm/s)	Classification description
<250 mm/s	No fracture of rock
250 - 525 mm/s	Tensile stress failure of rock
525 - 2500 mm/s	Tensile stress failure and radial cracks form
>2500 mm/s	Fragmentation of rock

Ground vibrations limiting criteria – Underground workings

According to Van Wijk (2001) most studies that deal with the effects of opencast blasting concentrate on the damage to surface structures (mostly buildings) during which the most severe damage to structures is caused by blast vibration frequencies in the order of 14Hz. Van Wijk further found that the PPV's up to 125 mm/s will not adversely affect future underground mining. When considering underground workings, the following guidelines are set apart in terms of damage to the underground workings.

Table 3-33: Vibration damage guideline to underground workings (Oriard, 1972):

PPV (mm/s)	Cause
< 50mm/s	Negligible effects on underground workings

50 to 100 mm/s	Will cause loose rock to fall underground
130 to 380 mm/s	Will cause partially loosened rock underground and on surface slope to fall
> 635 mm/s	Will cause damage to intact rock

Ground vibrations limiting criteria – Surface structures

South African legislation does not specify the maximum allowable ground vibration limits. However, several studies within South Africa have investigated vibration limits.

Table 3-34: Suggested vibration limits for civil and engineering structures (Rorke, 2011):

Structure	PPV (mm/s) limit	Description
Eskom Power Lines	<75 mm/s	Conservative value since the steel structure of pylons and concrete foundation blocks can both withstand significantly higher values.
Public Roads	<150 mm/s	Desegregation of road material will start to appear at vibration amplitudes above 150mm/s.
Pipelines (water and Transnet)	<50 mm/s	Blasting near pressurized steel pipelines has taken place safely at PPV's of >50 mm/s in South Africa.
Conveyors	< 200mm/s	A steel conveyor structure will withstand very high vibrations and the concrete plinths will remain undamaged by ground vibrations up to 200mm/s.

Ground vibrations limiting criteria – Buildings

Furthermore, the United States Bureau of Mines (Siskind et al, 1980) Criteria is used for civil infrastructure such as buildings and houses

Table 3-35: Ground vibrations limiting criteria United States Bureau of Mines

Type of Building	Ground vibration limit
General houses of proper construction	25 mm/s
Houses of lesser proper construction	12.5 mm/s
Rural buildings	6 mm/s

SOCIAL

The proposed project is located in Steve Tshwete Local Municipality (STLM), within the Nkangala District Municipality (NDM) in Mpumalanga Province. The socio-economic characteristics of the population within each of the aforementioned areas are listed below.

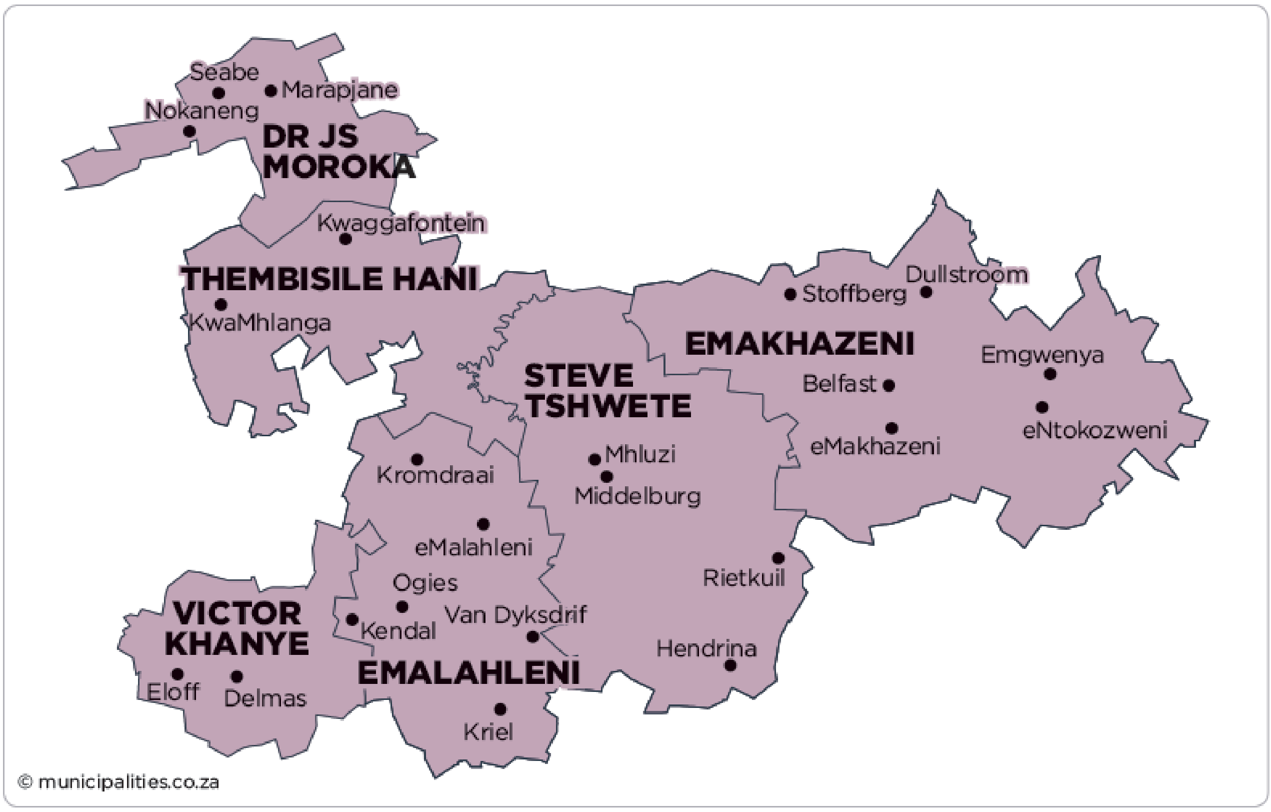

Figure 3-59: Nkangala District and Local Municipalities Map

Population and Demographics

According to the STLM 2022/23 IDP, Stats SA 2016, recorded a population of 278 749 people for the STLM. This makes STLM the 7th largest population in the province, accounting for 19.3% of Nkangala's total population. The municipality recorded a population growth rate of 4.4% per annum (highest in the province) between 2011 & 2016. The area's increase in population is attributed to the number of industries which opened in the past years, attracting workers into Middleburg. The STLM has a youthful population pyramid which is slightly skewed towards the male population, with 52.4% of the population being male. The Youth population (15 – 34 years) make up 40.7% of the total population.

The number of households in Steve Tshwete increased from 64 971 in 2011 to 86 713 households (almost 22 000 households increase) in 2016 - represents 20.6% of the Nkangala household figure - household size declining from 3.5 to 3.2 in the same period.

In 2016, there were 86 713 households in the STLM, with an average household size of 3.2 people. This is a relatively low family size, which may reflect the young age of the urban centres in the district, in which large family structures have not had time to develop. More established towns generally have average family sizes in excess of 4.5 people, while rural areas often average 5.5 people or more per household.

Educational Status

Educational achievement is a key development indicator of a population. STLM has the 2nd highest matric pass rate in the Mpumalanga province, with the majority of the population (ages over twenty) having completed high school level education. The municipality's functional literacy has been noted to be improving and it is the 2nd highest in the province.

Employment and Labour

Although significant, at 23.1%, statistics show that STLM has the lowest unemployment rates in the Mpumalanga Province. Steve Tshwete contributed 10.3% to total employment in the province. In 2020, the youth population's expanded unemployment rate was 34.4%. There is concern about the high share of unemployed youth & especially females. Although the municipality has a relatively good education status, there is a mismatch in the demand of the labour market.

A large portion of those employed are absorbed into the mining, manufacturing, community services and finance sectors. STLM contributed 13.3% to Mpumalanga Province's economy during 2022, this was the 3rd largest economy in the province. In 2020, the largest industries were mining, manufacturing, community services and finance. Together these four contributed 72.9% to the Steve Tshwete economy. Steve Tshwete holds comparative advantages in agriculture, mining, manufacturing and utilities.

Annual Household Income

It was reported by StatsSA that approximately 13% of the population in STLM have no annual income. Most of the population (17%) received an average income of R38,201 - R76,4000. According to the STLM 2022/23 IDP, the average annual household income increased from R 55 369 per annum in 2001 to R134 026 per annum in 2011. This represents an absolute increase in nominal terms over the 10-year period, which was the highest among the eighteen local municipalities in the province. This is closely related to its higher education levels and employment rates.

Social Infrastructure and Services

Approximately 89% of the STLM is categorised as an urban area, while 11% is categorised as a Farm area. A large percentage of households in the local study area have access to piped water either inside their house or within a communal yard, with an average of 90.7% having access to municipal water, whilst 4.8% have access to water through a borehole. The 2011 Census of the municipality also found that 62.2% of the STLM households have access to piped water inside their dwellings, while 23.5% of the household have access to piped water in their yard.

In terms of sanitation, data from the 2011 census show that an estimated 84% of households in the local study area have access to waterborne sewer services (flush toilets, with or without septic tanks). An estimated 85% of waste generated within the STLM is collected weekly by the local municipality. Of the households in local study area, 82 % use electricity for cooking, 63% for heating and 90.8% for lighting. The majority of the population (41.6%) rent their dwellings and 32.1% own their dwellings which are full paid off.

One of the most important features of the Steve Tshwete LM (STLM) is the fact that the intersection between two national transport corridors, the N4 (Maputo Development Corridor) and the N11 (Middelburg/ Bethal/ Ermelo/ Richards Bay Corridor) is located in the central part of the Municipality at Middelburg Town. Although roads in the STLM are sufficiently connected with district, provincial and national roads, many secondary road systems are in a state of disrepair, being insufficient to handle the increased traffic created by mining and other industrial developments.

Crime and community safety is generally a cause of concern for communities in the local study area. Steve Tshwete ranked 11th (7th highest/worst) in terms of the 17 serious crimes reported. Despite the unfavourable ranking, it recorded an improvement between 2014/15 and 2019/20.

Health Services

The mining operations in the municipality have resulted in an influx of inhabitants into the area which has put tremendous strain on health facilities. HIV and AIDS is one of the biggest challenges within the health sector of STLM. Fortunately, according to the 2013 Antenatal Care Survey, HIV prevalence rate has decreased from 52%- 43%. This positive change can be attributed to the active Aids Council, vigorous HCT campaigns and community awareness. STLM aims to promote health and primary healthcare in their communities and assisting the communities to adapt to climatic changing conditions, the institution shall ensure functionality of HIV/AIDS Councils within the municipality and ensuring the effectiveness of campaigns on HIV & AIDS.

3.8.4.1.2 Description of the current land uses.

When the surrounding environment is considered, the region is associated with crop cultivation, livestock rearing and mining activity. The proposed void / pit extension is located on old fallow land (also classified as other natural area in the CBA map of the ecological specialist study) and surrounding a pan / wetland area. Access to the area is via the Nndanganeni Colliery (operational).

3.8.4.1.3 Description of specific environmental features and infrastructure on the site.

The agricultural land consists of both pivot irrigated annual croplands as well as dry-croplands. The pan / wetland area on is being surrounded by the proposed pit extension. Mining activities are currently taking place towards the southeast of the proposed void / pit extension.

3.8.4.1.4 Environmental and current land use map.

(Show all environmental and current land use features)

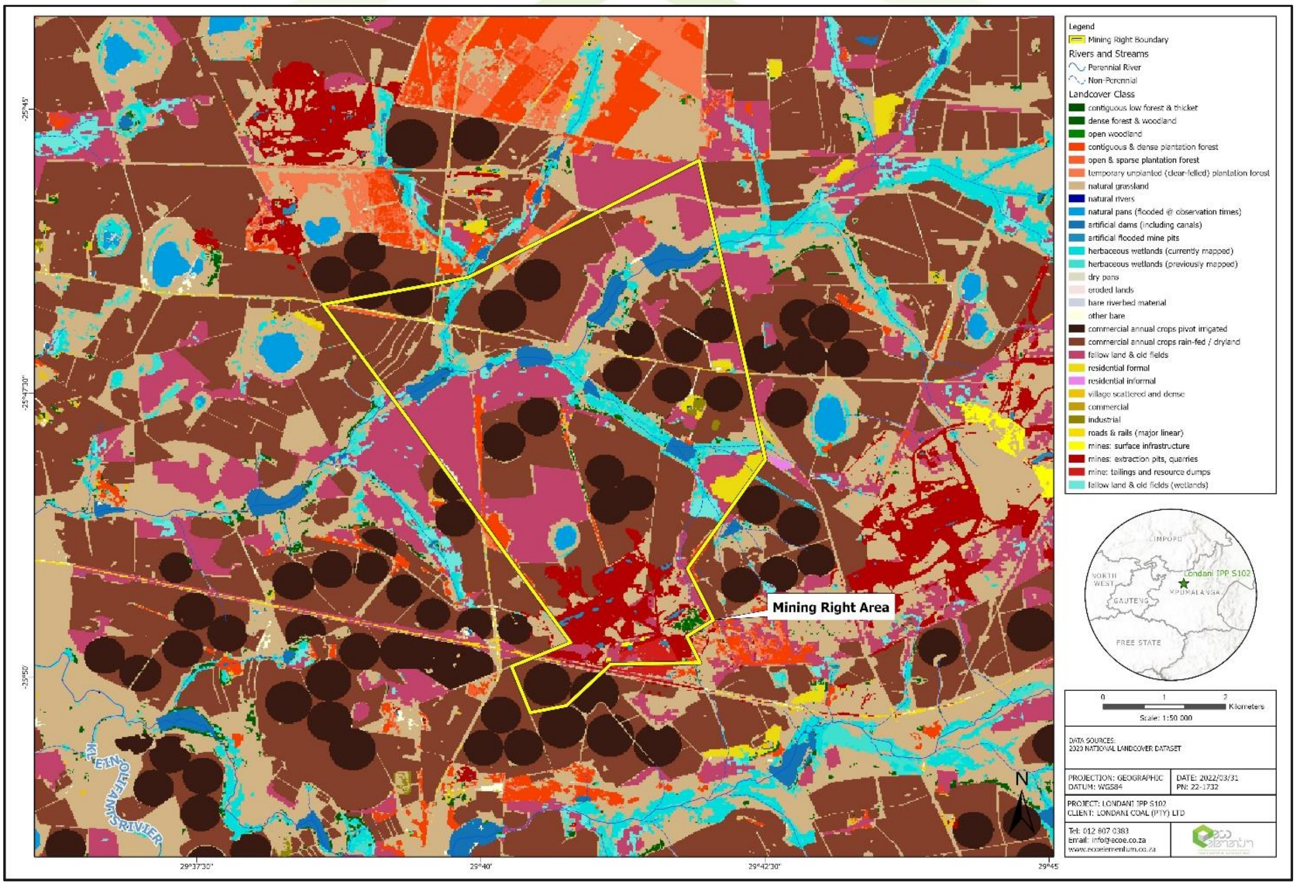

Figure 3-60: Land cover of the study area

Updated- 11/11/2022

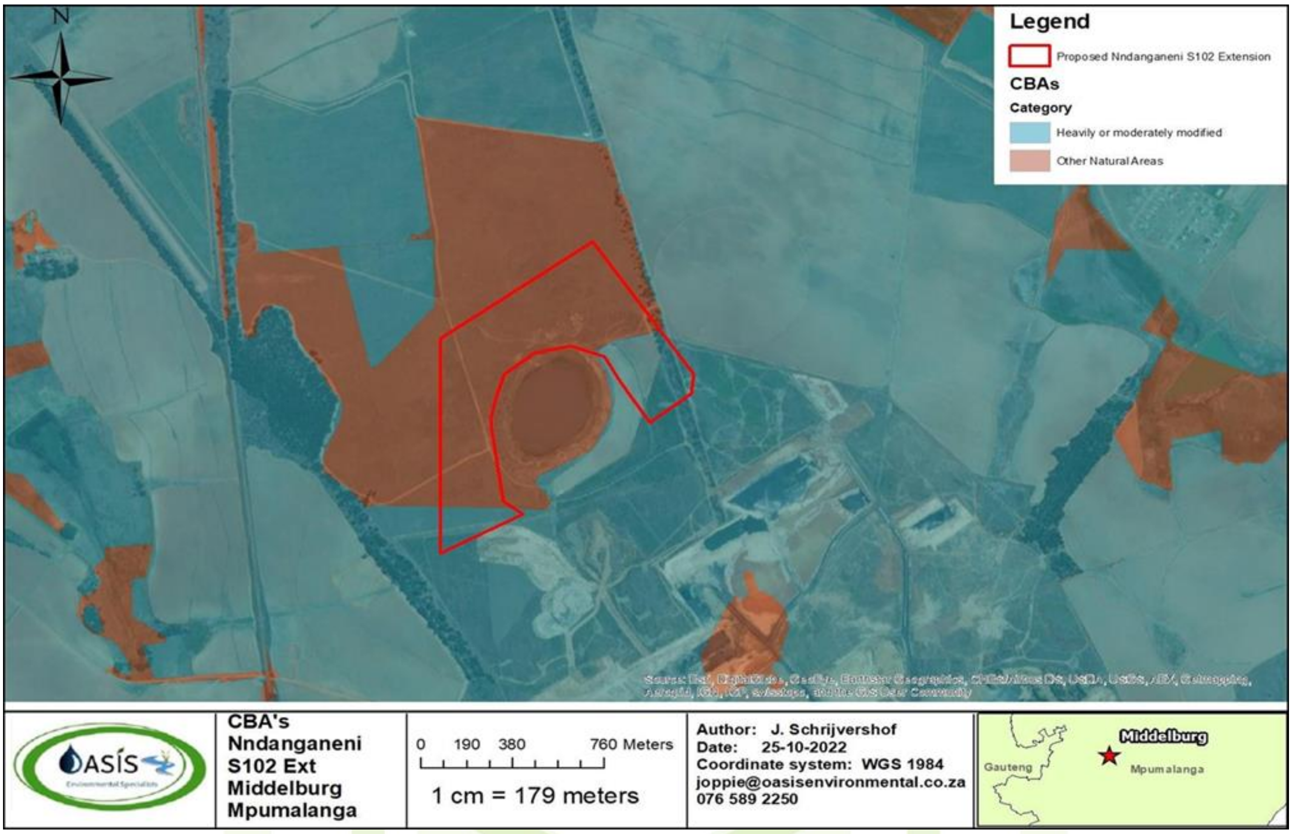

Figure 3-61: Table 3 36: CBA in relation to land uses

3.8.5 Impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impact.

Hydrogeological Impact Assessment

Construction Phase

Impacts on Groundwater Quantity

No significant impacts are expected during the construction phase in terms of groundwater quantity. The removal of vegetation in preparation of the mining area may cause an increase in surface runoff and therefore a small decrease in aquifer recharge. Since the pit will extent from an existing opencast pit, no box-cut will be required.

Impacts on Groundwater Quality

The proposed Nndaganeni activities are not expected to impact the groundwater quality during the construction phase. The only possible impacts may be from example fuel spillages from construction vehicles.

Operational Phase

Impacts on Groundwater Quantity

The operational phase impacts on the groundwater quantity will mainly be as a result of the dewatering of the surrounding aquifer during the opencast mining. The groundwater level in close proximity to the pit is expected to decrease since groundwater seepage to the void will be abstracted.

As simulated with the numerical model the extent of the dewatering cone in the shallow aquifer is approximately 450 m. No known groundwater users are located within this radius from the pit boundary.

Impacts on Groundwater Quality

If dewatering of the aquifer has occurred during the operational phase, which is expected, the opencast void will act as a groundwater sink since the water levels have not yet recovered. Groundwater gradients and therefore groundwater flow will be towards the pit area. For this reason, groundwater contamination will not be able to flow downgradient from the pit area during the operational phase.

Impacts on Surface Water

Figure 3-62 represents the NFEPA wetlands located within the mining area of the proposed Nndaganeni project. Two pans existed within the mining area and was previously referred to as the Northern and Southern pans. The southern pan has been mined out during the existing mining activities at Nndaganeni. The Northern pan has not been mined, but future mining is planned for the circumference of the pan. The mining will remain outside the 100m buffer area.

The Northern pan has a topographical catchment area of approximately 70ha. It is a perennial pan which is situated in a much deeper and more defined pan basin. This pan is an open water body with no vegetation in or right adjacent to it. (GCS, 2015).

Groundwater can contribute to surface drainage, baseflow to streams, pans and wetlands only if the static water level is higher or at the same elevation as the base of the surface water feature. Water levels recorded in close proximity to the northern pan were shallow at 2 - 4.6 mbs. The water levels in the boreholes in close proximity match the water elevation in the northern pan. This indicates that the pan is connected to the underlying weathered aquifer and is therefore partially dependent on groundwater for sustainability.

The groundwater levels within the catchment area of the northern pan are expected to be impacted on in terms of dewatering. Water level drawdown of up to 11 m is expected to the east of the pan.

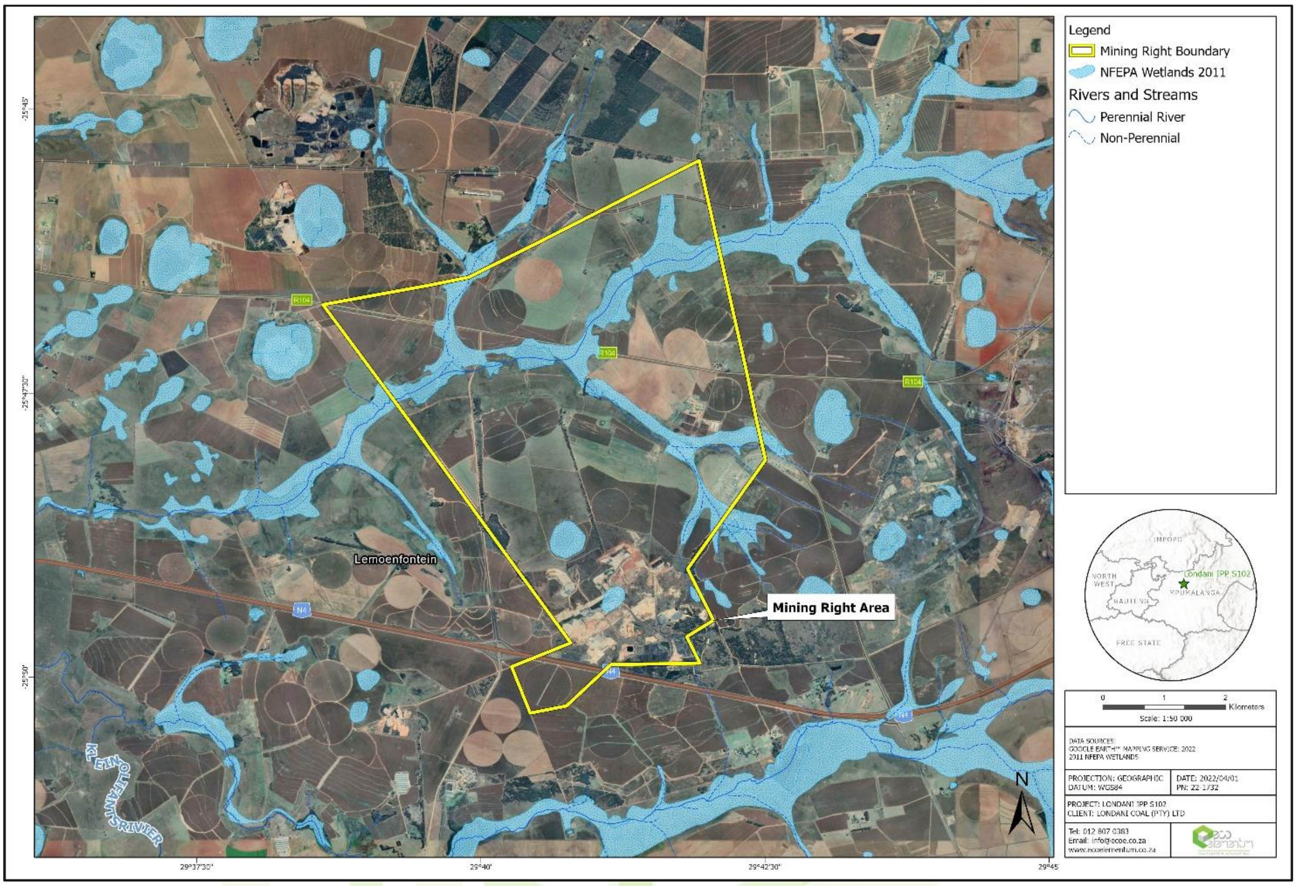

Figure 3-62: NFEPA Wetlands in the region of the Nndaganeni.

Decommissioning Phase

During the decommissioning phase all the potential surface contamination sources including the PCD's, ROM stockpiles and other infrastructure, will be removed. These include all carbonaceous or contaminated material. This will decrease the surface sources for further groundwater contamination.

The opencast pit area will be rehabilitated which will have a positive impact on the groundwater regime in some areas since the poor-quality seepage to the groundwater will decrease. Rehabilitation should occur in such a manner to divert as much as possible water away from the opencast areas.

Post Closure

Groundwater Quantity

When dewatering ceases at the end of the operational phase, the groundwater level will start to recover to a state of equilibrium. Decant from the lowest elevation on the pit boundaries may occur once the groundwater levels have recovered.

With sufficient rehabilitation, the recharge to the opencast pit may decrease to approximately 12,5%. Decant elevations and estimated rates were discussed in Section 7.8.3 of the Geohydrology report, attached in Annexure D – Specialist Studies of this BAR.

Groundwater Quality

The groundwater quality in the pit regions is expected to decrease as a result of the acidification. It is highly recommended that all carbonaceous material be placed on the pit floor and covered with overburden material. This will result in coverage of the carbonaceous material with water first, which will eliminate oxygen from the system to decrease the process of acid generation.

The contamination plume is expected to migrate away from the opencast area in a predominantly western, northern and north-eastern direction similar to the groundwater flow directions. The sulphate concentrations in the opencast area increase as a result of acid generation to a concentration over 2 700 mg/l. The contamination plume from the opencast is not expected to extent more than 850 m over the period of 100 years post-mining.

Please refer to Section 7.8.3 of the Geohydrology report, attached in Annexure D – Specialist Studies of this BAR of this document for more information on the expected groundwater quality conditions post closure.

Cumulative Impact

The Nndaganeni area is situated in an area with several mining and agricultural activities at or near its boundaries. These include:

- Existing Nndanganeni mining pits from which the proposed pit will extent;
- Optimum Pit – 5.5 km South of Nndaganeni;
- Masemanzi Boschfontein - <2.5 km south-west of Nndaganeni;
- Mafube Colliery – 3.7km east of Nndaganeni;
- Hahhono Coal – 6km north-west of Nndaganeni; and
- Agricultural activities bordering the proposed mining area.

Dewatering of the local aquifers is not limited to the Nndaganeni mining area. The mining operations as mentioned above will have a cumulative impact on the aquifers in terms of quality and quantity. Acid mine drainage, as well as the dewatering of the aquifers as a result of all these mining activities, may decrease the groundwater qualities and have a nett loss on the water supply to the groundwater users in the area.

Groundwater Management

Table 3-36: Mitigation measures for Groundwater Management

Potential Impacts	Mitigation Measures
• The water level post-closure will start to rise as the back-filled pit starts to fill. • Decant may occur once the water level in the back-filled opencast pit has recovered. • Once the water levels have recovered, a groundwater pollution plume will start to migrate down gradient away from the pit areas. • The Northern Pan is expected to be impacted on in terms of sulphate contamination at 100 years post closure.	• Carbonaceous material should be placed at the deeper base of the opencast pit to allow flooding with groundwater as soon as possible. This will reduce the redox reaction potential as oxygen is excluded from the system. • Rehabilitation should occur in such a manner that surface runoff is directed away from the rehabilitated pit and recharge to the pit minimized. • Flow paths which include fracture zones should be sealed to reduce inflow of fresh groundwater and outflow of contaminated groundwater. • Methods of handling the potential decant should be investigated and may include treatment of polluted water or a down gradient- intercepting trench.

	• The groundwater quality in the monitoring boreholes should continue to be analysed on a quarterly interval basis. • Monitoring of surface water features including the Northern pan should be conducted on a quarterly interval.

Wetlands / Watercourse Impact Assessment

The risk assessment focussed on the impacts associated with the proposed mining operations as mentioned above. Vegetation clearing will occur and this will lead to increased turbidity and sedimentation in the stream as well as altered flow patterns. The machinery used has a risk of hydrocarbon spills into the stream as discussed in the section above. There are impacts on the flow patterns to the stream as well as possibly increased nutrient levels from the waste materials entering the water course.

Sedimentation and soil erosion

Soil erosion will result in the deposition of sediment into the wetland system; posing a risk to the downstream catchment geomorphological/functional integrity. Subsequent impacts that are likely to result are: a loss of instream flow including aquatic refugia and flow dependent taxa; sedimentation of the watercourse that will be destructive to many faunal species affecting their habitat; breeding and feeding cycles.

Some of the key biological effects related to the deposition of sediment and suspension of fine sediment within the watercourses includes:

- Habitat alteration downstream of crossing points due to increased sediment deposition (degradation of coarse riverbed habitats by the infilling of interstitial spaces and the reduction of inter-granular flow for example);
- Reductions in photosynthetic activity and primary production caused by sediments impeding light penetration;
- Reduced density and diversity in benthic invertebrate communities as a result of habitat degradation, blanketing of fish spawning sites and the establishment of more tolerant taxa or exotic species; and
- Changes to the behaviour and feeding ability of fish at low levels of suspended sediments, while physiological damage and mortality can occur at very high concentrations of suspended sediment resulting in clogging of fish gills, interference in embryogenesis and larval development of amphibians and mortality of filter-feeding macro-invertebrates.

During the operational phase of the plants rainfall is likely to filter through into the waste dump. This water is likely to accumulate particles and pollutants that will pose a risk to the surrounding water courses. Sediment that washes off the waste dump during periods of rainfall will also contribute to increased sedimentation in the aquatic environment.

Erosion and sedimentation impacts are linked to alterations in hydrological regimes as a result of increased storm water flood peaks associated with increased impermeable surfaces and the concentration of flows. Increases in peak discharge may significantly increase stream power, increasing the risk of erosion (localised scouring and incision) and resultant sedimentation of watercourses. Local site factors such as soil erodibility, vegetation cover, gradient of local slopes and regional rainfall/runoff intensity will affect the probability and intensity of erosion impacts (Macfarlane et al., 2014). Typical results of erosion & sedimentation on water resources may include:

- Locally increased channel slopes;
- Loss of in-stream biotope diversity due to scouring or blanketing of sites with sediment;
- Localised scouring at stormwater discharge points into watercourses;
- Head cut migration upstream and subsequent deepening of channels (where base level lowering has occurred);
- Lowering of the local water table and subsequent desiccation of adjacent to the river and riparian areas;
- Relatively higher channel banks that may exceed critical height resulting in bank failure/collapse;
- Addition of sediment to the water column (increased turbidity) affecting suitability for aquatic organisms; and
- Deposition of large masses of sediment downstream causing localised channel braiding, instability of the river banks and alterations in water distribution.

Pollution of water resources and soil

Changes to the water quality will result in changes to the ecosystem structure and function as well as a potential loss of biodiversity. Water quality pollution leads to modification of the species composition where sensitive species are lost and organisms tolerant to environmental changes dominate the community structure. Any substances entering and polluting watercourses will directly impact downstream ecology through surface runoff during rainfall events, or subsurface water movement, particularly during the wetter summer months.

Contaminants such as hydrocarbons, solids, pathogens and hazardous materials may enter watercourses (examples include petrol/diesel, oil/grease, paint, cement/concrete and other hazardous substances). These contaminants negatively affect aquatic ecosystems including sensitive or intolerant species of flora and fauna. Where significant changes in water quality occur, this will ultimately result in a shift in aquatic species composition, favouring more tolerant species, and potentially resulting in the localised exclusion of sensitive species. Water quality monitoring must be implemented to ensure sustainable management of water sources within that area. Sudden drastic changes in water quality can also have chronic effects on aquatic biota leading to localised extinctions. Deterioration in water quality will also affect its suitability for human domestic/agricultural use and have far reaching impacts for local communities who may rely on rivers as water supply (Macfarlane et al., 2014).

Alien Invasive Species

There are minimal alien invasive plant species currently present within the area. Any ground disturbance provides an opportunity for alien invasive plant species to spread and for new species to establish themselves in the areas. Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both number and “quality” of species), change nutrient cycling and productivity, and modify food webs (Zedler & Kercher, 2004). Such changes on the ecology of the riparian habitat have/will have a detrimental impact on its ability to maintain both floral and faunal biodiversity. Invasive alien plant species, particularly woody species, have much increased water usage compared with indigenous vegetation. Many alien invasive plant species are particularly found in riparian ecosystems and their invasion results in the destruction of indigenous species; increased inflammable biomass (high fire intensity); erosion; clogging of waterways such as small streams and drainage channels causing decreased river flows and incision of river beds and banks. This results in an overall impact on the hydrological functioning of the system.

Physical alteration of cross-sectional and longitudinal profiles of rivers may also result from bulk earthworks associated with the plants for example, altering natural water flow and sediment dynamics within rivers, having a knock-on effect on habitat and ecosystem dynamics. These impacts can stimulate erosion, as well as potential sedimentation of downstream habitats and a change to water regimes of adjoining riverine and riparian habitat. Areas that are mainly natural/intact would be most affected by these impacts (Macfarlane et al., 2014).

Wetland Buffer

The wetland assessed within the proposed mining boundaries, namely the valley bottom system and riparian zones associated covers a great area and the buffer calculated for the wetland study should be implemented and adhered to by mine management.

The buffer tool aims to provide a method for determining appropriate buffer-widths for developments associated with wetlands, rivers or estuaries. This method takes into account a number of different factors in determining the buffer width including the impact on water resources, climatic factors and the sensitivity of the water resource

The calculated results indicate that a 110 m buffer is appropriate for the protection of the ecosystem services provided by the wetland systems and riparian zones. Any activity must occur outside of the recommended 110 m buffer zone and any current activities within this buffer must be rehabilitated immediately.

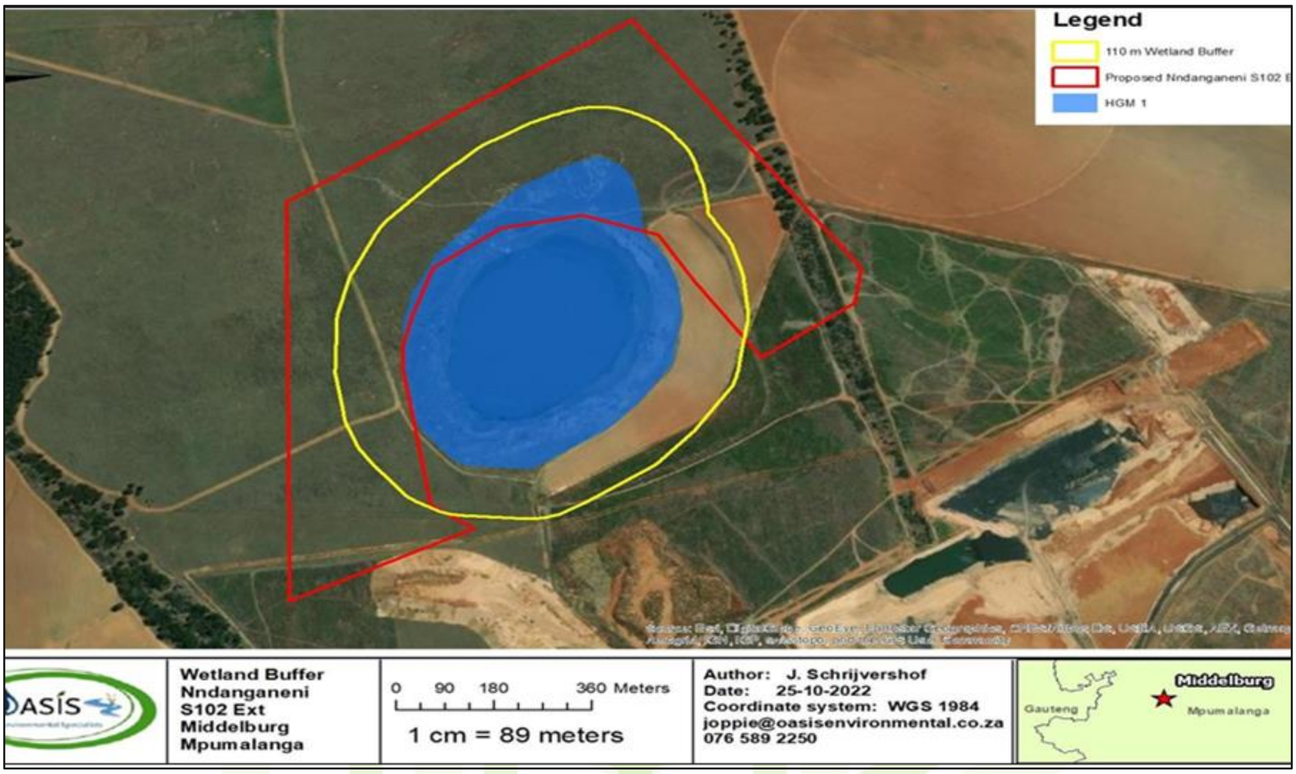

Figure 3-63: Wetland Buffer map

Hydropedological Impact Assessment

The wetlands on site reflect the behaviour of water, predominantly rainfall, and its behaviour following interception and infiltration into the soils. Thus, activities that affect the movement of water as well as its quality in the catchment areas supporting wetlands, translate into changes in the wetlands to which they are invariably linked. Expected impacts include:

- Loss and destruction of vegetation and wetland habitat within the proposed footprint during construction/operation;
- Soil compaction and increased risk of soil erosion due to machinery and vehicles used during construction and during routine maintenance in the operational phase;
- Change in water quality due to change in flow; and,
- Loss of wetlands and the biodiversity supported by these wetlands.

Impacts that lead to a change in hydrology include all impacts that influence the quantity (e.g., increased or decreased run-off) and velocity (e.g., concentration of flows) of flows leaving the site.

Impacts that lead to deteriorating water quality, together with the impacts that change the hydrology, are expected to be the most significant impacts on site. From a wetland perspective, mitigation measures and management plans should focus on these impacts, and it will need to be clearly shown in the EIA and EMPr how these impacts will be ameliorated to prevent significant deterioration of the quality and quantity of water discharged to downstream areas. The impact assessment is discussed below.

The impact quantification was done using the procedures for the assessment and minimum criteria for reporting aquatic biodiversity in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998. In terms of groundwater the proposed development impact on the functioning of the aquatic feature is in terms of:

- Baseflow.
- Quantity of water including change in the hydrological regime or hydroperiod of the aquatic ecosystem.
- Quality of water.
- The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.
- Additional environmental impacts expected from the proposed development
- The degree to which impacts, and risks can be mitigated.
- The degree to which the impacts and risks can be reversed.
- The degree to which the impacts and risks can cause loss of irreplaceable resources.
- A suitable construction and operational buffer for the aquatic ecosystem, using the accepted methodologies.

Current flow drivers

The flow driver's extension on the pan is expected to be in the order of the following as shown in the figure below. As expected, the water stored in the wetland soils is the dominant wetland flow driver in terms of volume.

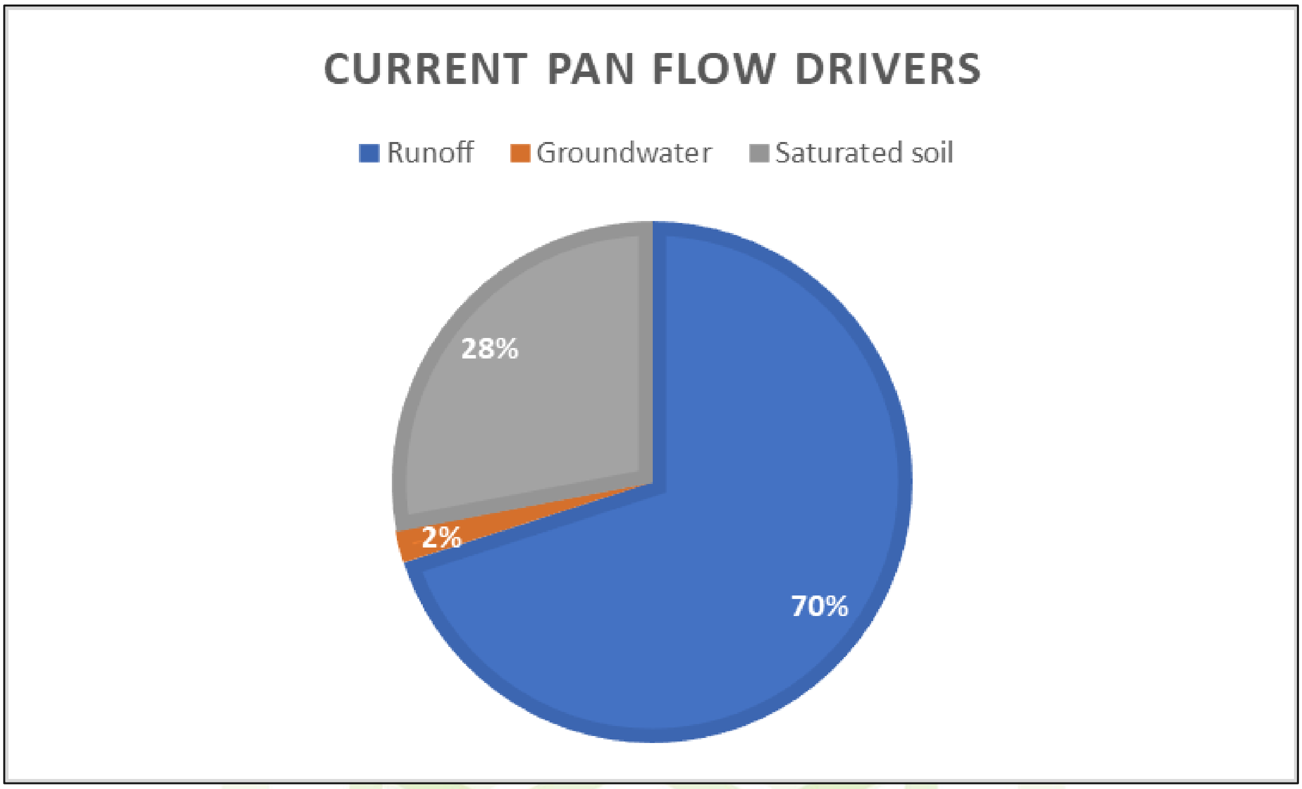

Figure 3-64: Wetland flow drivers pre development

Expected impacts by proposed opencast extension

The impact by the proposed extension is shown in the table below. The biggest impact is on the saturated soils surrounding the pan which stores surface water and groundwater. If the extension remains outside the saturated/responsive soils the impact is reduced from 41% to below 10%.

Table 3-37: Flow driver impacts relative to each other

Flow component	Pre extension flow drivers (m3)	Post extension flow drivers (m3)	Exclusion and 50 m buffer	Impact % (Proposed mining)	Impact % (50 m buffer and exclusion)
Runoff	10714	8026	2640	75%	2%
Groundwater recharge	16071	6039	0	5%	4%
Saturated soil	85225	32025	0	29%	0%
Total	112010	46090	2640	41%	2%

Conclusion

The following conclusions could be drawn from the assessment:

- The area is characterised by a gentle undulating topography and in the area of the mining site the slope is more or less in the order of 1:60 (0.016). Locally drainage is towards the tributary of the Klein Olifants River which flows in a westerly direction to the north of the Hartogshof Extension Colliery. A number of pans and dams are situated in and around the mining areas and drainage will locally be towards these features. On larger scale, drainage occurs towards the generalised flow of the Klein Olifants River which flows in an easterly direction approximately 2km south of the Sumo Coal Wash Plant site. The area surrounding the pan is predominantly agricultural land (maize field) that is bordered by eucalyptus trees to the east, by adjacent maize fields to the west, by the existing Nndanganeni Colliery to the south-southwest and by grazing land to the north.

- The auger holes permeabilities are typical of sandy gravel and can be regarded as responsive soils. These soils 'respond' quickly to rain events and typically generate overland flow. These soils can be shallow and overlie relatively impermeable bedrock, with limited storage capacity that is quickly exceeded following a rain event. Alternatively, they are soils with morphological indications of long periods of saturation. Given that the latter soils are close to saturation during the rainy season, additional precipitation will typically flow overland due to saturation excess.

- The soil outside the pan catchment are typical recharge soils without any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow direction.

- The soils within the pan catchment are typical responsive soils with saturation. Lateral flow is expected to be dominant.

- The biggest impact is on the saturated soils surrounding the pan which stores surface water and groundwater. If the extension remains outside the saturated/responsive soils the impact is reduced from 41% to below 10%. Based on the flow driver quantification it is clear that impacts on the wetland system are inevitable; however, by re-considering the mining layout and remaining at least 50 m from the edge of the pan/outside the catchment the impacts could be mitigated to some extent. Refer to the figure below.

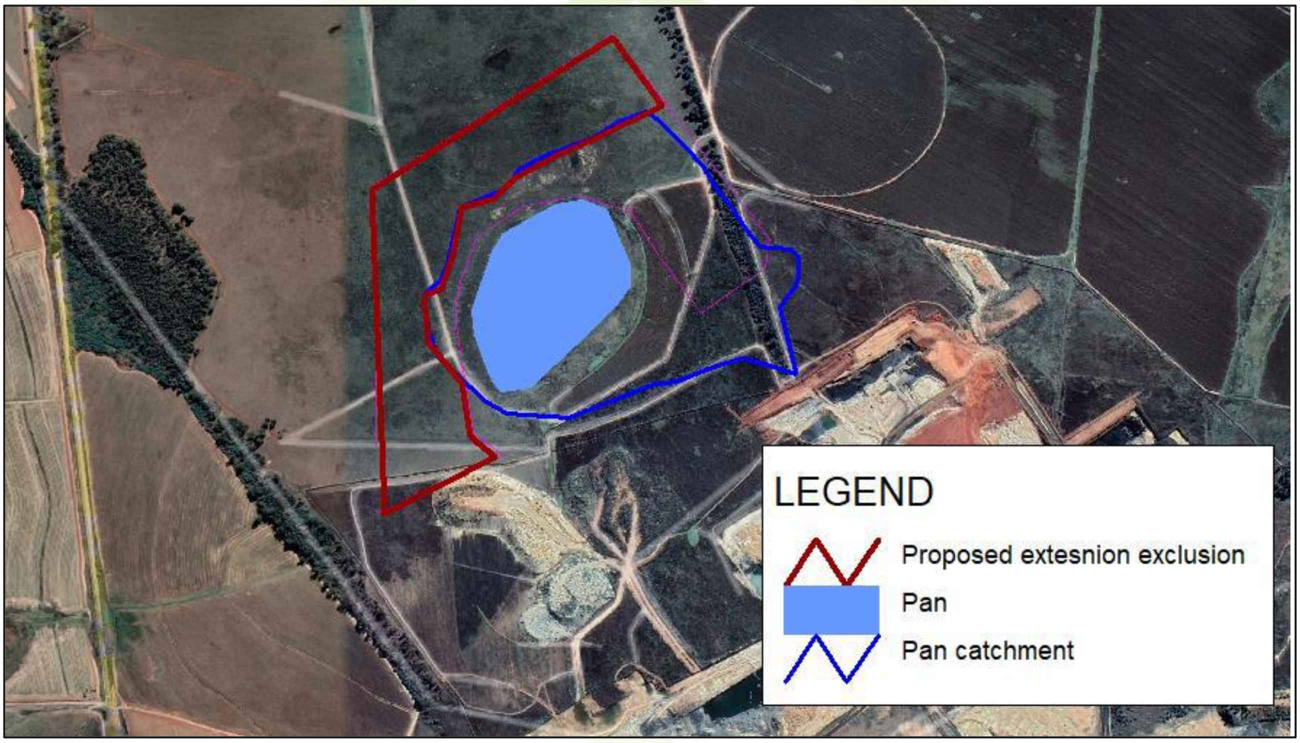

Figure 3-65: Proposed opencast mining with 50 m wetland buffer and exclusion

Recommendation

- Mining should consider the layout as proposed in Figure 3-65 above.
- A buffer of at least 50 m from the edge of the delineated wetland/pan catchment should be kept.
- Install seepage collection infrastructure to collect and contain contaminated seepage out of wetland system.
- Develop and implement a construction stormwater management plan prior to the start of construction activities.
- Install and regularly maintain and repair sediment barriers along the downslope edge of cleared areas.
- No vegetation clearing should take place in any wetland outside the direct development footprint.
- Phase vegetation clearing to limit exposed area at any one time. As far as possible, limit the major clearing activities and earthworks to the dry season.
- Install sediment barriers and/or low-level berms along the downslope edge of cleared areas.

- Rehabilitate all cleared areas outside the direct development footprint as soon as possible following the disturbance.
- Water quality monitoring and biomonitoring to be undertaken based on recommendations by an ecologist/wetland specialist.
- Inspect and maintain all stormwater discharge points. These points should be dispersive as far possible.
- Ensure separation of clean and dirty water. No dirty water to be discharged.
- Install clean water diversion of surface and sub-surface flow to pan:
  - Groundwater and sub-surface flow – 14065 m^3/annum

Ecological Impact Assessment

Any development activity in a natural system will have an impact on the surrounding environment, usually in a negative way. The purpose of this phase of the study was to identify and assess the significance of the potential impacts caused by the current mining operation.

A number of potential impacts relating to the loss of indigenous vegetation, floral habitat and ecological structure, loss of floral diversity and ecological integrity, proliferation of alien invasive species, loss of plant species of conservation concern, loss of faunal habitat, direct faunal impacts and disturbance to fauna are predicted to occur as a result of the mine operation.

Loss of Species of Conservation Concern

Due to the removal of vegetation within the project area, loss of floral diversity is inevitable. There will be a resultant increase in the risk of alien plant species that colonise the area, subsequently decreasing the indigenous species richness and composition of the area. The loss of ground cover will also expose soil leading to soil desiccation.

The proposed mining development is likely to have a negative impact in terms of loss of ecological connectivity through the clearing of vegetation. This will result in habitat fragmentation. Loss of habitat and habitat fragmentation will disrupt ecological functioning, negatively affecting the ecological integrity of the area. Small fragments of vegetation may not be large enough to support viable populations of pollinators and seed dispersers, resulting in the decreased reproduction of plant species. Moreover, an extinction debt may be present in cleared or fragmented areas, whereby, as a consequence to reduced floral diversity and disturbance to population structure, future extinction of local populations is unavoidable.

From a faunal perspective, endemic species and species of concern have specific habitat requirements and the impacts of the proposed mine will have significant effects on these species. The reptile species are slow moving and will likely be targeted during the construction and operational phase.

Loss of indigenous vegetation, floral and faunal habitat and ecological structure of water resources and soil

The proposed mining operation will result in the destruction of vegetation, floral habitat and a complete loss of faunal habitats within the area. This will directly impact the ecological condition of natural vegetation and habitat availability. These activities will have an impact on foraging, breeding and roosting ecology of faunal species. Loss of vegetation generally affects nutrient cycles, removes the organic litter layer and results in habitat fragmentation and destruction of wildlife corridors.

The vegetation on the proposed mine site itself is regarded as intact and species diverse. Disturbance of soil and removal of vegetation will promote the establishment and of alien invasive species.

Cumulative impacts include a decrease in floral habitat and ecological structure will lead to the proliferation of alien invasive species, a potential loss of red listed plant species, habitat fragmentation and an overall decrease in species richness in the area. The large land surface alterations will also change the composition of the ecosystem on the edge of structures. This will result in a loss of cohesiveness between larger fragments of habitat limiting gene exchanges and resources between these areas.

Loss of vegetation, in the case of a mine is irreversible, and although rehabilitation will take place after the mine is closed, restoration of the natural habitat on site cannot be achieved. This is particularly significant in an area where endemism of both flora and fauna is considered high and in ecologically sensitive areas.

Alien Invasive Species

Alien invasive species will quickly encroach into disturbed areas. Alien species generally out-compete indigenous species for water, light, space and nutrients as they are adaptable to changing conditions and are able to easily invade a wide range of ecological niches (Bromilow, 2010). Alien invader plant species pose an ecological threat as they alter habitat structure, lower biodiversity (both number and "quality" of species), change nutrient cycling and productivity, and modify food webs (Zedler, 2004). This negatively affects the ability of the disturbed area to maintain floral biodiversity.

Soil and Agricultural Potential Impact Assessment

An obvious sensitive receptor of the potential soil-related impacts of the proposed mining extension is the pan that the study site surrounds. The following potential soil-related impacts were identified as applicable in respect of the proposed project:

- Loss of soil
- Erosion and Sedimentation
- Change in surface profile
- Change in land use
- Change in land capability
- Contamination

The assessment of impact significance considers pre-mitigation as well as post-mitigation scenarios. Potential impacts associated with the construction, operation and closure of the site have been assessed and discussed in the following sections, along with identification of recommended mitigation measures. The soil protection strategies identified are, in part, taken from the International Finance Corporation (World Bank) Environmental, Health and Safety Guidelines for Mining, 2007 (IFC, 2007).

Construction Phase

This phase refers to the period when the proposed infrastructure is built/installed and usually has the largest direct impact on soils and land capability. This phase includes one of the major activities ahead of mining, which is to strip all useable soils for stockpiling and later rehabilitation use. It also includes site preparation prior to construction activities, involving vehicular movement (transportation of construction materials) and the removal of vegetation within the development footprint and associated disturbances to soil, and access to the site. Site preparation is followed by earthworks required for establishment of structures, leading to stockpiling and exposure of loose soils, as well as movement of construction equipment and personnel within the project area. The following potential impacts on soils were considered for the proposed project.

Impact 1: Loss of Soil

The stripping of soil, especially topsoil ahead of mining, will lead to a significant loss of usable soil if not undertaken correctly. Soil needs to be kept aside for later concurrent and then final closure rehabilitation. The soil horizons need to be separately stripped, stockpiled and replaced. The most common loss of soil is likely to be under stripping (not stripping all usable soil) resulting in soil be lost to the overburden spoiling process. A further potential risk is over stripping, which occurs when topsoil is stripped too deeply, so is removed with too much subsoil. This negatively affects the texture of the surface soils upon rehabilitation by changing their hydropedological properties. In the case of this proposed project, using the impact assessment methodology described in Section 3, the impact significance without mitigation is High and with mitigation is Medium-High. Recommended mitigation measures are as follows:

- Strip all useable soil material for rehabilitation.
- Topsoil stockpiles should be kept low (below 3m tall).
- Irrespective of where topsoil is stockpiled, it should be kept moist and vegetated as soon as possible to protect against erosion, discourage weeds and maintain active soil microbes.
- The shallower Clovelly soils should be stripped to a depth of 25 cm and this 25 cm stockpiled as topsoil only. The deeper Clovelly topsoils should also be stripped to a depth of 25 cm and stockpiled separately from the underlying 25cm of stripped subsoil. The Clovelly soils that have been cultivated should be considered to comprise only topsoil and should be stripped to 30cm and stockpiled with the other Clovelly topsoils. All stripping and stockpiling should be undertaken according to the guidelines below:
    - Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated
    - boundary.

- The stripped soil should be relocated by truck along set removal paths.
- The area to be stripped requires storm water management and the in-flow of water should be prevented
- with suitable structures.
- Prepare the haul routes prior to stripping.
- Stripping should not begin in wet conditions.

Impact 2: Erosion And Sedimentation

Soil stripping, clearing of vegetation, movement of vehicles, mobile plant and equipment, as well as earthworks is very likely to result in increased loose material being exposed and consequent erosion. The Clovelly soils are largely devoid of macrostructure, so are prone to erosion. As the study site surround a pan, the potential impact of sedimentation is linked to that of erosion. Although the magnitude and extent of erosion and sedimentation are likely to be limited if the recommended mitigation measures are properly implemented, some erosion is inevitable when clearing an area and erosion and sedimentation are not easily reversible. In the case of this proposed project, using the impact assessment methodology described in Section 3, the impact significance without mitigation is Medium-High and with mitigation is Medium. Recommended mitigation measures are as follows:

- Limit earthworks and vehicle movement to demarcated paths and areas.
- Limit the duration of construction activities, especially those involving earthworks / excavations.
- Access roads associated with the development should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for.
- Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces and soil stockpiles should be re-vegetated or stabilised as soon as is practically possible.
- A construction phase-specific storm water management plan should be designed for the site and adhered-to.
- Soil stockpiles should be vegetated as soon as possible.

Impact 3: Change in Surface Profile

Earthworks required for establishment of support structures, as well as establishment of access tracks, will result in a change of surface profile within the project area. A change in the surface profile would be long-term and inevitable as a result of earthworks. The current surface profile can only be re-established during mine closure. Although the site is not steep and the surface profile would not be changed to a large extent, the combination of the study site slope toward the pan and well drained soils lead to hydropedological processes that help to maintain the pan. The impact significance with mitigation is thus High and without mitigation is Medium-High.

Impact 4: Change in Land Use

Clearance of vegetation on site and establishment of infrastructure will result in a change of land use within the study area and affect the pan. The site is currently mainly grassland, and a small portion thereof is cultivated. The degree of alteration is very high (a complete change in land use), the change will definitely take place and will be irreversible for at least the duration of the project life (the impact will take place in the construction phase but will remain as long as the project infrastructure is in place). The change in land use will significantly increase the potential for negative impacts on the pan in the form of inputs of contaminants and sediment. The impact significance without mitigation is thus High and with mitigation is Medium-High.

Impact 5: Change in Land Capability

The movement of mobile plant / equipment is very likely to result in compaction, disturbance and possible sterilization of soils and associated change in land capability to the site and affect the processing of the pan. The degree of alteration is very high (complete loss of land capability) the change will definitely take place and will be irreversible for the duration of the project life (the impact will take place in the construction phase but will remain as long as the project infrastructure is in place). The largest disturbance in opencast mining is the pit itself. As mentioned, the study site capability is largely grassland. The impact significance without mitigation is thus High and with mitigation is Medium-High.

Impact 6: Soil Contamination

Movement of vehicles and plant / equipment on site could result in leaks and spills of hazardous materials including hydrocarbons. Contaminated soil is expensive to rehabilitate and contamination entering the apedal soils of the project area will infiltrate into the ground as well as migrate from site and toward the pan during rainfall events. With the correct implementation of mitigation measures, the probability and duration of the impact can be reduced, thereby reducing the potential impact from High to Low-Medium. During construction all potentially contaminated runoff including hydrocarbons and sediment must be prevented from entering the pan. Contaminated runoff should be contained using bund walls, sumps and sediment traps where necessary.

- Correctly implement and monitor a construction-phase storm water management plan.
- On-site vehicles should be well-maintained.
- Drip trays should be placed under stationary vehicles / plant.
- On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface.
- Ensure proper control of dangerous substances entering the site.
- Adequate disposal facilities should be provided.
- A non-polluting environment should be enforced.

Operation Phase

This phase refers to the period of operation of the mine (i.e. following commissioning through project life). As indicated above, the identified impacts to soil often take place during the construction phase but the impact is felt throughout the operation phase. The impacts to focus on during the operation phase are a Loss of Topsoil, Soil Contamination and Erosion and Sedimentation.

Impact 1: Loss of Topsoil

The major ongoing impact throughout operations is the loss of topsoil owing to ongoing stripping ahead of mining. The aforementioned mitigation measures should continue to be adhered to and an operation phase specific storm water management plan should be devised. The impact significance without mitigation is High and with mitigation is Medium. Vegetative cover of the stockpiles should be monitored.

Impact 2: Erosion and Sedimentation

Ongoing erosion and consequent sedimentation throughout the operational phase of the project should be monitored and mitigated against. The impact significance without mitigation is High and with mitigation is Medium. Mitigation should focus on erosion monitoring, vegetation of any bare areas on site, and correct implementation of an operation-phase Storm Water Management Plan as the pan is a sensitive receptor. This needs to minimize dirty water areas, separate clean and dirty water areas, release clean water from the site and store contaminated water until it has been treated suitably for discharge into the environment (water quality guidelines as specified in the relevant EIAs and WULs).

Impact 3: Soil Contamination

Everyday movement of vehicles and employees once the development is operational will likely lead to some soil contamination. The impact significance without mitigation is High and with mitigation is Low-Medium. Again, the operational phase Storm Water Management Plan should be adhered to, especially to prevent hydrocarbons from entering the soils and the pan. This needs to minimize dirty water areas and separate clean and dirty water areas through the use of Pollution Control Dams, bunded areas, sediment traps, berms, channels and sumps. Clean water must be released from the site and contaminated water stored until it has been treated suitably for discharge into the environment (water quality guidelines as specified in the relevant authorisations).

Closure phase

The closure phase will be similar to the construction phase as large vehicles will be on site and earth will be moved. Erosion and Sedimentation, and Soil Contamination are the most likely negative impacts.

Impact 1: Erosion and Sedimentation

Site rehabilitation associated with mine closure will involve movement of vehicles, mobile plant and equipment, as well as removal of structures. These activities are very likely to result in increased loose material being exposed. The site's apedal soils are susceptible to erosion and likely to add to sedimentation. The impact significance without mitigation is Medium-High and with mitigation is Low. Mitigation should focus again on limiting earthworks and vehicle movement to demarcated paths and areas, as well as limiting the duration of the activities. Establishing vegetation as soon as possible is very important, making concurrent rehabilitation throughout the construction phase vital. During the closure phase, as soon as an area becomes available, it should be revegetated.

Impact 2: Soil Contamination

Movement of vehicles and plant / equipment on site could result in spills of hazardous materials. Contaminated soil is expensive to rehabilitate and contamination entering the soils of the project area infiltrate into the ground as well as migrate from site during rainfall events. The impact significance without mitigation is Medium-High and with mitigation is Low.

Cumulative Impacts

The proposed study site is within a largely disturbed broader area. It is directly next to an existing mine, with other mines in the area, and the broader area is extensively cultivated. As mentioned, the study site borders a pan on 3 sides. Some larger pans exist within a 10 km radius of the site.

Impact 1: Erosion And Sedimentation

As the study site is proposed as an extension of an existing mine, the cumulative impacts of causing further soil erosion will be significant. Erosion will cause sediment to enter the pan and the nearest alternative pan is almost 5 km away.

Impact 2: Soil Contamination

Again, as the study site is proposed as an extension of an existing mine, the cumulative impact of potential leaks and spills of contaminants, especially hydrocarbons, will be significant. As the study site soils are sandy and apedal, they are well-drained, so the contaminants will be mobile, and the pan is a likely receptor thereof. As this is a sensitive landscape, extreme effort will need to be undertaken to protect it. This is a legal requirement.

Impacts 3 And 4: Change in Land Use And Capability

The current study site land capability and land use is mostly grassland. The larger area has been extensively cultivated. The change in land use of the study site is significant because it will affect the processes that support the functioning of the pan.

HERITAGE / ARCHAEOLOGICAL IMPACT ASSESSMENT

The proposed Nndanganeni Colliery S102 Project consists of the expansion of the existing void and will impact approximately 45.5 ha. Although the identified sites (Sites B01 – B03) are considered to be sufficiently recorded, sensitive subsurface cultural material might be located within the boundaries. Care should therefore be exercised during the construction and development phases of the project. Sites F01 and F02 are of contemporary origin and are not significant or sensitive from a heritage perspective. Should the recommendations made in this study be adhered to and with the approval of the South African Heritage Resources Agency, the proposed Nndanganeni Colliery S102 Project may proceed.

The general study area is associated with a combination of open veldt and cultivated land, while three potentially historical sites associated with demolished buildings and two contemporary sites were noted. The demarcated S102 area is completely located within 500 m of a perennial pan, a zone that is generally associated with a higher heritage site probability. However, the general area surrounding the pan appears to have been disturbed by cultivation and the immediate surroundings are not well known for Stone Age or Iron Age sites. The area is therefore not considered to be particularly sensitive from a heritage perspective.

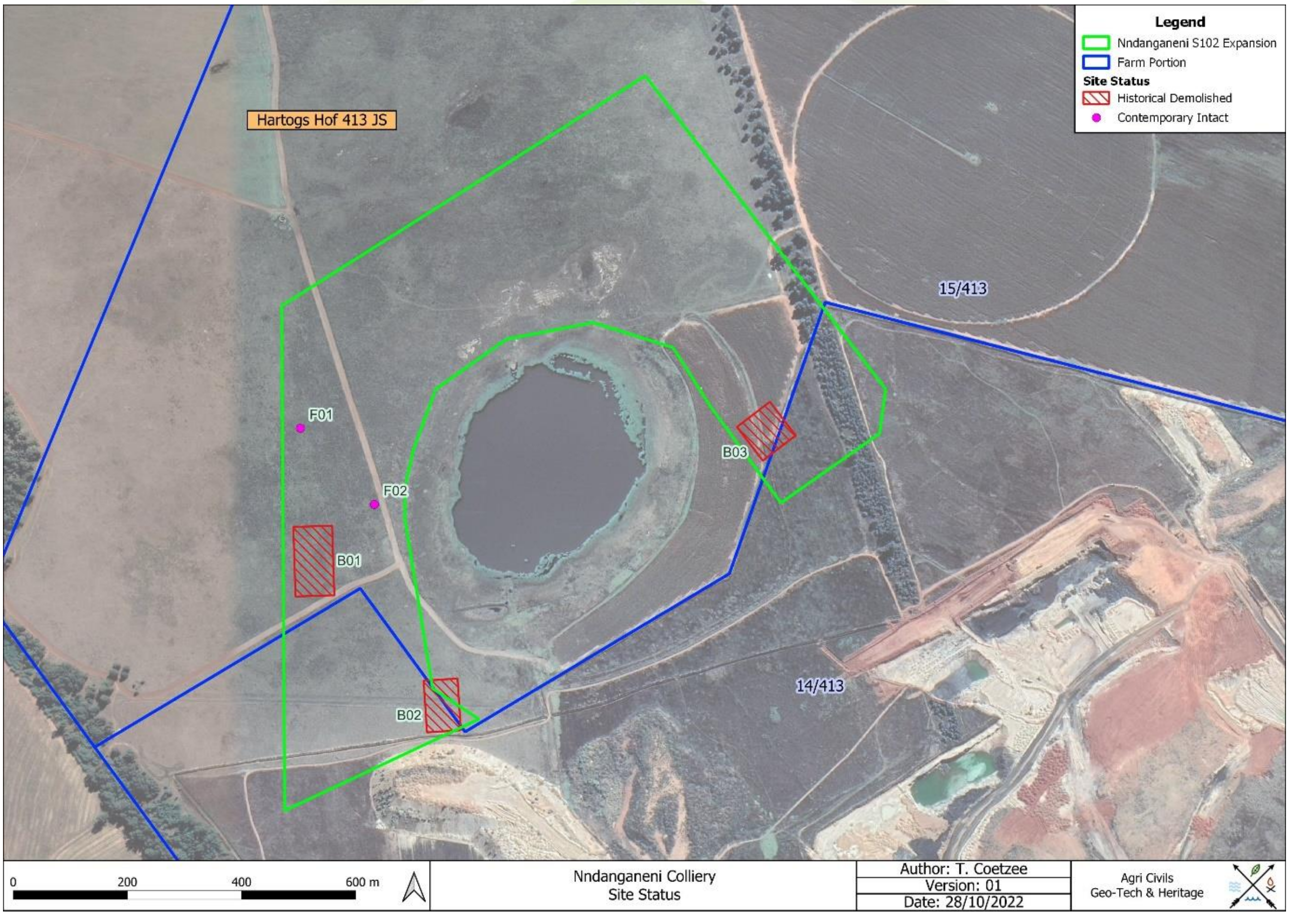

Figure 3-66: Site status portrayed on a 2021 satellite image.

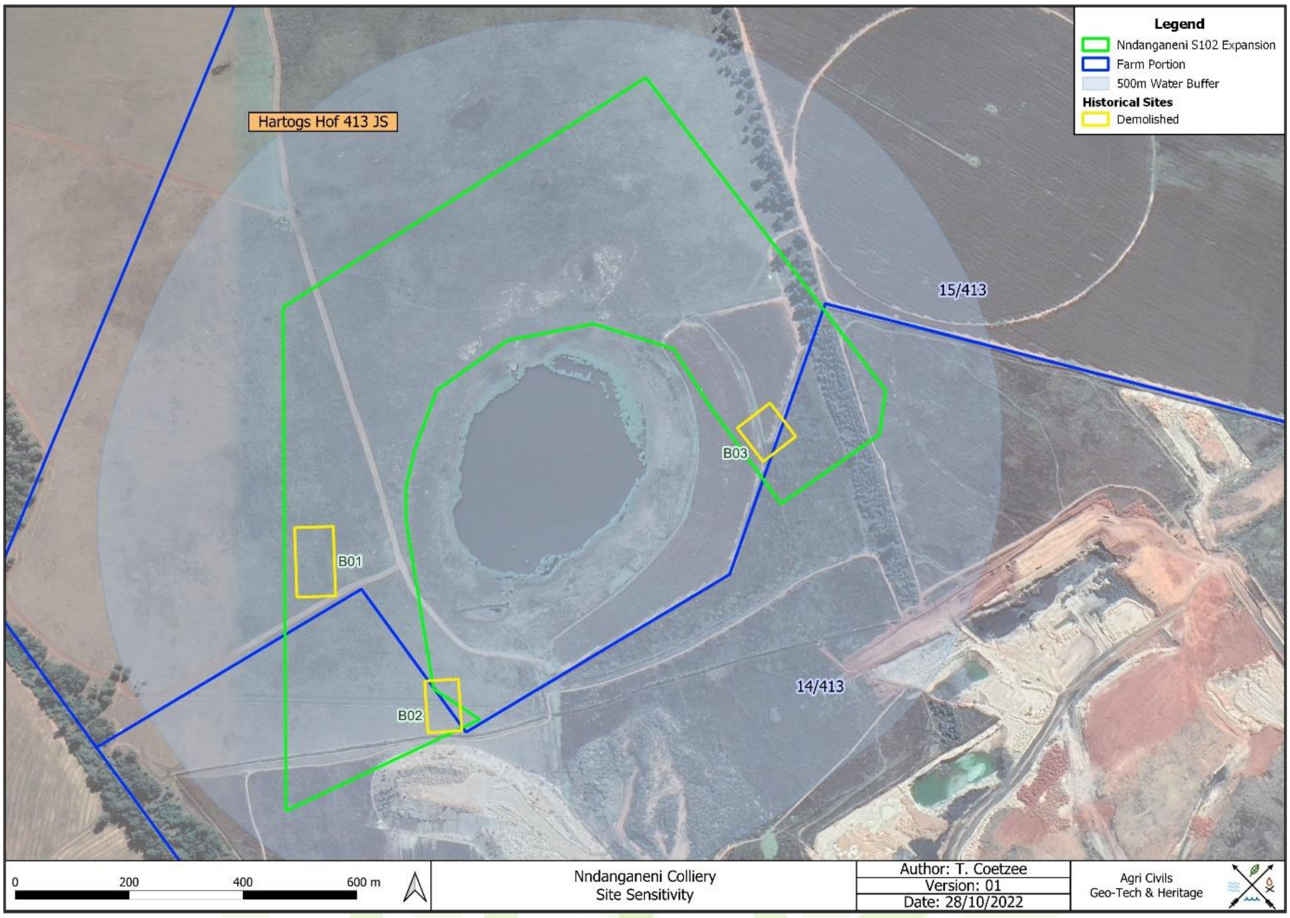

Figure 3-67: Study area and potentially sensitive areas portrayed on a 2021 satellite image.

Sites B01 – B03 were identified as buildings on the 1964 aerial image. Since these buildings appear to have been constructed between 1955 and 1964, the age of these buildings might exceed 60 years and would therefore be protected by the NHRA, 1999 (Act No. 25 of 1999). However, all three buildings were completely demolished, are not associated with surface remains and are therefore no longer considered to be significant from a heritage perspective. Additionally, the areas associated with Sites B02 and B03 were disturbed by the cultivation of crops. Although sites B01 – B03 were demolished, the possibility exists that significant cultural material might be unearthed within the demarcated boundaries. These sites are therefore considered to be potentially sensitive.

Sites F01 & F02 were respectively identified as a contemporary borehole and potential irrigation equipment. The sites are not significant from a heritage perspective.

Palaeontological Impact Assessment

Soils and sands do not preserve plant fossils; so far there are no records from the Vryheid formation of plant or animal fossils in this site, so it is very unlikely that fossils occur on the site. The impact would be very unlikely. Where manifest, the impact will be permanent. Since the only possible fossils within the area would be fossil plants from the Glossopteris flora in the shales, the spatial scale will be localised within the site boundary.

It is extremely unlikely that any fossils would be found in the loose sand and soil that cover the area but there might be fossils below the ground. Therefore, a **Fossil Chance Find Protocol should be added to the eventual EMPr**.

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were **NO FOSSILS** on the surface of the project footprint. Since there is a chance that fossils from the Vryheid Formation may occur below ground and be disturbed a **Fossil Chance Find Protocol** has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low to moderate.

Assumptions & Uncertainties

Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the dolomites, sandstones, shales, and sands are typical for the country and do contain fossil plant, insect, invertebrate and vertebrate material. The site visit and walk through on confirmed that there are no fossils on the surface. The sands of the Quaternary period would not preserve fossils. It is not known if there are fossils below the surface associated with the deeper coal seams.

Fossil Chance Find Protocol

Monitoring Programme for Palaeontology – to commence once the excavations / drilling / mining activities begin.

1. The following procedure is only required if fossils are seen on the surface and when drilling/excavations/mining commence.
2. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
3. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures.
4. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment.
5. If there is any possible fossil material found by the environmental officer/miners then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.
6. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
7. If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
8. If no fossils are found and the excavations have finished then no further monitoring is required.

Air Quality Impact Assessment

Predicted Impacts

Table 3-38: Impacts according to Development Phases

PHASE	ACTIVITIES
Construction Phase	**Typical Activities** - Site clearing, removal of topsoil and vegetation, Construction of Infrastructure, General Transportation and hauling of material.
Operational Phase	**Typical Activities** – Mining Operations such as Drilling and blasting, Hauling of ROM, Crushing and Screening etc.
Closure and Decommissioning	**Typical Activities** - Demolition & Removal of all infrastructure (incl. transportation off site) and Rehabilitation (Spreading of soil, revegetation, profiling / contouring)

Construction phase

Site clearing, removal of topsoil and vegetation, construction of Infrastructure, general transportation and hauling of material.

Operational phase

The following activities during the Operational Phases are identified as possible fugitive emission sources and may impact on the ambient air quality at the relevant environmental sensitive receivers:

1. Use and maintenance of access road.
2. Dust from material handling.
    - Inside & outside the pit area
3. Haul roads; for transporting the ROM
4. Wind erosion from stockpiles.

These sources were uses as inputs in the AERMOD model as unmitigated and mitigated, as discussed earlier.

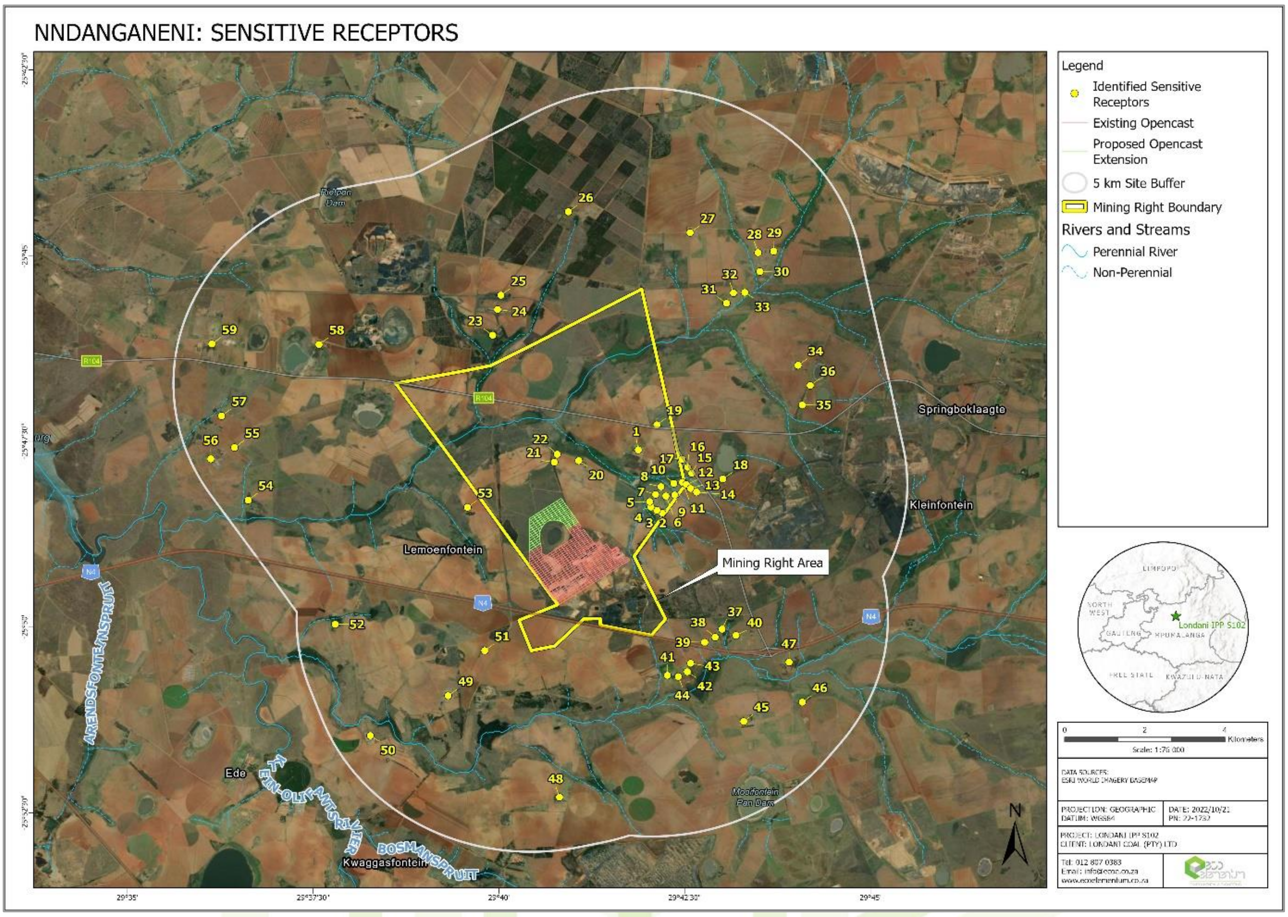

Figure 3-68: Air Quality Sensitive Receptors

PM10 (Particulate Matter)

For the unmitigated Daily PM10 concentrations it was predicted to be higher than the 75 µg/m³ limit for 3 of the sensitive receptors. Refer to **Error! Reference source not found.**.

When comparing the Daily Mitigated PM10 modelled concentrations, the sensitive receptors exceeding the 75 µg/m³ limit dropped to 0 of the identified sensitive receptors. This as well is the highest levels predicted for a 24 hour period within the period. Due to site specific atmospheric conditions these exceedances may still occur within the limit of 4 per year.

The annual average PM10 limit of 40 µg/m³ are predicted not to exceed at any of the identified sensitive receptors for the unmitigated or mitigated scenarios.

Table 3-39: PM Concentrations at sensitive receptors

Receptor	PM10 2nd Highest Daily (µg/m³)		PM10 Annual Average (µg/m³)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
1	24.0	3.3	1.3	0.2
2	44.3	4.9	2.6	0.4
3	45.8	5.0	2.6	0.4
4	47.7	5.2	2.6	0.3
5	46.8	4.8	2.5	0.3
6	40.6	4.4	2.1	0.3

Receptor	PM10 2nd Highest Daily (µg/m³)		PM10 Annual Average (µg/m³)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
7	41.0	4.3	2.2	0.3
8	35.4	4.0	1.9	0.3
9	38.2	4.2	1.9	0.3
10	36.3	3.9	1.7	0.2
11	35.3	3.8	1.6	0.2
12	34.9	3.8	1.6	0.2
13	35.7	4.0	1.6	0.2
14	37.2	4.4	1.6	0.2
15	32.7	3.5	1.4	0.2
16	27.1	3.4	1.4	0.2
17	20.8	3.5	1.3	0.2
18	32.0	4.2	1.3	0.2
19	19.6	2.6	1.0	0.1
20	29.9	4.4	1.5	0.2
21	36.4	5.1	1.6	0.2
22	27.3	3.5	1.4	0.2
23	13.1	1.6	0.5	0.1
24	12.1	1.5	0.4	0.1
25	9.1	1.3	0.4	0.1
26	6.1	0.8	0.2	0.0
27	5.8	0.8	0.3	0.0
28	5.9	0.8	0.3	0.0
29	6.2	0.8	0.3	0.0
30	6.8	0.8	0.3	0.0
31	7.8	1.0	0.4	0.1
32	7.4	0.9	0.4	0.1
33	7.6	0.9	0.4	0.0
34	8.2	1.3	0.5	0.1
35	18.7	2.5	0.6	0.1
36	15.0	2.4	0.5	0.1
37	64.8	7.9	3.1	0.4
38	67.8	8.6	3.4	0.5
39	67.3	8.2	4.0	0.6
40	61.3	7.4	2.6	0.4
41	68.7	9.8	6.5	0.9
42	59.0	7.7	4.9	0.7
43	85.9	9.1	4.9	0.7

Receptor	PM10 2nd Highest Daily (µg/m³)		PM10 Annual Average (µg/m³)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
44	59.4	8.5	5.4	0.8
45	35.5	5.0	2.3	0.3
46	41.0	4.8	1.5	0.2
47	38.9	4.6	1.6	0.2
48	29.1	3.6	2.0	0.3
49	75.2	8.3	9.1	1.1
50	41.0	5.0	4.4	0.5
51	115.1	13.4	22.3	2.6
52	60.2	6.8	6.5	0.8
53	35.8	5.6	4.0	0.6
54	22.9	2.7	2.1	0.3
55	19.9	2.3	1.3	0.2
56	18.1	2.1	1.4	0.2
57	17.9	2.2	1.0	0.1
58	13.7	1.8	0.7	0.1
59	15.6	2.0	0.7	0.1

Total Dust Fallout

In the unmitigated and mitigated scenarios, no sensitive receptors are predicted to exceed the monthly dust fallout for the highest month residential limit of 600 mg/m²/day. The predicted annual dust fall out for the unmitigated and mitigated scenarios are not predicted to exceed the annual limit of 300 mg/m²/day at any of the sensitive receptors.

Table 3-40: TSP Deposition rates at the sensitive receptors

Receptor	TSP Highest Monthly (mg/m²/day)		TSP Annual Average (mg/m²/day)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
1	7.1	0.8	2.7	0.3
2	24.8	2.8	10.7	1.2
3	24.1	2.7	10.6	1.2
4	23.3	2.6	10.3	1.2
5	20.9	2.3	9.2	1.0
6	16.5	1.8	6.9	0.8
7	16.4	1.8	7.2	0.8
8	13.1	1.5	5.7	0.7
9	14.4	1.6	6.3	0.7
10	10.8	1.3	4.8	0.6
11	10.0	1.2	4.4	0.5
12	9.9	1.2	4.5	0.5

Receptor	TSP Highest Monthly (mg/m²/day)		TSP Annual Average (mg/m²/day)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
13	10.1	1.3	4.7	0.6
14	10.1	1.2	4.8	0.6
15	7.8	1.0	3.6	0.4
16	7.6	0.9	3.3	0.4
17	7.3	0.9	2.9	0.3
18	7.1	0.8	3.2	0.4
19	5.3	0.6	1.6	0.2
20	14.3	1.6	3.6	0.4
21	13.4	1.4	3.6	0.4
22	10.6	1.2	2.9	0.3
23	1.0	0.1	0.3	0.0
24	1.0	0.1	0.3	0.0
25	0.9	0.1	0.2	0.0
26	0.4	0.0	0.1	0.0
27	0.4	0.0	0.1	0.0
28	0.6	0.1	0.2	0.0
29	0.6	0.1	0.2	0.0
30	0.7	0.1	0.2	0.0
31	1.1	0.1	0.2	0.0
32	1.0	0.1	0.2	0.0
33	1.0	0.1	0.2	0.0
34	1.5	0.2	0.4	0.1
35	1.7	0.2	0.6	0.1
36	1.4	0.2	0.5	0.1
37	45.5	6.4	24.0	3.5
38	54.5	7.3	26.8	4.0
39	65.5	9.3	30.8	4.6
40	38.6	5.2	19.2	2.8
41	71.0	9.7	24.2	3.6
42	72.4	10.0	25.5	3.9
43	76.7	10.6	29.2	4.5
44	69.8	9.7	23.7	3.6
45	24.6	3.4	7.8	1.1
46	20.3	2.7	6.1	0.9
47	20.8	2.9	8.6	1.2
48	3.5	0.4	0.7	0.1
49	10.4	1.1	1.8	0.2

Receptor	TSP Highest Monthly (mg/m²/day)		TSP Annual Average (mg/m²/day)	
	Unmitigated	Mitigated	Unmitigated	Mitigated
50	2.6	0.3	0.6	0.1
51	64.7	6.6	9.0	1.1
52	6.6	0.8	2.0	0.2
53	22.9	2.7	6.2	0.7
54	3.4	0.4	0.9	0.1
55	2.0	0.3	0.5	0.1
56	1.9	0.2	0.5	0.1
57	1.5	0.2	0.4	0.0
58	1.3	0.2	0.3	0.0
59	1.2	0.2	0.2	0.0

Decommissioning and Closure Phase

Demolition & Removal of all infrastructure (incl. transportation off site) and Rehabilitation (Spreading of soil, revegetation, profiling / contouring).

Mitigation Measures

- Demolition should not be performed during windy periods (August, September and October), as dust levels and the area affected by dust fallout will increase.
- The area of disturbance must be kept to a minimum, as demolition should be done judiciously avoid the exposure of larger areas to wind erosion.
- Cabs of machines should be swept or vacuumed regularly to remove accumulated dust.
- Exhaust pipes of vehicles should be directed so that they do not raise dust.
- Engine cooling fans of vehicles should be shrouded so that they do not raise dust.
- Hard surfaced haul roads or standing areas should be washed down and swept to remove accumulated dust.
- Dust suppression of roads being used during rehabilitation should be enforced.
- Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.
- Plants with roots that bind the soil, and vegetation cover should be used that breaks the impact of falling raindrops, thus preventing wind and water erosion.
- Plants used for revegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings.
- The area of disturbance must be kept to a minimum, as demolition should be done judiciously avoid the exposure of larger areas to wind erosion.
- Spreading of soil must be performed on less windy days.
- The bare soil will be prone to erosion and therefore there is need to reduce the velocity near the surface of the soil by re-vegetation.
- Leaving the surface of soil in a coarse condition reduces wind erosion and ultimately reduces dust levels.
- Additional mitigation measures include keeping soil moist using sprays or water tanks, using wind breaks.
- The best time to re-vegetate the area must be linked to the distribution and reliability of rainfall.
- Cabs of machines should be swept or vacuumed regularly to remove accumulated dust.
- Exhaust pipes of vehicles should be directed so that they do not raise dust.
- Engine cooling fans of vehicles should be shrouded so that they do not raise dust.
- Hard surfaced haul roads or standing areas to be washed down and swept to remove accumulated dust.
- Dust suppression of roads being used during rehabilitation should be enforced.
- It is recommended that the rehabilitation by vegetating should begin during the operational phase already as the objective is to minimise the erosion.

These measures should be aimed to reduce the potential for fugitive dust generation and render the impacts on ambient air quality negligible.

Cumulative Impacts

The proposed Nndanganeni project area surrounded by other mining areas. These mining operations will also generate fugitive dust and particulate matter emissions. The Nndanganeni project will contribute to the cumulative air quality impacts of the region.

Mitigation Measures

Table 3-41: Mitigation Method Summary

Operation	Reduction	Method
Material Handling	50%	Water Sprays
Wind Erosion	50%	Water Sprays
	90%	Revegetation on OB and Topsoil
Haul Road	90%	Encrusting (Dust Aside or Similar)
Primary Crushing	50%	Water Sprays
Secondary Crushing	50%	Water Sprays

Based on the results presented the following further recommendations are outlined:

It is recommended that ambient air quality monitoring be established to get a baseline condition prior to the onset of the operations and in order to establish the level at which the proposed operations are noted to impact on the ambient air quality.

Fallout monitoring should be continued for the life of mine to better assess the level of nuisance dust associated with both mining and process related operations. Sampling of fallout should be undertaken within the neighbouring areas as well as on-site. Dust fallout monitoring is recommended.

If it is found that dust levels are measured to be exceeding limits, it is highly recommended to establish a Real-Time indicative monitoring network to quantitatively help identify the sources and to assist in the management of the mitigation of these sources.

The impacts from dust fallout and Particulate matter can be reduced by implementing dust control measures. The highest intensity of the construction work should be carried out during the summer months and not over the harsh winter months as can result in increased dispersion of fugitive dust. The mine should ensure that unpaved roads are continuously watered and treated with dust binding additive products to reduce the volume of fugitive dust emitted from unpaved roads.

Mitigation and management measures for mining operation as discussed in this report should be sufficient to ensure the mining operation can be conducted with minimal impact on the receiving environment and therefore not have a detrimental effect and can go ahead.

VISUAL IMPACT ASSESSMENT

The impact assessment indicates that during the pre-construction and construction phases of the proposed mining activity, the identified sensitive receptors are expected to experience a low negative visual impact.

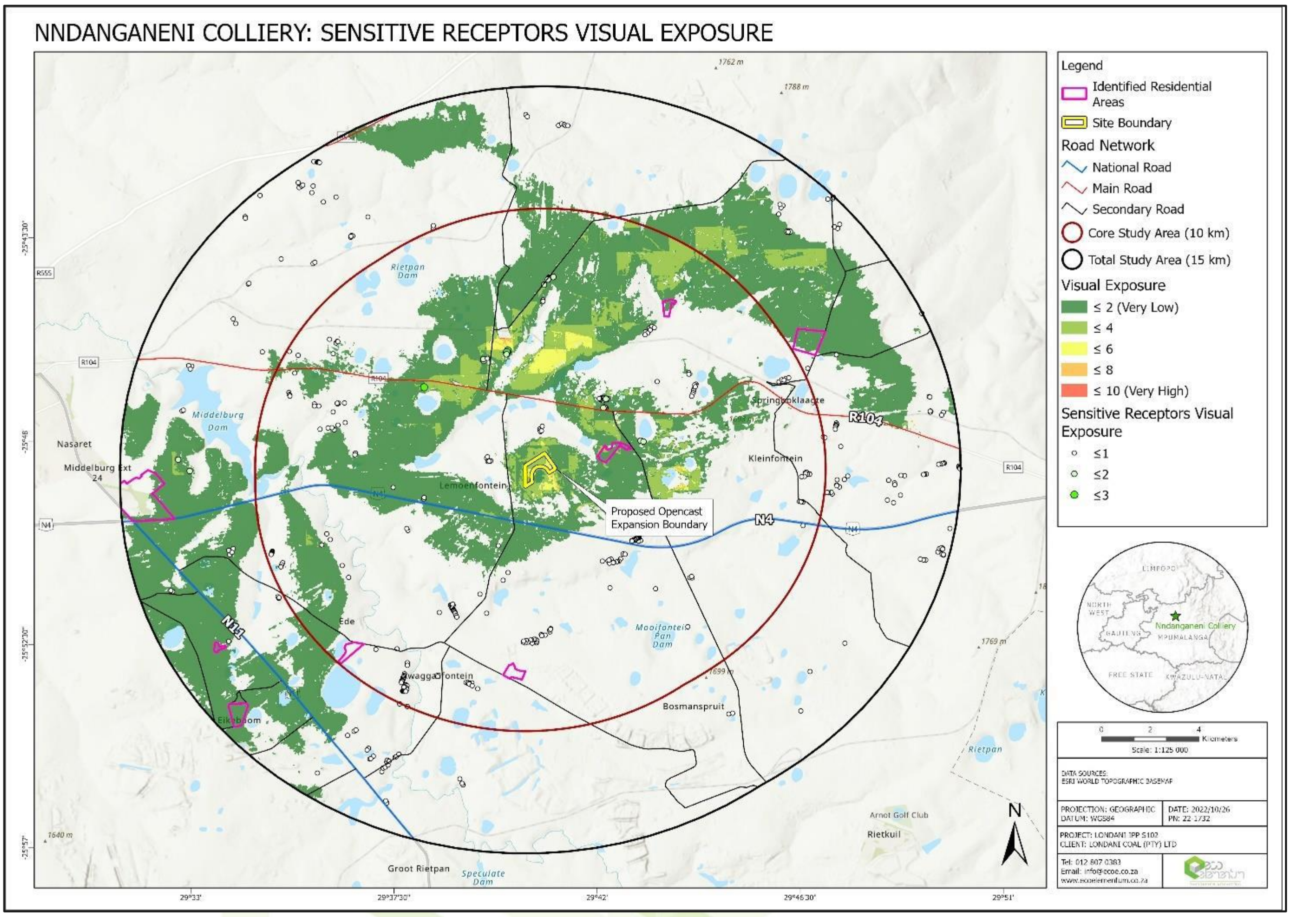

Figure 3-69: Visual exposure and sensitive receptors – showing the level of visual exposure potentially experienced by identified sensitive receptors

These low negative impacts can be lowered further after the recommended mitigation measures are implemented. For the operational phase of the mining activity, the identified visual impacts are expected to be of low to medium significance. These impacts can be lowered to a low significance if the recommended mitigation measures are adhered to. The reasons for the expected low level of visual impacts can be attributed to the high VAC of the study area along with the low density of sensitive receptors and the results of the viewshed and visual exposure analysis.

During the decommissioning, rehabilitation, and post-closure phases of the mining project, all low to medium negative visual impacts can be lowered to a low significance if the mitigation measures are implemented. This can be attributed to the rehabilitated mining areas being more visually appealing to the surrounding sensitive receptors.

Overall, the potential visual impacts of the proposed opencast pit expansion are expected to be low, during each phase of the activity, after the implementation of the recommended mitigation measures. The low impacts are mainly due to the ability of the existing land uses within the surrounding area being able to visually absorb the proposed mining activity.

Overall, the sense of place of the current study area can be characterized by the predominant mining, industrial and agricultural activities. The proposed mining operation is therefore not expected to significantly detract from the existing sense of place.

Blasting & Vibration Impact Assessment

Predicted ground vibrations

The outcome of the PPV calculations is illustrated below for different structures. The following notes are made on the outcomes:

- It can be seen that a higher charge per delay results in increased PPV outcomes.
- The distance from the surface structures also influences the PPV outcomes significantly.
- When using high charge weights (more than 300kg) structures in close proximity (50m or less) will be significantly affected – refer to the red area on the table.
- Low charge weights in combination to increased distance will be preferred.

Structures		Distance (m) D									
		50	100	150	200	250	300	350	400	450	500
Charge per Delay (Kg) E	100	80	26	13	8	6	4	3	3	2	2
	150	112	36	18	11	8	6	5	4	3	3
	200	142	45	23	14	10	7	6	5	4	3
	250	171	54	28	17	12	9	7	6	5	4
	300	199	63	32	20	14	10	8	6	5	4
	350	226	72	37	23	16	12	9	7	6	5
	400	252	80	41	26	18	13	10	8	7	6
	450	278	89	45	28	20	14	11	9	7	6
	500	303	97	49	31	21	16	12	10	8	7
	550	328	104	53	33	23	17	13	11	9	7
	600	352	112	57	36	25	18	14	11	9	8

PPV	Description
<50mm/s	Pipelines
<75mm/s	Eskom Power Lines
<150mm/s	Public Roads
<200mm/s	Conveyors
>200mm/s	too high for structures

Figure 3-70: Outcome – Opencast PPVs, Charge per delay versus distance from blast

The criteria and outcomes indicate that especially buildings will be susceptible to blasting induced ground vibrations whilst other structures will be more resilient to blast induced damage.

Air blast assessment

Air blast represents an undesirable and unavoidable output of the blasting technique. Air blasts can also be referred to as 'air – overpressure'. An air blast disturbance propagates as a compression wave in the air. Air blasts are often confused with sound that is within an auditable range. According to Thompson (2005), air blasts are the cause of most complaints regarding blasting since the public apt to confuse air blasts and ground vibrations with one another. Aloui et al (2016) indicates that the audible part of an air blast is characterized by higher frequencies from 20 to 20 000Hz whilst the sub-audible part of the air blast has low frequencies of below 20 Hz. The audible part of an air blast is called noise whilst the frequencies below 20 Hz is called as concussion and classified as "over pressure" when the air blast pressure exceeds atmospheric pressure. It is the over pressure that exerts a force on structures and in turn causes a secondary and audible rattle within a structure.

Table 3-42: Guidelines for air blasts in South Africa, set apart in Brovko et al. (2016):

Decibels	Effect
100	Barely noticeable
110	Readily acceptable
120	Currently accepted by South African authorities as being a reasonable level for public concern
134	Currently accepted by South African authorities that damage will not occur below this level
150	Windows break
176	Plaster cracks
180	Structural damage

Risk assessment – ground vibrations and air blast

The risk assessment conducted for the purpose of this report focuses on the effect of ground vibrations on the highwall and surrounding surface structures. The mining environment is heterogenous (diverse in characteristics and phases), conditions change from one mining block to the next and it may be that not one blast is similar to the next. It is for this reason that controls must be implemented as hazards occur and monitoring must be conducted throughout the process to continuously update and optimize the mining process.

IMPACT ASSESSMENT TABLE

Table 3-43: Impact Assessment

ACTIVITY	ASPECT	IMPACT	PHASE	+/-	SU[1]		+/-	SM[2]		MITIGATION MEASURES	ACTION PLAN
Heritage / Archaeological											
General subsurface activity & activity associated with historical Sites B01 – B03 (demolished)	Subsurface culturally significant material.	Destruction of subsurface culturally significant material.	Operational	Negative	22	Low-Med	Positive	8,8	Low	Monitor material unearthed.	Monitor subsurface material during operational and construction phases and contact a qualified archaeologist should culturally significant material be observed.
Site establishment	Clearance of the site	Destruction of culturally significant material.	Construction & Operational	Negative	18	Low	Positive	7,2	Low	Avoid heritage sites when encountered.	Monitor subsurface material during operational and construction phases and contact a qualified archaeologist should culturally significant material be observed.
Palaeontological											
Subsurface activity	Subsurface palaeontological significant material.	Destruction of palaeontological significant material.	Construction & Operational	Negative	55	Med	Negative	22	Low-Med	Monitor unearthed material & adhere to the Fossil Chance Find Protocol when material of palaeontological significance is found. It is extremely unlikely that any fossils would be found in the loose sand and soil that cover the area but there might be fossils below the ground.	Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were no fossils on surface of the project footprint. Since there is a chance that fossils from the Vryheid Formation may occur below ground and be disturbed a Fossil Chance Find Protocol has been added to the EMPr. **Adhere to the Fossil Chance Find Protocol when material of palaeontological significance is found.** The protocol can be found in the attached Palaeontological specialist report.
Blast & Ground vibration											
Blasting in close proximity to Surface Structures (ground vibrations)	Surface structures	Excessive ground vibrations resulting in damage to	Construction & Operational	Negative	75	Med-High	Negative	15	Low	Limit blasting distance in close proximity to structures to 500m unless specialist studies based on risk assessments is conducted and permission granted by the Principal Inspector of Mines to blast within 500m of surface structures.	**Implement a proper blast design plan.** Measure and record the effects of blasting and evaluate and improve on the plan continuously. **Compile a site specific blasting code of practice** for the mining area which must ensure that the ground vibrations caused by blasting is limited as far as practical possible for each mining block and its associated sensitive receptors.

[1] Significance unmitigated

[2] Significance mitigated

Updated- 11/11/2022

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
		surface structures								Limit ground vibration to an acceptable value with a proper blast design, measure and record, evaluate and improve. Ground vibrations can be limited by implementing controls such as recommend by Thompson, 2005: Small amount of explosive charge per delay should be used when blasting in close proximity to sensitive receptors. The delays between the rows must not strengthen the shockwave, i.e., single hole firing with electronic detonators. Blast parallel to the main joint set or geological discontinuities (dolerite dyke intrusions, slips etc.). Use a pre-split or other highwall control drilling method to isolate the main blast-block from the rest of the rock mass, i.e., create a second free face. Electronic, single hole firing is the preferred method to reduce the amount of explosive charge per delay.	**Appoint a qualified blaster as per Chapter 4 of the MHSA of 1996 to conduct a proper blast design** for each and every mining block that will be blasted. **Appoint a surveyor to identify all surface structures** located in close proximity to the mining area as per regulation 17.2 (a) of the MHSA of 1996.
Blasting in close proximity to Surface Structures (air blasts)	Surface structures	Excessive air blasts resulting in fly rock and damage to surface structures	Construction & Operational	Negative	75	Med-High	Negative	15	Low	Limit blasting distance in close proximity to structures to 500m unless specialist studies based on risk assessments is conducted and permission granted by the Principal Inspector of Mines to blast within 500m of surface structures. Limit the decibels to an acceptable value with a proper blast design, measure and record, evaluate and improve. Controls such as the following should be considered during the blast design process (Thompson 2005): Cover all detonating cord or use noiseless shock tube or electric trunk lines. Limit explosives per delay. Blasting should not be conducted early in the morning because of temperature inversion. Blasting should not be conducted when the wind is very strong.	**Implement a proper blast design plan.** Measure and record the effects of blasting and evaluate and improve on the plan continuously. **Compile a site specific blasting code of practice** for the mining area which must ensure that the ground vibrations caused by blasting is limited as far as practical possible for each mining block and its associated sensitive receptors. **Appoint a qualified blaster as per Chapter 4 of the MHSA of 1996 to conduct a proper blast design** for each and every mining block that will be blasted. **Appoint a surveyor to identify all surface structures** located in close proximity to the mining area as per regulation 17.2 (a) of the MHSA of 1996.

ACTIVITY	ASPECT	IMPACT	PHASE	+l	SU[1]		+l	SM[2]		MITIGATION MEASURES	ACTION PLAN
										Blast ideally at peak noise time. Avoid short collars and fill blast holes with enough stemming.	
Soil & Land Use											
Site Preparation	Soil stripping	Loss of soil	Construction	Negative	80	High	Negative	64	Med-High	Strip all useable soil material for rehabilitation. Topsoil stockpiles should be kept low (below 3m tall). Irrespective of where topsoil is stockpiled, it should be kept moist and vegetated as soon as possible to protect against erosion, discourage weeds and maintain active soil microbes. The shallower Clovelly soils should be stripped to a depth of 25 cm and this 25 cm stockpiled as topsoil only. The deeper Clovelly topsoil's should also be stripped to a depth of 25 cm and stockpiled separately from the underlying 25cm of stripped subsoil. The Clovelly soils that have been cultivated should be considered to comprise only subsoil and should be stripped to 30cm and stockpiled with the other Clovelly subsoils. All stripping and stockpiling should be undertaken according to the guidelines below. Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated boundary. The stripped soil should be relocated by truck along set removal paths. The area to be stripped requires storm water management and the in-flow of water should be prevented with suitable structures. Prepare the haul routes prior to stripping. Stripping should not begin in wet conditions.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Erosion and Sedimentation	Construction	Negative	75	Med-High	Negative	45	Med	Limit earthworks and vehicle movement to demarcated paths and areas. Limit the duration of construction activities, especially those involving earthworks / excavations. Access roads associated with the	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
										development should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for. Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces and soil stockpiles should be re-vegetated or stabilised as soon as is practically possible. A construction phase-specific storm water management plan should be designed for the site and adhered-to. Soil stockpiles should be vegetated as soon as possible.	
Site Preparation	Earthworks	Change in Surface Profile	Construction	Negative	80	High	Negative	64	Med-High	Re-establish surface profile at closure.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.
Site Preparation	Vegetation Removal	Change in Land Use	Construction	Negative	80	High	Negative	64	Med-High	Re-establish grassland at closure.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Change in Land Capability	Construction	Negative	80	High	Negative	64	Med-High	Limit earthworks and vehicle movement to demarcated paths and areas. Limit removal of vegetation to demarcated areas only. Avoid materials that sterilize the soil.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.
Site Preparation	Vehicles and equipment, onsite personnel	Soil Contamination	Construction	Negative	85	High	Negative	34	Low-Med	Correctly implement and monitor a construction-phase storm water management plan; On-site vehicles should be well-maintained; Drip trays should be placed under stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.
Ongoing mine management	Continued soil stripping	Loss of Topsoil	Operation	Negative	80	High	Negative	48	Med	The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
										management plan should be designed for the site and adhered-to.	An operational-phase storm water management plan should be designed for the site and adhered-to.
Ongoing mine management	Bare soil	Erosion and Sedimentation	Operation	Negative	85	High	Negative	51	Med	The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be implemented for the site and adhered-to.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be designed for the site and adhered-to.
Ongoing mine management	Vehicles and equipment, onsite personnel, chemical storage.	Soil Contamination	Operation	Negative	85	High	Negative	34	Low-Med	Chemicals should be stored in fully enclosed areas and the car park area should be covered. Both should be on impermeable hardstanding. Hardstanding should be monitored for cracks. If chemicals are kept outside of the enclosed area temporarily, this area should be on hardstanding and bunded. Ensure proper control of substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced. An operational-phase storm water management plan should be implemented for the site and adhered-to.	Chemicals should be stored in fully enclosed areas and the car park area should be covered. Both should be on impermeable hardstanding. Hardstanding should be monitored for cracks. If chemicals are kept outside of the enclosed area temporarily, this area should be on hardstanding and bunded.
Land Rehabilitation	Vehicles and equipment.	Erosion and Sedimentation	Closure	Negative	70	Med-High	Negative	14	Low	Limit earthworks and vehicle movement to demarcated paths and areas. Limit the duration of deconstruction activities where possible. Access roads associated with decommissioning should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for. Exposed surfaces should be re-vegetated or stabilised as soon as is practically possible. A decommissioning-specific storm water management plan should be designed for the site and adhered-to.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be designed for the site and adhered-to.
Land Rehabilitation	Vehicles and equipment,	Soil Contamination	Closure	Negative	70	Med-High	Negative	14	Low	On-site vehicles should be well-maintained, Drip trays should be placed under	On-site vehicles should be well-maintained, Drip trays should be placed under stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area

ACTIVITY	ASPECT	IMPACT	PHASE	+I	SU[1]		+I	SM[2]		MITIGATION MEASURES	ACTION PLAN
	onsite personnel.									stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.	and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.
Visual											
Site clearance/establishment	Removal of vegetation	Negative impact on aesthetics - due to the site being more visible	Pre-Construction Phase	Negative	6	Low	Negative	1,2	Low	Limit the construction footprint to only the development area	Demarcate the development area
Construction related activities	Movement of construction vehicles and heavy machinery Presence of laydown areas and construction camp	Dust creation and change in visual/landscape character	Construction Phase	Negative	9	Low	Negative	3,6	Low	Limit the construction footprint to only the development area Regulate the speed of vehicles on site Implement dust suppression activities Laydown areas and construction camps should blend in or be screened from surrounding sensitive receptors	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas Locate laydown areas and construction camps in areas where they would be less visible to the surrounding sensitive receptors, or screen these areas using suitable screening methods
Construction related activities	Night Lighting	Light pollution at night on the identified sensitive receptors	Construction Phase	Negative	10	Low	Negative	4	Low	Reduce spill light and glare	Choose lighting types which reduce spill light and glare Only focus lighting to where it is needed When possible, limit construction activities to daylight hours
Mining activity	Presence and operation of open pit	Visual impact on surrounding identified sensitive receptors	Operational Phase	Negative	36	Low-Med	Negative	14,4	Low	Establish and maintain visual screens/barriers between the development and the identified sensitive receptors Ancillary infrastructure should blend in with the surrounding existing sense of place	Ensure that the existing vegetation along the secondary road directly west of the site is maintained. Plant indigenous vegetation along the northern and eastern border of the proposed site. Consult a botanist/landscape architect if needed Ancillary infrastructure should be painted natural colours
Mining activity	Movement of construction vehicles and heavy machinery	Dust creation and change in visual/landscape character due to an increased	Operational Phase	Negative	22	Low-Med	Negative	8,8	Low	Limit the operational activities to only the development area Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
		number of vehicles									
Mining activity	Night lighting	Light pollution at night on the identified sensitive receptors	Operational Phase	Negative	24	Low-Med	Negative	9,6	Low	Reduce spill light and glare	Choose lighting types which reduce spill light and glare Only focus lighting to where it is needed
Backfilling of open pit	Movement of construction vehicles and heavy machinery	Dust creation and change in visual/landscape character due to an increased number of vehicles	Decommissioning Phase	Negative	20	Low-Med	Negative	8	Low	Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas
Decommissioning, rehabilitation and post-closure	Revegetation of the site Post-Closure Phase rehabilitation	Change in landscape character	Decommissioning/Rehabilitation Phase Post-Closure Phase	Negative	20	Low-Med	Negative	4	Low	Revegetate areas/slopes with suitable indigenous vegetation Where possible, reshape the area so that it resembles the pre-construction landscape Remove as much infrastructure as possible Ensure that any residual infrastructure remains in good condition where possible	Consult a botanist/landscape architect if needed Implement monitoring programmes to monitor any rehabilitated areas for at least a year after closure
Noise											
Site clearance/establishment	Removal of vegetation	Bulldozers operating generating noise	Construction Phase	Negative	8	Low	Negative	3,2	Low	Limit the construction footprint to only the development area Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use.	Demarcate the development area Ensure regular maintenance of construction equipment to ensure noise suppression mechanism are in good working order
Construction related activities	Movement of construction vehicles and heavy machinery	Equipment moving around and construction related noise	Construction Phase	Negative	9	Low	Negative	3,6	Low	Limit the construction footprint to only the development area Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of construction equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise
Mining	Material Handling (Loading and unloading of ROM, loading and unloading of stockpiles)	Excavators and truck loading and unloading generated noise	Operational Phase	Negative	30	Low-Med	Negative	18	Low	Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order
Mining	Haul trucks moving on the Haul Road	Haul truck moving on	Operational Phase	Negative	42	Med	Negative	25,2	Low-Med	Noise barriers such as a berm between sensitive receptors	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain haul roads to reduce road related noise

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
		the Haul Roads									
Mining	Commercial trucks moving on the Access Road	Commercial Trucks moving on the access road	Operational Phase	Negative	45	Med	Negative	27	Low-Med	Noise barriers such as a berm between sensitive receptors	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain the access road to reduce road related noise
Mining	Crushing of Coal	Crusher plant generating Noise	Operational Phase	Negative	42	Med	Negative	25,2	Low-Med	Enclose the crusher to reduce the noise impact on the surrounding area	Enclose the crusher to reduce the noise impact on the surrounding area
Removal of any infrastructure	Movement of construction vehicles and heavy machinery	Demolition equipment generated noise	Decommissioning Phase	Negative	22	Low-Med	Negative	8,8	Low	Regulate the speed of the vehicles Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise
Decommissioning, rehabilitation and post-closure	Reshaping of stockpiles and revegetation of the site Post-Closure Phase rehabilitation	Bulldozers shaping the final landform generated noise	Decommissioning/Rehabilitation Phase	Negative	33	Low-Med	Negative	13,2	Low	Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise
Air											
Site clearance/establishment	Removal of vegetation	Bulldozers generating fugitive particulate matter emissions including Dust and PM10	Construction Phase	Negative	8	Low	Negative	3,2	Low	Limit the construction footprint to only the development area	Demarcate the development area Implement monitoring program to monitor the off-site impacts
Construction related activities	Movement of construction vehicles and heavy machinery	Fugitive particulate matter emissions including Dust and PM10 from vehicle moving on roads	Construction Phase	Negative	9	Low	Negative	3,6	Low	Limit the construction footprint to only the development area Implement dust suppression specially on windy days	Implement dust suppression activities on the relevant areas Revegetate open areas as soon as possible Implement monitoring program to monitor the off-site impacts
Mining	Material Handling (Loading and unloading of ROM, loading	Fugitive particulate matter emissions including	Operational Phase	Negative	30	Low-Med	Negative	18	Low	Water sprays at tipping points Wind breaks at tipping points	Water Sprays at tipping points Implement monitoring program to monitor the off-site impacts

ACTIVITY	ASPECT	IMPACT	PHASE	+/-	SU[1]		+/-	SM[2]		MITIGATION MEASURES	ACTION PLAN
	and unloading of stockpiles)	Dust and PM10									
Mining	Wind Erosion	Wind blown fugitive particulate matter emissions including Dust and PM10 from stockpiles	Operational Phase	Negative	42	Med	Negative	33,6	Low-Med	Water sprays at ROM stockpiles Revegetate topsoil and OVB stockpiles	Water sprays at ROM stockpiles Revegetate topsoil and OVB stockpiles Implement monitoring program to monitor the off-site impacts
Mining	Haul trucks moving on the Haul Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Haul road	Operational Phase	Negative	75	Med-High	Negative	60	Med-High	Water Sprays mitigating 75%	Water sprays spraying >2l/m² on the Haul road Implement monitoring program to monitor the off-site impacts
Mining	Commercial trucks moving on the Access Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Access road	Operational Phase	Negative	75	Med-High	Negative	60	Med-High	Adding a dust binding additive to the access road to achieve 90% or more mitigation	Adding a dust binding additive to the access road Implement monitoring program to monitor the off-site impacts
Mining	Crushing of Coal	Fugitive particulate matter emissions including Dust and PM10 from the crusher plant	Operational Phase	Negative	42	Med	Negative	25,2	Low-Med	Water sprays or fully enclose the crusher	Water sprays or fully enclose the crusher Implement monitoring program to monitor the off-site impacts
Removal of any infrastructure	Movement of construction vehicles and heavy machinery	Fugitive particulate matter emissions including Dust and	Decommissioning Phase	Negative	22	Low-Med	Negative	8,8	Low	Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
		PM10 from vehicle moving on roads									
Decommissioning, rehabilitation and post-closure	Reshaping of stockpiles and revegetation of the site Post-Closure Phase rehabilitation	Fugitive particulate matter emissions including Dust and PM10 from bulldozers shaping the landform	Decommissioning/Rehabilitation Phase	Negative	33	Low-Med	Negative	13,2	Low	Revegetate areas/slopes with suitable indigenous vegetation	Consult a botanist if needed Implement monitoring programmes to monitor any rehabilitated areas for at least a year after closure
Groundwater											
Surface clearing and preparation.	Removal of vegetation.	Increase in surface run-off and therefore decrease in aquifer recharge.	Construction Phase	Negative	9	Low	Negative	1,8	Low	Re-vegetate.	Rehabilitation plan.
Topsoil and overburden stockpiling.	Leaching from stockpiles.	Acid generation in the case of carbonaceous material placement.	Operation Phase	Negative	24	Low-Med	Negative	9,6	Low	Should a contamination plume be detected, groundwater abstraction to contain plume.	Quarterly monitoring of monitoring boreholes.
ROM stockpiling.	Leaching from stockpiles.	Acid generation as a result of carbonaceous material.	Operation Phase	Negative	24	Low-Med	Negative	9,6	Low	Should a contamination plume be detected, groundwater abstraction to contain plume.	Quarterly monitoring of monitoring boreholes.
Hydrocarbon spills.	Plume migration.	Spills from mining vehicles can infiltrate to the aquifer and cause a down gradient plume migration.	Construction & Operation Phase	Negative		Low	Negative	2,8	Low	Clean any hydrocarbon spills in the appropriate manner.	Report any hydrocarbon spillage. Ensure spoil kits are always available and personnel trained in how to use them.
Opencast mining	Dewatering	The water infiltrating the voids will be removed for	Operation Phase	Negative	85	High	Negative	85	High	No management can be incorporated to limit the impacts of dewatering.	Quarterly Monitoring. Compensate users for losses. Monitor pit inflow rates, Annual Monitoring report, Update Numerical Model.

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
		safe mining, causing a decrease in the water level. **The drawdown will decrease the groundwater contribution volume to the Northern pan.**									
Closure of the mine	Groundwater rebound	Groundwater decant is expected hold the system behave as predicted. Decant is expected to occur on the lowest elevation on the pit boundary.	Closure and Decommissioning Phase	Negative	36	Low-Med	Negative	14,4	Low	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.
Closure of the mine	Groundwater rebound	Pollution Plume spread	Closure and Decommissioning Phase	Negative	39	Low-Med	Negative	26	Low-Med	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.
Hydropedological Flow driver											
Pit extension (Opencast mining activities)	Flow driver cut-off	Impact on pan catchment	Construction & Operational Phase	Negative	51	Med	Negative	30,6	Low-Med	Cleanwater diversion Mining outside the responsive soils	Clean surface water should be diverted from the top of the wetland/pan catchment to the depression in the south through berms or cut-off trenches
Surface water											
Construction activities	Vegetation clearance and site establishment	Sedimentation and pollution of the watercourse	Construction Phase	Negative	64	Med-High	Negative	51,2	Med	Separate Clean and Dirty Water System	Construct and implement SWMP
Dewatering	Water level drawdown	Reduction in Baseflow	Operational Phase	Negative	65	Med-High	Negative	65	Med-High	No mitigation available	N/A

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ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
Operational Activities	Hydrocarbon spills Dirty Water release Sediment runoff	Water quality deterioration	Operational Phase	Negative	85	High	Negative	51	Med	Separate Clean and Dirty Water System	Construct and implement SWMP
Closure of the mine	Groundwater rebound	Decant of poor quality water	Closure and Decommissioning Phase	Negative	70	Med-High	Negative	28	Low-Med	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.
Ecological (Wetland, Aquatic Terrestrial)											
Operational Activities	Infrastructure Work Revetments New access routes Site clearing for opencast area Placement of cleared topsoil into allocated stockpiles Use of heavy machinery	Flow alterations due to erosion and sedimentation	Construction Phase	Negative	52	Med	Negative	41,6	Med	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	Design and implementation of a suitable stormwater system; Implement a programme for the clearing/eradication of alien species including long term control of such species; A 110 m buffer implemented for the wetland / pan system; Water quality monitoring must take place every month during operational phases; and Wetland monitoring and biomonitoring must take place bi-annually. A topsoil stripping and stockpiling guideline must be completed to ensure rehabilitation success. Attenuation measures must include, but are not limited to - the use of sand bags, erosion control blankets, and silt fences. Long term attenuation measures, such as attenuation/infiltration trenches, swales must be established to control stormwater from hardened surfaces Vegetation clearing must be undertaken as and when necessary in phases. Install sediment barriers (silt catchers and Reno mattresses) along any drainage areas to prevent the migration of silt. Exposed soils must be rehabilitated as soon as practically possible to limit the risk of erosion. All roads need to be maintained and any erosion ditches forming along the road filled and compacted. Demarcate wetland areas to avoid unauthorised access. No washing of any equipment in close proximity to a watercourse is permitted. No releases of any substances that could be toxic to fauna or faunal habitats within the channels or any watercourses is permitted. Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using proper solid/hazardous waste facilities Portable toilets must be placed on impervious level surfaces that are lipped to prevent spillage. The general consensus is that they should be within 30 m to 50 m of a work face Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas.
Operational Activities	Use of heavy machinery using oils and fuels	Pollution of watercourse	Construction Phase	Negative	52	Med	Negative	41,6	Med	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the	

ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
	during site clearing Accidental spillages of chemicals, cements, oils, etc.									watercourse. Erosion control measures must be employed where required.	
Operational Activities	New access routes Use of heavy machinery Placement of cleared topsoil into allocated stockpiles Bank trampling leading to erosion	Spread of alien invasive vegetation	Construction Phase	Negative	48	Med	Negative	28,8	Low-Med	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	
Operational Activities	Increased traffic Use of heavy machinery Bank Erosion	Flow alterations due to erosion and sedimentation	Operational Phase	Negative	90	High	Negative	90	High	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	
Operational Activities	Increased traffic leading to potential accidental spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	Operational Phase	Negative	85	High	Negative	85	High	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	
Operational Activities	Increased runoff from hardened surfaces Increased traffic	Spread of alien invasive vegetation	Operational Phase	Negative	72	Med-High	Negative	57,6	Med	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	
Social											
Establishment of underground mine	Mining	Employment opportunities	Construction and	Positive	70	Med-High	Positive	84	High	Where reasonable and practical the mine should appoint local contractors; Opportunities for training of workers	Implement SLP or a similar Social Development Plan

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ACTIVITY	ASPECT	IMPACT	PHASE	±	SU[1]		±	SM[2]		MITIGATION MEASURES	ACTION PLAN
			Operational Phase							should be maximised; Ways to enhance local community benefits with a focus on broad based BEE need to be explored; Establish targets for the employment and training; Train workforce for longer term employment; Prevent nepotism/corruption in local recruitment structures; Conditions stipulated by property owners in terms of the construction activities should be implemented and monitored; All activities should be restricted to working areas; workers should wear name tags and clothing to ensure that they can be readily identified A specific contact person should be identified to allow community members and property owners to easily direct their queries and concerns and obtain general information regarding the operations; Vehicles used should be clearly marked; Promote employment of women and youth;	
Supplier acquisition	Direct and indirect appointment of local suppliers	Multiplier effect on the local economy	Construction and Operational Phase	Positive	70	Med-High	Positive	84	High	Linkages with skills development/ Small, Medium and Micro Enterprises (SMME) development institutions and other mining operations; Preference should be given to capable subcontractors who based within the local municipal area; Monitoring of sub-contractors procurement; Local procurement targets should be formalised in the mines procurement policy.	Development of a register of local SMMEs; SMME skills development as part of mine SLP/LED commitments
Mining operation	Community development	Social upliftment	Construction and Operational Phase	Positive	70	Med-High	Negative	84	High	Ensure that there is stakeholder buy-in; Collaboration with other developmental role players (e.g. local and district municipalities, neighbouring mines and NGOs) during implementation of envisaged projects, and where possible	Aligning LED projects with those of other development role-players Liaison with beneficiaries to ensure needs are met; Expanding its skills development and capacity building programmes for non-employees Monitoring system to regulate Historically Disadvantaged South African procurement

ACTIVITY	ASPECT	IMPACT	PHASE	+I	SU[1]		+I	SM[2]		MITIGATION MEASURES	ACTION PLAN
										aligning envisaged development projects with existing ones;	Where feasible, training should be NQF Accredited; and A record of training courses completed per individual should be kept.
Mining operation	Mining activities	Impact on health and safety	Construction and Operational Phase	Negative	44	Med	Negative	17,6	Low	Measures suggested minimising the impact of flyrock on surrounding roads and structure; Measures suggested in the Health Impact Assessment to minimize traffic related accidents; Traffic calming measures to prevent speeding Road maintenance; Provide safe road crossing points and fencing of the main road and the mine site	Access control to all project elements, including fencing; Personal Protective Equipment for mine workers; Notification of blasting schedules; Blasting and storage of hazardous materials to adhere to prescribed regulation speed bumps and speed limit installation Community education to sensitize community members to potential traffic and blasting safety risks
Mining operations	Mine area access restrictions	Change in access and movement to resident and livestock	Construction and Operational Phase	Negative	85	High	Negative	51	Med	Where possible ensure that access to fields and grazing areas are uninterrupted The Mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked; Measures to prevent deterioration of roads suggested in Traffic Impact Assessment (e.g. drivers to report road deterioration to the NW Province Department of Transport); Regulation of traffic at intersections and access roads to the site; Ensure that access to key services are uninterrupted	Provide alternative access routes and/or temporary access points during construction and operational activities Road upgrading measures should be investigated and implemented in conjunction with the relevant government department (e.g. repairing and rehabilitating the main roads and sealing the roadway to increase its capacity for Heavy Moving Vehicles);
Mine establishment	Change in land use	Loss of and/or Damage to Agricultural Land	Construction and Operational Phase	Negative	85	High	Negative	51	Med	Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; engage with each directly affected landowner; Mitigation measures should be implemented to avoid any negative impact on animals (e.g. fencing off the construction area); Where damage is incurred, suitable remedial action must be negotiated with the affected farmer; Prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase.	Should the Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes where possible; Remedial action for the temporary loss of cultivated land should be included in the negotiation process with the landowner Nndanganeni Colliery should discuss the construction schedule and activities with the affected farmers to enable them to plan their farming activities and livestock movement accordingly;

ACTIVITY	ASPECT	IMPACT	PHASE	+I	SU[1]		+I	SM[2]		MITIGATION MEASURES	ACTION PLAN
Mine establishment	Influx of job seekers	Increased Pressure on Municipal Services	Construction and Operational Phase	Negative	85	High	Negative	51	Med	Liaise openly and frequently with affected stakeholders to ensure they have information about the proposed mining project; and Liaison with district and local municipalities well in advance to ensure needs are met Ensure that municipalities consider expected population influx Promotion of mining methods to allow for surface development	Influx management to make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders.
Mine establishment	Mine operations	Increased Nuisance Factors and Changed Sense of Place	Construction and Operational Phase	Negative	56	Med	Negative	44,8	Med	Minimise all nuisance factors such as noise, air quality, traffic, and visual- Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	Implement all mitigation measures as specified in the relevant specialist studies; Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders;
Roll Over Mining	Influx of workers and job seekers	Increased social pathologies	Operation	Negative	80	High	Negative	48	Med	Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; implement measures to address potential conflict between locals and non-locals.	Maximisation of the proportion of job opportunities allocated to locals; Workers should be clearly identifiable by wearing proper construction uniforms; The appointed contractor should establish clear rules and regulations for access to the site Extensive HIV/AIDS awareness and general health campaign; Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development if possible.
Mine closure	Dependency on Mine for Sustaining Local Economy	Job losses	Closure and Decommissioning	Negative	80	High	Negative	48	Med	Effect retrenchments according to procedures stipulated in approved SLP; The Mine's SLP should provide strategies and measures that prevent job loss; Support economic diversification through development of alternative markets; Alternatives to save jobs/avoid downscaling should be investigated beforehand; Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and	Develop a Mine Closure Plan; Proactively and effectively implement mine closure plan; Collaborate with adjacent mining companies to develop and implement sustainable community; Develop alternative and sustainable livelihoods; Partner with the relevant government departments, to jointly manage Closure process.
Closure of the mine	Groundwater rebound	Pollution Plume spread	Closure and Decommissioning Phase	Negative	39	Low-Med	Negative	26	Low-Med	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.

3.8.6 The positive and negative impacts that the proposed activity (in terms of the initial site layout) and alternatives will have on the environment and the community that may be affected.

Refer to Table 3-43

3.8.7 Methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

Table 3-44: Impact Criteria and Assigned Rating

Intensity (Magnitude)		ASSIGNED QUANTITATIVE SCORE
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it has a significant, moderate or insignificant		
(L)OW	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	**1**
(M)EDIUM	The affected environment is altered, but functions and processes continue, albeit in a modified way.	**3**
(H)IGH	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.	**5**
Duration		
The lifetime of the impact, that is measure in relation to the lifetime of the proposed development.		
(S)HORT TERM	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.	**1**
(SM) SHORT MEDIUM TERM	The impact will be relevant through to the end of a construction phase.	**2**
(M)MEDIUM	The impact will last up to the end of the development phases, where after it will be entirely negated.	**3**
(L)ONG TERM	The impact will continue or last for the entire operational lifetime (i.e. exceed 20 years) of the development, but will be mitigated by direct human action or by natural processes thereafter.	**4**
(P)ERMANENT	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact is transient.	**2**
Spatial Scale/Extent		
Classification of the physical and spatial aspect of the impact		

(F)OOTPRINT	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	**1**
(S)ITE	The impact could affect the whole, or a significant portion of the site.	**2**
(R)EGIONAL	The impact could affect the area including the neighbouring Farms, the transport routes and the adjoining towns.	**3**
(N)ATIONAL	The impact could have an effect that expands throughout the country (South Africa).	**4**
(I)NTERNATIONAL	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	**5**
Probability		
This describes the likelihood of the impact actually occurring. The impact may occur for any length of time during the life cycle of the activity. The classes are rated as follows:		
(I)MPROBABLE	The possibility of the Impact occurring is none, due to the circumstances or design. The chance of this Impact occurring is zero (0%)	**1**
(P)OSSIBLE	The possibility of the Impact occurring is very low, due either to the circumstances or design. The chance of this Impact occurring is defined as 25% or less	**2**
(L)IKELY	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of Impact occurring is defined as 50%	**3**
(H)IGHLY LIKELY	It is most likely that the Impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.	**4**
(D)EFINITE	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.	**5**
Weighting Factor		
Subjective score assigned by Impact Assessor to give the relative importance of a particular environmental component based on project knowledge and previous experience. Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance		
(L)OW		**1**
LOW- MEDIUM		**2**
MEDIUM (M)		**3**
MEDIUM-HIGH		**4**

<table>
<tr><td colspan="2">HIGH (H)</td><td>5</td></tr>
<tr><td colspan="3">Mitigation Measures and Mitigation Efficiency</td></tr>
<tr><td colspan="3">Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures</td></tr>
<tr><td colspan="3">Mitigation measures were recommended to enhance benefits and minimise negative impacts and address the following:

<u>Mitigation objectives:</u> what level of mitigation must be aimed at: For each identified impact, the specialist must provide mitigation objectives (tolerance limits) which would result in measurable reduction in impact. Where limited knowledge or expertise exists on such tolerance limits, the specialist must make “educated guesses” based on professional experience;

<u>Recommended mitigation measures:</u> For each impact the specialist must recommend practicable mitigation actions that can measurably affect the significance rating. The specialist must also identify management actions, which could enhance the condition of the environment. Where no mitigation is considered feasible, this must be stated and reasons provided;

<u>Effectiveness of mitigation measures:</u> The specialist must provide quantifiable standards (performance criteria) for reviewing or tracking the effectiveness of the proposed mitigation actions, where possible; and

<u>Recommended monitoring and evaluation programme:</u> The specialist is required to recommend an appropriate monitoring and review programme, which can track the efficacy of the mitigation objectives. Each environmental impact is to be assessed before and after mitigation measures have been implemented.

The management objectives, design standards, etc., which, if achieved, can eliminate, minimise or enhance potential impacts or benefits. National standards or criteria are examples, which can be stated as mitigation objectives.</td></tr>
<tr><td>HIGH</td><td>The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.</td><td>1</td></tr>
<tr><td>MEDIUM-HIGH</td><td>The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.</td><td>0.8</td></tr>
<tr><td>MEDIUM</td><td>Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.</td><td>0.6</td></tr>
<tr><td>LOW -MEDIUM</td><td>The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.</td><td>0.4</td></tr>
<tr><td>LOW</td><td>The impact will be mitigated to the point where it is of limited importance.</td><td>0.2</td></tr>
</table>

Table 3-45: Description of bio-physical assessment parameters with its respective weighting

Extent	Duration	Intensity	Probability	Weighting Factor (WF)	Significance Rating (SR)	Mitigation Efficiency (ME)	Significance Following Mitigation (SFM)
Footprint 1	Short term 1	Low 1	Probable 1	Low 1	Low 0-19	High 0,2	Low 0-19
Site 2	Short to medium 2	2	Possible 2	Low to medium 2	Low to medium 20-39	Medium to high 0,4	Low to medium 20-39
Regional 3	Medium term 3	Medium 3	Likely 3	Medium 3	Medium 40-59	Medium 0,6	Medium 40-59
National 4	Long term 4	4	Highly Likely 4	Medium to high 4	Medium to high 60-79	Low to medium 0,8	Medium to high 60-79
International 5	Permanent 5	High 5	Definite 5	High 5	High 80-100	Low 1,0	High 80-100

Table 3-46: Significant Rating Scale Without Mitigation

Potential Impacts Without Mitigation Measures (WOM) Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).		
SIGNIFICANT RATING EQUATION Significant Rating (SR) = (Extent + Intensity + Duration) x Probability		
S=0	**INSIGNIFICANT**	The impact will be mitigated to the point where it is regarded as insubstantial.
SR < 30	**LOW (L)**	The impact will be mitigated to the point where it is of limited importance.
20<SR<39	**LOW- MEDIUM**	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels;
40<SR<59	**MEDIUM (M)**	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
60<SR<79	**MEDIUM-HIGH**	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
80<SR<100	**HIGH (H)**	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

Table 3-47: Significant Rating Scale with Mitigation

Potential Impacts with Mitigation Measures (WM) – In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact.
SIGNIFICANT RATING WITH MITIGATION EQUATION Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency. Or WM = WOM x ME

S=0	**INSIGNIFICANT**	The impact will be mitigated to the point where it is regarded as insubstantial.
SR < 30	**LOW (L)**	The impact will be mitigated to the point where it is of limited importance.
20<SR<39	**LOW- MEDIUM**	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels;
40<SR<59	**MEDIUM (M)**	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw.
60<SR<79	**MEDIUM-HIGH**	The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
80<SR<100	**HIGH (H)**	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

3.8.8 Possible Mitigation Measure that could be applied and the level of risk

Refer to Table 3-43.

3.8.9 Motivation where no alternative sites were considered.

Nndanganeni Colliery already has an existing opencast pit with associated mining infrastructure. The proposed void / pit extension will allow for the continuation of the box cut opencast mining with a roll-over rehabilitation sequence.

The area is located in the Witbank Coal Field. This extension area is preferred due to the shallow nature of the coal reserve and its accessibility via the existing highwall in the opencast where mining is currently taking place. In terms of the technologies and activities proposed, roll-over mining is seen as the most efficient way to undertake concurrent rehabilitation as mining progresses, therefore also reducing the cost required for rehabilitation after cessation of mining activities. Location of infrastructure on site will be based on the most effective way to handle clean and dirty water separation. Therefore, no alternative sites were considered.

3.8.10 Statement motivating the alternative development location within the overall site.

The resource location and wetlands on the site restricts the infrastructure layout as well as the most optimal placement of the stormwater infrastructure which will ensure no release of dirty water to the environment.

3.9 Full description of the process undertaken to identify, assess and rank the impacts and risks the activity will impose on the preferred site (In respect of the final site layout plan) through the life of the activity.

(Including (i) a description of all environmental issues and risks that are identified during the environmental impact assessment process and (ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.)

The same impact ranking criteria and methodology was employed as discussed in Section 3.8.7 of this report.

3.10 Assessment of each identified potentially significant impact and risk

Refer to Table 3-43.

3.11 SUMMARY OF SPECIALIST REPORTS.

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):

Table 3-48: Summary of Specialist Reports

List of Studies Undertaken	Recommendations of Specialist Reports	Recommendations that Have Been Included in the EIA Report	Reference to Applicable Section of Report
Heritage / Archaeological Impact Assessment.	The following recommendations are made in terms with the National Heritage Resources Act, 1999 (Act No. 25 of 1999) in order to avoid the destruction of heritage remains associated with the area demarcated for the proposed mining expansion: • Historical Sites B01 – B03 used to be associated with buildings potentially exceeding 60 years of age. However, the buildings were demolished, and the sites were sufficiently recorded. Since infrastructure existed at these sites, the possibility of uncovering cultural material within the demarcated boundaries is higher compared to other areas. Should such remains be discovered, it is recommended that the associated activity be suspended and that a qualified archaeologist be contacted. These sites are therefore considered to be potentially sensitive. • Contemporary Sites F01 and F02 are associated with a borehole and possible irrigation equipment that do not to exceed 60 years of age. These sites are not significant or sensitive from a heritage perspective and the recording conducted during the study is considered to be sufficient. No further action is required. • Should uncertainty regarding the presence of heritage remains exist, or if heritage resources are discovered by chance, it is advised that the potential site be avoided and that a qualified archaeologist be contacted as soon as possible. • Since archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended, and the relevant heritage resources authority contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)). • From a heritage point of view, development may proceed on the demarcated area, subject to the abovementioned conditions, recommendations, and approval by the South African Heritage Resources Agency.	X	Table 3-48 & Section 3.8.4
Paleontological Impact Assessment	Based on the fossil record but confirmed by the site visit and walk through there are NO FOSSILS of the Glossopteris flora on the surface even though fossils have been collected and recorded from rocks of a similar age and type in South Africa. It is extremely unlikely that any fossils would be preserved in the overlying soils and sands of the Quaternary. There is a chance that fossils may occur in below the ground surface in the shales of the Vryheid Formation so a **Fossil Chance Find Protocol** should be added to the EMPr. If fossils are found by the environmental officer, or other responsible person once mining, excavations or drilling have commenced, then they should be rescued, and a palaeontologist called to assess and collect a representative sample. A Fossil Chance Find Protocol is stipulated in the attached specialist study & under the Palaeontological Impact Assessment in Section 3.8.5 of this report.	X	Table 3-48 & Section 3.8.4

List of Studies Undertaken	Recommendations of Specialist Reports	Recommendations that Have Been Included in the EIA Report	Reference to Applicable Section of Report
Visual Impact Assessment	Mitigation measures may be considered in two categories: • Primary measures that intrinsically comprise part of the development design through an iterative process. Mitigation measures are more effective if they are implemented from project inception when alternatives are being considered. • Secondary measures designed to specifically address the remaining negative effects of the final development proposals. Primary measures that will be implemented will mainly be measures that will minimise the potential visual impact by softening the visibility of the structures by "blending" with the surrounding areas. Such measures will include rehabilitation of the structures by re-vegetation. Secondary measures will include final rehabilitation, after care and maintenance of the vegetation and to ensure that the final landform is maintained. The proposed opencast pit expansion is expected to create low negative visual impacts on the surrounding sensitive receptors during the pre-construction and construction phases of the activity. Low to medium negative visual impacts on the surrounding sensitive receptors are expected during the operational, decommissioning, rehabilitation, and post-closure phases. However, these identified impacts can be reduced to a low negative impact provided that the recommended mitigation measures are implemented. The low impacts are mainly due to the ability of the existing land uses within the surrounding area being able to visually absorb the proposed mining activity. Furthermore, the proposed opencast pit expansion is expected to increase the cumulative visual impact on the surrounding sensitive receptors. It is important to note that the identified sensitive receptors expected to experience some level of visual impact, as determined by the visual exposure analysis, are currently exposed to and familiar with the existing visual landscape i.e., the existing mining, industrial and agricultural activities. The proposed activity is also expected not to contrast with the areas existing sense of place. However, notwithstanding these factors and notwithstanding the study area's ability to visually absorb the proposed activity, it is still recommended that the recommended mitigation measures are implemented to help reduce potential cumulative visual impacts on the surrounding sensitive receptors. Overall, considering the results of the VIA and from a visual perspective, the proposed opencast pit expansion may proceed provided that the recommended mitigation measures are implemented.	X	Table 3-48 & Section 3.8.4
Soil & Agricultural Potential Impact Assessment	Should the project go ahead, the site should be monitored for erosion and for spills that could lead to contamination of the environment throughout all three of the abovementioned phases. Signs of erosion and soil contamination should be monitored visually. The vegetative cover and fertility levels of stockpiled soil should also be monitored. Further to this, the monitoring of all stormwater infrastructure will be critical to protect the pan. The proposed development area is currently largely grassland with small, cultivated areas. The soils identified at the site are shallow and moderately shallow Clovellys and shallow Mispahs. The capability of the majority of the site is Grassland. The major limitations to cultivation are stoniness and overall depth. As the soils are apedal and the site borders a pan on three sides, a number of the identified potential impacts remain Medium to High post-mitigation. These include a Loss of Topsoil, Erosion and Sedimentation, Change in Land Use and Change in Land Capability. The pan represents sensitive wetland habitat with wetland land capability, so protecting the pan is extremely important for mining in the proposed study site. Further to this, the study site would be an extension of an existing mine, so the potential cumulative effects of the proposed mining project could be significant, especially the impacts of a loss of soil and a change in land capability. It is the specialist's opinion that the impacts of this potential mining project on the	X	Table 3-48 & Section 3.8.4

List of Studies Undertaken	Recommendations of Specialist Reports	Recommendations that Have Been Included in the EIA Report	Reference to Applicable Section of Report
	site soils have the potential to be high because developing the area could affect the soils in such a way that the pan could cease to exist. Recommendations made within this report should be read in conjunction with the site Water Use License and other specialist studies, especially the wetland study.		
Hydropedological Impact Assessment	• Mining should consider the layout as proposed in Figure 3-65. • A buffer of at least 50 m from the edge of the delineated wetland/pan catchment should be kept. • Install seepage collection infrastructure to collect and contain contaminated seepage out of wetland system. • Develop and implement a construction stormwater management plan prior to the start of construction activities. • Install and regularly maintain and repair sediment barriers along the downslope edge of cleared areas. • No vegetation clearing should take place in any wetland outside the direct development footprint. • Phase vegetation clearing to limit exposed area at any one time. As far as possible, limit the major clearing activities and earthworks to the dry season. • Install sediment barriers and/or low-level berms along the downslope edge of cleared areas. • Rehabilitate all cleared areas outside the direct development footprint as soon as possible following the disturbance. • Water quality monitoring and biomonitoring to be undertaken based on recommendations by an ecologist/wetland specialist. • Inspect and maintain all stormwater discharge points. These points should be dispersive as far possible. • Ensure separation of clean and dirty water. No dirty water to be discharged. • Install clean water diversion of surface and sub-surface flow to pan: o Groundwater and sub-surface flow – 14065 m^3/annum	X	Table 3 34 & Section 3.8.4
Geohydrological Assessment	• Should fuel spillages occur during the construction phase immediate action is required to minimise the impact on the groundwater regime. • No management can be incorporated to limit the impacts of dewatering should the box-cut floor be lower than the groundwater level. • Groundwater levels in the monitoring boreholes should be measured on at least a quarterly interval. • Should the water levels of surrounding users be influenced in terms of groundwater level or quality decline, the users should be compensated. • Monitor groundwater inflow rates on a monthly basis throughout the mining operation. • The groundwater quality in the monitoring boreholes should be analysed on a quarterly basis. • Annual reporting on the groundwater qualities and levels should be conducted and submitted to the DWA. • The numerical model should be updated once more time-series monitoring data (water levels and qualities) are available and on an annual basis. • Remove as much coal from the mining pit as possible to prevent continuous acid generation. • Carbonaceous material should be placed at the deeper base of the opencast pit to allow flooding with groundwater as soon as possible. This will reduce the redox reaction potential as oxygen is excluded from the system. • Rehabilitation should occur in such a manner that surface runoff is directed away from the rehabilitated pit and recharge to the pit minimized.	X	Table 3-48 & Section 3.8.4

List of Studies Undertaken	Recommendations of Specialist Reports	Recommendations that Have Been Included in the EIA Report	Reference to Applicable Section of Report
	• Flow paths which include fracture zones should be sealed to reduce inflow of fresh groundwater and outflow of contaminated groundwater. • Methods of handling the potential decant should be investigated and may include a down gradient- intercepting trench. • The groundwater quality in the monitoring boreholes should continue to be analysed on a quarterly interval basis. • Monitoring of surface water features including the Northern Pan should be conducted on a quarterly interval.		
Ecological (Wetland, Aquatic & Terrestrial) Specialist Assessment.	Mitigation measures, aimed at minimising the afore-mentioned impacts in the wetland report, include (but are not limited to): • Design and implementation of a suitable stormwater system within any of the mining trenches ; • Rehabilitation of the disturbed areas; • Adhering to the recommended protection buffer as per the baseline assessment; • Limiting instream sedimentation; • Minimising pollutants entering any watercourses; • Implement a programme for the clearing/eradication of alien species including long term control of such species; • A 110 m buffer was implemented for the wetland systems; • Ongoing water quality monitoring must take place monthly; • Wetland monitoring where/if flow conditions allow for effective sampling analysis must take place bi-annually to determine any trends in ecology and hydrology; and • A hydropedological investigation in order to identify pronounced hydrological pathways.	X	Table 3-48 & Section 3.8.4
Air Quality Impact Assessment	Based on the results presented in the air quality report the following further recommendations are outlined: • It is recommended that ambient air quality monitoring be established to get a baseline condition prior to the onset of the operations and in order to establish the level at which the proposed operations are noted to impact on the ambient air quality. • Fallout monitoring should be continued for the life of mine to better assess the level of nuisance dust associated with both mining and process related operations. Sampling of fallout should be undertaken within the neighboring areas as well as on-site. Dust fallout monitoring is recommended locations to be determined. • If it is found that dust levels are measured to be exceeding limits, it is highly recommended to establish a Real-Time indicative monitoring network to quantitatively help identify the sources and to assist in the management of the mitigation of these sources. The impacts from dust fallout and Particulate matter can be reduced by implementing dust control measures. The highest intensity of the construction work should be carried out during the summer months and not over the harsh winter months as can result in increased dispersion of fugitive dust. The mine should	X	Table 3-48 & Section 3.8.4

List of Studies Undertaken	Recommendations of Specialist Reports	Recommendations that Have Been Included in the EIA Report	Reference to Applicable Section of Report
	ensure that unpaved roads are continuously watered and treated with dust binding additive products to reduce the volume of fugitive dust emitted from unpaved roads. Mitigation and management measures for mining operation as discussed in this report should be sufficient to ensure the mining operation can be conducted with minimal impact on the receiving environment and therefore not have a detrimental effect and can go ahead.		
Blasting & Vibrations	• Once mining commences a proper operational blast design and code of practice must be compiled, implemented, monitored, evaluated and improved. • Ground vibration • Ground vibrations are the unfortunate, unavoidable side effect of blasting; however, ground vibrations can be limited by implementing mitigating measures such as recommend by Thompson, 2005: ○ Small amount of explosive charge per delay should be used when blasting in close proximity to sensitive receptors. ○ The delays between the rows must not strengthen the shockwave, i.e., single hole firing with electronic detonators. ○ Blast parallel to the main joint set or geological discontinuities (dolerite dyke intrusions, slips etc.). ○ Use a pre-split or other highwall control drilling method to isolate the main blast-block from the rest of the rock mass, i.e., create a second free face. ○ Electronic, single hole firing is the preferred method to reduce the amount of explosive charge per delay. ○ Since air blasts damage and annoyance can be influenced by various different factors, it is recommended that a well-balanced conceptual design be generated as to not generate significant air blast. Controls such as the following should be considered during the design process (Thompson 2005): ○ Cover all detonating cord or use noiseless shock tube or electric trunk lines. ○ Limit explosives per delay ○ Blasting should not be conducted early in the morning because of temperature inversion ○ Blasting should not be conducted when the wind is very strong ○ Blast ideally at peak noise time ○ Avoid short collars and fill blast holes with enough stemming.	X	Table 3-48 & Section 3.8.4

3.12 Environmental Impact Statement

3.12.1 Summary of the key findings of the environmental impact assessment;

The most significant impacts after mitigation and with a cumulative medium to high significance are:

Table 3-49: Summary of key findings

Activity	Aspect	Impact	Phase	+/-	SU	+/-	SM
Groundwater							
Opencast mining	Dewatering	The water infiltrating the voids will be removed for safe mining, causing a decrease in the water level. The drawdown will decrease the groundwater contribution volume to the Northern pan.	Operational Phase	Negative	High	Negative	High
Surface Water							
Pit extension	Flow drivers cut-off	Impact on pan catchment	Construction & Operational Phase	Negative	Med	Negative	Low - Med
Construction activities	Vegetation clearance and site establishment	Sedimentation and pollution of the watercourse	Construction Phase	Negative	Med - High	Negative	Med
Dewatering	Water level drawdown	Reduction in Baseflow	Operational Phase	Negative	Med - High	Negative	Med - High
Operational Activities	Hydrocarbon spills Dirty Water release Sediment runoff	Water quality deterioration	Operational Phase	Negative	High	Negative	Med
Ecological (Wetland, Aquatic Terrestrial)							
Operational Activities	Increased traffic Use of heavy machinery Bank Erosion	Flow alterations due to erosion and sedimentation	Operational Phase	Negative	High	Negative	High
Operational Activities	Increased traffic leading to potential accidental spills of hydrocarbon materials Hazardous materials entering the watercourses. Increased road runoff during rainfall events	Pollution of watercourse	Operational Phase	Negative	High	Negative	High
Operational Activities	Increased runoff from hardened surfaces	Spread of alien invasive vegetation	Operational Phase	Negative	Med - High	Negative	Med

	Increased traffic						
Social Economic							
Mine establishment	Mining operations	Employment and income opportunity.	Construction and Operation Phase	Positive	Med	Negative	Med
Mining operations	Mine closure	Job losses.	Decommissioning and Closure	Negative	Med - High	Negative	Med
Mining operations	Mine Closure	Decrease/termination of community investment funds and support to local communities.	Decommissioning and Closure	Negative	Med - High	Negative	Med
Soil, Lands use							
Site Preparation	Soil stripping	Loss of soil	Construction	Negative	High	Negative	Med - High
Site Preparation	Earthworks	Change in Surface Profile	Construction	Negative	High	Negative	Med - High
Site Preparation	Vegetation Removal	Change in Land Use	Construction	Negative	High	Negative	Med - High
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Change in Land Capability	Construction	Negative	High	Negative	Med - High
Site Preparation	Earthworks	Change in Surface Profile	Construction	Negative	High	Negative	Med - High
Ongoing mine management	Continued soil stripping	Loss of Topsoil	Operation	Negative	High	Negative	Med
Ongoing mine management	Bare soil	Erosion and Sedimentation	Operation	Negative	High	Negative	Med
Air Quality							
Mining	Haul trucks moving on the Haul Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Haul road	Operational Phase	Negative	Med - High	Negative	Med - High
Mining	Commercial trucks moving on the Access Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Access road	Operational Phase	Negative	Med - High	Negative	Med - High

3.12.2 Final Site Map

Provide a map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers. Attach as Appendix C.

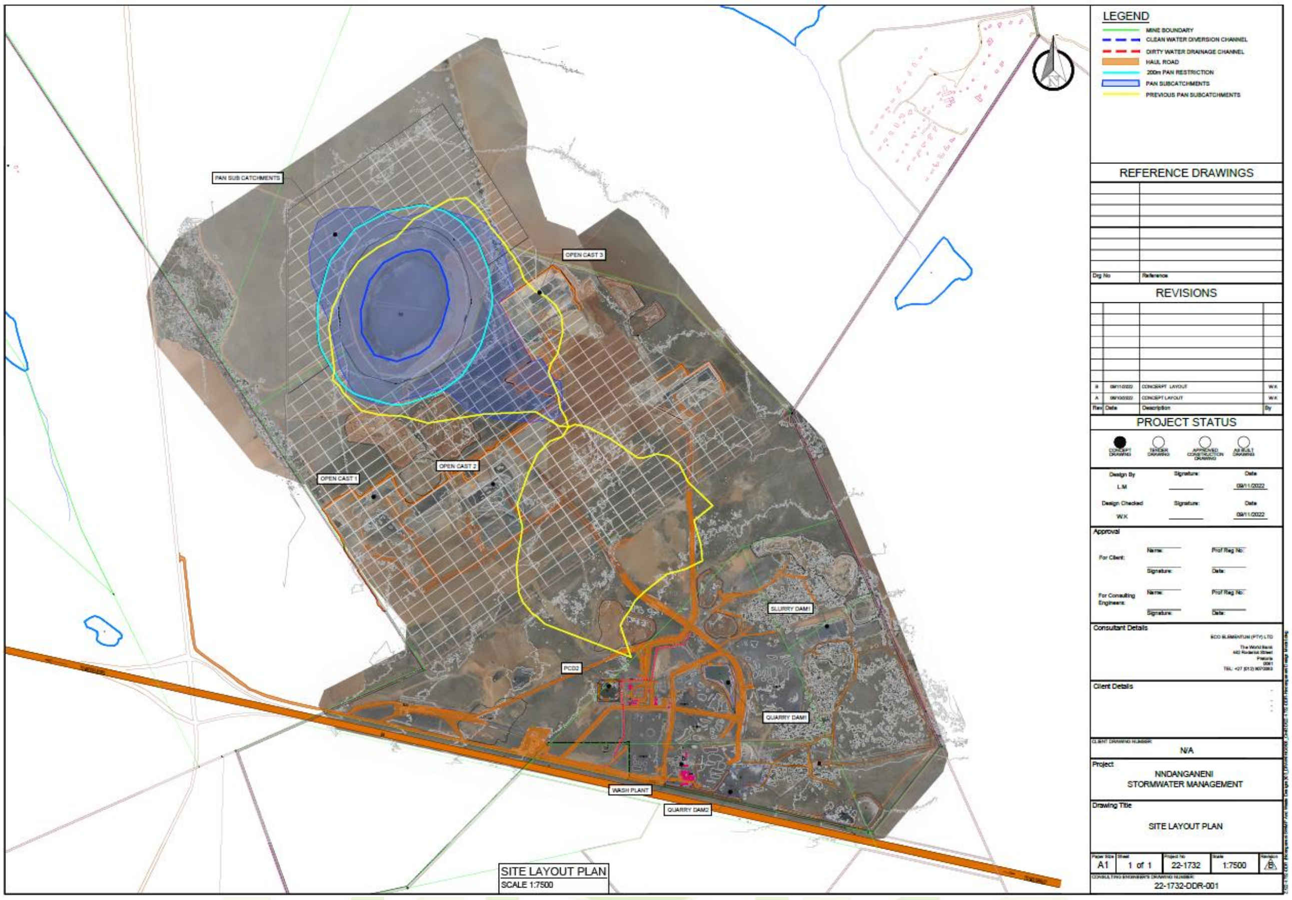

Figure 3-71: The proposed mine layout with sensitiviites

3.12.3 Summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.

Description	Advantages	Disadvantages
	Mining Alternatives	
Mining on cultivated area.	• Remaining coal resources can be optimally extracted and benefited from financially. • Additional job creation.	• Production from cultivate land will be compromised for the duration of the operation until rehabilitation has established the area to pre-mining conditions.
The no go option of not mining.	• Area remains a modified cultivated land and agricultural practises continue.	• Loss of remaining coal resources and the financial gain from mining it. • No additional jobs will be created.

3.13 PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPR;

Based on the assessment and where applicable the recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.

The objectives of impact mitigation and management are to:

- Primarily pre-empt impacts and prevent the realisation of these impacts - PREVENTION.
- To ensure activities that are expected to impact on the environment are undertaken and controlled in such a way so as to minimise their impacts – MODIFY and/or CONTROL.
- To ensure a system is in place for treating and/or rectifying any significant impacts that will occur due to the proposed activity – REMEDY.
- Implement an adequate monitoring programme to:
  - Ensure that mitigation and management measure are effective.
  - Allow quick detection of potential impacts, which in turn will allow for quick response to issue/impacts.
  - Reduce duration of any potential negative impacts.

Environmental impact management outcomes are:

- Efficient groundwater recharge.
- Record of Groundwater Levels.
- Limit of the extent of contamination plume.
- Prevention of groundwater pollution.
- Fair compensation for loss of groundwater.
- Prolong period before decanting and allow for decant to be of an acceptable quality.
- Minimised impact on aquifer recharge.
- Maintenance and improvement of water quality in the watercourse.
- Limited noise disturbance.
- No soil erosion on site.
- No soil compaction in areas outside of the construction / operation area.
- Preservation of topsoil and seed bank.
- No soils pollution occurrence.
- Offset of agricultural areas for sustainable co-existence.
- Minimal dust nuisance.
- Minimise the cumulative impact on sense of place.
- Maintenance and conservation of heritage resources.

- Increased employment in the local community.
- Improved economic status locally.
- health and safety issues within the community remain the same or improve.
- Social uplifting of neighbouring communities.

3.14 Aspects for inclusion as conditions of Authorisation.

- All relevant permits and authorisation must be obtained prior to construction commencing.
- Adhere to all monitoring requirements.
- Adhere to the existing water use licence conditions
- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended, and the relevant heritage resources authority contacted.
- From a palaeontological perspective – the possibility exists that fossiliferous significant material (plants, insects, bone, coal) may be exposed during the development (construction & operational phase). These materials generally occur below the surface and is of palaeontologic significance. In cases where such material is found, all activities must be suspended pending further palaeontological investigations by a qualified palaeontological scientist.
- Methods of handling the potential decant should be investigated, approved, and set in place prior to mine closure.
- All acoustic screening measures must be in place before commissioning the mining activities.
- No off-road driving, hunting, poaching, or fires should be permitted on the property.
- An incident and complaints register must be present on site and submitted to the Municipality on quarterly basis.
- The applicant must have dust fallout monitoring points around the proposed mining area and have the monitoring reports submitted to the Municipality on quarterly basis.

3.15 Description of any assumptions, uncertainties and gaps in knowledge.

Wetland and Aquatics

It is difficult to apply pure scientific methods within a natural environment without limitations, and consequential assumptions need to be made. The following constraints may have affected this assessment:

A hand-held Garmin eTrex 30 were used to delineate the watercourses had an accuracy of 3 m to 6 m. The findings, results, observations, conclusions and recommendations provided in this report are based on the author's best scientific and professional knowledge as well as available information regarding the perceived impacts on the watercourses and biodiversity; and The assessment in determining the present ecological state (PES) of the identified system was based on a single site visit. Site visits should ideally be conducted over differing seasons in order to better understand the vegetation, hydrological and geomorphologic processes driving the characteristics of the watercourse. In order to obtain a comprehensive understanding of the dynamics of the aquatic ecosystem in an area, ecological assessments should always consider investigations at different time scales (across seasons/years) and through replication, as river systems are in constant change. The watercourse management and rehabilitation plan will need to be updated as more information about the dynamics of the system and its response to the implemented management measures are observed over time.

3.16 Reasoned opinion as to whether the proposed activity should or should not be authorised

3.16.1 Reasons why the activity should be authorized or not.

The EAP believes that the authorisation for the void extension on portion 15 of the remaining extent of the farm Hartogshof 413 JS should be granted provided that IPP Mining Equipment (Pty) Ltd strictly adhere to their existing water use licence conditions, specifically the conditions relating to the Northern Pan (Licence no: 03/B12C/CGIJ/4850 File no: 27/2/2/B412/10/4).

- Mining within 500m of the Northern Pan (mining will however not take place within 200m of the Northern Pan).
- Further mining of the Northern Pan's sub catchment should be avoided to prevent the pan's degradations. Refer to Figure 3-72. A 10m buffer around the pan sub catchment should be implemented.

Taking the status quo of Northern Pan into consdeiration, the risks of the proposed mining activity is minimal and can be mitigated by following the mitigation measures stipulated in the EMPr, which will reduce impacts significantly to acceptable levels.

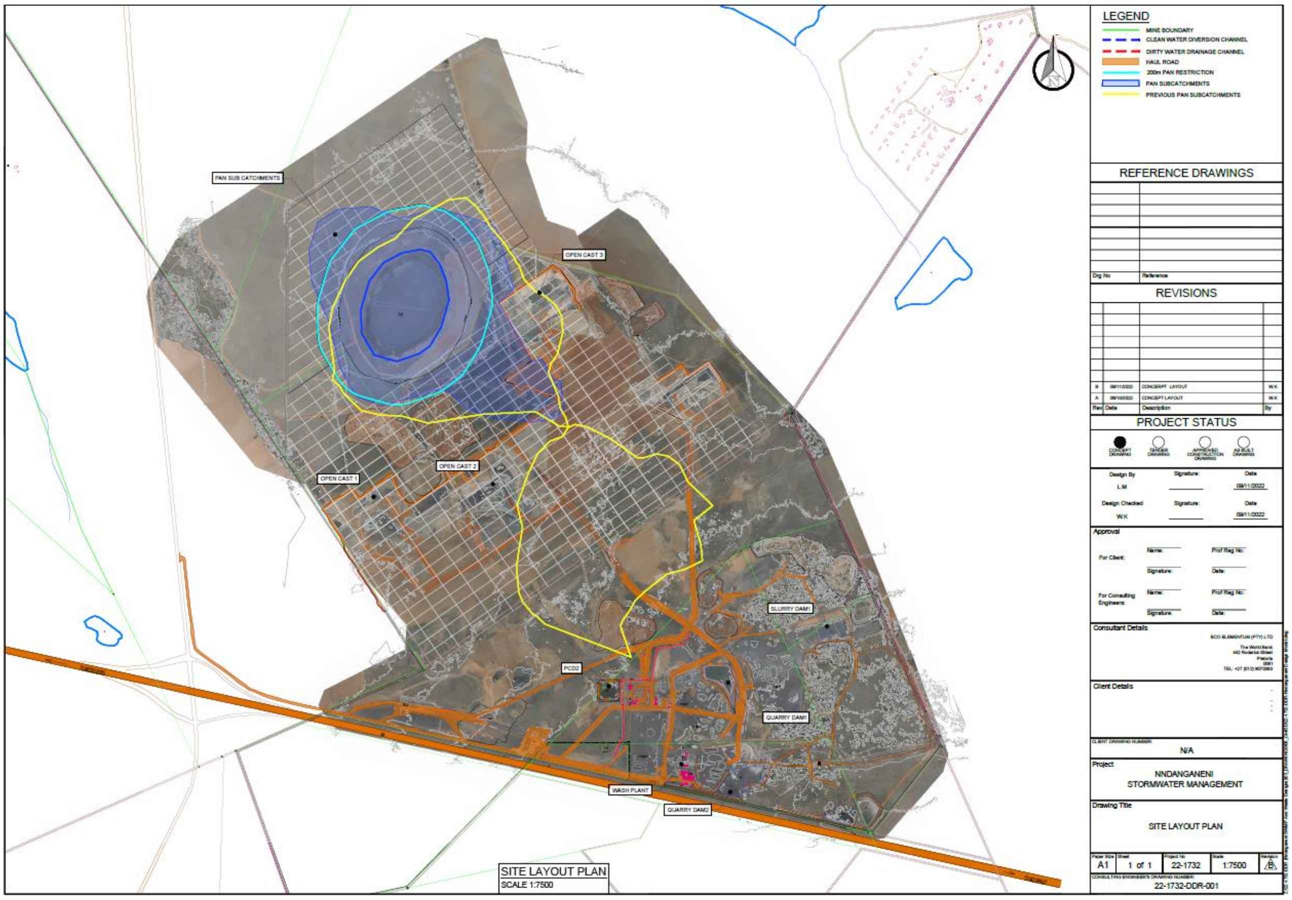

Figure 3-72: Northern Pan sub catchment

3.16.2 Conditions that must be included in the authorisation

- All relevant permits and authorisation must be obtained prior to construction commencing.
- Adhere to all monitoring requirements.
- Adhere to the existing water use licence conditions
- Because archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains

be exposed during development and construction phases, all activities must be suspended, and the relevant heritage resources authority contacted.

- From a palaeontological perspective – the possibility exists that fossiliferous significant material (plants, insects, bone, coal) may be exposed during the development (construction & operational phase). These materials generally occur below the surface and is of palaeontologic significance. In cases where such material is found, all activities must be suspended pending further palaeontological investigations by a qualified palaeontological scientist.
- Methods of handling the potential decant should be investigated, approved, and set in place prior to mine closure.
- All acoustic screening measures must be in place before commissioning the mining activities.
- No off-road driving, hunting, poaching, or fires should be permitted on the property.
- An incident and complaints register must be present on site and submitted to the Municipality on quarterly basis.
- The applicant must have dust fallout monitoring points around the proposed mining area and have the monitoring reports submitted to the Municipality on quarterly basis.

3.17 PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED.

10 Years.

3.18 UNDERTAKING

Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Basic assessment report and the Environmental Management Programme report.

For the undertaking refer to Part B: EMP

3.19 Financial Provision

Table 3-50: Closure Cost

Mine Closure Financial Liability		
	Item description	**Cost**
1	**Surface Infrastructure**	**R6 306 350.75**
1	Dismantling of processing plant and associated structures (including associated conveyors & power lines)	R286 452.33
2(A)	Demolition of steel buildings and structures (including floor slabs)	R0.00
2(B)	Demolition of reinforced concrete buildings and structures	R0.00
3	Rehabilitation of access roads	R4 978 447.29
4(A)	Demolition of electrified railway lines	R0.00
4(B)	Demolition and rehabilitation of non-electrified railway lines	R0.00
5	Demolition of housing and facilities (including floor slabs)	R870 302.42
12	Fencing	R171 148.72
2	**Mining Areas & Waste Sites**	**R22 844 256.36**
6	Opencast rehabilitation (including final voids and ramps)	R22 844 256.36
7	Sealing of shafts, adits and inclines (including concrete cap)	R0.00
3	**Mine Residue Sites**	**R9 504 372.67**
8(A)	Rehabilitation of overburden and spoils	R0.00
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	R0.00
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	R8 856 681.67
9	Rehabilitation of subsided areas	R0.00
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required)	R647 691.00
4	**General Rehabilitation**	**R9 248 745.67**
10	General surface rehabilitation, including of all denuded areas	R9 248 745.67
5	**Aftercare & Maintenance**	**R3 344 723.00**
13	Monitoring	R1 420 000.00
14	Maintenance	R1 924 723.00
15	Water Treatment Facility	R0.00
	Sub Total 1	**R51 248 448.45**
	Mobilisation and Project Management (10% of Subtotal 1)	**R5 124 844.85**
	Sub Total 2	**R56 373 293.30**
	Contingency (10% of subtotal 2)	**R5 637 329.33**
	Sub Total 3 (Closure Liability for Mine)	**R62 010 622.62**
	VAT (15% of subtotal 3)	**R9 301 593.39**
	Total	**R71 312 216.02**

3.19.1 Explain how the aforesaid amount was derived.

Table 3-50 shows that the sudden closure costs calculated for the mine using contractor rates. A closure cost calculation based on rates provided by the DMR for financial provision can be provided upon the DMR's request. A bill of quantity was determined for each of the units and applied to the rates to determine a closure cost per unit. The unit costs determined the category costs and the category costs resulted in a preliminary closure cost also called Sub-Total 1. A contingency of 10% was included on Subtotal 2 to obtain a Financial Liability Cost in Subtotal 3. Finally, a 15% VAT was added to Subtotal 3 to obtain a subtotal 4. Subtotal 3 is regarded as the Final closure liability of the mine.

3.19.2 Confirm that this amount can be provided for from operating expenditure.

The applicant confirms that this amount will be provided for.

3.20 SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

3.20.1 Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998). the EIA report must include the:

3.20.1.1 Impact on the socio-economic conditions of any directly affected person.

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as an **Appendix D**.

Mining operations.	Employment and income opportunity.	Med -	Med -
Employee training.	Upskilling of Labour force.	Low-Med +	Low-Med +
Coal production and sales.	Increased Public revenue.	Low-Med +	Low-Med +
Social Development Plan.	Increase in Local Economic Development Funds.	Low-Med +	Low-Med +
Employment creation.	Project Induced In-Migration.	Low-Med +	Low-Med +
Increased traffic Mining related hazards Increased dust Water quality deterioration Historical subsidence Blasting.	Safety and Health Risks.	Med -	Low-Med +
Open pit establishment.	Change in sense of place.	Low-Med +	Low-Med +
Mine closure.	Job losses.	Med-High -	Med -
Mine Closure.	Decrease/termination of community investment funds and support to local communities.	Med-High -	Med -
Water quality deterioration Historical subsidence.	Safety and Health Risks.	Med -	Low-Med +

3.20.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act. (Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

The phase 1 archaeological impact assessment for the proposed mining area examined the area and identified sites B01 – B03 as buildings on a 1964 aerial image. Since these buildings appear to have been constructed between 1955 and 1964, the age of these buildings might exceed 60 years and would therefore be protected by the NHRA, 1999 (Act No. 25 of 1999). However, all three buildings were completely demolished, are not associated with surface remains and are therefore no longer considered to be significant from a heritage perspective. Additionally, the areas associated with Sites B02 and B03 were disturbed by the cultivation of crops. Although sites B01 – B03 were demolished, the possibility exists that significant cultural material might be unearthed within the demarcated boundaries. These sites are therefore considered to be potentially sensitive. Sites F01 & F02 were respectively identified as a contemporary borehole and potential irrigation equipment. The sites are not significant from a heritage perspective.

3.21 Other matters required in terms of sections 24(4)(a) and (b) of the Act.

Section 24(4) (b) (i) of the Act specifies “investigation of the potential consequences or impacts of the alternatives to the activity on the environment and assessment of the significance of those potential consequences or impacts, including the option of not implementing the activity”. The alternatives assessed and the impacts associated with the alternatives assessed have been fully presented in Section 3.8.

PART B

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

4. ENVIRONMENTAL MANAGEMENT PROGRAMME

4.1 DETAILS OF THE EAP

(Confirm that the requirement for the provision of the details and expertise of the EAP are already included in PART A, section 1(a) herein as required).

Name of The Practitioner:	Lian Roos - Candidate EAP (2022/4550)
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Fax No. :	
e-mail address:	lian@ecoe.co.oza

4.2 DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

Nndanganeni Colliery has exisiting and fully functioning infrastructure (PCD, stormwater infrastrucutre, offices, workshop, stockpiles, etc). The activities associated with the void extenstion therefore, are somewhat limited to only the following: Box Cut Opencast Mining with a Roll-over Rehabilitation Sequence. Clean and dirty water separation system (Stormwater management infrastructure). Hauling, access road, haul road.

Site Preparation

Site preparation mainly deals with the stripping and stockpiling of topsoil prior to the mining activities commencing as this might affect the quality and quantity of available valuable topsoil resources. The main objectives of soil management are to:

- Minimal removing and stockpiling of topsoil due to historical mining activities;
- optimise the preservation and recovery of topsoil for rehabilitation;
- identify soil resources and stripping guidelines;
- identify surface areas requiring stripping (to minimise over clearing);
- manage topsoil reserves to not degrade the resource;
- identify stockpile locations and dimensions; and
- identify soil movements for rehabilitation use.

In accordance with the objective of providing sufficient stable soil material for rehabilitation and to optimise soil recovery, the following strategies have been adopted:

- stockpiles to be located outside proposed mine disturbance areas;
- construction of stockpiles by dozers rather than scrapers to minimise structural degradation;
- construction of stockpiles with a "rough" surface condition to reduce erosion hazard, improve drainage and promote revegetation; and
- revegetation of stockpiles with appropriate fertiliser and seed to minimise weed infestation, maintain soil organic matter levels, soil structure and microbial activity and maximise the vegetative cover of the stockpile depending on the exposure timeframes.

Disturbance areas will be stripped progressively (i.e. only as required) to reduce erosion and sediment generation, to reduce the extent of topsoil stockpiles and to utilise stripped topsoil as soon as possible for rehabilitation. Rehabilitation of disturbed areas (i.e. roads, embankments and stripped mining footprint) will be undertaken as practicable after these structures are completed or as areas are no longer required. Soil surveys over the open cut area, beneath proposed mine waste emplacements and other infrastructure areas will determine the depth of topsoil. It should be noted that it is important that for topsoil recovered from the areas it is required that underlying material is not inadvertently collected since it is unsuitable for reuse in rehabilitation.

A general protocol for soil handling is presented below and includes soil handling measures which optimise the retention of soil characteristics (in terms of nutrients and micro-organisms) favourable to plant growth:

- The surface of the completed stockpiles will be left in a "rough" condition to help promote water infiltration and minimise erosion prior to vegetation establishment;
- Topsoil stockpiles to have a maximum height of 3 m to limit the potential for anaerobic conditions to develop within the soil pile;
- Topsoil stockpiles to have an embankment grade of approximately 1V:4H (to limit the potential for erosion of the outer pile face);
- Topsoil stockpiles will be seeded and fertilised; and
- Soil rejuvenation practices will be undertaken if required prior to re-spreading as part of rehabilitation works.

Box Cut Opencast Mining with a Roll-over Rehabilitation Sequence

Opencast mining using the truck and shovel lateral sequential rollover mining method will be undertaken. Mining will commence from the initial box cut. A haul road that will be extended from the nearby existing road will be used as access to the mining area.

The soft overburden will be removed by mechanical methods. The hard overburden will be drilled and blasted and then removed by mechanical methods. The coal will be drilled and blasted prior to removal.

Replacement of overburden materials into the mining pit will be according to the following sequence:

4. Placement of hard overburden at base of pit;
5. Placement of soft overburden; and
6. Final cover of topsoil (minimum 500 mm).

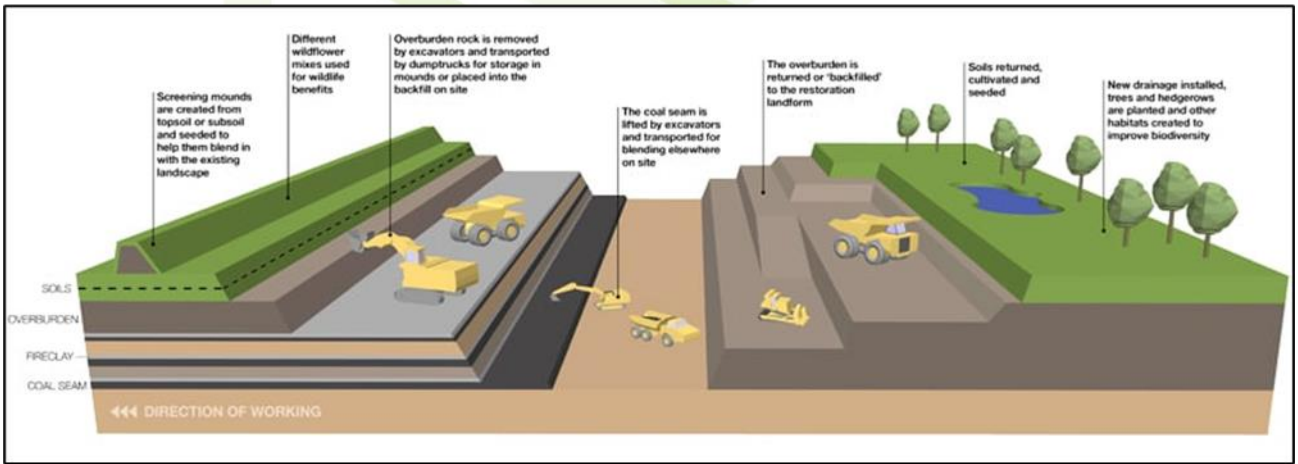

Figure 4-1: Typical Opencast Concurrent Roll Over Rehabilitation Mining Technique

Access and Haul Roads Construction

The mine access road will lead off one a dirt road serving the purpose as a farm road. The dirt road will be upgraded to the applicable standards which includes a gravel road leading into the mine. The road will be used to access the mine offices, workshop complex, and mining area. Coal transportation trucks will also use this road to enter and exit the mine premises, including travelling to the weighbridge.

Clean and Dirty Water Separation

A detailed surface water management plan will be drawn up as part of the Water Use License Application including the determination of flood lines, identification of sensitive receptors and existing surface water systems and flow paths, and civil engineering design reports for the required trenches and water management facilities. The Geohydrological investigation will also feed into these designs as the anticipated pollution will be modelled. Trenching around the mining area forms part of the clean and dirty water separation and is to a large extent based on the water balance as calculated by the civil engineering team. The image below is a typical illustration of aspects to consider during the calculation of the opencast mining area water balance.

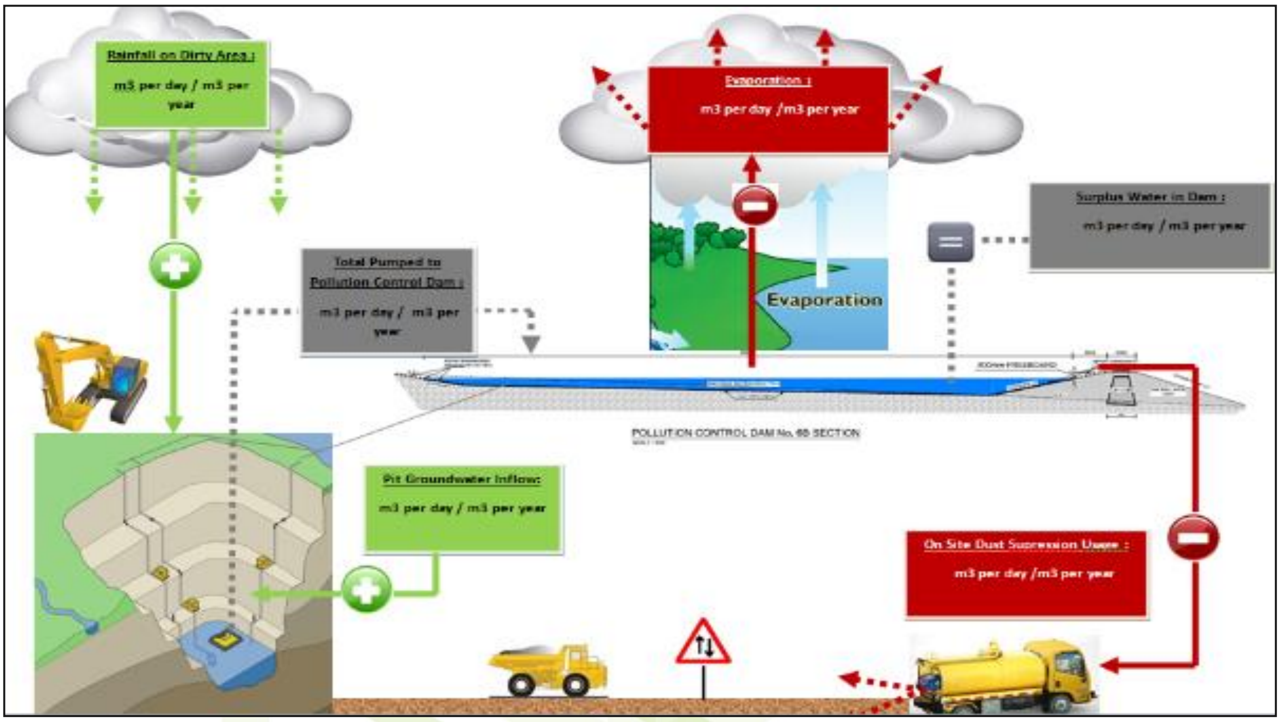

Figure 4-2: Typical water balance considerations during the design of a clean and dirty water separation system

Further images for clarification purposes have been provided below to indicating cross sections of both the dirty water and clean water diversion trenches which will be constructed around the mining area. These designs will also form part of the final master plan to be implemented during the Water Use License Application.

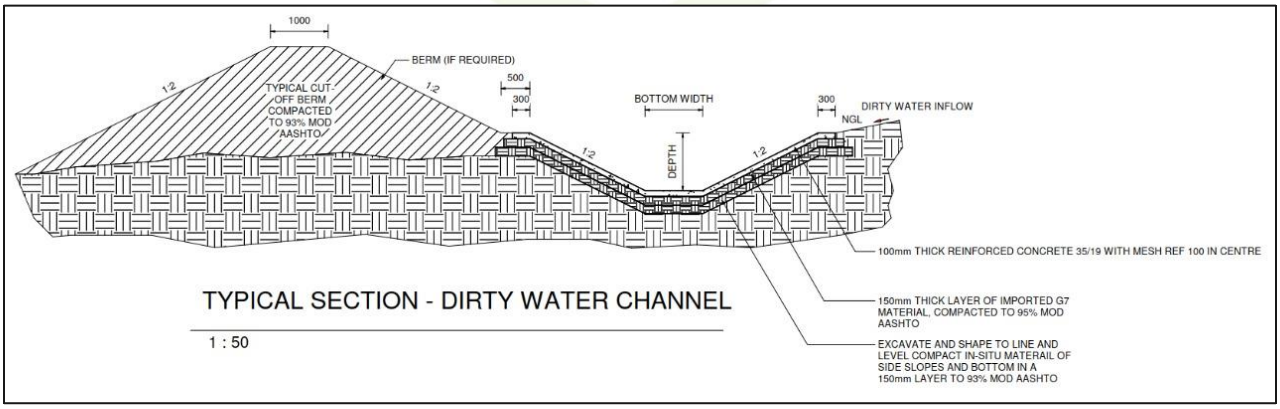

Figure 4-3: Typical Channel / Berm Cross Section For Polluted Water Diversion

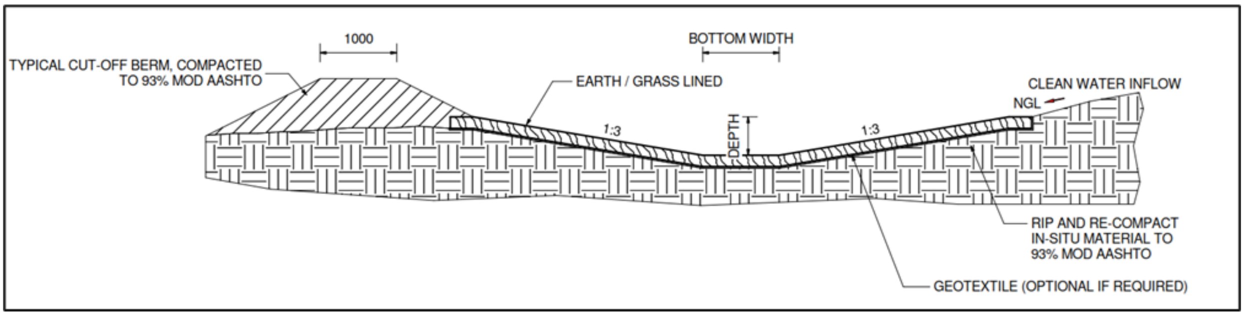

Figure 4-4: Typical channel/berm cross section for Clean water diversion

Fencing

Fencing of the entire mining area will be required as a means of ensuring safety and also keeping trespassers at bay. Fences will be clearly demarcated and appropriate signage will be displayed, similar to the signs in the images below. Fencing of the sensitive receptors such as wetlands will also take place ensuring no mining personnel will enter these areas and that it will remain protected for the duration of the project. Sites of archaeological and heritage importance will also need to be fenced off while safe access to these sites will be provided. The necessary signage will also be erected at sites of archaeological and/or heritage importance to ensure visitors can easily and safely access the premises.

Figure 4-5: Typical mine fence signage

Drilling and Blasting

Blasting of mine overburden to allow efficient recovery of the underlying coal can have impacts on the surrounding community. These impacts mainly include vibration through the air (overpressure) and earth (ground vibration) along with the generation of dust and fume. Overpressure and ground vibration limits in place for private residences and heritage structures are prescribed by government based on standards. Blasts are designed and managed to minimise the risk of exceeding these limits, and to minimise impacts they have on the community, surrounding structures and environment.

Due to the nature of the activities associated with open cast activities, blasting might occur during the construction phase of the initial box cut, however, subsequent blasting to remove overburden and gain access to the mineral reserve will also take place during the life of mine. A suitably qualified blasting contractor will be appointed to construct a blasting design and conduct blasting activities. There will be no explosives magazine on site and the blasting contractor will be required to supply the explosives and consumables required to blast if blasting is required.

Topsoil, Subsoil, Overburden Stockpiles

All topsoil, subsoil and overburden material will be removed during the mining operation and stockpiled separately for the purpose of backfill rehabilitation.

Composite Map

(Provide a map **(Attached as an Appendix)** at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers)

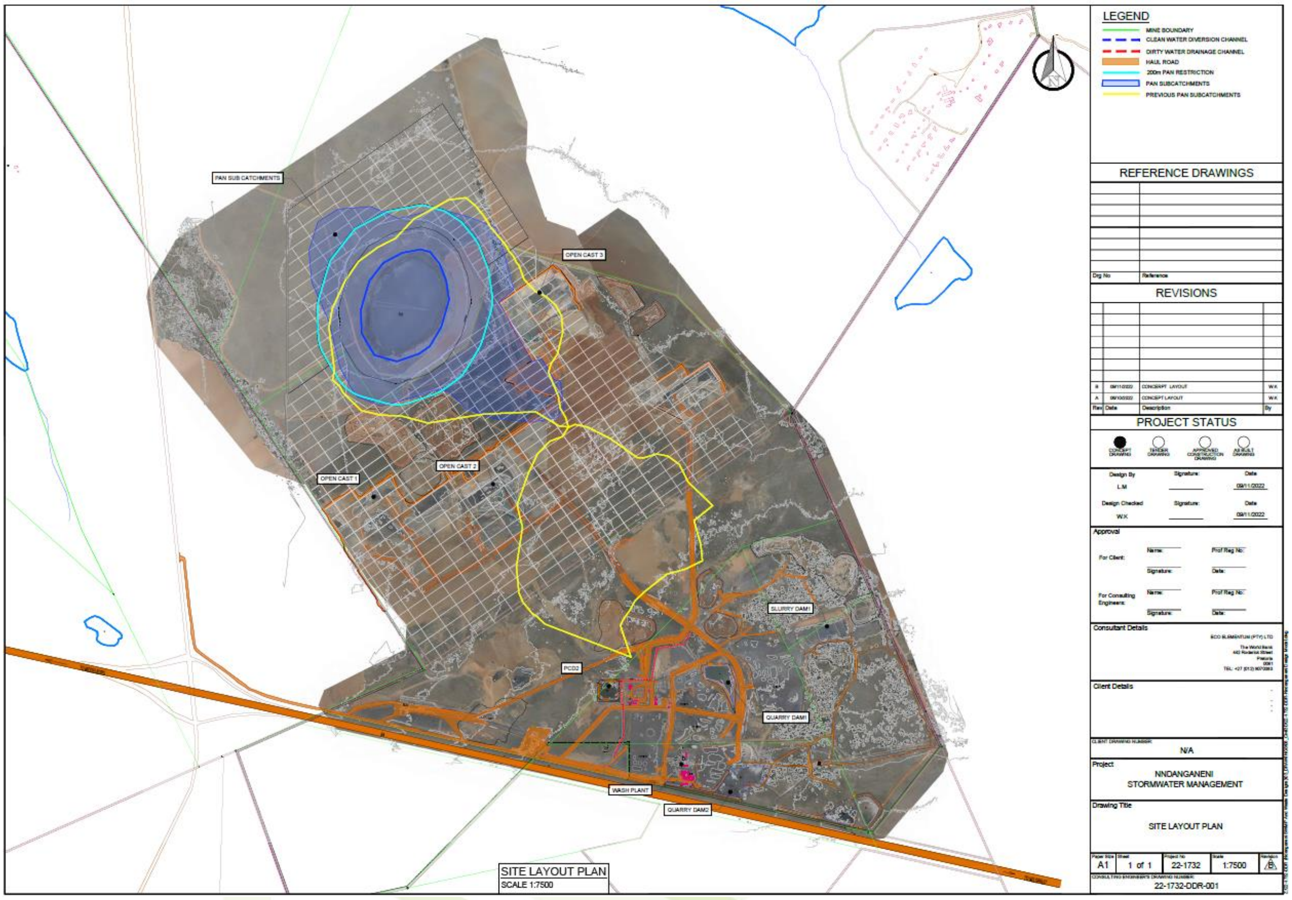

Figure 4-6: Northern Pan sub catchment

Refer to Appendix C for the Site Layout Map.

4.3 Description of Impact Management Objectives Including Management Statements

4.3.1 Determination of closure objectives.

The closure vision is supported by the objectives as listed below;

- Create a safe, physically stable rehabilitated landscape that limits long-term erosion potential and environmental degradation;
- Sustain the long term catchment water yield and ensure suitable water quality;
- Rehabilitation of the surface infrastructure where necessary to minimize infiltration into the underground water regime (the philosophy of concentration and containment);
- Rehabilitation to minimise contamination of surface water resources (the philosophy of dilution and dispersion);
- Focus on establishing a functional post-mining landscape that would ensure self-sustaining agricultural practices post mine closure where possible;
- Ensure interconnectivity between the rehabilitated landscapes with surrounding regionally biologically diverse areas;
- Encourage, if and where required, the re-instatement of terrestrial and aquatic wetland biodiversity over time; and
- Create opportunities for alternative post-mining livelihoods by aligning to the regional planning;
- Meet with prevailing environmental legal requirements outlined in this report; and
- Prevent / Minimise negative impacts and risks as identified in this report.

4.3.2 Volumes and rate of water use required for the operation.

Only a small volume of water will be required for the mining activities. Approximately 500 m^3 of water will be used per day for mining activities.

4.3.3 Has a water use licence has been applied for?

IPP – Nndanganeni Colliery has an existing water use licence (Licence no: 03/B12C/CGIJ/4850 File no: 27/2/2/B412/10/4). The following Section 21 water uses are stipulated therein: (c), (i), (g) and (j).

4.3.4 Impacts to be mitigated in their respective phases.

Table 4-1: Impacts to be mitigated in their respective phases, Impact Management outcomes, Impact Management Action

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Heritage / Archaeological										
General subsurface activity & activity associated with historical Sites B01 – B03 (demolished)	Subsurface culturally significant material.	Destruction of subsurface culturally significant material.	Operational	Monitor material unearthed.	Monitor subsurface material during operational and construction phases and contact a qualified archaeologist should culturally significant material be observed.	Prevent impact on subsurface culturally significant material.	Limit impact on subsurface culturally significant material.	National Heritage Resources Act 25 of 1999.	Control through management and monitoring.	During Operation
Site establishment	Clearance of the site	Destruction of culturally significant material.	Construction & Operational	Avoid heritage sites when encountered.	Monitor subsurface material during operational and construction phases and contact a qualified archaeologist should culturally significant material be observed.	Prevent impact on culturally significant material.	Limit impact on culturally significant material.	National Heritage Resources Act 25 of 1999.	Control through management and monitoring.	During site clearance, construction, and topsoil removal.
Palaeontological										
Subsurface activity	Subsurface palaeontological significant material.	Destruction of palaeontological significant material.	Construction & Operational	Monitor unearthed material & adhere to the Fossil Chance Find Protocol when material of palaeontological significance is found. It is extremely unlikely that any fossils would be found in the loose sand and soil that cover the area but there might be fossils below the ground.	Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the correct age and type to preserve fossils. The site visit and walk through confirmed that there were no fossils on surface of the project footprint. Since there is a chance that fossils from the Vryheid Formation may occur below ground and be disturbed a Fossil Chance Find Protocol has been added to the EMPr. **Adhere to the Fossil Chance Find Protocol when material**	Prevent impact on subsurface palaeontological significant material.	Limit impact on subsurface palaeontological significant material.	South African Heritage Resources Agency (SAHRA) in terms of Section 38(8) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	Control through management and monitoring	During Construction & Operational phases

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
					of palaeontological significance is found. The protocol can be found in the attached Palaeontological specialist report.					
Blast & Ground vibration										
Blasting in close proximity to Surface Structures (ground vibrations)	Surface structures	Excessive ground vibrations resulting in damage to surface structures	Construction & Operational	Limit blasting distance in close proximity to structures to 500m unless specialist studies based on risk assessments is conducted and permission granted by the Principal Inspector of Mines to blast within 500m of surface structures. Limit ground vibration to an acceptable value with a proper blast design, measure and record, evaluate and improve. Ground vibrations can be limited by implementing controls such as recommend by Thompson, 2005: Small amount of explosive charge per delay should be used when blasting in close proximity to sensitive receptors. The delays between the rows must not strengthen the	**Implement a proper blast design plan.** Measure and record the effects of blasting and evaluate and improve on the plan continuously. **Compile a site-specific blasting code of practice** for the mining area which must ensure that the ground vibrations caused by blasting is limited as far as practical possible for each mining block and its associated sensitive receptors. **Appoint a qualified blaster as per Chapter 4 of the MHSA of 1996 to conduct a proper blast design** for each and every mining block that will be blasted. **Appoint a surveyor to identify all surface structures** located in close proximity to the mining area as per regulation 17.2 (a) of the MHSA of 1996.	Prevent impact on surface infrastructure	Limit impact on surface infrastructure	Mines Health and Safety Act (Act 29 of 1996)	Control through managemen t and monitoring	During Construction & Operational phases

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				shockwave, i.e., single hole firing with electronic detonators. Blast parallel to the main joint set or geological discontinuities (dolerite dyke intrusions, slips etc.). Use a pre-split or other highwall control drilling method to isolate the main blast-block from the rest of the rock mass, i.e., create a second free face. Electronic, single hole firing is the preferred method to reduce the amount of explosive charge per delay.						

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Blasting in close proximity to Surface Structures (air blasts)	Surface structures	Excessive air blasts resulting in fly rock and damage to surface structures	Construction & Operational	Limit blasting distance in close proximity to structures to 500m unless specialist studies based on risk assessments is conducted and permission granted by the Principal Inspector of Mines to blast within 500m of surface structures. Limit the decibels to an acceptable value with a proper blast design, measure and record, evaluate and improve. Controls such as the following should be considered during the blast design process (Thompson 2005): Cover all detonating cord or use noiseless shock tube or electric trunk lines. Limit explosives per delay. Blasting should not be conducted early in the morning because of temperature inversion. Blasting should not be conducted when the wind is very strong. Blast ideally at peak noise time. Avoid short collars and fill blast holes with enough stemming.	**Implement a proper blast design plan.** Measure and record the effects of blasting and evaluate and improve on the plan continuously. **Compile a site spesfiic blasting code of practice** for the mining area which must ensure that the ground vibrations caused by blasting is limited as far as practical possible for each mining block and its associated sensitive receptors. **Appoint a qualified blaster as per Chapter 4 of the MHSA of 1996 to conduct a proper blast design** for each and every mining block that will be blasted. **Appoint a surveyor to identify all surface structures** located in close proximity to the mining area as per regulation 17.2 (a) of the MHSA of 1996.	Prevent impact on surface infrastructure	Limit impact on surface infrastructure	Mines Health and Safety Act (Act 29 of 1996)	Control through management and monitoring	During Construction & Operational phases
Soil & Land Use										

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Site Preparation	Soil stripping	Loss of soil	Construction	Strip all useable soil material for rehabilitation. Topsoil stockpiles should be kept low (below 3m tall). Irrespective of where topsoil is stockpiled, it should be kept moist and vegetated as soon as possible to protect against erosion, discourage weeds and maintain active soil microbes. The shallower Clovelly soils should be stripped to a depth of 25 cm and this 25 cm stockpiled as topsoil only. The deeper Clovelly topsoil's should also be stripped to a depth of 25 cm and stockpiled separately from the underlying 25cm of stripped subsoil. The Clovelly soils that have been cultivated should be considered to comprise only subsoil and should be stripped to 30cm and stockpiled with the other Clovelly subsoils. All stripping and stockpiling should be undertaken according to the guidelines below. Demarcate the area to be stripped clearly, so that the contractor does not strip beyond the demarcated boundary. The stripped soil should be relocated by truck	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	Different morphology of different stockpiles No rills formed on stockpiles pH of soils remains in natural range	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				along set removal paths. The area to be stripped requires storm water management and the in-flow of water should be prevented with suitable structures. Prepare the haul routes prior to stripping. Stripping should not begin in wet conditions.						
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Erosion and Sedimentation	Construction	Limit earthworks and vehicle movement to demarcated paths and areas. Limit the duration of construction activities, especially those involving earthworks / excavations. Access roads associated with the development should have gradients or surface treatment to limit	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	To minimise the areas where soil surfaces will be exposed to soil erosion	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				erosion, and road drainage systems should be accounted for. Removal of vegetation must be avoided until such time as soil stripping is required and similarly exposed surfaces and soil stockpiles should be re-vegetated or stabilised as soon as is practically possible. A construction phase-specific storm water management plan should be designed for the site and adhered-to. Soil stockpiles should be vegetated as soon as possible.						
Site Preparation	Earthworks	Change in Surface Profile	Construction	Re-establish surface profile at closure.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	Bulk density less than 1.5 kg.m-3 in rehabilitated soils	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase
Site Preparation	Vegetation Removal	Change in Land Use	Construction	Re-establish grassland at closure.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	Effective rehabilitation of impacted areas for agricultural practices	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Site Preparation	Vehicles and equipment, vegetation removal and earthworks.	Change in Land Capability	Construction	Limit earthworks and vehicle movement to demarcated paths and areas. Limit removal of vegetation to demarcated areas only. Avoid materials that sterilize the soil.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	Effective rehabilitation of impacted areas for agricultural practices	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase
Site Preparation	Vehicles and equipment, onsite personnel	Soil Contamination	Construction	Correctly implement and monitor a construction-phase storm water management plan; On-site vehicles should be well-maintained; Drip trays should be placed under stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. Adhere to the storm water management plan and soil management plan.	Limit mining impacts	Different morphology of different stockpiles No rills formed on stockpiles pH of soils remains in natural range	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Construction phase
Ongoing mine management	Continued soil stripping	Loss of Topsoil	Operation	The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated	Limit mining impacts	Different morphology of different stockpiles No rills formed on stockpiles	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural	Remedy through rehabilitation Control through managemen	During Operational phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				be designed for the site and adhered-to.	An operational-phase storm water management plan should be designed for the site and adhered-to.		pH of soils remains in natural range	Resources (Act 43 of 1983) (CARA)	t and monitoring	
Ongoing mine management	Bare soil	Erosion and Sedimentation	Operation	The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be implemented for the site and adhered-to.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be designed for the site and adhered-to.	Limit mining impacts	Different morphology of different stockpiles No rills formed on stockpiles pH of soils remains in natural range	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Operational phase
Ongoing mine management	Vehicles and equipment, onsite personnel, chemical storage.	Soil Contamination	Operation	Chemicals should be stored in fully enclosed areas and the car park area should be covered. Both should be on impermeable hardstanding. Hardstanding should be monitored for cracks. If chemicals are kept outside of the enclosed area temporarily, this area should be on hardstanding and bunded. Ensure proper control of substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced. An operational-phase storm water	Chemicals should be stored in fully enclosed areas and the car park area should be covered. Both should be on impermeable hardstanding. Hardstanding should be monitored for cracks. If chemicals are kept outside of the enclosed area temporarily, this area should be on hardstanding and bunded.	Limit mining impacts	Different morphology of different stockpiles No rills formed on stockpiles pH of soils remains in natural range	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Operational phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				management plan should be implemented for the site and adhered-to.						
Land Rehabilitation	Vehicles and equipment.	Erosion and Sedimentation	Closure	Limit earthworks and vehicle movement to demarcated paths and areas. Limit the duration of deconstruction activities where possible. Access roads associated with decommissioning should have gradients or surface treatment to limit erosion, and road drainage systems should be accounted for. Exposed surfaces should be re-vegetated or stabilised as soon as is practically possible. A decommissioning-specific storm water management plan should be designed for the site and adhered-to.	Implement a landscape rehabilitation plan as per the approved designs for sloping and rehabilitation. The site should be monitored for signs of erosion continually Bare areas should be kept well vegetated An operational-phase storm water management plan should be designed for the site and adhered-to.	Limit mining impacts	Limit mining impacts	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitation Control through management and monitoring	During Closure phase

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementatio n
Land Rehabilitation	Vehicles and equipment, onsite personnel.	Soil Contamination	Closure	On-site vehicles should be well-maintained, Drip trays should be placed under stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.	On-site vehicles should be well-maintained, Drip trays should be placed under stationary vehicles / plant; On-site pollutants/hazardous materials should be contained in a bunded area and on an impermeable surface; Ensure proper control of dangerous substances entering the site; Adequate disposal facilities should be provided, and A non-polluting environment should be enforced.	Limit mining impacts	Limit mining impacts	Soil Management Plan as per the Specialist Soils report Conservation of Agricultural Resources (Act 43 of 1983) (CARA)	Remedy through rehabilitatio n Control through managemen t and monitoring	During Closure phase
Visual										
Site clearance/establishme nt	Removal of vegetation	Negative impact on aesthetics - due to the site being more visible	Pre-Construction Phase	Limit the construction footprint to only the development area	Demarcate the development area	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Construction related activities	Movement of construction vehicles and heavy machinery Presence of laydown areas and construction camp	Dust creation and change in visual/landscap e character	Construction Phase	Limit the construction footprint to only the development area Regulate the speed of vehicles on site Implement dust suppression activities Laydown areas and construction camps should blend in or be screened from surrounding sensitive receptors	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas Locate laydown areas and construction camps in areas where they would be less visible to the surrounding sensitive receptors, or screen these areas using suitable screening methods	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Construction related activities	Night Lighting	Light pollution at night on the identified	Construction Phase	Reduce spill light and glare	Choose lighting types which reduce spill light and glare Only focus lighting to where it	Reduce the visual disturbance to the area	Effective visual barriers surrounding the	N/A	Modify through	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
		sensitive receptors			is needed When possible, limit construction activities to daylight hours		mining operation.		design measures	
Mining activity	Presence and operation of open pit	Visual impact on surrounding identified sensitive receptors	Operational Phase	Establish and maintain visual screens/barriers between the development and the identified sensitive receptors Ancillary infrastructure should blend in with the surrounding existing sense of place	Ensure that the existing vegetation along the secondary road directly west of the site is maintained. Plant indigenous vegetation along the northern and eastern border of the proposed site. Consult a botanist/landscape architect if needed Ancillary infrastructure should be painted natural colours	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Mining activity	Movement of construction vehicles and heavy machinery	Dust creation and change in visual/landscape character due to an increased number of vehicles	Operational Phase	Limit the operational activities to only the development area Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppresion activities on the relevant areas	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Mining activity	Night lighting	Light pollution at night on the identified sensitive receptors	Operational Phase	Reduce spill light and glare	Choose lighting types which reduce spill light and glare Only focus lighting to where it is needed	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Backfilling of open pit	Movement of construction vehicles and heavy machinery	Dust creation and change in visual/landscape character due to an increased number of vehicles	Decommissioning Phase	Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM
Decommissioning, rehabilitation and post-closure	Revegetation of the site Post-Closure Phase rehabilitation	Change in landscape character	Decommissioning/Rehabilitation Phase Post-Closure Phase	Revegetate areas/slopes with suitable indigenous vegetation Where possible, reshape the area so that it resembles the pre-construction landscape Remove as much infrastructure as possible	Consult a botanist/landscape architect if needed Implement monitoring programmes to monitor any rehabilitated areas for at least a year after closure	Reduce the visual disturbance to the area	Effective visual barriers surrounding the mining operation.	N/A	Modify through design measures	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				Ensure that any residual infrastructure remains in good condition where possible						
Noise										
Site clearance/establishment	Removal of vegetation	Bulldozers operating generating noise	Construction Phase	Limit the construction footprint to only the development area Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use.	Demarcate the development area Ensure regular maintenance of construction equipment to ensure noise suppression mechanism are in good working order	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Construction related activities	Movement of construction vehicles and heavy machinery	Equipment moving around and construction related noise	Construction Phase	Limit the construction footprint to only the development area Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of construction equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Mining	Material Handling (Loading and unloading of ROM, loading and unloading of stockpiles)	Excavators and truck loading and unloading generated noise	Operational Phase	Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Mining	Haul trucks moving on the Haul Road	Haul truck moving on the Haul Roads	Operational Phase	Noise barriers such as a berm between sensitive receptors	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain haul roads to reduce road related noise	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Mining	Commercial trucks moving on the Access Road	Commercial Trucks moving on the access road	Operational Phase	Noise barriers such as a berm between sensitive receptors	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain the access road to reduce road related noise	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Mining	Crushing of Coal	Crusher plant generating Noise	Operational Phase	Enclose the crusher to reduce the noise impact on the surrounding area	Enclose the crusher to reduce the noise impact on the surrounding area	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Removal of any infrastructure	Movement of construction vehicles and heavy machinery	Demolition equipment generated noise	Decommissioning Phase	Regulate the speed of the vehicles Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Decommissioning, rehabilitation and post-closure	Reshaping of stockpiles and revegetation of the site Post-Closure Phase rehabilitation	Bulldozers shaping the final landform generated noise	Decommissioning/Rehabilitation Phase	Noise barriers such as a berm between sensitive receptors Switch of equipment when not in use	Ensure regular maintenance of equipment to ensure noise suppression mechanism are in good working order Maintain on-site roads to reduce road related noise	Minimise noise disturbance	Zero noise disturbance complaints	SANS 10103	Control through management and monitoring	Throughout LoM
Air										
Site clearance/establishment	Removal of vegetation	Bulldozers generating fugitive particulate matter emissions including Dust and PM10	Construction Phase	Limit the construction footprint to only the development area	Demarcate the development area Implement monitoring program to monitor the off-site impacts	Only clear areas required for immediate operation	Minimal vegetation clearance and immediate rehabilitation where possible	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Construction related activities	Movement of construction vehicles and heavy machinery	Fugitive particulate matter emissions including Dust and PM10 from vehicle moving on roads	Construction Phase	Limit the construction footprint to only the development area Implement dust suppression specially on windy days	Implement dust suppression activities on the relevant areas Revegetate open areas as soon as possible Implement monitoring program to monitor the off-site impacts	Only clear areas required for immediate operation	Minimal vegetation clearance and immediate rehabilitation where possible	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Mining	Material Handling (Loading and unloading of ROM, loading	Fugitive particulate matter emissions including Dust and PM10	Operational Phase	Water sprays at tipping points Wind breaks at tipping points	Water Sprays at tipping points Implement monitoring program to monitor the off-site impacts	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
	and unloading of stockpiles)									
Mining	Wind Erosion	Wind blown fugitive particulate matter emissions including Dust and PM10 from stockpiles	Operational Phase	Water sprays at ROM stockpiles Revegetate topsoil and OVB stockpiles	Water sprays at ROM stockpiles Revegetate topsoil and OVB stockpiles Implement monitoring program to monitor the off-site impacts	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Mining	Haul trucks moving on the Haul Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Haul road	Operational Phase	Water Sprays mitigating 75%	Water sprays spraying >2l/m² on the Haul road Implement monitoring program to monitor the off-site impacts	Prevent excessive dust creation on site	Rehabilitation of cleared areas	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Mining	Commercial trucks moving on the Access Road	Fugitive particulate matter emissions including Dust and PM10 from vehicles moving on the Access road	Operational Phase	Adding a dust binding additive to the access road to achieve 90% or more mitigation	Adding a dust binding additive to the access road Implement monitoring program to monitor the off-site impacts	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Mining	Crushing of Coal	Fugitive particulate matter emissions including Dust and PM10 from the crusher plant	Operational Phase	Water sprays or fully enclose the crusher	Water sprays or fully enclose the crusher Implement monitoring program to monitor the off-site impacts	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Removal of any infrastructure	Movement of construction vehicles and heavy machinery	Fugitive particulate matter emissions including Dust	Decommissioning Phase	Regulate the speed of vehicles on site Implement dust suppression activities	Implement a suitable speed limit of construction vehicles Implement dust suppression activities on the relevant areas	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
		and PM10 from vehicle moving on roads								
Decommissioning, rehabilitation and post-closure	Reshaping of stockpiles and revegetation of the site Post-Closure Phase rehabilitation	Fugitive particulate matter emissions including Dust and PM10 from bulldozers shaping the landform	Decommissioning/Rehabilitation Phase	Revegetate areas/slopes with suitable indigenous vegetation	Consult a botanist if needed Implement monitoring programmes to monitor any rehabilitated areas for at least a year after closure	Prevent excessive dust creation on site	Effective dust management on site	NEMAQA, 2004 (Act 39 of 2004)	Control through management and monitoring	Throughout LoM
Groundwater										
Surface clearing and preparation.	Removal of vegetation.	Increase in surface run-off and therefore decrease in aquifer recharge.	Construction Phase	Re-vegetate.	Rehabilitation plan.	To have minimal impact on aquifer recharge	Minimal impact on aquifer recharge	N/A	Control through management and monitoring	Throughout LoM
Topsoil and overburden stockpiling.	Leaching from stockpiles.	Acid generation in the case of carbonaceous material placement.	Operation Phase	Should a contamination plume be detected, groundwater abstraction to contain plume.	Quarterly monitoring of monitoring boreholes.	Prevent the spread of poor quality groundwater	Containment of poor quality groundwater	SANS241:2015	Control through management and monitoring	Throughout LoM
ROM stockpiling.	Leaching from stockpiles.	Acid generation as a result of carbonaceous material.	Operation Phase	Should a contamination plume be detected, groundwater abstraction to contain plume.	Quarterly monitoring of monitoring boreholes.	Prevent polluted water spreading	Effective prevention of the pollution of the groundwater resource	SANS241:2015	Control through management and monitoring	Throughout LoM
Hydrocarbon spills.	Plume migration.	Spills from mining vehicles can infiltrate to the aquifer and cause a down gradient plume migration.	Construction & Operation Phase	Clean any hydrocarbon spills in the appropriate manner.	Report any hydrocarbon spillage. Ensure spoil kits are always available and personnel trained in how to use them.	Prevent hydrocarbon spills and runoff	Effective prevention of the pollution of the groundwater resource	Standard Operating Procedure for Spill containment and clean-up	Control through management and monitoring	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementatio n
Opencast mining	Dewatering	The water infiltrating the voids will be removed for safe mining, causing a decrease in the water level. **The drawdown will decrease the groundwater contribution volume to the Northern pan.**	Operation Phase	No management can be incorporated to limit the impacts of dewatering.	Quarterly Monitoring. Compensate users for losses. Monitor pit inflow rates, Annual Monitoring report, Update Numerical Model.	Prevent polluted water spreading	Effective prevention of the pollution of the groundwater resource	Follow the approved Closure and Rehabilitation Plan	Control through managemen t and monitoring	Throughout LoM
Closure of the mine	Groundwater rebound	Groundwater decant is expected hold the system behave as predicted. Decant is expected to occur on the lowest elevation on the pit boundary.	Closure and Decommission ing Phase	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.	Continued increase in water quality	Continued increase in water quality	Follow the approved Closure and Rehabilitation Plan	Control through managemen t and monitoring	Throughout LoM
Closure of the mine	Groundwater rebound	Pollution Plume spread	Closure and Decommission ing Phase	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.	Continued increase in water quality	Continued increase in water quality	Follow the approved Closure and Rehabilitation Plan	Control through managemen t and monitoring	Throughout LoM
Hydropedological Flow driver										
Pit extension (Opencast mining activities)	Flow driver cut-off	Impact on pan catchment	Construction & Operational Phase	Cleanwater diversion Mining outside the responsive soils	Clean surface water should be diverted from the top of the wetland/pan catchment to the depression in the south through berms or cut-off trenches	Prevent impact on surface infrastructure	Supply the wetlands system with clean water by diverting surface water from the top of the wetland catchment to	As per Wetland flow driver report	Remedy	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
							the depression in the south through berms or cut-off trenches.			
Surface water										
Construction activities	Vegetation clearance and site establishment	Sedimentation and pollution of the watercourse	Construction Phase	Separate Clean and Dirty Water System	Construct and implement SWMP	To separate the clean water from entering the dirty water areas, and visa versa	Effective onsite dirty water management and retention.	SWMP	Modify through design measures	Throughout LoM
Dewatering	Water level drawdown	Reduction in Baseflow	Operational Phase	No mitigation available	N/A	N/A	N/A	N/A	N/A	Throughout LoM
Operational Activities	Hydrocarbon spills Dirty Water release Sediment runoff	Water quality deterioration	Operational Phase	Separate Clean and Dirty Water System	Construct and implement SWMP	To separate the clean water from entering the dirty water areas, and visa versa	Effective onsite dirty water management and retention.	SWMP	Remedy through control measures	Throughout LoM
Closure of the mine	Groundwater rebound	Decant of poor quality water	Closure and Decommissioning Phase	Treat decant water before release to the environment	Establish a Passive treatment system in the form of a constructed wetland or similar.	Treatment of poor quality decant to an acceptable quality	Release of acceptable quality water to the downstream environment	ISO 5667: Grab Samples Water parameters as approved in the IWULA	Control through management and monitoring	Throughout LoM
Ecological (Wetland, Aquatic Terrestrial)										
Operational Activities	Infrastructure Work Revetments New access routes Site clearing for opencast area Placement of cleared topsoil into allocated stockpiles	Flow alterations due to erosion and sedimentation	Construction Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	Design and implementation of a suitable stormwater system; Implement a programme for the clearing/eradication of alien species including long term control of such species; A 110 m buffer implemented for the wetland / pan system; Water quality monitoring must take place every month during operational phases; and	Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species irradiation	Implement SWMP as per GN704 Follow the approved Closure and Rehabilitation Plan	Control through management and monitoring Remedy through rehabilitation	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
	Use of heavy machinery				Wetland monitoring and biomonitoring must take place bi-annually. A topsoil stripping and stockpiling guideline must be completed to ensure rehabilitation success. Attenuation measures must include, but are not limited to - the use of sand bags, erosion control blankets, and silt fences. Long term attenuation measures, such as attenuation/infiltration trenches, swales must be established to control stormwater from hardened surfaces Vegetation clearing must be undertaken as and when necessary in phases. Install sediment barriers (silt catchers and Reno mattresses) along any drainage areas to prevent the migration of silt. Exposed soils must be rehabilitated as soon as practically possible to limit the risk of erosion. All roads need to be maintained and any erosion ditches forming along the road filled and compacted. Demarcate wetland areas to avoid unauthorised access. No washing of any equipment					
Operational Activities	Use of heavy machinery using oils and fuels during site clearing Accidental spillages of chemicals, cements, oils, etc.	Pollution of watercourse	Construction Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.		Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species irradiation	Implement SWMP as per GN704 Follow the approved Closure and Rehabilitation Plan	Control through management and monitoring Remedy through rehabilitation	Throughout LoM
Operational Activities	New access routes Use of heavy machinery Placement of cleared topsoil into allocated stockpiles Bank trampling leading to erosion	Spread of alien invasive vegetation	Construction Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.		Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species eradication	Follow approved Alien Invasive plan as guided by SANBI	Control through management and monitoring Remedy through rehabilitation	Throughout LoM
Operational Activities	Increased traffic Use of heavy machinery Bank Erosion	Flow alterations due to erosion and sedimentation	Operational Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.		Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species eradication	Implement SWMP as per GN704 Follow the approved Closure and Rehabilitation Plan	Control through management and monitoring Remedy through rehabilitation	Throughout LoM

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Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Operational Activities	Increased traffic leading to potential accidental spills of hydrocarbon materials Hazardous materials entering the watercourses Increased road runoff during rainfall events	Pollution of watercourse	Operational Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.	in close proximity to a watercourse is permitted. No releases of any substances that could be toxic to fauna or faunal habitats within the channels or any watercourses is permitted. Spillages of fuels, oils and other potentially harmful chemicals must be cleaned up immediately and contaminants properly drained and disposed of using proper solid/hazardous waste facilities Portable toilets must be placed on impervious level surfaces that are lipped to prevent spillage. The general consensus is that they should be within 30 m to 50 m of a work face Re-instate indigenous vegetation (grasses and indigenous trees) in disturbed areas.	Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species eradication	Implement SWMP as per GN704 Follow the approved Closure and Rehabilitation Plan	Control through management and monitoring Remedy through rehabilitation	Throughout LoM
Operational Activities	Increased runoff from hardened surfaces Increased traffic	Spread of alien invasive vegetation	Operational Phase	Rehabilitation of the disturbed areas; Limiting instream sedimentation; Minimising pollutants entering the watercourse. Erosion control measures must be employed where required.		Avoid canalisation, and sedimentation Prevent pollution to the watercourse Alien and invasive species control and management	Dispersed flow to and in the wetland areas Prevent pollution to the water Alien and invasive species eradication	Follow approved Alien Invasive plan as guided by SANBI	Control through management and monitoring Remedy through rehabilitation	Throughout LoM
Social										

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Establishment of underground mine	Mining	Employment opportunities	Construction and Operational Phase	Where reasonable and practical the mine should appoint local contractors; Opportunities for training of workers should be maximised; Ways to enhance local community benefits with a focus on broad based BEE need to be explored; Establish targets for the employment and training; Train workforce for longer term employment; Prevent nepotism/corruption in local recruitment structures; Conditions stipulated by property owners in terms of the construction activities should be implemented and monitored; All activities should be restricted to working areas; workers should wear name tags and clothing to ensure that they can be readily identified A specific contact person should be identified to allow community members and property owners to easily direct their queries and concerns and obtain general information regarding the operations; Vehicles used should be clearly marked;	Implement SLP or a similar Social Development Plan	Job security for local communities and current employees.	Increased employment throughout the local communities	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				Promote employment of women and youth;						
Supplier acquisition	Direct and indirect appointment of local suppliers	Multiplier effect on the local economy	Construction and Operational Phase	Linkages with skills development/ Small, Medium and Micro Enterprises (SMME) development institutions and other mining operations; Preference should be given to capable subcontractors who based within the local municipal area; Monitoring of sub-contractors procurement; Local procurement targets should be	Development of a register of local SMMEs; SMME skills development as part of mine SLP/LED commitments	Local economic betterment	Local economical gain	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				formalised in the mines procurement policy.						
Mining operation	Community development	Social upliftment	Construction and Operational Phase	Ensure that there is stakeholder buy-in; Collaboration with other developmental role players (e.g. local and district municipalities, neighbouring mines and NGOs) during implementation of envisaged projects, and where possible aligning envisaged development projects with existing ones;	Aligning LED projects with those of other development role-players Liaison with beneficiaries to ensure needs are met; Expanding its skills development and capacity building programmes for non-employees Monitoring system to regulate Historically Disadvantaged South African procurement Where feasible, training should be NQF Accredited; and A record of training courses completed per individual should be kept.	Local skills betterment	Local skills gain	As per SLP	Remedy through Social and Labour Plan	Throughout LoM
Mining operation	Mining activities	Impact on health and safety	Construction and Operational Phase	Measures suggested minimising the impact of flyrock on surrounding roads and structure; Measures suggested in the Health Impact Assessment to minimize traffic related accidents; Traffic calming measures to prevent speeding Road maintenance; Provide safe road crossing points and fencing of the main road and the mine site	Access control to all project elements, including fencing; Personal Protective Equipment for mine workers; Notification of blasting schedules; Blasting and storage of hazardous materials to adhere to prescribed regulation speed bumps and speed limit installation Community education to sensitize community members to potential traffic and blasting safety risks	Zero incidents on and related to the mining operations	Zero incidents on and related to the mining operations	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Mining operations	Mine area access restrictions	Change in access and movement to resident and livestock	Construction and Operational Phase	Where possible ensure that access to fields and grazing areas are uninterrupted The Mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked; Measures to prevent deterioration of roads suggested in Traffic Impact Assessment (e.g. drivers to report road deterioration to the NW Province Department of Transport); Regulation of traffic at intersections and access roads to the site; Ensure that access to key services are uninterrupted	Provide alternative access routes and/or temporary access points during construction and operational activities Road upgrading measures should be investigated and implemented in conjunction with the relevant government department (e.g. repairing and rehabilitating the main roads and sealing the roadway to increase its capacity for Heavy Moving Vehicles);	to minimise the impact on access and movement	Create effective access for required movement by residents and livestock.	As per SLP	Remedy through Social and Labour Plan	Throughout LoM
Mine establishment	Change in land use	Loss of and/or Damage to Agricultural Land	Construction and Operational Phase	Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; engage with each directly affected landowner; Mitigation measures should be implemented to avoid any negative impact on animals (e.g. fencing off the construction area); Where damage is incurred, suitable remedial action must be negotiated with the affected farmer;	Should the Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes where possible; Remedial action for the temporary loss of cultivated land should be included in the negotiation process with the landowner;ounding NdanganeniColliery should discuss the construction schedule and activities with the affected farmers to enable them to plan their farming activities and livestock movement accordingly;	minimise the impact of loss of agricultural land	A good and accommodating relationship with neighbours, Adequate remedial action for loss of land.	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
				Prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase.						
Mine establishment	Influx of job seekers	Increased Pressure on Municipal Services	Construction and Operational Phase	Liaise openly and frequently with affected stakeholders to ensure they have information about the proposed mining project; and Liaison with district and local municipalities well in advance to ensure needs are met Ensure that municipalities consider expected population influx Promotion of mining methods to allow for surface development	Influx management to make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders.	To limit, as far as reasonably possible, additional pressure on existing infrastructure and services;	To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services;	As per SLP	Remedy through Social and Labour Plan	Throughout LoM
Mine establishment	Mine operations	Increased Nuisance Factors and Changed Sense of Place	Construction and Operational Phase	Minimise all nuisance factors such as noise, air quality, traffic, and visual-Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	Implement all mitigation measures as specified in the relevant specialist studies; Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders;	Limit mining impacts	Effectively implement mitigation measures.	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

Activity	Aspect	Impact	Phase	Mitigation measures	Action Plan	Mitigation and management objective	Mitigation and management goals	Compliance with standards	Mitigation type	Time period for implementation
Roll Over Mining	Influx of workers and job seekers	Increased social pathologies	Operation	Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; Discourage influx of job-seekers by prioritising employment of unemployed members of local communities; implement measures to address potential conflict between locals and non-locals.	Maximisation of the proportion of job opportunities allocated to locals; Workers should be clearly identifiable by wearing proper construction uniforms; The appointed contractor should establish clear rules and regulations for access to the site Extensive HIV/AIDS awareness and general health campaign; Create synergies with local government IDP and other companies' SLP/CSR projects to promote infrastructure development if possible.	Limit external job seekers and promote jobs within the local community	Maximisation of the proportion of job opportunities allocated to locals	As per SLP	Remedy through Social and Labour Plan	Throughout LoM
Mine closure	Dependency on Mine for Sustaining Local Economy	Job losses	Closure and Decommissioning	Effect retrenchments according to procedures stipulated in approved SLP; The Mine's SLP should provide strategies and measures that prevent job loss; Support economic diversification through development of alternative markets; Alternatives to save jobs/avoid downscaling should be investigated beforehand; Proactively assess and manage the social and economic impacts on individuals, regions and economies where retrenchment and/or closure of the mine are certain; and	Develop a Mine Closure Plan; Proactively and effectively implement mine closure plan; Collaborate with adjacent mining companies to develop and implement sustainable community; Develop alternative and sustainable livelihoods; Partner with the relevant government departments, to jointly manage Closure process.	Upskill workers for future job opportunities	Provide skills training for workers that can assist in future job acquiring.	As per SLP	Remedy through Social and Labour Plan	Throughout LoM

4.3.5 Financial Provision

4.3.5.1 Determination of the amount of Financial Provision.

4.3.5.1.1 Describe the closure objectives and the extent to which they have been aligned to the baseline environment described under the Regulation.

The closure vision is supported by the objectives as listed below;

- Create a safe, physically stable rehabilitated landscape that limits long-term erosion potential and environmental degradation;
- Sustain the long term catchment water yield and ensure suitable water quality;
- Rehabilitation of the surface infrastructure where necessary to minimize infiltration into the underground water regime (the philosophy of concentration and containment);
- Rehabilitation to minimise contamination of surface water resources (the philosophy of dilution and dispersion);
- Focus on establishing a functional post-mining landscape that would ensure self-sustaining agricultural practices post mine closure where possible;
- Ensure interconnectivity between the rehabilitated landscapes with surrounding regionally biologically diverse areas;
- Encourage, if and where required, the re-instatement of terrestrial and aquatic wetland biodiversity over time; and
- Create opportunities for alternative post-mining livelihoods by aligning to the regional planning;
- Meet with prevailing environmental legal requirements outlined in this report; and
- Prevent / Minimise negative impacts and risks as identified in this report.

4.3.5.1.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties.

The basic assessment report and environmental management programme will be provided to IAPs for review and comment for 30 days. The objective is to be communicated to IAP's during the public consultation process.

4.3.5.1.3 Provide a rehabilitation plan that describes and shows the scale and aerial extent of the main mining activities, including the anticipated mining area at the time of closure.

The scheduling of actions for final rehabilitation, decommissioning and closure which will ensure avoidance, rehabilitation and management of impacts is presented in the table below. As the disturbance after construction occurs on surface, linking the rehabilitation plan to the mine works program is not meaningful. Rather, the schedule is linked to applicant's intention to undertake rehabilitation activities over a 1-year closure period at the end of the Life of Mine. The perceived schedule drivers of this plan are also indicated in the table. This schedule is based on implementing the actions described in this report and relates to the aspects considered in this section.

Aspect	Scheduling	
Quarter 1		***Continuous***
Opencast workings	Concurrent backfilling sequence and removal of salvageable equipment.	Topsoil stripping, handling, stockpiling, preservation and replacement in line with the general surface rehabilitation and revegetation actions prescribed in
Surface Infrastructure related to mining operations (including plant)	Removal, decommissioning and demolition of infrastructure.	
Final void	Backfilling and sealing.	

Aspect	Scheduling	
Contaminated land remediation	Hydrocarbons – Removal of fuel storage and refuelling bays Chemical – contaminated equipment removal.	this report as land becomes available for rehabilitation.
Quarter 2		
Pollution Control Dams	Management of stormwater in closure period, but capacity requirements can be assessed to remove upon closure.	
Waste Management Facilities	Removal, decommissioning and demolition of infrastructure.	
Roads and parking areas	Only roads required after closure to remain in place.	
Fencing and walling	Only fences required to remain after closure to stay in place.	
Quarter 3 - 4		
Water Management	Monitoring, measurement and management where required.	
Maintenance and aftercare	All rehabilitated areas.	

Appendix 4 requires that a spatial map or schedule, showing planned spatial progression throughout operations be included in the plan. However, as the spatial progression is limited to the mining footprint and the mine haul route, the inclusion of a plan showing the spatial progression will not add any further information than that included in the table above.

4.3.5.1.4 Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

The rehabilitation plan aims to provide a project site that is similar to the pre-mining environment through the shaping of backfilled areas, capping of boreholes, closing of trenches and vegetating of disturbed areas (where not within cultivated lands).

4.3.5.1.5 Calculate and state the quantum of the financial provision required to manage and rehabilitate the environment in accordance with the applicable guideline.

Table 4-2: Closure Cost

Mine Closure Financial Liability		
	Item description	**Cost**
1	**Surface Infrastructure**	**R6 306 350.75**
1	Dismantling of processing plant and associated structures (including associated conveyors & power lines)	R286 452.33
2(A)	Demolition of steel buildings and structures (including floor slabs)	R0.00
2(B)	Demolition of reinforced concrete buildings and structures	R0.00
3	Rehabilitation of access roads	R4 978 447.29
4(A)	Demolition of electrified railway lines	R0.00
4(B)	Demolition and rehabilitation of non-electrified railway lines	R0.00
5	Demolition of housing and facilities (including floor slabs)	R870 302.42
12	Fencing	R171 148.72
2	**Mining Areas & Waste Sites**	**R22 844 256.36**
6	Opencast rehabilitation (including final voids and ramps)	R22 844 256.36
7	Sealing of shafts, adits and inclines (including concrete cap)	R0.00
3	**Mine Residue Sites**	**R9 504 372.67**
8(A)	Rehabilitation of overburden and spoils	R0.00
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	R0.00
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	R8 856 681.67
9	Rehabilitation of subsided areas	R0.00
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required)	R647 691.00
4	**General Rehabilitation**	**R9 248 745.67**
10	General surface rehabilitation, including of all denuded areas	R9 248 745.67
5	**Aftercare & Maintenance**	**R3 344 723.00**
13	Monitoring	R1 420 000.00
14	Maintenance	R1 924 723.00
15	Water Treatment Facility	R0.00
	Sub Total 1	**R51 248 448.45**
	Mobilisation and Project Management (10% of Subtotal 1)	**R5 124 844.85**
	Sub Total 2	**R56 373 293.30**
	Contingency (10% of subtotal 2)	**R5 637 329.33**
	Sub Total 3 (Closure Liability for Mine)	**R62 010 622.62**
	VAT (15% of subtotal 3)	**R9 301 593.39**
	Total	**R71 312 216.02**

4.3.5.1.6 Confirm that the financial provision will be provided as determined.

The applicant hereby commits to undertaking to provide the calculated amount in the form of either method provided in section 53 of the MPRD Regulations and the financial provisioning regulations, 2015 Published under Government Notice R1147 (GN R. 39425 of 2015). It should however be noted that no new guideline for determining the quantum for closure and rehabilitation has been published and therefore the guideline published under the MPRDA regulation was used to assess the quantum for closure liability.

MECHANISMS FOR MONITORING COMPLIANCE WITH A PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND REPORTING THEREON, INCLUDING –

4.3.5.1.7 Monitoring of Impact Management Actions (Table 4-3).

4.3.5.1.8 Monitoring and reporting frequency (Table 4-3).

4.3.5.1.9 Responsible persons (Table 4-3).

4.3.5.1.10 Time period for implementing impact management actions (Table 4-3).

4.3.5.1.11 Mechanism for monitoring compliance (Table 4-3).

Table 4-3: Monitoring compliance

Source activity	Impacts requiring monitoring programmes	Functional requirements for monitoring.	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions.
Construction, Operation and Decommissioning Activities	Water Quality	ISO 5667 Grab Samples.	Independent Specialist.	Monthly as per WUL.
Construction, Operation and Decommissioning Activities	Water Quantity	Water Balance to be Updated Annually Flow Meter Reading and Update of Datasheet.	SHEQ/ Engineering.	Daily
Construction, Operation and Decommissioning Activities	Bio-Monitoring	SASS 5 and IHAS Sampling Sites are to be established upstream and downstream of all Potential Impact.	Aquatic Ecologist	Bi-Annually
Construction, Operation and Decommissioning Activities	Storm Water Management	Visual Inspection Check the system for blockages and possible spillage areas.	SHEQ/ Engineering	After heavy rainfall.
Construction, Operation and Decommissioning Activities	Biodiversity Assessment	Align the Fauna & Flora Compare the annual findings with those of the Baseline Studies.	Ecologist	Annually
Construction, Operation and Decommissioning Activities	Alien Invasive Control Program (AICP)	Implement an Alien Invasive Control Programme. During the Biodiversity Assessment a qualified ecologist must be contracted to ensure that the implementation of the AICP are adequately addressed.	Ecologist	Bi-Annually
Construction, Operation and Decommissioning Activities	Vegetation and Rehabilitation.	RSIP to be adhered to as specified in EMP.	Ecologist	Bi-Annually
Construction, Operation and	Groundwater Quality.	SANAS Standards As specified in Geo-Hydro Report.	Independent Specialist.	Quarterly

Source activity	Impacts requiring monitoring programmes	Functional requirements for monitoring.	Roles and responsibilities (for the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions.
Decommissioning Activities				
Construction, Operation and Decommissioning Activities	Groundwater Levels.	Depth meters. Determine the groundwater fluctuation over a LOM.	Independent Specialist.	Determine the groundwater fluctuation over a LOM.
Construction, Operation and Decommissioning Activities	Dust Fallout.	Implement a Monitoring Programme Gravimetric Dust Fallout.	To be analysed by an Accredited Laboratory Independent Specialist.	Monthly.
Construction, Operation and Decommissioning Activities	Environmental Noise & Vibration.	Implement a Monitoring Programme SANAS Standards Noise monitoring are to be done to determine the effect of mining, and associated activities, on the receptors.	Independent Specialist (Noise Specialist).	Annually.
Construction, Operation and Decommissioning Activities	Visual Inspection of receptors.	Implement Monitoring Schedule in-house Physical Census Any incidents of cracking must be recorded and addressed.	SHEQ/ Engineering.	Before and After each blasting event.

4.3.5.1.12 Indicate the frequency of the submission of the performance assessment/ environmental audit report.

A performance assessment/ Environmental audit will be undertaken as stipulated in Table 4-3 above. The performance assessment will be conducted internally twice a year and by an external consultant annually throughout the life of operation as required under NEMA. This is conducted to assess the adequacy and compliance to the EMP, EA and the relevant legislation. The reports should be submitted to the DMRE.

4.3.5.1.13 Emergency Preparedness, Response and Environmental Awareness Plan

Manner in which the applicant intends to inform his or her employees of any environmental risk which may result from their work

An environmental awareness training manual will be developed for the project.

All employees must be provided with environmental awareness training to inform them of any environmental risks that may result from their work and of the manner in which the risks must be dealt with to avoid pollution or the degradation of the environment.

Employees should be provided with environmental awareness training before operations start. All new employees should be provided with environmental awareness training. Environmental awareness and training is an important aspect of the implementation of the EMP. The onus is on the different parties involved in the various stages of the life cycle of the project to be environmentally conscious. Hence, it is suggested that all members of the project team are familiar with the findings of the site-specific EA report and the EMPr. For instance, the contractor is responsible for the lack of environmental knowledge of his/her crew members. The contractor could forward internal environmental awareness and training procedures to the project manager and environmental officer for comment prior to the commencement of the project. Likewise, the above is applicable to the programming, design, operations and maintenance, and decommissioning teams. Environmental awareness ensures that environmental accidents are minimized and environmental compliance maximized.

All staff and contractors will be submitted to an annual training / awareness course as to inform the staff of any environmental risks which may result from their work and the manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment.

Section 39 (3) (c) requires that an applicant who prepares an Environmental Management Programme or Environmental Management Plan must "develop an environmental awareness plan describing the manner in which the applicant intends to inform his or her employees of any environmental risks which may result from the work and the manner in which the risks must be dealt with in order to avoid pollution and degradation of the environment". Environmental Awareness is required not only for management and employees (as described in Section 39 (3) (c) but also for visitors to the site. the following strategies and plans will be put into place for each of the parties.

Visitor Environmental Awareness

Visitor/sub-contractor environmental awareness will be generated through the provision of a signboard describing very briefly the environmental considerations applicable to them. The signboard should contain the following information:

- Statement of the applicant's commitment to environmental principles;
- List of the "rules" to which the visitor must abide. This will include:
  - No littering. Dispose of all waste in the bins provided;
  - No fires;
  - Stay on demarcated roadways and paths only;
  - Kindly report any environmental infringements they may notice;

- Check your vehicle/equipment for diesel/oil leaks.

Senior and Middle Management Environmental Awareness:

Achieving environmental awareness at upper levels of management is slightly different from the process at the operational level. There is often a fair level of the general value of environmental awareness but site-specific issues will most often need to be communicated. This will be achieved by:

- Management must make themselves fully familiar with the EMPr;
- Ensuring that there is a spare copy of the approved EMPr at his/her disposal; management is encouraged to make notes in the document regarding the difficulty / ease of implementing the environmental management measures. These notes should be sent to the consultants to assist in future revisions of the EMPr;
- The manager must ensure that the operators perform regular monitoring of their workstations / areas.

During the management's execution of their activities/being at the site, the management must constantly be aware of and observant of especially the following:

- Dust levels - movement outside of demarcated areas;
- Litter management - general housekeeping;
- Erosion during rainy season.

Topsoil management - fuel/oil management/leaks/changes;

- Success of operational re-vegetation; and
- Alien vegetation.

Operator / Workforce Environmental Awareness:

Achieving environmental awareness amongst the operators and labour is probably the most important because they are usually present at the place where most environmental transgressions take place or in fact cause them. It is the aim of increased environmental awareness to reduce any such environmental transgressions.

Increasing environmental awareness at these levels can be achieved through the following strategies:

- Induction environmental training must take place prior to any contract period.
- Training: Each and every employee (contractor or not) must go through an environmental training process where at least the following items area covered:
  - The oil/fuel management policy must be explained to the employees. The reason for the policy must also be explained (i.e. to not impact on groundwater, surface water, soil quality etc.);
  - The domestic and industrial waste management policy & method must also form part of the training;
  - The topsoil handling method and the reasons for preserving topsoil (i.e. post prospecting re vegetation, erosion prevention etc.);
  - Alien vegetation management: How to recognize and remove such species;
  - Protection of the natural veld by not driving/manoeuvring or walking through the demarcated protection areas. Reporting that demarcation posts/tape is broken or removed;

Emergency management procedures such as dealing with oil spills or fires must also be drilled; and

- Such training will, in this case, be carried out by the site manager/resident engineer.

Manner in which risks will be dealt with in order to avoid pollution or the degradation of the environment.

Training, as detailed above, will address the specific measures and actions as listed in the EMPr and also conditions of the EA. In this way the team will be provided the knowledge required to conduct the mining activities without resulting in environmental non-compliance, the liability of which would lie with the applicant. Secondly, informing the team of the EMPr will also assist the team in identifying if an impact is likely to occur / has occurred and communicate this appropriately to the Environmental Manager.

In order for appropriate action to be taken, proper communications network and reporting protocol must be established, with the team and the site manager reporting all environmental issues to the Environmental Manager and then all social issues to the General Manager.

4.3.5.1.14 Specific information required by the Competent Authority

The following specific information will be required by the competent authority:

- The financial provision will be reviewed annually.

1) UNDERTAKING

The EAP herewith confirms

- **a.** the correctness of the information provided in the reports ☒
- **b.** the inclusion of comments and inputs from stakeholders and I&APs ; ☒
- **c.** the inclusion of inputs and recommendations from the specialist reports where relevant; ☒and
- **d.** that the information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested and affected parties are correctly reflected herein. ☒

Signature of the Environmental Assessment Practitioner:

Eco Elementum

Name of Company:

08/11/2022

Date:

-END-

APPENDIX A: EAP CV

APPENDIX B: PUBLIC PARTICIPATION REPORT

APPENDIX C: LAYOUT MAPS

APPENDIX D: SPECIALIST STUDIES