Glencore Operations (Pty) Ltd

Waterval Mine

Draft Environmental Impact Assessment and Environmental Management Programme Report

March 2023

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Glencore Operations South Africa (Pty) Ltd

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March 2023

Project Ref: 151-002

Prepared by: Suzanne van Rooy

The opinions expressed in this Report have been based on the information supplied to Alta van Dyk Environmental Consultants cc (AvDEnvironmental) by company officials. The opinions in this Report are provided in response to a specific request from company officials to do so. AvDEnvironmental has exercised all due care in reviewing the supplied information. Whilst AvDEnvironmental has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. AvDEnvironmental does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of AvDEnvironmental's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which AvDEnvironmental had no prior knowledge nor had the opportunity to evaluate.

VERSION CONTROL

Alta van Dyk Environmental cc

Version: Draft

Approved by: Alta van Dyk

Signed:

Position: Environmental Specialist

Date: March 2023

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH MINING RIGHT ACTIVITIES

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:	Glencore Operations South Africa (Pty) Ltd: Waterval Mine
PROJECT:	UG1 Opencast project
CONTACT PERSON:	Keitumetse Mthimunye
TEL NO:	014 597 8154
FAX NO:	014 597 8408
POSTAL ADDRESS:	PO Box 310, Kroondal, 0350
PHYSICAL ADDRESS:	Portion 27, Farm Waterval 306 JQ, Rustenburg, 0299
DMRE Reference No:	**NW30/5/1/2/2/157 MR**
	NW30/5/1/2/2/244 MR
	NW30/5/1/2/2/246 MR
	NW30/5/1/2/2/192 MR
	NW30/5/1/2/2/260 MR
	Section 102 Application Reference:
	NW-00274-MR/102

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.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the environmental impact assessment process is to, through a consultative process: -

(a) determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
(c) identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the—-
    (i) nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
    (ii) degree to which these impacts—
        (aa) can be reversed;
        (bb) may cause irreplaceable loss of resources, and
        (cc) can be avoided, managed or mitigated;
(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to manage, avoid or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored.

Executive Summary

Introduction

Glencore Operations South Africa (Pty) Ltd (Glencore) is involved in the mining of Chrome and Platinum Group Metals (PGMs). The company was previously known as Xstrata Alloys prior to the merger of Glencore International plc and Xstrata plc in May 2013.

Glencore Waterval Mine (Waterval Mine) is an existing mining operation situated approximately 3 km east of Rustenburg in the North West Province on various portions and holdings of the farm Waterval 306 JQ. The primary mineral mined is chromite. The mineral deposit is developed to the east of the town Rustenburg with the ore body that dips towards the north and strikes east-west.

Shangoni Management Services (Pty) Ltd (Shangoni) was appointed by Glencore to facilitate the updating and consolidation of the Waterval Mine's Environmental Impact Assessment Report (EIAR) and Environmental Management Programme Report (EMPr). This Consolidated EIAR and EMPr intended on superseding all prior EMPrs previously compiled and approved for the mine and served the purpose of incorporating and consolidating all approved activities at the mine up to February 2021 (collectively termed the Consolidated EMPr).

The EMPr Consolidation (2021) was approved as an addendum by the Department of Mineral Resources and Energy (DMRE) on 6 December 2021. **It is the intention of Waterval Mine to amend the 2021 Consolidated EMPr to include the following activities:**

- Include prospecting right 2060PR into the mining right area; and
- UG1 opencast project.

Waterval Mine appointed Alta van Dyk Environmental Consultants cc (AVDE) as the independent Environmental Assessment Practitioner (EAP) for this project to undertake the environmental-related authorisations and associated public participation process.

Project Description

The proposed UG1 opencast project will include the opencast mining of the chromite layer on the remaining extent of portion 82 of the farm Waterval 306 JQ. There is possible 3 million tons of the UG1 chromite layer that can potentially be mined using opencast mining methods.

Several new infrastructure will be constructed in support of the opencast project. The following buildings and amenities will be constructed for the UG1 opencast project:

- Roads, powerlines and pipelines;
- Fencing;
- Site offices and change houses;
- Stockpiles (topsoil, overburden and Run of Mine);
- General and hazardous waste management areas; and
- Water pollution management facilities.

The project will take place in three phases: The proposed schedule for the phases is as follows:

- Construction Phase ≈Two months
- Operation Phase ≈3 years
- Decommissioning and Closure Phase ≈6 – 12 months

Authorisation Requirements

Before Waterval Mine may commence with the development of the proposed UG1 opencast project, the following environmental authorisations are required:

- A Scoping and Environmental Impact Reporting (S&EIR) process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) and the Environmental Impact Assessment (EIA) Regulations (2014, as amended). The competent authority for this process is the North West Department of Minerals and Energy (DMRE).
- Approval in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) (combined application in terms of NEMA and NEM:WA to be submitted to the DMRE).
- A Water Use Licence Application (WULA) in terms of the National Water Act (Act 36 of 1998). The competent authority for this process is the Department of Water and Sanitation (DWS).

EMPr Amendment

The following additions to the approved EIA/EMPr have been made:

- Property description for the UG1 opencast project (Table 7)
- Property description for inclusion of PR 2060 in the mining right area (Table 8)
- Listed activities relating to the proposed UG1 opencast project (Table 10)
- Project description for the proposed UG1 opencast project (Part A, Section 4.3)
- Policy and legislative context for the proposed UG1 opencast project (Table 27)
- Need and desirability of the proposed UG1 opencast project (Part A, Section 6)
- Description of the process followed to reach the preferred site relating to the proposed UG1 opencast project (Part A, Section 7)
- Alternatives considered for the proposed UG1 opencast project (Part A, Section 8)
- Details of the public participation process followed (Part A, Section 9)
- Environmental attributes associated with the proposed UG1 opencast project (Part A, Section 11)
- Impacts and risks associated with the UG1 opencast project (Part A, Section 15.4)
- Impact assessment methodology used for the UG1 opencast project (Part A, Section 16.4)

The following changes to the approved EIA/EMPr have been made:

- Updated locality maps (Figure 4, Figure 5 and Figure 6)
- Updated Waterval Mine water balance (Figure 13)
- Although underground mining is authorised through Waterval Mine East and West shafts, the shafts are currently on care and maintenance (Part A, Section 4.2.2.1, Section 4.2.2.2, Section 4.2.2.5)
- Updated surface water quality information (Part A, Section 10.6.5)
- Updated Aquatic Environment (Part A, Section 10.7)
- Updated groundwater quality information (Part A, Section 10.9.4)
- Updated Air Quality (Part A, Section 10.10)
- Updated Social information (Part A, Section 10.15)
- Updated Rehabilitation and Closure Plan for Waterval East Chrome Mine and Waterval West Chrome Mien (Part B Section 6.3)
- Monitoring information (Table 125)

Identified Environmental Impacts (relating to the proposed UG1 opencast project)

The following impacts were identified as summarised in the table overleaf.

Aspect	Impact	Significance before mitigation	Significance after mitigation
Construction phase			
Soils	The loss of utilisable resource (sterilisation and erosion), compaction and contamination or salinisation	Medium (-)	Low (-)
	Contamination of soil	Medium (-)	Low (-)
	Soil erosion	Medium (-)	Low (-)
Terrestrial Biodiversity	Loss of indigenous vegetation	Low (-)	Low (-)
	Spread and/or establishment of alien and/or invasive species	Medium (-)	Low (-)
Surface water	Siltation of watercourses	Medium (-)	Low (-)
	Contamination of surface water resources	Medium (-)	Low (-)
Wetlands	Degradation of wetlands	Low (-)	Low (-)
	Spread and/or establishment of alien and/or invasive species	Low (-)	Low (-)
	Alterations in hydrological regime (flow of surface and sub-surface water)	Low (-)	Low (-)
Groundwater	Increased vulnerability of the aquifer to contamination due to an increase in the surface infiltration rate	Low (-)	Low (-)
	Impact on groundwater quality	Medium (-)	Low (-)
	Lowering of groundwater levels	Low (-)	Low (-)
Air quality	Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations	Low (-)	Low (-)
	Increase in dust deposition	Low (-)	Low (-)
Noise	Increase in ambient noise levels	Medium (-)	Low (-)
Visual	Impact on Landscape Character and Sense of Place	Medium (-)	Low (-)
	Visual Intrusion and VAC impacts	Medium (-)	Medium (-)
	Visual Exposure and Visibility Impacts	Medium (-)	Low (-)
Heritage	Impact on Archaeological Resources	Medium (-)	Low (-)
Waste management	Increase waste generation due to construction activities	Low (-)	Low (-)
Social	Benefits resulting from employment and income opportunities created by the construction of the UG1 opencast project	Low (+)	Medium (+)
Operational Phase			
Soils	Contamination of soil	Medium (-)	Low (-)
	Soil erosion	Medium (-)	Low (-)
Terrestrial biodiversity	Spread and/or establishment of alien and/or invasive species	Medium (-)	Low (-)
	Introduction of nuisance vectors (pests) such as flies, rodents and monkeys	Low (-)	Low (-)

Aspect	Impact	Significance before mitigation	Significance after mitigation
Surface water	Siltation of watercourses	Medium (-)	Low (-)
	Contamination of surface water resources	Medium (-)	Low (-)
	Reduced catchment yield	Medium (-)	Low (-)
Wetlands	Degradation of wetlands	Low (-)	Low (-)
	Environmental pollution due to contamination, increased sedimentation and erosion of watercourses	Medium (-)	Low (-)
	Alterations in hydrological regime (flow of surface and sub-surface water)	Medium (-)	Low (-)
Groundwater	Lowering of groundwater levels	Low (-)	Low (-)
	Reduction of baseflow to the Hex River	Medium (-)	Low (-)
	Deterioration in water quality due to leakages from the Pollution control dam	Medium (-)	Low (-)
	Deterioration of groundwater quality	Medium (-)	Low (-)
Air Quality	Increase in ambient TSP concentrations	Low (-)	Low (-)
	Increase in ambient, PM_{10} and $PM_{2.5}$ concentrations	Medium (-)	Low (-)
Noise	Noise increase in excess of the permissible threshold value of 7.0dBA	Medium-high (-)	Medium (-)
Visual	Impact on Landscape Character and Sense of Place	Medium-high (-)	Medium (-)
	Visual Intrusion and VAC impacts	Medium-high (-)	Medium (-)
	Visual Exposure and Visibility Impacts	Medium-high (-)	Medium (-)
	Impacts due to Night Time Lighting	Medium-high (-)	Medium (-)
Blasting	Increased ground vibration	Medium-high (-)	Low (-)
	Fly rock	Medium-high (-)	Low (-)
	Increased ground vibration	Medium-high (-)	Low (-)
Waste management	Increase waste generation due to operational activities	Low (-)	Low (-)
Social	Improved infrastructure in the study area due to social investment activities	Low (+)	Low (+)
	Benefits resulting from employment and income opportunities created by the UG1 opencast project	Low (+)	Low (+)
	Dissatisfaction over employment opportunities and conditions of procurement which could potentially lead to community protests and unrests, as well as conflicts within communities	Medium (-)	Low (-)
Closure			
Soils	Potential for compaction and contamination of soils	Medium (-)	Low (-)
Terrestrial biodiversity	Re-vegetation of rehabilitated areas	Medium (-)	Low (-)

Aspect	Impact	Significance before mitigation	Significance after mitigation
Surface water	Siltation of watercourses	Medium (-)	Low (-)
Groundwater	Deterioration of groundwater quality (impact on the neighbouring groundwater user (HBH2))	Medium-high (-)	Medium (-)
	Deterioration of groundwater quality (impact on the Hex River water quality	Medium (-)	Low (-)
	Contamination of surface water bodies by decanting water	Medium (-)	Low (-)
Air quality	Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations	Low (-)	Low (-)
Noise	Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas	Medium (-)	Low (-)
Visual	Impact on Landscape Character and Sense of Place	Medium (-)	Low (-)
	Visual Intrusion and VAC impacts	Medium (-)	Low (-)
	Visual Exposure and Visibility Impacts	Medium (-)	Low (-)
Social	Loss of employment and enterprise development opportunities due to closure of mine	Medium (-)	Low (-)

Stakeholder Engagement

Pre-application phase

During the pre-application phase, the following stakeholder engagement activities were undertaken:

- Updating the existing stakeholder database by identifying competent authorities, adjacent landowners and businesses in close proximity to the proposed opencast project;
- Pre-application meeting with the DMRE;
- Project announcement:
    - Placing of site notices around the proposed opencast project area;
    - Distribution of a Background Information Document (BID) to identified stakeholders inviting them to register as Interested and Affected Parties (I&APs).

Scoping Phase

During the Scoping Phase, the following stakeholder engagement activities were undertaken:

- Distribution of notification letter to stakeholders, informing them of the availability of the Draft Scoping Report for comment and requesting comments on the proposed project and Draft Scoping Report; and
- Placing an advertisement in the Rustenburg Herald and Platinum Weekly newspapers to announce the availability of the Draft Scoping Report for public comment;
- Making the Draft Scoping Report available for public comment for a period of 30 days (2 September to 3 October 2022);
- Public Open Day (held on 22 September 2022). Comments raised by stakeholders during the pre-application and Scoping Phase are captured in the Comment and Response Table.

Impact Assessment Phase

During the Impact Assessment Phase, the following stakeholder engagement activities were undertaken:

- Distribution of notification letter to stakeholders, informing them of the availability of the Draft EIA/EMPr for comment and requesting comments on the proposed project and Draft EIA/EMPr; and
- Placing an advertisement in the Rustenburg Herald and Platinum Weekly newspapers to announce the availability of the Draft EIA/EMPr for public comment
- Making the Draft EIA/EMPr available for public comment for a period of 30 days (10 March to 12 April 2023);
- Public Open Day. Comments raised by stakeholders during the pre-application, scoping phase and impact assessment phase are captured in the Comment and Response Table;

Conclusion

No fatal flaws in the project have been identified thus far through the impact assessment process. However, several environmental and social impacts are envisaged from construction phase through to post-closure, which require careful mitigation and monitoring. It is the opinion of the EAP that all major impacts have been identified and have been assigned appropriate management measures. Most Medium-high negative impacts with mitigation, are reduced to a MEDIUM or LOW significance, and can be managed accordingly.

It is recommended by the EAP that the proposed UG1 opencast project is allowed to proceed, on the assumption that the environmental and social management commitments included in this EIA/EMPr are adhered to, the project description remains as per the description provided in this document.

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Tables

Figures

Abbreviations

ASPT	Average Score Per Taxa
AVDE	Alta van Dyk Environmental Consultants cc
BID	Background Information Document
CBA	Critical Biodiversity Area
CI	Conservation Important
C-Plan	Conservation Plan
CR	Critically Endangered
CV	Curriculum Vitae
dBL	Decibel value
DEA	Department of Environmental Affairs
DFFE	Department of Forestry Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EI	Ecological Importance
EIA	Environmental Impact Assessment
EMFs	Environmental Management Frameworks
EMPr	Environmental Management Programme Report
EN	Endangered
ES	Ecological Sensitivity
FAII	Fish Assemblage Integrity Index
Glencore	Glencore Operations South Africa (Pty) Ltd
HDSA	Historically Disadvantaged South Africans
IDP	Integrated Development Plan
IHAS	Integrated Habitat Assessment System
ISEE	International Society of Explosives Engineers
KOP	Key Observation Point
LOM	Life of Mine
MAR	Mean Annual Runoff
MHSA	Mine Health and Safety Act
MPB	Moot Plains Bushveld
MPRDA	Mineral and Petroleum Resources Development Act
MRD	Mine Residue Deposit
MSDS	Material Safety Data Sheet
MT	Marikana Thornveld
MWP	Mine Work Programme
NAAQS	National Ambient Air Quality Standard
NBA	National Biodiversity Assessment
NEM:AQA	National Environmental Management: Air Quality Act, Act No. 39 of 2004
NEM:BA	National Environmental Management: Biodiversity Act No. 10 of 2004
NEM:PAA	National Environmental Management: Protected Areas Act, Act 58 of 2003
NEM:WA	National Environmental Management: Waste Act, Act 59 of 2008
NEMA	National Environmental Management Act, Act 107 of 1998
NFA	National Forestry Act, Act 84 of 1998

NFEPA	National Freshwater Ecosystem Priority Areas
NHRA	National Heritage Resources Act
NPA	National Terrestrial Priority Areas
NPAES	National Protected Areas Expansion Strategy
NWA	National Water Act, Act No. 36 of 1998
NWBMA	North West Biodiversity Management Act
NWDEDECT	North West Department of Economic Development, Environment and Tourism
Pa.	Pascal
PCD	Pollution Control Dam
PES	Present Ecological State
PGM	Platinum Group Metals
POI	Point of Interest
RLM	Rustenburg Local Municipality
RoM	Run of Mine
S&EIR	Scoping and Environmental Impact Reporting
SACNASP	South African Council for Natural Science Professions
SAHRA	South African Heritage Resources Agency
SAIAB	South African Institute of Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	Biodiversity (SAIAB) and South African National Parks
SASS5	South African Scoring System (Version 5)
SDFs	Spatial Development Frameworks
SEA	Strategic Environmental Assessments
Shangoni	Shangoni Management Services (Pty) Ltd
SLP	Social and Labour Plan
SWSA	Strategic Water Source Areas
TAPM	The Air Pollution Model
TSF	Tailings Storage Facility
TSP	Total Suspended Particles
VAC	Visual Absorption Capacity
VU	Vulnerable
WRC	Water Research Commission
WULA	Water Use Licence Application
WWF	Worldwide Fund for Nature

PART A: SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 Introduction and scope of report

1.1 Introduction

Glencore Operations South Africa (Pty) Ltd (Glencore) is involved in the mining of Chrome and Platinum Group Metals (PGMs). The company was known as Xstrata Alloys prior to the merger of Glencore International plc and Xstrata plc in May 2013. Refer to Figure 1.

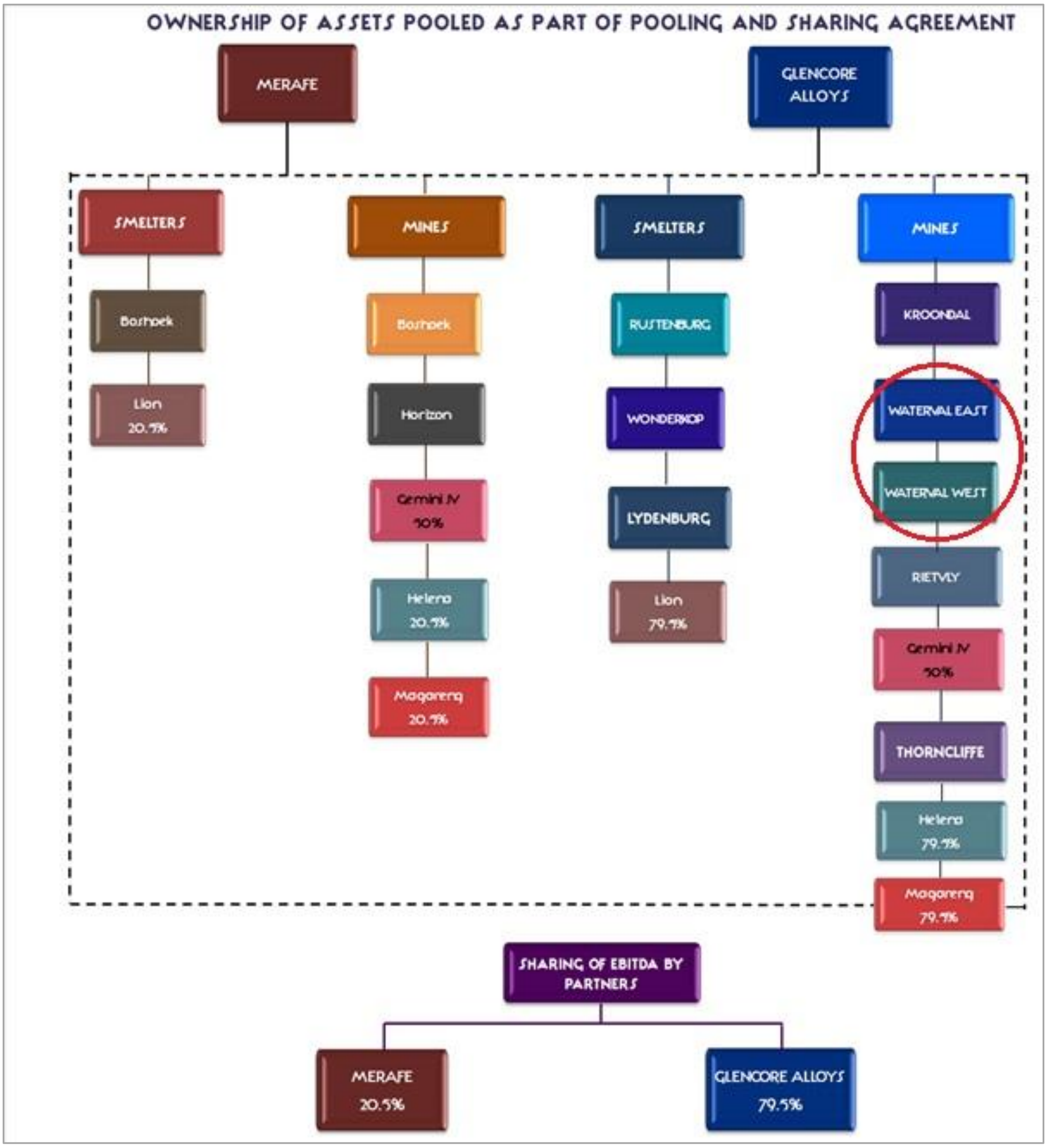

Figure 1: Current corporate structure of Glencore Operations South Africa (Pty) Ltd (Shangoni, 2021)

Waterval Mine is an existing mining operation situated approximately 3 km east of Rustenburg in the North West Province, within the Rustenburg Local Municipality, on various portions and holdings of the farm Waterval 306 JQ. The primary mineral mined is chromite (with general formula (Mg, Fe^{2+}) (Cr, Al, $Fe^{3+})_2$ O_4). The mineral deposit is developed to the east of the town Rustenburg with the ore body that dips towards the north and strikes east-west. The main target for the mining at Waterval Mine is the LG6 Chromitite Package. The package consists of the LG6A Chromitite Layer which is separated from the LG6 Chromitite Layer by the LG6 Pyroxenite Middling (Shangoni, 2021).

Shangoni Management Services (Pty) Ltd (Shangoni) was appointed by Glencore to facilitate the updating and consolidation of the Waterval Mine's Environmental Impact Assessment (EIA) and Environmental Management Programme Report (EMPr). This Consolidated EIA and EMPr intended on superseding all prior EMPrs previously compiled and approved for the mine and served the purpose of incorporating and consolidating all approved activities at the mine up to February 2021 (collectively termed the Consolidated EMPr).

The following reasons resulted in a decision to amend and consolidate the Waterval Mine EMPr (Shangoni, 2021):

- Consolidated the following approved EMPrs into one EMPr:
  - Environmental Management Programme report for the Xstrata Waterval Chrome Mine, dated July 2009 and compiled by CHEMC environmental;
  - Environmental Impact Assessment and Environmental Management Programme, Waterval PGM plant EMPr, dated 2011 and compiled by Environmental and Energy Services; and
  - Waterval Mine has recently obtain a new section of mining right (Section 11 consent, in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) from the adjacent Samancor Chrome: WCM Millsell – Waterkloof operation).
- More up-to-date information is available on the various environmental aspects in the form of specialist studies and monitoring data for inclusion into the EMPr;
- Various new environmental legislative publications have occurred since the previous EMPr and EMPr addendum, dated 2009 and 2011, respectively were approved; and
- Practical Management and Mitigation Measures, in compliance with the latest environmental legislation needed to be incorporated into the EMPr.

The EMPr Consolidation (2021) was approved as an addendum by the North West Department of Mineral Resources and Energy (DMRE) on 6 December 2021. It is the intention of Waterval Mine to amend the 2021 Consolidated EMPr to include the following activities:

- Include prospecting right 2060PR into the mining right area; and
- UG1 opencast project.

1.2 Authorisations required

Before Waterval Mine may commence with the development of the proposed UG1 opencast project, the following environmental authorisations are required:

- A Scoping and Environmental Impact Reporting (S&EIR) process in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA) and the EIA Regulations (2014, as amended). The competent authority for this process is the North West DMRE.
- Approval in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA) (combined application in terms of NEMA and NEM:WA to be submitted to the DMRE).
- A Water Use Licence Application (WULA) in terms of the National Water Act (Act No. 36 of 1998). The competent authority for this process is the Department of Water and Sanitation (DWS).

Alta van Dyk Environmental Consultants cc (AVDE) has been appointed as the independent Environmental Assessment Practitioner (EAP) for this project to undertake the environmental-related authorisations and associated public participation process.

The S&EIR process is illustrated in Figure 2.

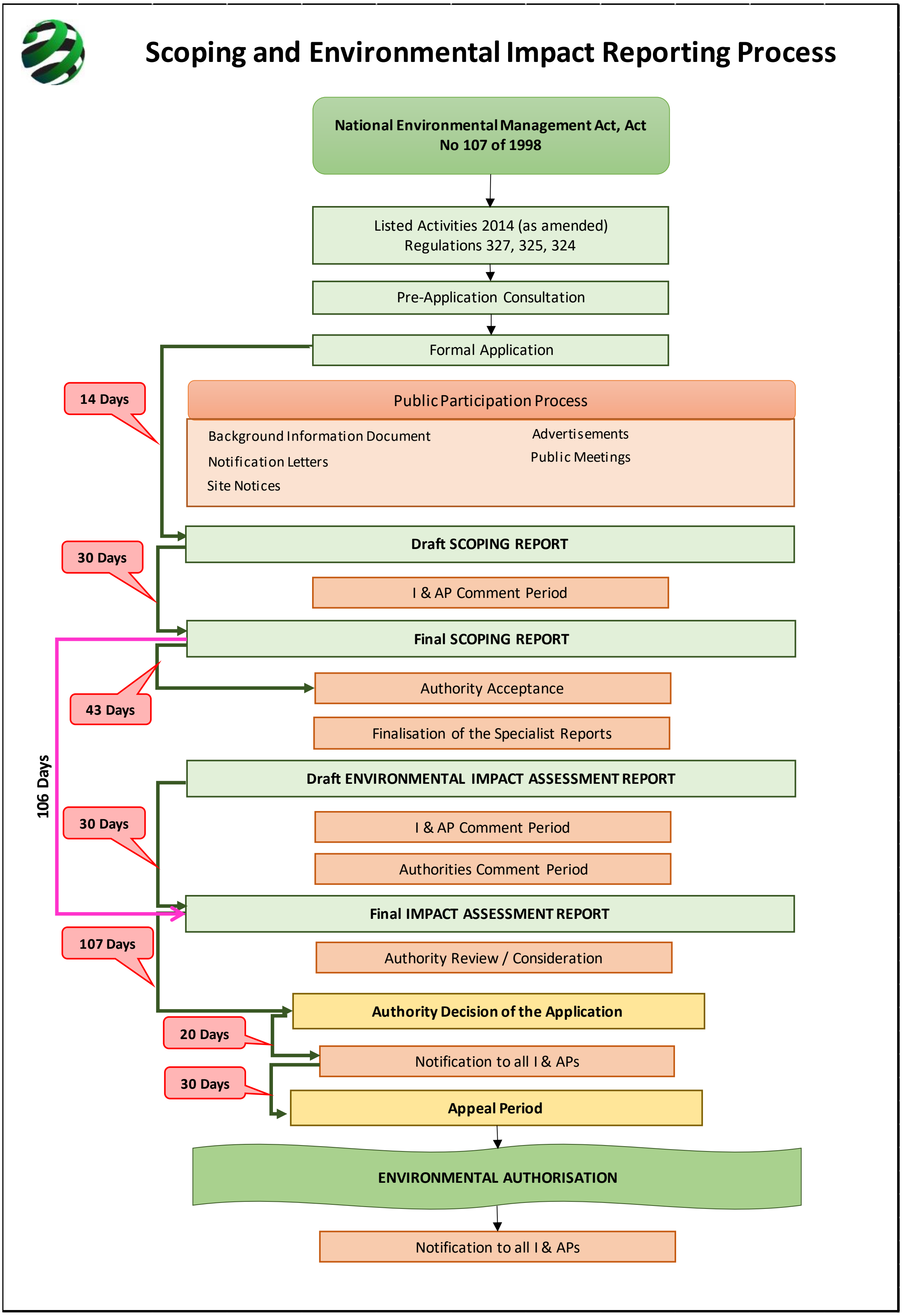

Figure 2: Scoping and Environmental Impact Reporting process

1.3 Details of Project Applicant and Environmental Assessment Practitioner

1.3.1 Details of the project applicant

The applicant for this project is Glencore Operations South Africa (Pty) Ltd. The details of the applicant are shown in Table 1.

Table 1: Contact details of the applicant

Applicant	Glencore Operations South Africa (Pty) Ltd
Company Registration	1997/017998/07
Postal Address	PO Box 310, Kroondal, 0350
Responsible person	Keitumetse Mthimunye
Telephone number	014 597 8154
Fax Number	014 597 8408
Email	keitumetse.mthimunye@glencore.co.za

1.3.2 Details of the Environmental Assessment Practitioner who prepared the report

AVDE is appointed as the independent EAP to conduct the environmental authorisation for the proposed UG1 opencast project. AVDE assigned Suzanne van Rooy as the lead EAP to undertake the integrated environmental authorisation process. Details of the EAPs are provided in Table 2.

Table 2: Details of the EAP

EAP Name	Contact Number	Fax Number	Email
Suzanne van Rooy	012 940 9457	086 634 3967	suzanne@avde.co.za

1.3.3 Qualifications of the EAP

The qualifications and professional registrations held by the EAP are shown in Table 3. Refer to Appendix A for copies of the qualifications and Curriculum Vitae (CV) of the EAP.

Table 3: Qualifications of the EAP

EAP name	Qualifications	Professional registration
Suzanne van Rooy	MPhil Environmental Management (University of Stellenbosch)	Pr.Sci.Nat (Reg nr. 400378/11) EAPASA Registered EAP (Ref 2019/1079)

1.3.4 Summary of the EAP’s past experience

Suzanne van Rooy holds a Master's Degree in Environmental Management from the University of Stellenbosch. In terms of professional affiliations, Suzanne is registered with the South African Council for Natural Science Professions (SACNASP - 400378/11) in Environmental Science field of practice. Suzanne's expertise is in the mining industry sector, focusing on Environmental Impact Assessments, Water Use Licence Applications, environmental performance assessments, water use licence audits, public participation and closure cost assessments. Her involvement in such projects varies from project management and co-ordination to the compilation and review of technical and environmental documents and reports. She has been involved in environmental authorisations for both underground and open cast mining operations, as well as the associated activities such as waste disposal facilities, conveyor routes, access roads, pollution control and other dams, undermining of wetlands and river crossings. She has also conducted various environmental feasibility reporting for potential mining projects.

Suzanne van Rooy meets the requirements for independence as she do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the EIA Regulations, 2017, and has no vested interest in the proposed activity proceeding, and also has no, and will not engage in, conflicting interests in the undertaking of the activity.

2 Description of the Property

2.1 Waterval Mine mining rights

Table 4 provides more detail with regards to the various mining rights granted to Waterval Mine and the farm portions associated therewith. Table 5 provides information on the surface rights and title deeds of the relevant farm portions (Shangoni, 2021). **It is the intension of Waterval Mine to include PR2060 into their current mining right area.** The Waterval Mine mining right areas are indicated in Figure 4.

Table 4: Waterval Mine approved mining rights issued by the Department of Mineral Resources (Shangoni, 2021)

Mining Right	Description of Mining Right	Farm portions included in Mining Right
Converted Mining Right: File No's: • NW30/5/1/2/2/157 MR • NW30/5/1/2/2/244 MR • NW30/5/1/2/2/246 MR 20 February 2007	Conversion of old order Mining Right: Converted in terms of Item 7 of Schedule II of MPRDA.	Portions 45 and 97 of the farm Rustenburg Town and Townlands 272 JQ and Holdings 25 and 26, Portion 1 of Holding 27, Portions 27, 30, 31, 32, 34 (all portions of Portion 2) and Mineral area 1 on Remainder of Portion 2, and Portions 35, 36, 37, Mineral area 1, Holdings 21, 22, 23 and Remaining Extent of Holding 24, all of the farm Waterval 306 JQ.
Amendment / Variation of a Mining Right: File No's: • NW30/5/1/2/2/157 MR • NW30/5/1/2/2/244 MR • NW30/5/1/2/2/246 MR • NW30/5/1/2/2192MR (This is the mining right area included in the main mining right in terms of S102 22 December 2014	Amended / varied by the inclusion of Platinum Group Metals, Nickel ore, Copper ore, Cobalt ore, Iron ore and Silver ore (excluding Platinum Group Metals and Minerals mines out of necessity in the mining of platinum group metals found in the UG2 and Merensky Reefs; and Portions 7, 8 and 145 of the farm Rustenburg Town and Townlands 272 JQ, thereby extending the original mining rights area.	Portions 45 and 97 of the farm Rustenburg Town and Townlands 272 JQ and Holdings 25 and 26, Portion 1 of Holding 27, Portions 27, 30, 31, 32, 33, 34 (all portions of Portion 2) and Mineral area 1 on remainder of Portion 2, and Portions 35, 36, 37, Mineral area 1, Holdings 21, 22, 23 and Remaining extent of Holding 24, all of the farm Waterval 306 JQ.
Mining Right: File No: • NW30/5/1/2/2/260 MR	Mining Right transferred to Waterval Mine in terms of Section 11 of MPRDA.	Portion 1(RE), Portion 3, Portion 7, Portion 8, Portion 9, Portion 10 (RE), Portion 11, Portion 12 of the Farm Waterval 307JQ. Portion RE of the farm Waterval 581JQ and a Portion of Portion 1 of the Farm Waterval 581JQ. A portion of Portion 53 (RE) of the Farm Waterkloof 305JQ.

Table 5: Surface rights owners and title deed numbers (Shangoni, 2021)

Farm portions	Title deed no	Property size	Surface rights owner
Portion 135 of the Farm Town and Townlands of Rustenburg 272 JQ	T15039/1976	1.0 ha	Republic of South Africa
Portion 136 of the Farm Town and Townlands of Rustenburg 272 JQ	T18494/1987	Unknown	Unknown
Portion 137 of the Farm Town and Townlands of Rustenburg 272 JQ	T40140/1979	1.8 ha	Republic of South Africa
Portion 138 of the Farm Town and Townlands of Rustenburg 272 JQ	T17253/1977	29.2608 ha	Provincial Government of the North-West Province
Portion 141 of the Farm Town and Townlands of Rustenburg 272 JQ	T28281/1981	0.44 ha	Municipality of Rustenburg
Portion 53 of the Farm Waterkloof 305 JQ	T15249/2003	16.3412 ha	SAMANCOR Chrome Ltd.
Portion 2 of the Farm Waterval 306 JQ	T2465/1961	2394182 ha	Rustenburg Platinum Mines Ltd.
Portion 27 of the Farm Waterval 306 JQ	T104380/2000	50.2310 ha	Glencore Operations South Africa (Pty) Ltd.
Portion 33 of the Farm Waterval 306 JQ	T152202/1999	9.4331 ha	Glencore Operations South Africa (Pty) Ltd.
Portion 34 of the Farm Waterval 306 JQ	T152202/1999	9.6324 ha	Glencore Operations South Africa (Pty) Ltd.
Portion 75 of the Farm Waterval 306 JQ	Unknown		
Portion 76 of the Farm Waterval 306 JQ	Unknown		
Portion 81 of the Farm Waterval 306 JQ	T60892/2003	12.5251 ha	Xvest Invc 2009 cc
Portion 82 of the Farm Waterval 306 JQ	T4731/2004	121.7951 ha	Glencore Operations South Africa (Pty) Ltd.
Portion 116 of the Farm Waterval 306 JQ	T83629/2013	1.5 ha	ADLU Projects cc
Portion 26 of the Farm Waterval SH 450 JQ	Unknown		
Portion 1 of the Farm Waterval 307 JQ	T74967/2014	12.5437 ha	Rustenburg Local Municipality
Portion 7 of the Farm Waterval 307 JQ	T39996/2013	9.6433 ha	Rustenburg Local Municipality
Portion 8 of the Farm Waterval 307 JQ	T74967/2014	9.3982 ha	Rustenburg Local Municipality
Portion 9 of the Farm Waterval 307 JQ	T74967/2014	6.9191 ha	Rustenburg Local Municipality

Farm portions	Title deed no	Property size	Surface rights owner
Portion 3 of the Farm Waterval 307 JQ	T39996/2013	27.4304 ha	Rustenburg Local Municipality
Portion 12 of the Farm Waterval 307 JQ	T112737/2003	4.4996 ha	Bouvest 2263 cc
Portion 10 of the Farm Waterval 307 JQ	T74967/2014	56.4776 ha	Rustenburg Local Municipality
Portion 11 of the Farm Waterval 307 JQ	T83347/2004	11.1500 ha	Rustenburg Platinum Mines Ltd

2.2 Description of the property

The description of the properties applicable to Waterval Mine in the approved Consolidated 2021 EMPr are provided in Table 6.

Table 6: Description of the properties applicable to Waterval Mine (Shangoni, 2021)

Farm name	Various portions and holdings of the farm Waterval 306 JQ, the Farm Rustenburg Town and Townlands 272JQ and Waterval 307 JQ.
Application area (ha)	• 616.9699 hectares (as per existing approved mining rights 244MR 246MR 157 MR and 192MR) • 389.3787 hectares (as per additional mining right area 260MR)
Magisterial district	Bojanala District Municipality Rustenburg Local Municipality
Distance and direction from nearest town	3 km east of Rustenburg in the North West Province
21-digit Surveyor General code for each farm portion	T0JQ00000000027200135; T0JQ00000000027200136; T0JQ00000000027200137; T0JQ00000000027200138; T0JQ00000000027200141; T0JQ00000000030500053; T0JQ00000000030600002; T0JQ00000000030600027; T0JQ00000000030600022; T0JQ00000000030600034; T0JQ00000000030600075; T0JQ00000000030600076; T0JQ00000000030600081; T0JQ00000000030600116; T0JQ00000000045000026

The property description for the proposed UG1 opencast project is provided in Table 7.

Table 7: Property description of proposed UG1 opencast project

Farm name	Portion 82 of Waterval 306 JQ
Application area (ha)	85 ha
Magisterial district	Bojanala District Municipality Rustenburg Local Municipality
Distance and direction from nearest town	3 km east of Rustenburg in the North West Province
21-digit Surveyor General code for each farm portion	T0JQ00000000030600082

The property description for inclusion of PR 2060 into the mining right areas is provided in Table 8.

Table 8: Property description of PR 2060

Farm name	Remaining portion of portion 1 of the farm Town and Townlands of Rustenburg 272 JQ
Application area (ha)	17.1988 hectares (as per prospecting right area to be added 2060PR – Applied for inclusion of this area in terms of S102 of the MPRDA – DMRE Reference Number NW-00274-MR/102.
Magisterial district	Bojanala District Municipality Rustenburg Local Municipality
Distance and direction from nearest town	3 km east of Rustenburg in the North West Province
21-digit Surveyor General code for each farm portion	T0JQ00000000027200001

3 Locality map

The following maps indicate the locality of Waterval Mine, its mining right areas and location of the proposed UG1 opencast project.

- Figure 3: Locality map of the Waterval Mine (Shangoni, 2021)
- Figure 4: Mining right areas for Waterval Mine
- Figure 5: Farm portions relevant to the Waterval Mine mining right area
- Figure 6: Locality map of proposed UG1 opencast project

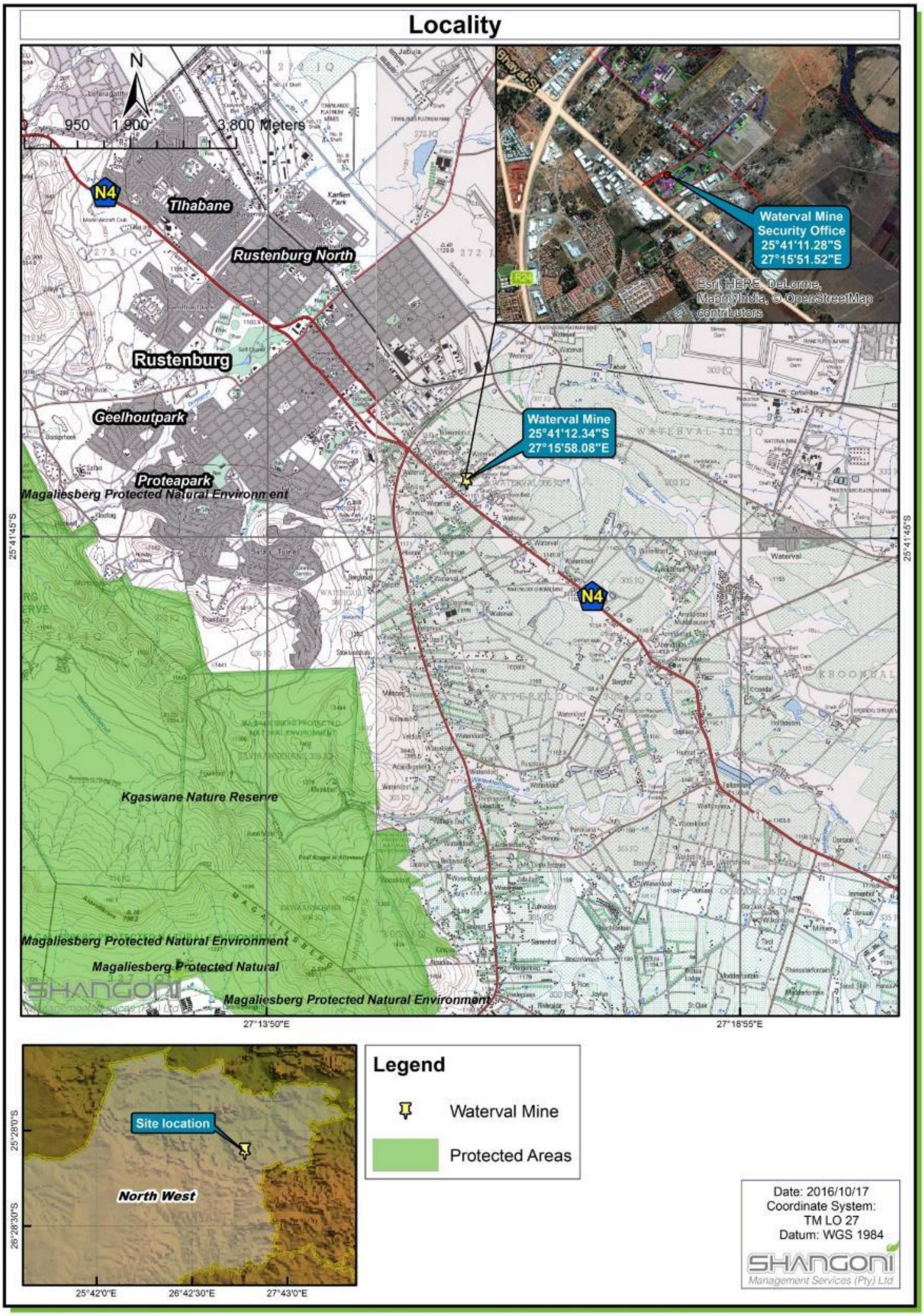

Figure 3: Locality map of the Waterval Mine (Shangoni, 2021)

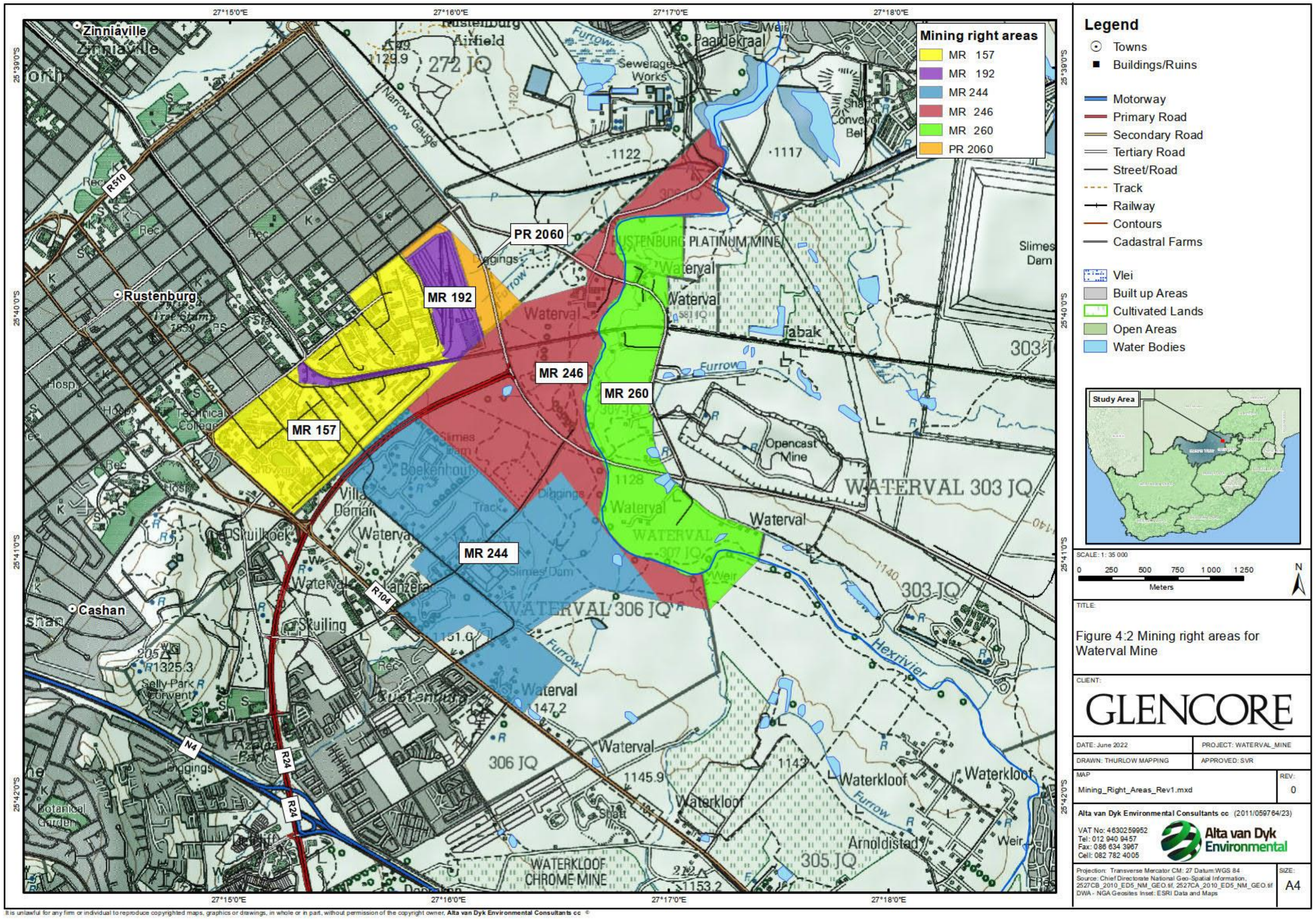

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Figure 4: Mining right areas for Waterval Mine

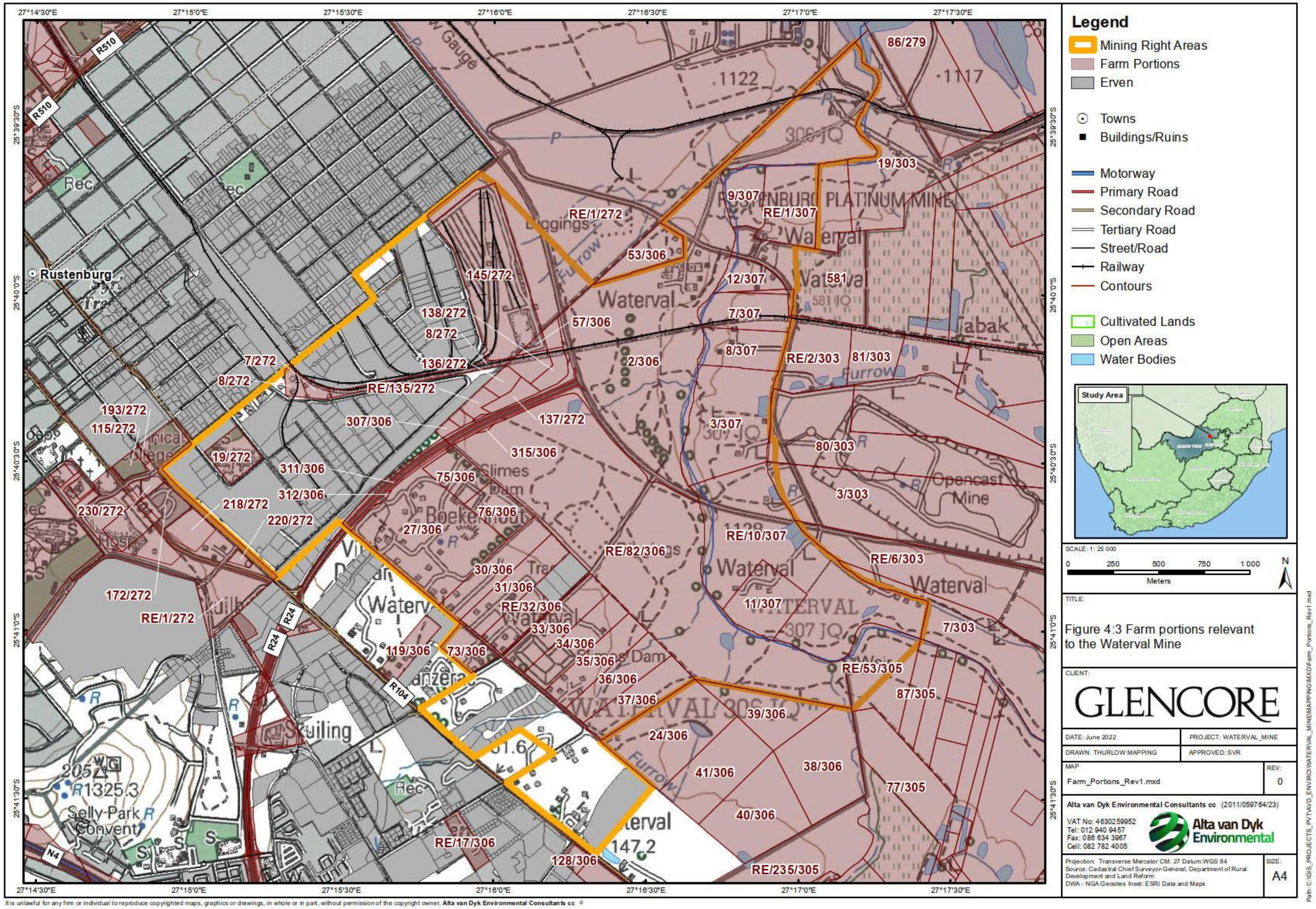

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Figure 5: Farm portions relevant to the Waterval Mine mining right area

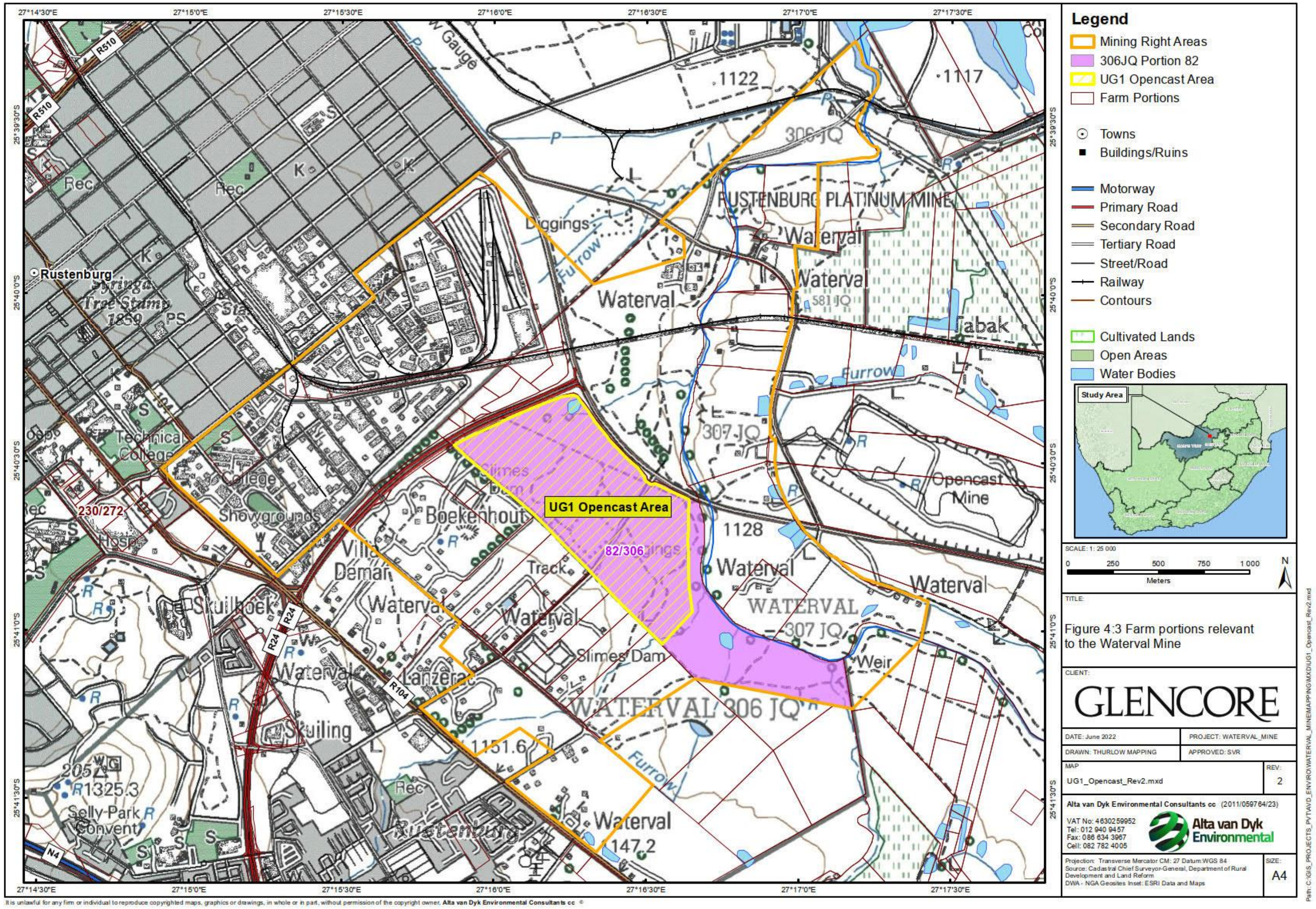

Figure 6: Locality map of proposed UG1 opencast project

4 Description of the scope of the proposed overall activity

4.1 Listed and specified activities

4.1.1 Authorised listed and specified activities

Waterval Mine has several **authorised listed activities** included in the approved 2021 Consolidated EMPr. These approved listed activities are shown in Table 9.

Table 9: Authorised activities and listed activities associated with the existing Waterval Mine (Shangoni, 2021)

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Waterval East and Waterval West: Underground mining and associated activities (including the following): • Marking, drilling and blasting of holes; • Provision of support (underground); • Engineering activities (underground); • Shafts and Ventilation Shafts	Total extent of mining rights area (in terms of farm portions): • 616.9699 hectares (as per existing approved mining rights 244MR 246MR 157 MR and 192MR) • 389.3787 hectares (as per additional mining right area 260MR)	-	This activity forms part of the approved mining right and EMPr (in terms of the MPRDA, 2002) for Waterval Mine. This activity is also considered to form part of an existing 'Environmental Authorisation' for the mine. The mining activities (as per all mentioned mining rights covered in this EIAR / EMPr) were also included in the approved EMPr, dated 2009. The activities commenced prior to the promulgation of the EIA Regulations (GN. R 385, GN. R 386 and GN. R 387), dated April 2006.
Waterval East and Waterval West: Transporting of ore from underground to an area adjacent to the plant area by means of a conveyor.	Linear activity. Refer to Figure 7 for aerial view of conveyors on the mine.	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East			
Loading of ore at pickup area by means of a front-end loader into the jaw crusher.	Total plant area: ± 4.68 Ha (including all stockpiles)	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Ore-processing: Crushing and Screening			
Ore-processing: Washing			
Waterval West			

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Loading of ore at pickup area by means of a front-end loader into the jaw crusher.	Total plant area: ± 8.56 Ha (including all stockpiles)	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Ore-processing: Crushing and Screening			
Ore-processing: Washing			
Waterval East and Waterval West: Conveying of ore within the plant area (from crushing and screening to washing plant and to various stockpiles) (i.e. use of conveyors).	Linear activity. Refer to Figure 7 for aerial view of conveyors on the mine.	-	
Waterval East			
Stockpiling of topsoil	Total plant area: ± 4.68 Ha (including all stockpiles)	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Stockpiling of waste rock on waste rock dumps		-	
Stockpiling of Chrome product		-	
Pumping of tailings (via pipelines): • From washing plant to thickener, and • From thickener to existing Tailings Storage Facility (TSF).	Linear activity. Refer to Figure 7 for aerial view of pipelines on the mine.	-	These activities were included in the approved EMPr, dated 2009, and the approved EMPr, dated 2011, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval West			
Stockpiling of topsoil	Total plant area: ± 8.56 Ha (including all stockpiles)	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Stockpiling of waste rock on waste rock dumps		-	
Stockpiling of Chrome product		-	
Pumping of tailings (via pipelines): • From washing plant to thickener, and • From thickener to existing TSF.	Linear activity. Refer to Figure 7 for aerial view of pipelines on the mine.	-	These activities were included in the approved EMPr, dated 2009, and the approved EMPr, dated 2011, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West:	-	-	These activities were included in the approved EMPr, dated 2009 and are therefore

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Operation and maintenance of process water storage and pumping facilities at the plants.			considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West: Pumping of process water via pipelines: • Within the plant process; • Between storage facilities; • From the storm water dam and return water dam back to the process (from existing TSF).	Linear activity. Refer to Figure 7 for aerial view of pipelines on the mine.	-	These activities were included in the approved EMPr, dated 2009, and the approved EMPr, dated 2011, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West: Operation and maintenance of existing TSF and associated infrastructure.	<u>Waterval East TSF & infrastructure:</u> ± 7.45 Ha <u>Waterval West TSF & infrastructure:</u> ± 7.05 Ha	-	These activities were included in the approved EMPr, dated 2009, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West: Operation and maintenance of storm water and dirty water management measures (channels, berms etc.) within the mining area.	Linear activity. Forms part of the overall mining activities.	-	The storm water management measures include both existing and proposed measures for Waterval East and Waterval West. Existing storm water management measures were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.[1]
Waterval East and Waterval West: Supply of water for domestic- and processing purposes: Abstraction from boreholes and underground.	Not applicable	-	These activities were included in the approved EMPr, dated 2009, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West: Pumping of borehole water (via pipelines) from abstraction points to clean water storage facilities.	Linear activity. Refer to Figure 7 for aerial view of pipelines on the mine.	-	
Waterval East			

[1] Any new storm water management measures, as per Annexure H11 (storm water management plan), that trigger listed activities (if any) in terms of the EIA Regulations, dated 2014, will be applied for as part of an Environmental Authorisation Application prior to construction thereof.

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Operation and maintenance of clean water storage facilities.	-	-	These activities were included in the approved EMPr, dated 2009, and the approved EMPr, dated 2011, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine. The Waterval Mine has further been issued with a Water Use Licence (Licence No.: 03/A22H/ABFGJ/2749).
Waterval West			
Operation and maintenance of clean water storage facilities:	-	-	These activities were included in the approved EMPr, dated 2009, and the approved EMPr, dated 2011, and are therefore considered to form part of the existing environmental authorisation for Waterval Mine. The Waterval Mine has further been issued with a Water Use Licence (Licence No.: 03/A22H/ABFGJ/2749).
Waterval East and Waterval West: Use of borehole water: Plant processing activities, At septic tanks, and A change houses (ablution block), offices and workshops.	Not applicable	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.
Waterval East and Waterval West: Dust suppression activity on roads			
Waterval East and Waterval West: Operation and maintenance of septic tanks			
Waterval East and Waterval West: Maintenance activities: Workshop area	Waterval East workshop, maintenance and waste management areas: ± 2.07 Ha Waterval West workshop,	-	
Waterval East and Waterval West: Possible on-site maintenance activities: Mining area			
Waterval East and Waterval West: Washing of vehicles			

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Waterval East and Waterval West: Storage, offloading and refuelling of hazardous substances (e.g. hydrocarbons (diesel and oil); chemicals etc.)	maintenance and waste management areas: ± 2.95 Ha		
Waterval East and Waterval West: Waste management activities on the mine, including: • The operation of the Salvage Yard; • Storage, handling, removal and disposal of general waste; • Storage, handling, removal and disposal of hazardous waste and old oil; • Storage, handling, removal and disposal of medical waste; and • Waste re-use and recycling activities.			These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation and waste management licence for Waterval Mine. Furthermore, Waterval Mine has a waste management licence (dated September 2013) (Ref: 12/9/11/L726/7) in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (Government Notice (GN) 718, dated July 20092), for the following waste management activities: Category A (1); (2) and (19).
Waterval East and Waterval West: Use and maintenance of: • Security entrance; • Weighbridge; • Office(s); and • Change houses (ablution block).	Waterval East offices and change house areas: ± 1.08 Ha Waterval West offices and change house areas: ± 1.97 Ha	-	These activities were included in the approved EMPr, dated 2009 and are therefore considered to form part of the existing environmental authorisation for Waterval Mine.

[2] The list of Waste Management Activities that have, or are likely to have, a detrimental effect on the environment published under Government Notice (GN) 718, dated July 2009, in terms of section 19(2) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), has since been amended as part of GN 921, dated November 2013 and GN 633, dated July 2015. Category A(1), A(2) and A(3) are now regarded as Category C activities (for compliance with certain norms and standards, where relevant).

Transitional Provision No. 5 of GN 921 states that "*A person who lawfully conducted a waste management activity that is no longer listed in Category A or B, but listed in Category C of this Schedule, on the date of coming into effect of this Notice, may continue with the waste management activity for the duration stipulated in the permit or waste management licence until the expiry date of the permit or waste management licence whereafter such a person must comply with the requirements or standards for that waste management activity.*"

As per condition 13.11 of the waste management licence, the licence is valid for a period of 10 years (i.e. up until January 2023).

NAME OF ACTIVITY	ARIAL EXTENT OF ACTIVITY Ha or m²	LISTED ACTIVITY (mark with X)	APPLICABLE LISTING NOTICE (GNR 544, GNR 545 or GNR 546)/NOT LISTED
Waterval East and Waterval West: Operation and maintenance of explosives magazine	Waterval East explosive depot: ± 0.08 Ha Waterval West explosive depot: ± 0.39 Ha	-	
Waterval East and Waterval West: Use and / or maintenance of transformers.	Not Applicable	-	
Rehabilitation activities during the Decommissioning Phase, including: • Removal / demolition of mine infrastructure; • Sloping and levelling of all previously disturbed areas to sustainable free-draining land forms; • Topsoil placement (where applicable); • Re-vegetation; and Shaping, capping and vegetating of TSFs.	Refer to area extent for activities above.	-	Rehabilitation and Closure-related activities were included in the approved EMPr, dated 2009. However, Waterval Mine has a remaining Life of Mine in excess of 30 years. Any additional necessary authorisations for decommissioning and rehabilitation activities, will be applied for in future, where required.
Mine Closure		-	

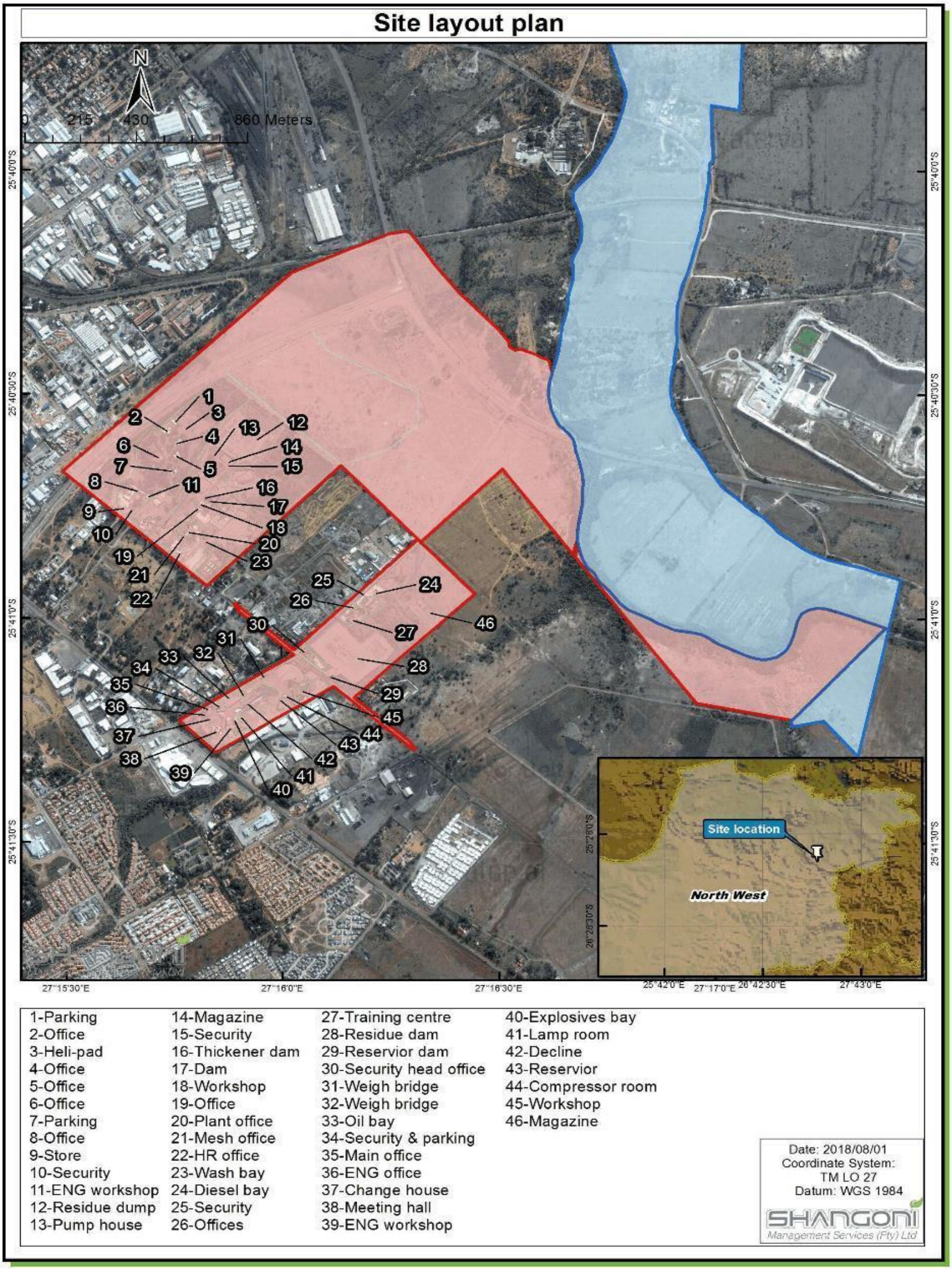

Figure 7: Current Waterval Mine site layout plan (Shangoni, 2021)

4.1.2 Listed and specified activities associated with the proposed EMPr amendment

The listed activities associated with the proposed EMPr amendment to include the UG1 opencast project is shown in Table 10. The site layout plan is shown in Figure 18.

Table 10: Listed activities triggered by the UG1 opencast project

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
The development of- *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs-* *(a) within a watercourse* *(c) within 32 metres of a watercourse, measures from the edge of a watercourse* • The following infrastructure will be situated within or within 32m of a delineated wetland or artificial wetland: ○ Opencast area ○ Overburden stockpile ○ Pollution water trench ○ Pollution water pipeline ○ Haul road ○ Internal roads ○ Berm ○ Fence ○ Topsoil stockpile	~14 ha ~10 ha ~750 m ~1 300 m ~3 000 m ~2 000 m ~1 500m ~3 800m ~1,5 ha	Activity 12	GN R. 327	-
The infilling or depositing of any material of more than 10m³ into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10m³ from a watercourse • The following infrastructure will be situated within a delineated artificial wetland: ○ Opencast area ○ Pollution water trench ○ Pollution water pipeline ○ Haul road ○ Internal roads ○ Topsoil stockpile	~14 ha ~750 m ~1 300 m ~3 000 m ~2 000 m ~1,5 ha	Activity 19	GN R. 327	-
Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the	17,1988 ha	Activity 21D	GN R. 327	-

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
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 amendment. Inclusion of PR 2060 into Glencore's mining right area requires a Section 102 amendment of a mining right in terms of the MPRDA.				
The development of a road – *(ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres* • Haul road • Internal access roads	~3 000 m ~2 000 m	Activity 24	GN R. 327	-
The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, • The following Section 21(g) water uses will be applied for: o Pollution control dam o Overburden stockpiles o Run of mine/muck stockpile o Backfilling with overburden material	1,5 ha 10 ha ~1ha ~14 ha	Activity 6	GN R. 325	-
The clearance of an area of 20 ha or more of indigenous vegetation, • Clearance of vegetation for the construction of: o Opencast area o Overburden stockpile o Run of Mine stockpile o Pollution water trench o Pollution water pipeline o Pollution Control Dam o Haul road o Internal roads o Berm o Fence o Parking Area o Topsoil stockpile	~45 ha	Activity 15	GN R. 325	-

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
○ Changehouse and offices				
Any activity including the operation of that activity which requires a mining right in terms of section 22 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity as contained in this Listing Notice, in Listing Notice 1 of 2014 or Listing Notice 3 of 2014, required to exercise the mining right • Development of an opencast mine	~14 ha	Activity 17	GN R. 325	-
The development of a road wider than 4 meters with a reserve of less than 13.5m • Haul road • Internal access roads	 ~3 000 m ~2 000 m	Activity 4	GN R. 324	-
The clearance of an area of more than 300m² or more of indigenous vegetation • Clearance of vegetation for the construction of: ○ Opencast area ○ Overburden stockpile ○ Run of Mine stockpile ○ Pollution water trench ○ Pollution water pipeline ○ Pollution Control Dam ○ Haul road ○ Internal roads ○ Berm ○ Fence ○ Parking Area ○ Topsoil stockpile ○ Changehouse and offices • Some of these areas cleared of vegetation will falls within a CBA as per the North West Biodiversity Sector Plan	~45 ha	Activity 12	GN 324	-
The development of- *(ii) infrastructure or structures with a physical footprint of 10 square meters or more* *where such development occurs* *(a) within a watercourse* *(c) within 32 metres of a watercourse, measured from the edge of watercourse*		Activity 14	GN 324	

Name of activity	Aerial extent of the activity	Listed activity	Applicable listing notice	Waste management authorisation
• The following infrastructure will be situated within a delineated artificial wetland: ○ Opencast area ○ Pollution water trench ○ Pollution water pipeline ○ Haul road ○ Internal roads ○ Topsoil stockpile	~14 ha ~750 m ~1 300 m ~3 000 m ~2 000 m ~1,5 ha			
The disposal of any quantity of hazardous waste to land • Overburden stockpile • ROM/muck stockpile	10 ha ~1 ha			Category B Activity 7
Construction of a facility for a waste management activity listed under Category B of this Schedule (not in isolation to associated waste management activity) • Overburden stockpile • ROM/muck stockpile	10 ha ~1 ha	-	-	Category B Activity 10
The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA • Overburden stockpile • ROM/muck stockpile	10 ha ~1 ha	-	-	Category B Activity 11

4.2 Description of the activities undertaken (as per 2021 Consolidated EIA/EMPr, Shangoni, 2021)

The following section describes the **existing facilities/activities** at Waterval Mine which were included in the approved 2021 Consolidated EMPr.

4.2.1 Minerals mined

The minerals mined at Waterval Mine are listed in Table 11. The primary mineral mined is chromite (with general formula $(Mg, Fe^{2+})(Cr, Al, Fe^{3+})_2 O_4$).

The mineral deposit is developed to the east of the town Rustenburg with the ore body that dips towards the north and strikes east-west. The main target for the mining at Waterval Mine is the LG6 Chromitite Package. The package consists of the LG6A Chromitite Layer which is separated from the LG6 Chromitite Layer by the LG6 Pyroxenite Middling.

Table 11: Minerals mined (source: Amended Mining Works Programme, dated January 2012) (Shangoni, 2021)

Mineral	Primary/ Associated	Formula	Description	Definition as per MPRDA
Chromite	Primary	General formula; $(Mg,Fe^{2+})(Cr,Al,Fe^{3})_2O_4$	Mineral is developed in Upper, Middle-and Lower Group Chromitite Layers in the Critical Zone of the Bushveld Complex.	Code: Cr Commodity: Chrome Ore Type_Code: B Type_Description: Ferrous and base metals
Platinum Group Minerals	Associated	Includes the formula of all ore minerals bearing platinum group minerals (Pt, Pd, Os, Ir, Ru & Rh)	All ore minerals bearing Platinum, Palladium, Osmium, Iridium, Rhodium & Ruthenium) Metals are developed in the various layers of the Bushveld Complex.	Code: PGM Commodity: Platinum Group Metals Type_Code: PGM Type_Description: Platinum Group Minerals
Copper Ore Minerals	Associated	Includes the formula of all ore minerals bearing copper (Cu)	All ore minerals bearing copper (Cu).	Code: Cu Commodity: Copper Ore Type_Code: B Type_Description: Ferrous and base metals
Gold Ore Minerals	Associated	Includes the formula of all ore minerals bearing gold (Au)	All ore mineral bearing gold (Au)	Code: Au Commodity: Gold Ore Type_Code: GS Type_Description: Gemstones (except diamonds)
Nickel Ore Minerals	Associated	Includes the formula of all ore minerals bearing nickel (Ni)	All ore mineral bearing nickel (Ni)	Code: Ni Commodity: Nickel Ore Type_Code: B Type_Description: Ferrous and base metals
Lead Ore Minerals	Associated	Includes the formula of all ore minerals bearing lead (Pb)	All ore mineral bearing lead (Pb)	Code: Au Commodity: Lead Type_Code: B Type_Description: Ferrous and base metals

[5]The Mining Works Programme is available from the mine upon request

4.2.2 Description of the main mining activities and processes

The descriptions of the current activities at Waterval Mine are detailed in Table 9 and illustrated on Figure 7. Waterval Mine is divided into a Waterval East and a Waterval West section. Refer to Figure 8.

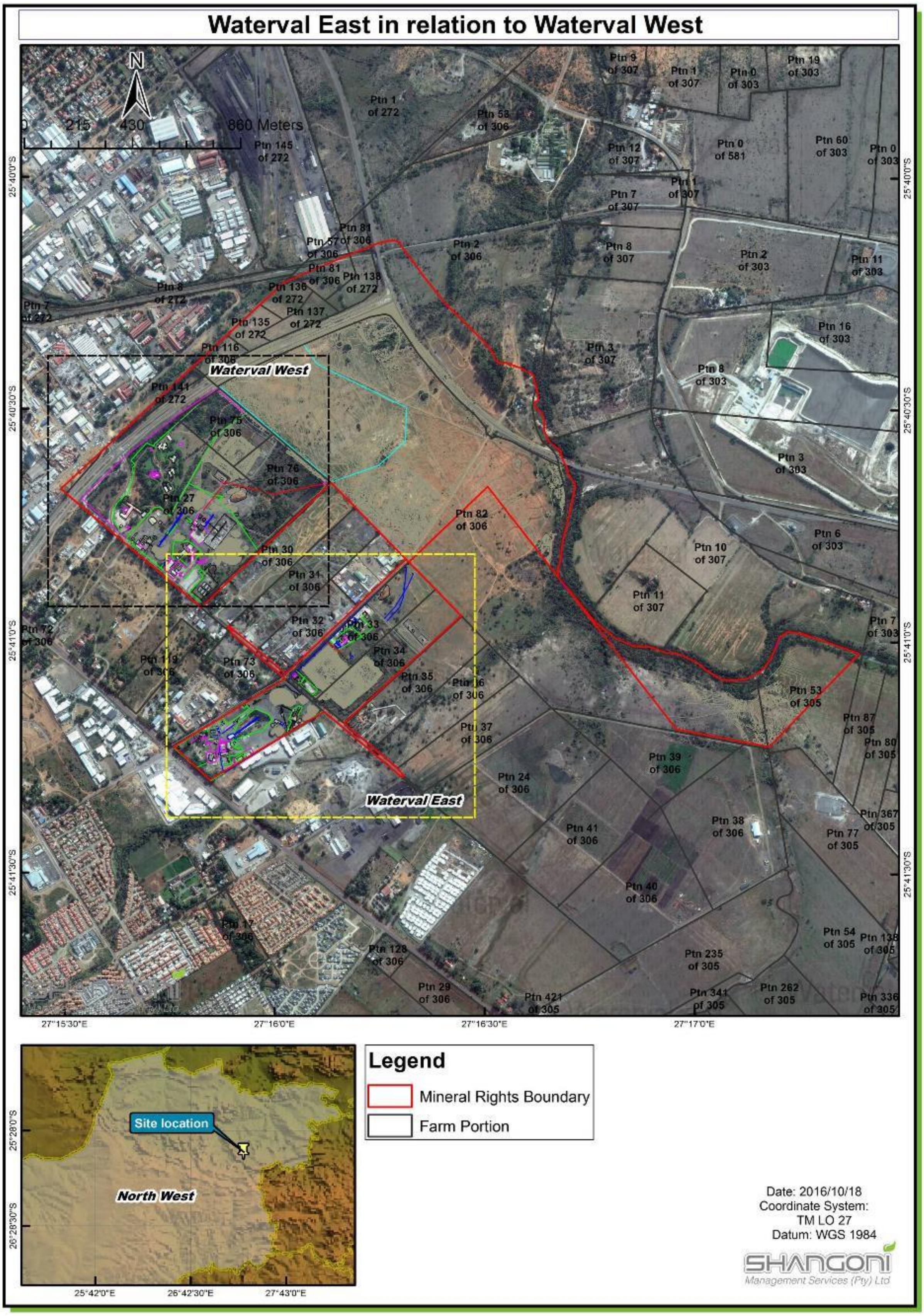

Figure 8: Waterval East and Waterval West Sections (Shangoni, 2021)

4.2.2.1 Current infrastructure and activities

Current infrastructure and activities at Waterval Mine include:

Current and proposed (authorised) Waterval Mine infrastructure, areas and activities:

- Underground mining and associated activities including the following:[3]
  - Marking, drilling and blasting of holes;
  - Provision of support (underground);
  - Engineering activities (underground);
  - Shafts and Ventilation Shafts
- Buildings and parking areas;
- Beneficiation plants;
- Conveyor systems;
- Topsoil stockpiles;
- Security buildings;
- Workshops;
- Change houses;
- Explosives magazine areas;
- Training Centre;
- Medical Centre;
- Compressor house;
- Salvage Yard;
- Sub-stations and transformers;
- Roads;
- Powerlines;
- Telephone lines;
- Weighbridge;
- Monitoring boreholes;
- Water metres;
- Fences;
- Diesel storage tanks and refuelling areas;
- Water and minewaste management infrastructure and facilities, including:
  - Silt traps, sumps and trenches;
  - Storage of water pumped from borehole(s) used for irrigation at Waterval East;
  - Other potable water tanks / dams;
  - East Storage dam ESD1;
  - East Storage dam ESD2;
  - New Earth / Return Water Dam ESD3;
  - Main Supply dam ESD4;
  - Water Supply Dam ESD9;
  - Cement Dam ESD5;
  - West Earth Dam WSD1;
  - West Earth Dam WSD2;
  - Penstock Overflow WSD3;
  - West Erickson dam WCD6;
  - East Slimes dam ESD7;

[3] There is currently no underground mining taking place at Waterval Mine. Both Waterval East and Waterval West shafts are under care and maintenance.

- West Slimes dam WSD7;
    - West Waste Rock Dump;
    - East stockpiles (Run of Mine (ROM));
    - West stockpiles (ROM);
    - West stockpile (product);
    - Waterval new Tailings Storage Facility (yet to commence);
    - New storm water dam;
    - New Return Water Dam;
    - West Septic tank WST1; and
    - West Septic tank WST2.
- Water supply networks;
- Process / return water pipelines;
- Pumps;
- Tailings pipelines;
- Use of water from underground (dewatering) for processing and irrigation (licenced i.t.o NWA, Act No. 36 of 1998) as well as for safety purposes; and
- Discharging of water dewatered from underground workings into the Hex River through a pipe (licenced i.t.o NWA, 1998).

Table 12: Photographs showing some of the infrastructure and facilities at Waterval Mine (Shangoni, 2021)

Waterval East	
 **Rondawel Dam**	 **Workshop areas**
 **Flammable substance storage**	 **Plant and conveyor system**

Waterval East	
 **Decline entrance for chairlifts**	 **Above-ground diesel storage and refuelling area**
 **General and waste storage areas**	 **Oil skimming bay**
 **Ventilation shaft**	 **Waste skips**
 **Water management infrastructure at plant**	 **Potable water tank**

Waterval East	
 **Entrance to Salvage Yard**	 **Plant and conveyor system**
 **Hazardous substance storage areas (e.g. Paint store)**	 **Transformer**

4.2.2.2 Mining Method

The mining method currently authorised at the Glencore Waterval Mine is room and pillar underground mining. Room and pillar is a mining system in which the mined material is extracted across a horizontal plane, creating horizontal arrays of rooms and pillars. However, the Waterval East and Waterval West shafts are currently under care and maintenance, therefore no underground mining is currently taking place.

Pillars of 6m wide by 12m long are spaced at 16m centres on dip and strike. Typical extraction ratios of 73% are being achieved.

Glencore Waterval Mine has also applied for the mining of Platinum Group Metals (PGMs), for which the mining rights were granted. Refer to Table 4. Traditional chrome mining as is currently done, will continue. The mine is already operational and Glencore Waterval Mine will be removing its own tailings from the TSF footprint (as well as the underflow from the current chrome processing plant) and process it again for minerals other than chrome (PGM's and associated minerals). The waste currently emanating from the chrome plant will also be redirected to the new PGM flotation section for further processing. The resulting slimes from the PGM plant will then be deposited onto a temporary TSF and once the current footprint is processed, it will be lined, and the tailings will be pumped to the "new" TSF that will lie on the current TSF footprint.

4.2.2.3 Ore processing

There are two main plants in the Waterval Mining Complex - Waterval West plant and Waterval East plant. All ore is transported to the Waterval plants for main crushing and washing.

When in operation, run of mine is received from the underground workings at -400mm in size averaging 28%Cr_2O_3 and 20%SiO_2. The ore is crushed by using a jaw crusher and reduced to a -90mm material. The crushed ore is processed in the screening plant whereby it is classified into different size fractions. The ore is then classified into the following size fractions:

- 90mm +17.5mm Lumpy ore;
- 17.5mm +0.85mm Chips ore; and
- 0.85mm Fines ore.

Lumpy ore is upgraded via a Drum Separator to a Lumpy saleable product of 39% Cr_2O_3 and 8.5% SiO_2.

The chips product is upgraded via a Dense Medium Cyclone to a -17.5mm +0.85mm chips product. This product is screened into 2 fraction sizes, namely the+10mm at 38% $Cr_2)_3$ and 9% SiO_2 and -10mm at 37% Cr_2O_3 and 10% SiO_2.

Fines are upgraded in the Spiral plant using a gravity separation method into three saleable products, namely:

- Metallurgical grade of 43.5% Cr_2O_3 and 3.5% SiO_2;
- Chemical grade of 46.0% Cr_2O_3 and 1% SiO_2; and
- Foundry grade of 46.0% Cr_2O_3 and 1% SiO_2.

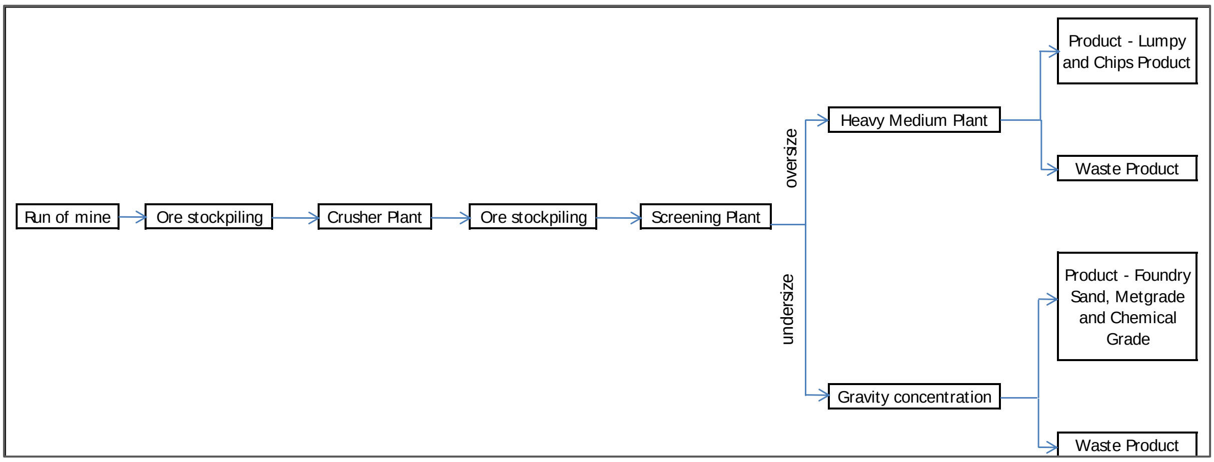

Figure 9: Waterval plant schematic diagram (Waterval MWP) (Shangoni, 2021)

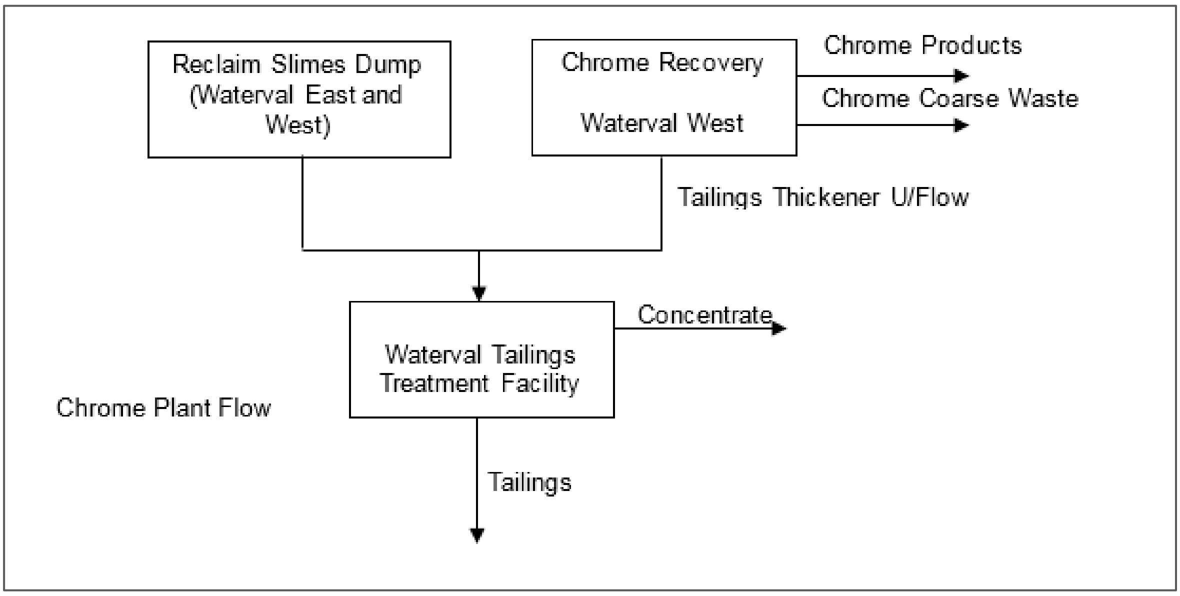

Figure 10: PGM Plant flow (Waterval MWP) (Shangoni, 2021)

The proposed PGM plant project plans to collect the tailings underflow, which was previously deposited on the tailings dam, and to treat it before it is passed through a flotation cell. A platinum flotation plant, tailings facility, pipelines and storm water management infrastructure will be established on the same footprint as the current Waterval Chrome plant. The reclamation and excavation of the old and current tailings facility will be done first. This involves pushing the top tailings from the top down to the loading area to form a slope. The stability of the dump renders it unsafe to load it from the bottom as the tailings easily form a high wall which can cave in onto the loader. The material is then screened to remove all foreign, metallic and oversize particles. It is then hauled with a dumper truck to a plant stockpile area. Only in-mine roads will be used. The tailings are then dumped in a feeder bin and conveyed into the plant.

Pipes, pumps and valves will be constructed to ensure all underflow water from the current chrome facility is pumped to the PGM plant when needed.

The plant feed will consist of two types of material, namely:

- Current material arising from the Waterval chrome plant (Approximate feed rate: 19 $t.hr^{-1}$); and
- Slimes dump material from the Waterval tailings dams (Approximate feed rate: $11t.hr^{-1}$).

Both of types of material have an approximate PGM grade of $4\text{-}7g.t^{-1}$. The slimes material is oxidized to some degree and this does hamper flotation. This material will need some form of milling and attritioning to polish the surfaces so that the material can be susceptible to floatation. High Energy flotation cells will be used (with absorbed power at 4-5 kW/m^3 based on the normal running live cell volume). From Tailing Technology experience gained on similar applications, high energy is needed to float finer material, such as that of the Waterval tailings.

Milling

The objective of any milling for this type of application is not to grind the material finer but to just attrition-grind and polish the surfaces of the particles so that the reagents may act and enhance the recovery of material by flotation. From the test work done it can be seen that a large fraction of the PGM's (84.8% and 78.5% in slimes dam and thickener underflow respectively) is in the -75um size fraction. Thus, further size reduction is not necessary, but only attritioning will be of an advantage for the flotation of the oxidised slimes dam material. From experience on a similar application, the ball mill is capable of achieving this, and operability is easier than that of a SMD.

Slimes dump material is fed from the re-mining section at an SG of 1.4-1.6 $t.m^{-1}$ at a federate of 11t/hr to the Feed Tank 1. Feed is then pumped at constant rate to the 250kW ball mill.

Flotation

The primary flotation circuit will receive its feed from the 20m3 holding tank. The feed will be presented at a slurry density of 1.3 to 1.5 $t.m^{-3}$, dry solids feedrate of $30t.h^{-1}$, and volumetric flowrate of between $46m3.h^{-1}$ and $74m3.h^{-1}$.

The primary flotation bank will comprise of 6 x $15m^3$ (6 off) forced-draught, tank-type flotation cells arranged in series on individual steps. An inter-cell step height of 800mm will be accommodated in the design. This cell combination will provide an effective flotation volume of can 90m3 equating to a residence time of 44 minutes, including a 20% allowance for froth, mechanism and aeration volumes. The anticipated rougher circuit mass pull to concentrate is 8%, based on plant feed. Cleaners and re-cleaners will comprise of 4 x $10m^3$ (4 off) and 3 x $5m^3$ (3 off) flotation cells. The flotation bank will consist of 6 roughers, 4 cleaners and 3 re-cleaners.

The slimes material has the option of being pumped to Feed tank 2 or Rougher 3. From previous experience the slime dam material has been found to yield lower recoveries than the current arising material, and treating the current arising material separately can yield higher recovery than treating both materials together. The collector is added into the Feed tank. The frother is added into the rougher feed. Depressant is added into the rougher feed. All the rougher concentrates and re-cleaner tails gravitate down to the cleaner feed sump, which is pumped to cleaner feed. The cleaner concentrates gravitate to the recleaner feed and cleaner tails are pumped to the feed tank. As an optional measure, the cleaner tails can also be pumped to rougher tails if the grade is low enough, thus decreasing circulating loads of slow-floating material. The rougher tails are pumped to the tailings dam.

The re-cleaner 3 can also be converted to a Re-cleaner which could be necessary to get the final concentrate to meet the following specifications: 150g/t and 3% Cr_2O_3. The final concentrate from the re-cleaner concentrator is then pumped to the thickener, and then to the filter press ready for dispatch.

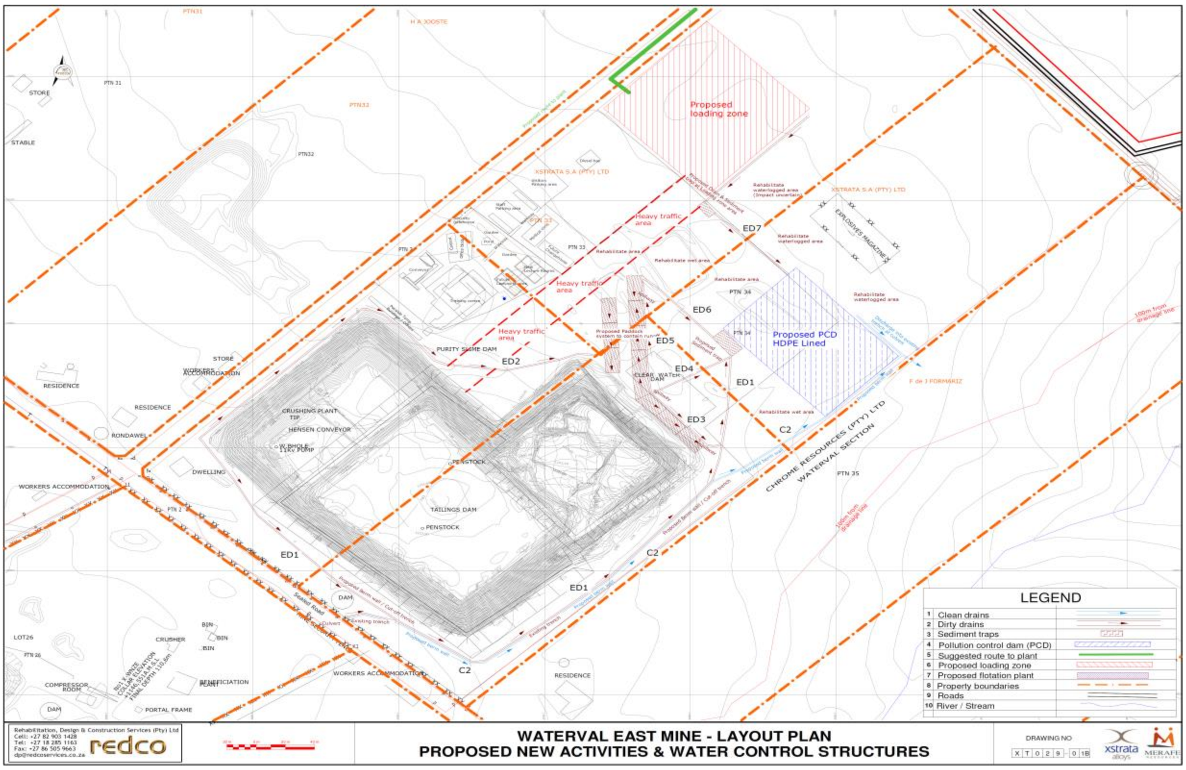

Figure 11: Surface Layout plan for Waterval East – Including PGM Project (Shangoni, 2021)

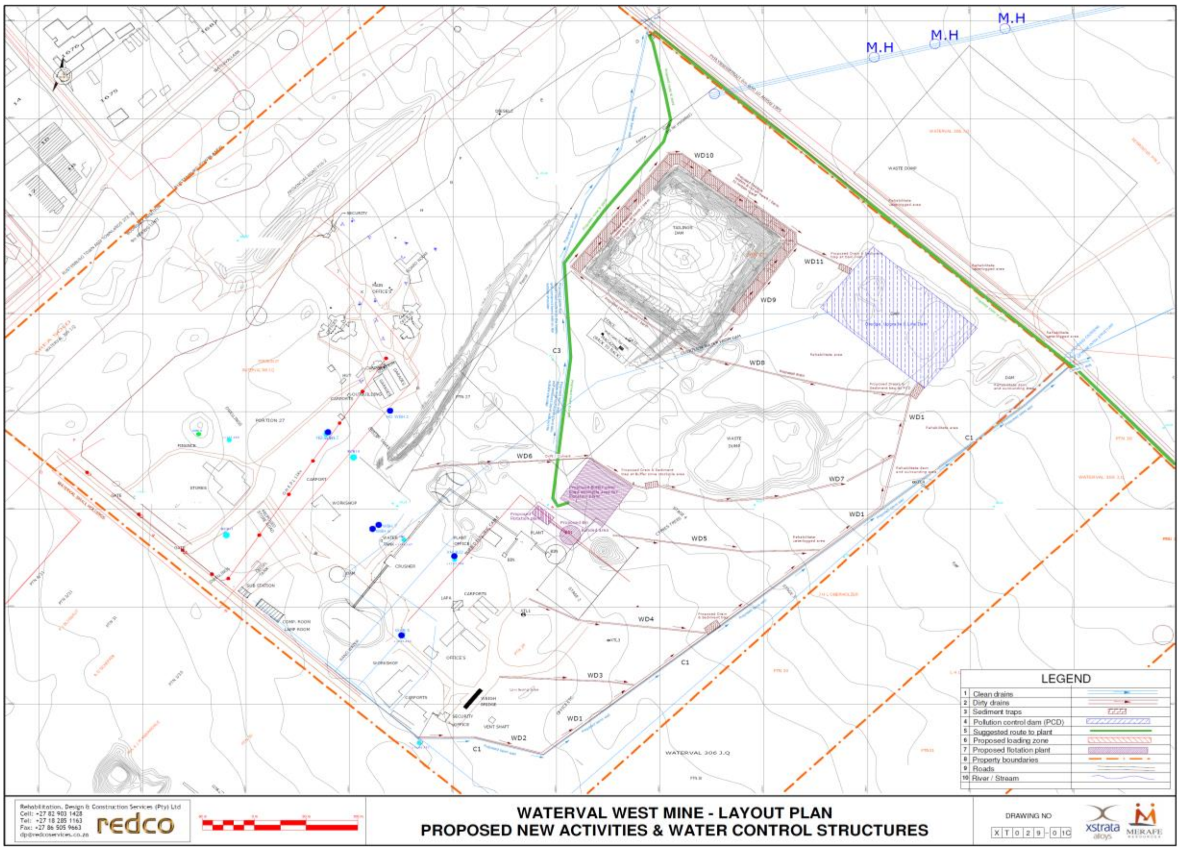

Figure 12: Surface layout plan for Waterval West – Including PGM Project (Shangoni, 2021)

4.2.2.4 Mine and plant residue

The following mine and plant residue facilities are authorised at Waterval Mine:

Mine Residue Deposit (MRD): Waterval West Waste Rock Dump

<u>Location</u>: Farm Waterval 306JQ, (Portion 27)

<u>Residue type:</u> Chrome residue

<u>All commodities produced when generating this residue:</u> Chrome concentrates for Ferrochrome and chemical uses

MRD: Waterval East Waste Rock Dump

<u>Location</u>: Farm Waterval 306JQ, (Portion 33)

<u>Residue type</u>: Chrome residue

<u>All commodities produced when generating this residue:</u> Chrome concentrates for Ferrochrome and chemical uses

MRD: Waterval West Tailings Storage Facility (also referred to as the old tailings dam)

<u>Location</u>: Farm Waterval 306JQ, (Portion 27)

<u>Size</u>: 9 ha

<u>Residue type:</u> Chrome tailings

<u>All commodities produced when generating this residue:</u> Chrome concentrates for Ferrochrome and chemical uses

MRD: Waterval East Tailings Storage Facility (also referred to as the old tailings dam)

Status: Not currently in use

Location: Farm Waterval 306JQ, (Portion 33)

Size: 4 ha

Residue type: Chrome tailings

All commodities produced when generating this residue: Chrome concentrates for Ferrochrome and chemical uses

Method of residue delivery: Cyclone

Average monthly delivery to Residue deposit: Previously 10 000 tonnes / month

Design Life: 2 years remaining

4.2.2.5 Transport and conveyance

General

The Rustenburg / Pretoria tarred provincial road (N4) bypasses the mine 0.5km to the south. An un-tarred road from the R104 (that lead from the N4) is used to access the mine.

There are no railway lines on the mine site, nor does the mine use railways to transport ore. Employees are responsible for their own transport to the site.

Mineral transport on site

Ore is authorised to be transported on-site from the underground workings (via conveyors) to the processing plants. From the processing plants / mining areas, waste rock is transported to the waste rock dumps via conveyor and tailings to the TSF via pipeline. The Waterval East and Waterval West shafts are currently on care and maintenance and therefore material is currently not transported from underground to the processing plants.

Mineral transport off-site

Ore is transported to the smelter(s) (off-site) via road transport (truck).

4.2.2.6 Water Management

Waterval Mine has an existing Water Use Licence (WUL) (Licence Number 03/A22H/ABFGJ/2749), issued by the Department of Water and Sanitation on 11 January 2015.

Water supply and use

All potable water is obtained from the Rand Water Board. Water used in the processing plants is mainly water that is recycled from the return water dam, as well as small quantities from underground dewatering activities. The water in the plants is recycled and utilised in a closed water system.

Table 13: Section 21(a) licenced water use activities (WUL, 2015) (Shangoni, 2021)

Description	Source	Properties	Coordinates	Volume
Water is pumped from underground workings in the mine and used in the processing plant	Underground dewatering	Portion 33 of the farm Waterval 306 JQ.	25°40'44.09" S 27°16'12.08" E	480 000 m^3/a
Abstraction of groundwater used as	Borehole WBH1	Portion 27 of the farm Waterval 306 JQ	25°40'36.05" S 27°16'04.01" E	32 602 m^3/a

Description	Source	Properties	Coordinates	Volume
make-up water for the plant				
Abstraction of groundwater used as emergency make up water for the plant	Borehole WBH3	Portion 27 of the farm Waterval 306 JQ	25°40'33.08" S 27°15'36.04" E	32 602 m^3/a
Abstraction of groundwater used for irrigation of gardens at Head Office	Borehole WBH9	Portion 27 of the farm Waterval 306 JQ	25°40'35.05" S 27°15'45.02" E	51 m^3/a
Abstraction of groundwater used for irrigation of gardens at Head Office	Borehole WBH10	Portion 27 of the farm Waterval 306 JQ	25°40'35.05" S 27°15'45.02" E	51 m^3/a
Abstraction of groundwater used for irrigation of gardens at Head Office	Borehole WBH4	Portion 27 of the farm Waterval 306 JQ	25°40'44.09" S 27°15'47.06" E	51 m^3/a
Abstraction of groundwater used for irrigation of gardens at Waterval East	Borehole EB3	Portion 26 of the farm Waterval 306J Q	25°41'13.05" S 27°15'45.07" E	64.2 m^3/a
Abstraction of groundwater used for irrigation at the Training Centre and Clinic	Borehole EB4	Portion 26 of the farm Waterval 306J Q	25°40'59.06" S 27°16'10.01" E	64.2 m^3/a

Table 14: Section 21(j) licenced dewatering activities (WUL, 2015) (Shangoni, 2021)

Description	Properties	Coordinates	Volume
Underground dewatering from underground mine workings for safety purposes.	Portion 33 of the farm Waterval 306 JQ.	25°40'44.09" S 27°16'12.08" E	1 440 000 m^3/a

Process water management facilities

Waterval Mine is authorised (as per its Water Use Licence dated 11 January 2015) to dispose a maximum quantity (in m^3/annum) into the waste and / or water management facilities, as listed in Table 15. Refer also to Figure 7 for an indication of the location of these facilities.

Table 15: Section 21(g) licenced process water management facilities (WUL, 2015) (Shangoni, 2021)

Facility	Location	Coordinates	Volume / Capacity	Description
East storage dam ESD1	Portion 34 of the farm Waterval 306 JQ	25°40'58.60" S 27°16'14.45" E	253 630 m^3/a (10 500m^3)	Disposal of storm water runoff from the tailings
East storage dam ESD2	Portion 34 of the farm Waterval 306 JQ	25°42'59.88" S 27°16'16.64" E	253 630 m^3/a (10 500m^3)	Disposal of storm water runoff from the tailings
New Earth / Return water dam ESD3	Portion 34 of the farm Waterval 306 JQ	25°41'2.13" S 27°16'14.19" E	253 630 m^3/a (10 500m^3)	Disposal of storm water runoff from the tailings

Facility	Location	Coordinates	Volume / Capacity	Description
Main Water Supply dam ESD4	Portion 34 of the farm Waterval 306 JQ	25°41’1.33” S 27°16’15.67” E	470 160 m^3/a (4 500m^3)	Disposal of underground water into the main water supply dam ESD4 to the Waterval East plant for use in the process
Water Supply dam ESD9	Portion 33 of the farm Waterval 306 JQ	25°41’59.50” S 27°16’13.15” E	470 160 m^3/a (4 500m^3)	Disposal of underground water into the main water supply dam ESD9 to the Waterval East plant for use in the process
Cement dam ESD5	Portion 26 of the farm Waterval 306 JQ	25°44’4.57” S 27°16’4.32” E	299 620 m^3/a (3180 m^3)	Disposal of water pumped from underground into plant feed water Cement dam ESD5. Used in the processing plant
West Earth Dam WSD1	Portion 27 of the farm Waterval 306 JQ	25°40’40.02” S 27°16’5.22” E	115 147 m^3/a (14 737 m^3)	Disposal of storm water from Waterval West
West Earth Dam WSD2	Portion 27 of the farm Waterval 306 JQ	25°41’4.57” S 27°16’4.32” E	115 147 m^3/a (14 737 m^3)	Disposal of storm water from Waterval West
Penstock Overflow WSD3	Portion 27 of the farm Waterval 306 JQ	25°41’4.57” S 27°16’4.32” E	77 989 m^3/a (9 375 m^3)	Overflow of water from the Waterval West old tailings
West Erickson dam WCD6	Portion 27 of the farm Waterval 306 JQ	25°40’44.10” S 27°15’49.03” E	183 960 m^3/a (3 400 m^3)	Disposal of water from underground dewatering. Used in the plant for processing and also used for dust suppression on the roads.
East Slimes dam ESD7	Portion 33 of the farm Waterval 306 JQ	25°41’07.1” S 27°16’07.4” E	463 550 m^3/a (45 328 m^3)	Disposal of slimes into East slimes dam ESD7 (old slimes dam that is no longer in use)
West Slimes dam WSD7	Portion 27 of the farm Waterval 306 JQ	25°40’35.8” S 27°15’53.8” E	180 097 m^3/a (42 464 m^3)	Disposal of slimes into West slimes dam WSD7 (old slimes dam that is no longer in use)
West Waste Rock Dump	Portion 27 of the farm Waterval 306 JQ	25°40’43.57” S 27°15’45.93” E	77 925 m^3/a	Disposal of waste rock
East stockpiles (ROM)	Holding 26 of the farm Waterval 306 JQ	25°41’07.09” S 27°16’00.67” E	608 m^3/a	Stockpiling of ROM material
West stockpiles (ROM)	Portion 27 of the farm Waterval 306 JQ	25°40’45.68” S 27°15’51.28” E	None specified in Licence	Stockpiling of ROM material
West stockpile (Product)	Portion 27 of the farm Waterval 306 JQ	25°40’48” S 27°15’50” E	None specified in Licence	Stockpiling of product
Waterval new TSF	Portion 82 of the farm Waterval 306 JQ	25°40’37.86” S 27°16’18.27” E	None specified in Licence	Disposal of tailings into planned new TSF from

Facility	Location	Coordinates	Volume / Capacity	Description
				Waterval West and East plants
New Storm water dam	Portion 82 of the farm Waterval 306 JQ	25°40’39.25” S 27°16’18.27” E	35 000 m^3/a (5000 m^3)	Disposal of dirt storm water from the TSF into a planned new storm water dam
New Return water dam	Portion 82 of the farm Waterval 306 JQ	25°40’39.25” S 27°16’18.27” E	6 250 m^3/a (1000 m^3)	Disposal of dirt storm water from TSF
Dust suppression	Portion 27 of the farm Waterval 306 JQ	25°40’46.42” S 27°15’41.95” E	53.86 m^3/a	Dust suppression on the haul roads using water taken from the West Erickson Dam
West Septic tank WST1	Portion 27 of the farm Waterval 306 JQ	25°40’48.66” S 27°15’45.29” E	182 m^3/a (7.65 m^3)	Disposal of sewage effluent from offices
West Septic tank WST2	Portion 27 of the farm Waterval 306 JQ	25°40’44.80” S 27°15’47.09” E	252 m^3/a (10.5 m^3)	Disposal of sewage effluent from offices

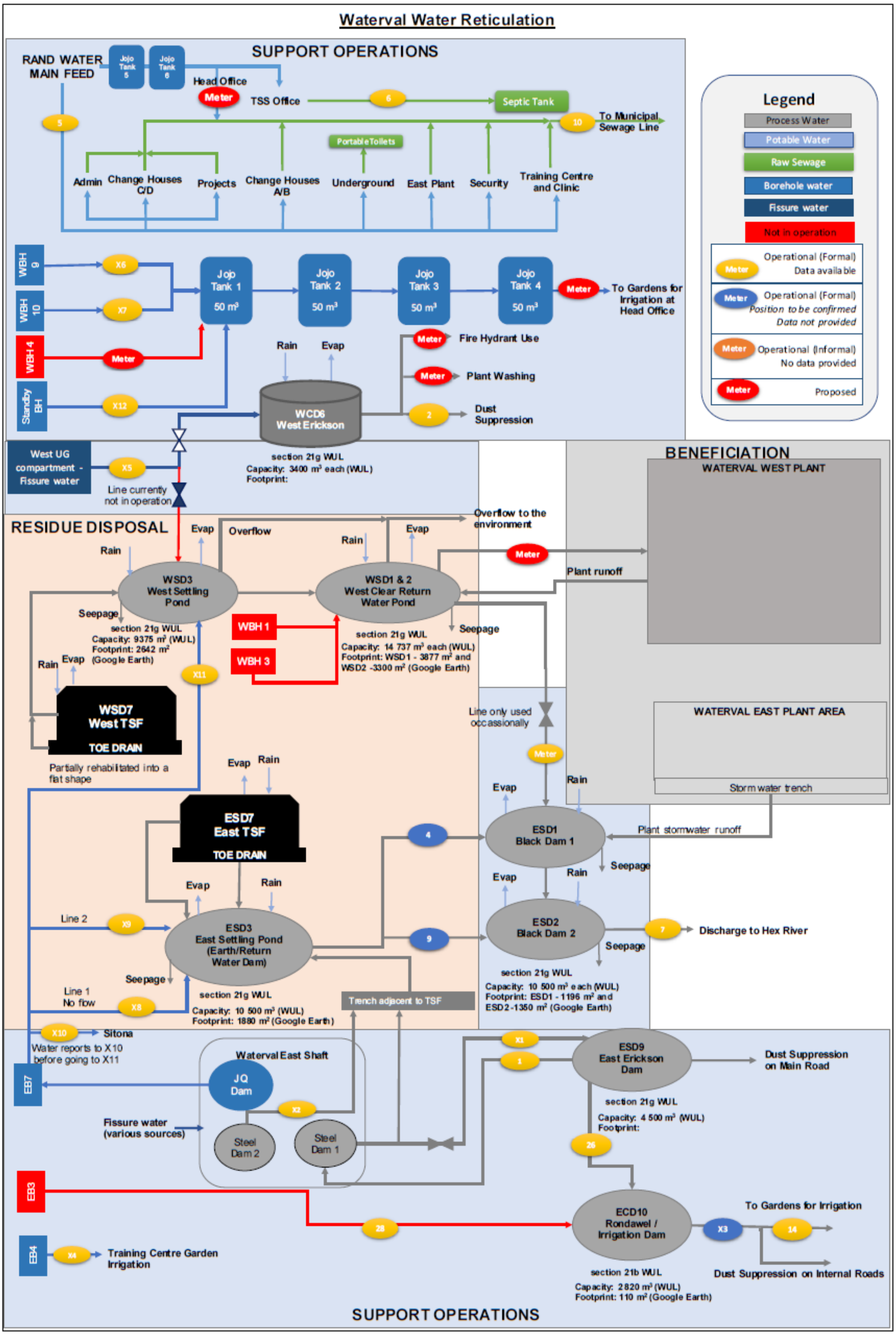

Figure 13: Waterval water flow diagram (WSP Golder, 2022)

Discharges

Waterval Mine is authorised (as per its Water Use Licence dated 11 January 2015) for the Section 21(f) water use activities listed in Table 16.

Table 16: Section 21(f) licenced water use activities (WUL, 2015) (Shangoni, 2021)

Facility	Location	Coordinates	Volume / Capacity
Discharging of water dewatered from underground workings into the Hex River through a pipe	Portion 34 of the farm Waterval 306 JQ.	25°42'68.46.6" S 27°27'37.9" E	960 000m^3/a

Storm water management

Existing Glencore Waterval Mine

Conceptual Storm Water Management Plans for Xstrata (now Glencore) Alloys – Waterval East and West operations were developed in March 2011 by Metago (Shangoni, 2021). The clean and dirty catchments delineation is indicated on Figure 14. Figure 15 and Figure 16 indicate the storm water management plans for the Waterval East and West sections respectively.

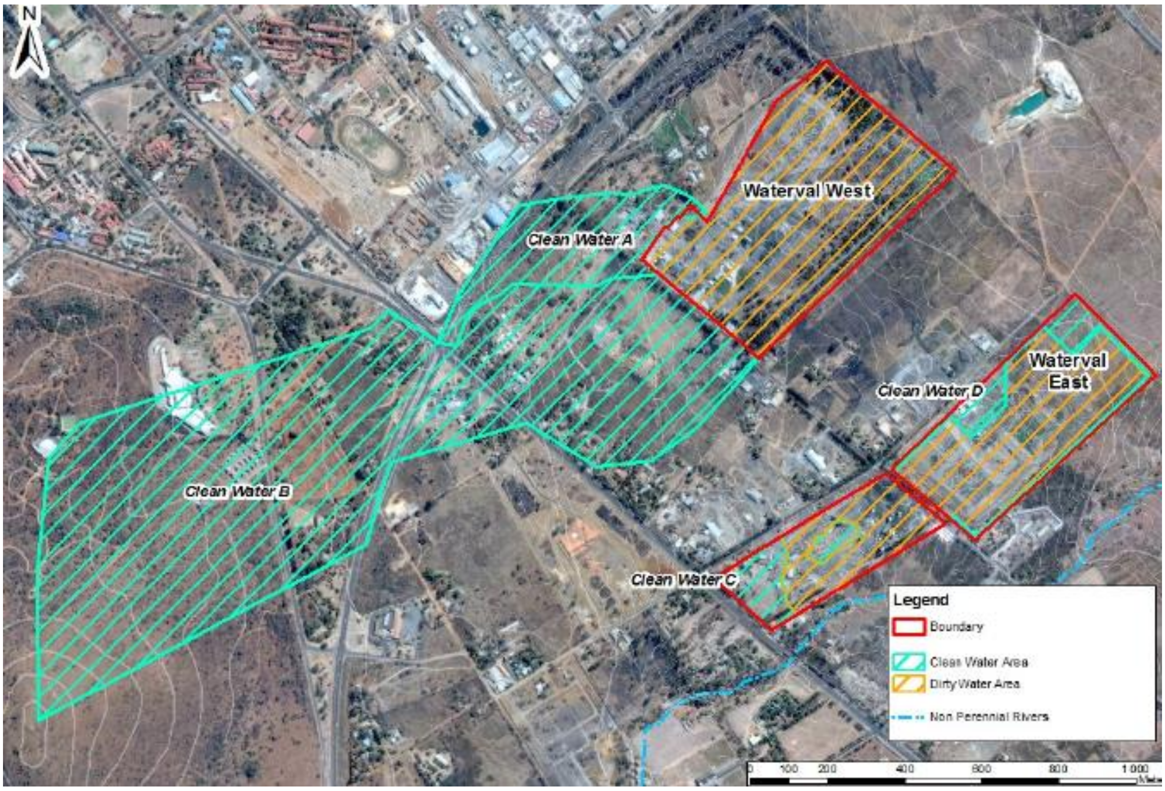

Figure 14: Clean and dirty water catchments affecting the Waterval Operation (Metago, 2011) (Shangoni, 2021)

Waterval East:

Clean and dirty water catchments:

In Figure 14 above, clean and dirty catchments have been delineated. For Waterval East it can be seen that there is no upstream contributing area which will require diversion around the mine site. There is however, two small upstream clean areas within the mine site (Clean Water C and D). These clean water areas require diversion away from the dirty areas on the mine site. The dirty catchment is limited to the remainder of the mine site and will require routing via channels/berms to a containment facility. It is important to note that the Waterval East operation is divided by a road into the eastern and western sections for the purposes of discussion in the Storm Water Management report.

Majority of the Waterval East mining area is considered to be a dirty water generating area (Figure 14). The storage/handling of fuel, lubricants and chemicals will require special attention due to their hazardous nature. These areas are therefore managed on impermeable floors, appropriate bunding and sumps. The dirty water catchment area has the following catchment characteristics and associated 1:50 year flood peak, (Table 17) as calculated using the Rational Method.

Table 17: Calculated catchment characteristics and peak flow rates for 1:50 year flood for the dirty catchment

Catchment	Area (km^2)	Drainage length (km)	Slope (m/m)	Time of Concentration (minutes)	Peak flow rate (m^3/s)
Western Dirty Area	0.07	0.18	0.02	23	1.1
Eastern Dirty Area	0.16	0.3	0.02	31	2.6

Storm water management infrastructure:

Storm water management infrastructure has been designed as per the requirements of GN 704, dated 1999. The dirty water containment facilities presented in the figure have been indicatively sized and positioned and do not represent final design.

Dirty water generated on the western area will be routed to an appropriately sized sand trap. The purpose of this will be to contain the first flush of storm water, assumed to be high in sediment. During flood events, water will flow from the silt trap into an appropriately sized storm water culvert (under the road); into the eastern side of the mining operations and routed to the dirty water containment facility.

Clean water diversions:

The Storm Water Management Plan includes two upstream clean water diversions (Clean Water C and D) that consist of both a berm and channel components (compacted earth-fill). Clean water diversion berms are designed to divert upstream clean water around dirty water generating areas (i.e. intercepting clean water runoff and diverting this water around mining activities). These have been sized to cater for the 1:50 year flood event and will serve two main purposes:

- The channel section will divert upstream clean water which would otherwise flow into the identified dirty areas.
- The berm section will ensure containment of dirty water in dirty areas.

It should be noted that in Figure 15, there is an additional clean water diversion which is planned to run along the eastern side of the dividing road. This is merely to ensure that any runoff generated on the road does not enter the dirty water management system of the mine, but is rather diverted around the property.

Dirty water containment (berms and channels):

As per the clean water diversions, dirty water containment systems have been designed to ensure dirty water generated on the site is contained. These systems will also consist of a berm and channel component. Unlike the earthen clean water diversions, these channels will be lined with concrete and soil-crete (filled in cells). The berm component to this design has not been indicated in this design but will be constructed from the earthen material excavated from the channel and located on the clean catchment side of the channel. The berm and channel component have been designed to accommodate the 1:50 year flood and serve two main purposes:

- Diverting upstream clean water which would otherwise flow into the identified dirty areas.

- Contain dirty water in the identified dirty areas and direct towards the appropriate dirty water containment facility.

Dirty water containment (containment facility):

Regulation 6 of GN 704, deals with the capacity requirements of clean and dirty water systems, and states that clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated such that these clean and dirty water systems do not spill into each other as a result of storm events below and including the 1 in 50-year event. A minimum freeboard of 0.8 m above full supply level must also be maintained as per the requirements of GN 704. Water accumulated in this containment facility during the wet season should be used as a priority in the process water circuit to ensure the capacity requirements are not compromised during periods of heavy/extended rainfall.

In this project, the capacity of the dirty water containment facility was calculated based on the summation of the 1:50 year design rainfall (24 hour) event for the catchment area and the highest monthly rainfall (January) falling over the catchment, less the corresponding monthly evaporation (January) taking place over the surface area of the proposed containment facility. Runoff coefficients used were determined according to the return period of interest, such that maximum monthly rainfall event was associated with a smaller runoff coefficient than the 1:50-year design rainfall event. All dams were sized based on an average operating depth of 2 m (excluding any freeboard allowance). The addition of any process water from the mine has not been included in the sizing's of this facility. Table 18 presents the volume requirements for the dirty water containment facility.

Table 18: Dirty water containment facility volumes requirements for 1:50 year flood event (Shangoni, 2021)

Catchment	Volume (m^3)
Waterval East Dirty area	25,575

The design of the dirty water containment facility is such that there will be three interlinked components. These include concrete lined pollution and effluent dams, and a storage dam which is lined with both geo-membrane and clay. The pollution dam serves to contain the first flush of dirty water, assumed to be the dirtiest water. Water will overflow from the pollution dam into the storage and effluent dams during flood events, from where it can be pumped back for use in the process. The volume of the dirty water containment facility according to Metago's calculation (25,575m^3).

The dirty water containment facility has also been designed to include a downstream seepage containment channel which will be approximately 3 metres deep and serve to identify and contain lateral seepage losses from the containment facility.

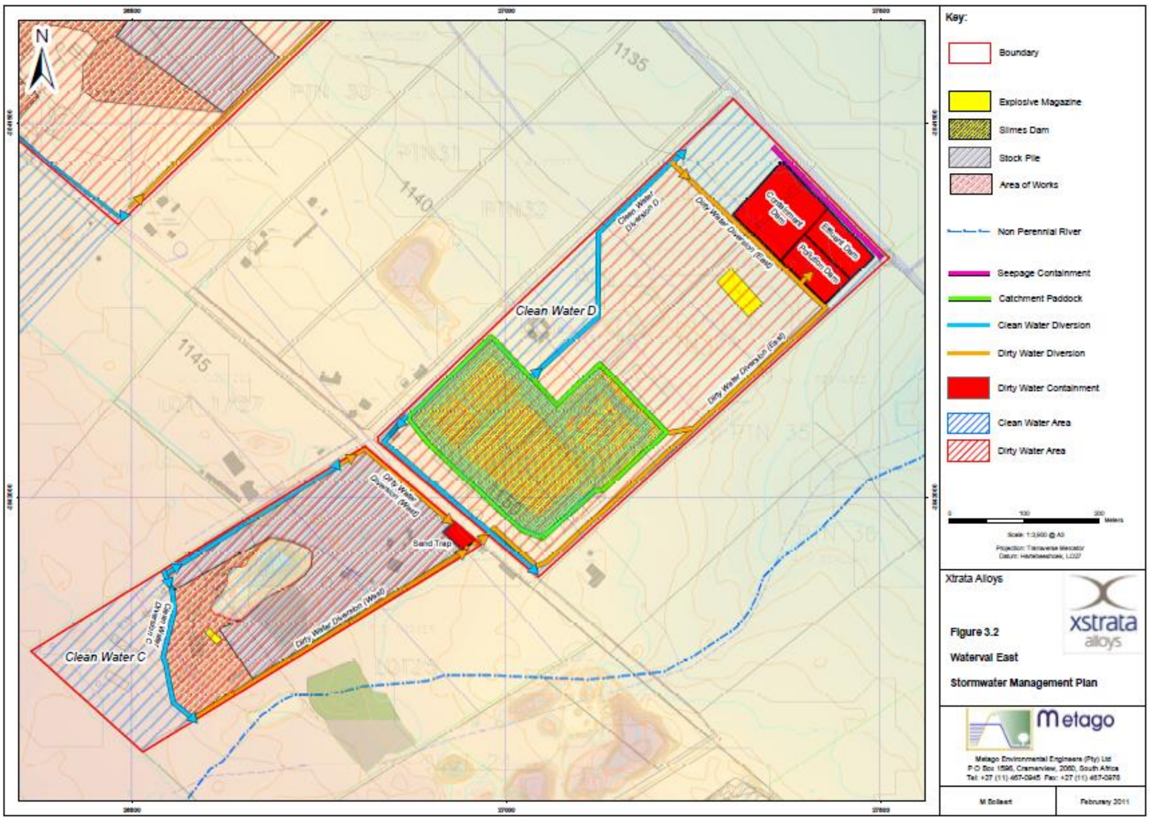

Figure 15: Waterval East Storm Water Management Plan (Metago, 2011) (Shangoni, 2021)

Waterval West:

Clean and dirty water catchments:

For Waterval West it can be seen that there is a substantial upstream clean catchment area (Clean Water A and Clean Water B) which will require diversion around the site. The dirty catchment is limited to the mine property and will require routing via channels/berms to a containment facility, all of which should be sized according to the regulations.

The entire Waterval West mining area has been considered to be a dirty water generating area. The storage/handling of fuel, lubricants and chemicals will require special attention due to their hazardous

nature. These areas are therefore managed on impermeable floors, appropriate bunding and sumps. The dirty water catchment area has the following catchment characteristics and associated 1:50 year flood peak, (**Table 19**) as calculated using the Rational Method.

Table 19: Calculated catchment characteristic and peak flow rates for 1:50 year flood for the dirty catchment (Shangoni, 2021)

Catchment	Area (km^2)	Drainage length (km)	Slope (m/m)	Time of Concentration (minutes)	Peak flow rate (m^3/s)
Dirty Area	0.29	0.5	0.02	39	3.6

Storm water management infrastructure:

Storm water management infrastructure has been designed as per the requirements of Government Notice (GN) 704, dated 1999. The dirty water containment facilities presented in the figure have been indicatively sized and positioned and do not represent final design.

Clean water diversions:

The storm water management plan includes upstream clean water diversions (clean water A and B) which consist of both a berm and channel component (compacted earth-fill). Clean water diversion berms are designed to divert upstream clean water around dirty water generating areas (i.e. intercepting clean water runoff and diverting this water around mining activities). These have been sized to cater for 1:50 year flood event and will serve two main purposes:

- The channel section will divert upstream clean water which would otherwise flow into the identified dirty areas.
- The berm section will ensure containment of dirty water in dirty areas.

Dirty water containment (berms and channels):

As per the clean water diversions, dirty water containment systems have been designed to ensure dirty water generated on the site is contained. These systems will also consist of a berm and channel component. Unlike the earthen clean water diversions, these channels will be lined with concrete and soil-crete (filled in cells).

The berm component to this design has not been indicated in this design but will be constructed from the earthen material excavated from the channel and located on the clean catchment side of the channel. The berm and channel component have been designed to accommodate the 1:50 year flood and serve two main purposes:

- Diverting upstream clean water which would otherwise flow into the identified dirty areas.
- Contain dirty water in the identified dirty areas and direct towards the appropriate dirty water containment facility.

Dirty water containment (containment facility):

Regulation 6 of GN 704 deals with the capacity requirements of clean and dirty water systems, and states that clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated such that these clean and dirty water systems do not spill into each other as a result of storm events below and including the 1:50 year event. A minimum freeboard of 0.8 m above full supply level must also be maintained as per the requirements of GN 704. Water accumulated in this containment facility during the wet season should be used as a priority in the process water circuit to ensure the capacity requirements are not compromised during periods of heavy/extended rainfall.

In this project, the capacity of the dirty water containment facility was calculated based on the summation of the 1:50 year design rainfall (24 hour) event for the catchment area and the highest monthly rainfall January) falling over the catchment, less the corresponding monthly evaporation (January) taking place over the surface area of the proposed containment facility. Runoff coefficients used were determined according to the return period of interest, such that maximum monthly rainfall event was associated with a smaller runoff coefficient than the 1:50 year design rainfall event. All dams were sized based on an average operating depth of 2 m (excluding any freeboard allowance). The addition of any process water from the mine has not been included in the sizings. **Table 20** presents the volume requirements for the dirty water containment facility.

Table 20: Dirty water containment facility volumes requirements for 1:50 year flood event (Shangoni, 2021)

Catchment	Volume (m^3)
Waterval West Dirty area	30,042

The design of the dirty water containment facility is such that there will be three interlinked components. These include concrete lined pollution and effluent dams, and a storage dam which is lined with both geo-membrane and clay. The pollution dam serves to contain the first flush of dirty water, assumed to be the dirtiest water. Water will overflow from the pollution dam into the storage and effluent dams during flood events, from where it can be pumped back for use in the process. The volume of the dirty water containment facility according to VIP (2011) is 30,125m^3 and corresponds well with Metago's calculation (30,042m^3)

The dirty water containment facility has also been designed to include a downstream seepage containment channel which will be approximately 3m deep and serve to identify and contain lateral seepage losses from the containment facility.

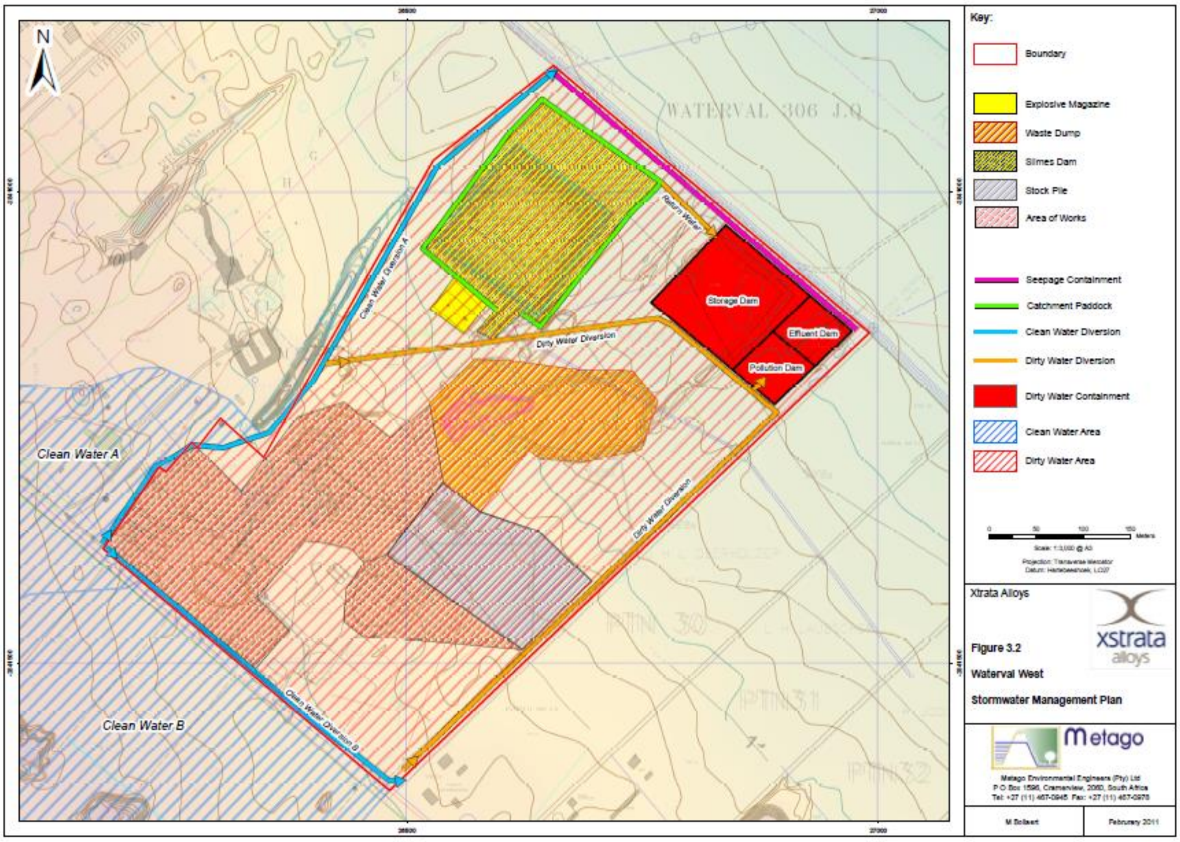

Figure 16: Waterval West Storm Water Management Plan (Metago, 2011) (Shangoni, 2021)

Surface water monitoring

Glencore Alloys: Waterval Mine has a surface water monitoring programme in place. Surface water quality monitoring is conducted on a monthly basis by a contractor.

Groundwater monitoring

Glencore Alloys: Waterval Mine has a groundwater monitoring programme in place.

Domestic wastewater management

Two conservancy tanks are located at Waterval West. These conservancy tanks are drained on weekly basis by an external contractor, with the sewage taken to the Rustenburg Sewage Treatment Works for disposal and treatment. Further, the Waterval East offices and other facilities dispose sewage into the Rustenburg municipal reticulation, which is then conveyed to Rustenburg sewage plants for treatment. The Rustenburg Municipality operates the sewage plants.

4.2.2.7 Non-mineral waste management

Waste management on-site

Glencore's Chrome Mining Division has a central waste management procedure that is to be adhered to by Waterval Mine. According to the mentioned procedure all possible recycling methods are to be identified in order to reduce the quantities of waste at all sites.

Chrome Mining Division has appointed a contractor to manage and control all waste and scrap generated within all sites, excluding tyres.

Colour coded bins are placed at strategic points and once full the bins are transported to the Salvage yard by the contractor, where the contractor will sort the waste into the respective storage areas for example, plastic, paper, hazardous and domestic waste, etc. Waste is to be separated into mainly 6 categories:

- Scrap metal, plastic (skips where applicable);
- Domestic waste (green colour coded drums);
- Hazardous waste (black colour coded drums);
- Fluorescent tubes (yellow colour coded drums equipped with capped crusher pipe);
- Old Personal Protective Equipment (PPE) (blue and orange drums); and
- Old cartridges (kept in office) (Red).

Further to the above, the following management and disposal methods (for other waste types) are followed as described in Table 21.

Table 21: Disposal and management methods for additional waste types on site (Shangoni, 2021)

Waste type	Management / disposal method
Used oil	All used oil is drained from oil sumps and associated facilities and are sold to an external contractor for recycling purposes.
Medical waste	An appointed service provider is responsible for the handling and removal of medical waste according to protocol and ensuring subsequent incineration. Needles, scalpels, blades (sharps) are placed in a puncture-resistant leak-proof container dedicated specifically for that purpose.
Old batteries	Batteries are checked by the Engineering foreman to determine whether the battery can be charged or disposed of. All old batteries are taken back by the suppliers.
Explosives packaging	Explosives bags collected by external contractor for off-site incineration.
Building rubble	Building rubble is to be removed by the building contractor.
Waste tyres	All waste tyres are transported to the Salvage yard for temporary storage, where they are sorted by the contractor before taken for recycling or re-use purposes.

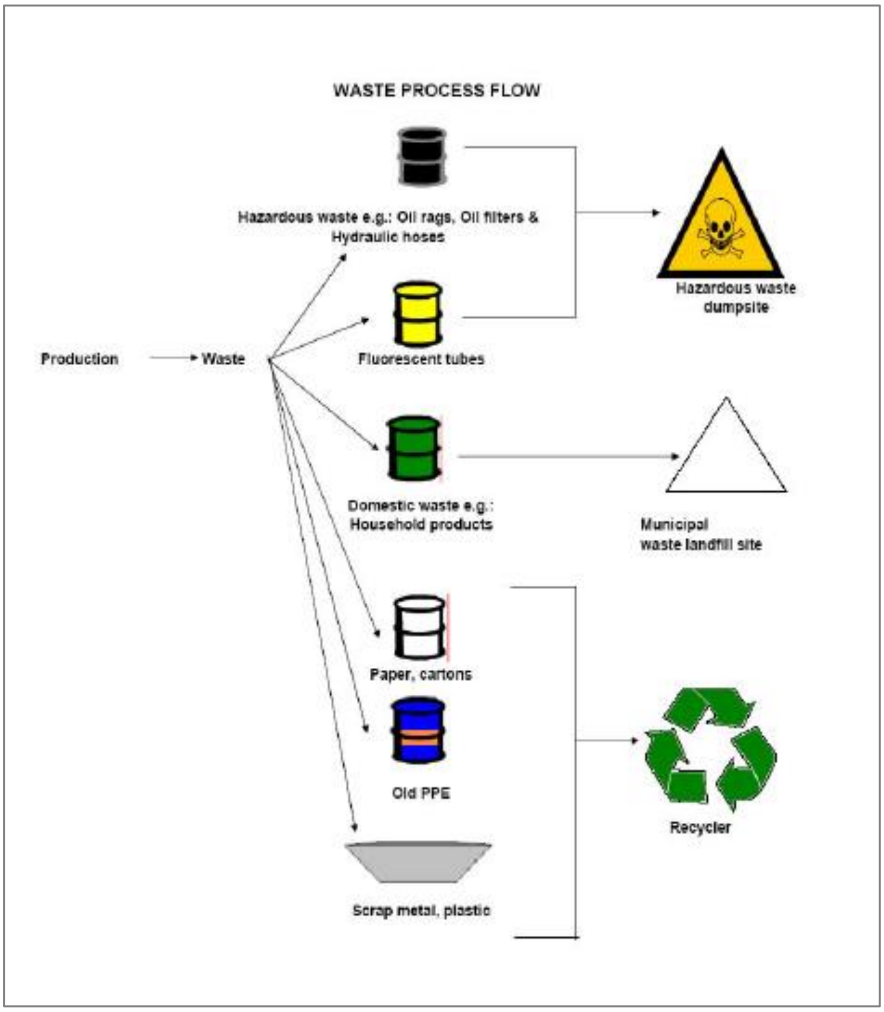

Figure 17: Basic waste process flow (Shangoni, 2021)

The collection of waste on the mine's various sites is done as required to ensure that the Salvage yard stays in a neat and tidy condition.

The contractor keeps a detailed register for all the waste by commodity that enters and leaves the Salvage yard. A printout of the register is supplied at the end of each month to the environmental department. Reconciliation is done and a report is compiled indicating waste consumption / usage.

Removal and disposal of general (domestic) waste (not recycled)

Non-mineral general waste is removed off-site by a registered waste contractor to a licenced municipal waste landfill site in Rustenburg.

Removal and disposal of hazardous waste

Non-mineral hazardous waste is removed off-site by a registered hazardous waste contractor to a licenced hazardous waste landfill site.

Waste minimisation and recycling

Glencore Chrome Mining Division has a documented Waste management procedure. The overall objective of the waste management procedure is to reduce generation and environmental impacts of all forms of waste.

The mentioned plan provides guidance on waste management, disposal, re-use, recycling, reporting and auditing and divides waste types into the 'reduce, re-use and recycle' streams.

4.2.2.8 Hazardous substance management

According to a Hazardous Chemical substance survey conducted for Glencore (then Xstrata) Alloys: Western Mines, by Enhanced Water Solutions, hazardous substances as listed in Table 22 were found at Waterval Mine.

Table 22: List of Hazardous substances (not limited to) found at Waterval Mine (EWS, 2010) (Shangoni, 2021)

Hazardous substances	
Acetylene	Habitant spray
Ammonia Clean	Iodine Solutions
Anti-Freeze	Laser jet cartridge
Betadine	Long-time PD2
Bio Scrub	Methyl Silicate
Bleach	Methylated spirits
Brake Fluid	Minova
Car batteries	Miracle tool
Carbon dioxide	Mycota Powder
Cetidine	Oxygen gas
Chlorohydrexine 5 L	Paint
Engine oil	Paste Hand Cleaner
Floxit 9024	Safety Spray
Foam cleaner	Toilet cubes
Gear lube EP 80W/90	Green Detergent

Glencore Alloys Western Chrome Mining Division has a documented Waste Management Procedure, which is to be adhered to by Waterval Mine. The following main requirements (amongst other) are set out in the mentioned procedure:

- A Material Safety Data Sheet (MSDS) register of all substances used on-site shall be prepared. The register will also identify the location where the material is used;
- A MSDS of each hazardous substance will be readily accessible to all employees who may reasonably use or come into contact with such substance;
- All persons potentially affected by exposure to workplace hazardous substances and their supervisors will receive training;
- Large quantities of dangerous goods can only be transported on designated vehicles driven by appropriately trained people with transportation certificates;
- Pump and piping system that handle hazardous substances must be well maintained and constructed using appropriate materials;
- Incidents will be reported immediately;
- Regular checks must be carried out on the fuel storage equipment;
- Storage bays should be bunded to provide for a minimum retention capacity of not less than 150% of the largest tank’s capacity;
- Drainage valves should be constructed at the base of the wall and be secured in a closed position;
- Tanks for the storage of diesel should comply to the SANS standards and with any relevant hazardous substances regulations. The tanks should be inspected periodically and where a tank is found to be leaking it should not be used for storage of dangerous goods until that leaks has been repaired;
- Each hazardous substance storage area should be labelled appropriately; and

- The floor of the storage area should be constructed of concrete and slopes that any spillage will flow to a sump contained within the bunded area.

Diesel (fuel) storage areas

A surface diesel storage area is managed and operated at Waterval Mine. Refer to Table 12 which includes a photograph of the mentioned diesel storage area. The site consists of two (2) 23 000 litre tanks.

The following main requirements (amongst other) are set out in the above-mentioned manual:

- Vehicles should be refuelled underground with their engines stopped, and only while they are within the designated refuelling bay where the ventilation is adequate and spillage can be controlled. The dispending hose length should be restricted accordingly;
- The floor of the refuelling bay should be constructed of concrete and slopes that any spillage will flow into a concrete drain then into a sump within the refuelling bay;
- Diesel, fuel and oil should be pumped from the storage tanks to the service bay, not gravity fed, and any pump supplying hydrocarbons to a second storage tank or a vehicle shall be provided with a shut off device which is readily accessible, clearly identified and capable of shutting off power to the pump in an emergency;
- Where tanks on surface are used to supply diesel to the tanks underground via a pipeline:
    - The combined capacity of the surface batch tank and pipeline feeding the underground tanks should not exceed 50 % of the largest underground tank capacity;
    - The surface tanks should be fully bunded and securely fenced;
    - Filling of the surface batch tanks should not take place while diesel is being transferred to the underground storage tank; and
    - A communication system should be provided between the surface batch tank and the underground storage area, outside the bunded areas.
- Pipes carrying diesel fuel and oil underground should be either screwed or welded steel and restricted to a maximum diameter of 25mm to reduce spillage in the case of failure.

4.2.2.9 Energy management

The Glencore Chrome Mining Division Resource Reduction Procedure sets out a list of energy saving initiatives for the western mines (including Waterval Mine). These relate to:

- Air compressors;
- Buildings and air conditioning;
- Fuel efficient diesel engines,
- Lighting systems;
- Pumps;
- Equipment operation and upgrades;
- Greenhouse gas emissions;
- Diesel energy use;
- Baseline energy use;
- Walk-around energy surveys; and
- Management review.

Programmes are in place across Glencore operations to reduce energy intensity and achieve cost savings. Energy efficiency audits are routinely carried out at the operations and the capital expenditure approval processes requires energy efficiency to be considered for all major new investment and projects.

4.2.2.10 Power supply

The power supply originates at a local substation. The substation covers 0.01ha and is situated on Waterval East. Power is supplied by the local municipality.

4.2.2.11 Housing

Waterval Mine does not operate any hostels or living quarters at present.

Housing Allowance

All employees receive a housing allowance which is calculated on their basic salary.

Housing Subsidy

A housing subsidy is paid to employees who can provide proof of a registered housing bond. The value of the subsidy is also based on the basic salary of the individual.

4.2.2.12 Shafts

Incline- and Shafts

There are two incline shafts. One at Waterval West and one at Waterval East. Waterval East Shaft used to be an opencast mine, but has been converted to an underground shaft. All ventilation shafts are located within the mining area except for one that is located in the municipal area.

4.2.3 Estimated reserves

Table 23 summarises the mineral resources for the area (as at December 2017), as per the Mine Work Programme (MWP), February 2018.

Table 23: Mineral resources and reserves statement (MWP, 2018) (Shangoni, 2021)

Metals and Minerals
Ferroalloys

Chrome Mineral Resources

Bushveld Complex – Western Limb

Name of operation	Attributable interest	Mining method	Commodity	Measured Mineral Resources 31.12.17	Measured Mineral Resources 31.12.16	Indicated Mineral Resources 31.12.17	Indicated Mineral Resources 31.12.16	Measured and Indicated Resources 31.12.17	Measured and Indicated Resources 31.12.16	Inferred Mineral Resources 31.12.17	Inferred Mineral Resources 31.12.16	Competent Person
Western Chrome Mines – LG6 Chromitite Package and MG1 Chromitite Layer												
Waterval Mine	79.5%	UG	Ore (Mt)	16.044	16.199	0.98	0.98	17.03	17.18	0.6	0.6	MM/DR
			Cr_2O_3 (%)	41.30	41.30	42.6	42.6	41.4	41.4	43	43	
Marikana West	79.5%	UG	Ore (Mt)	2.827	2.807	1.60	1.60	4.43	4.41	–	–	MM/DR
			Cr_2O_3 (%)	42.44	42.46	42.6	42.6	42.5	42.5	–	–	

4.2.4 Production rate and Life of Mine

The Life of Mine (LoM) for Waterval Mine is in excess of 30 years. The production forecast for each year (10-year period) is provided in Table 24.

Table 24: Chrome production (MWP, 2018) (Shangoni, 2021)

COMBINED (2018 -2027)	YEAR									
PRODUCTION	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
PRODUCTION	362582	421994	438672	438672	438672	438672	438672	438672	438672	438672
SALEABLE PRODUCTION (52% Yield)	194525	226400	235348	235348	235348	235348	235348	235348	235348	235348
2028 -2037	YEAR									
PRODUCTION	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037
PRODUCTION	480000	480000	480000	480000	480000	480000	480000	480000	480000	480000
SALEABLE PRODUCTION (52% Yield)	257520	257520	257520	257520	257520	257520	257520	257520	257520	257520
2038 - 2047	YEAR									
PRODUCTION	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
PRODUCTION	480000	480000	480000	480000	480000	480000	480000	480000	480000	480000
SALEABLE PRODUCTION (52% Yield)	257520	257520	257520	257520	257520	257520	257520	257520	257520	257520

4.3 Description of the proposed activities for the UG1 Opencast Project

The proposed UG1 opencast project will include the opencast mining of the chromite layer on the remaining extent of portion 82 of the farm Waterval 306 JQ. There is possible 1 million tons of the UG1 chromite layer that can potentially be mined using opencast mining methods.

Several new infrastructure will be constructed in support of the opencast project. Detailed information is presented in Table 25.

The project will take place in three phases: The proposed schedule for the phases is as follows:

- Construction Phase = ~Two months
- Operation Phase = ~3 years
- Decommissioning and Closure Phase = ~6 – 12 months

4.3.1 Construction phase

The construction phase for the Waterval opencast project will take a maximum of two months. The opencast operation area will be fenced and will cover an area of approximately 85 ha.

During the construction phase, surface preparations of the project area will be done by vegetation clearing and compaction. A laydown area for the receipt, temporary storage, and assembly of construction equipment and other supplies will be demarcated.

The following buildings and amenities will be constructed for the UG1 opencast project:

- Roads, powerlines and pipelines
- Fencing
- Site offices and change-house
- Stockpiles
- General and hazardous waste management areas; and
- Water pollution management facilities.

Table 25 details the proposed surface infrastructure to be constructed as part of the UG1 opencast project. The site layout plan is shown in Figure 18.

Table 25: Proposed infrastructure for the UG1 open cast project

Proposed infrastructure	Description
Surface infrastructure	
Roads	<u>Access roads and internal roads</u> Access and internal roads will be gravel compacted and ~10 – 12m wide. <u>Haul roads</u> A 12m wide haul road gravel will be constructed from the opencast area to the Waterval West plant. The haul road will be approximately 3km in length. <u>In-pit roads</u> Access roads ramps will be built to the different benches within the pit (9m wide.
Power	<u>Electrical reticulation:</u> Electrical reticulation for the offices and change house area will be installed. A new High Tension (HT) substation will be constructed to feed the Low Tension substation with a 70 x 3 HT cable buried into the ground – 800m long. From LT substation load will be split to different locations ie: change houses – 100 kW, offices – 50 kW. All cables to be buried in the ground in trenches. <u>Powerlines:</u> A 1.2 km 11 kV overhead line will be constructed from the planned new HT substation.
Pipelines	<u>Potable water lines</u> Potable water will be received from the Rustenburg Local Municipality. A 90mm HDPE line x 900m will be installed from Head Quarters manifold to UG1 manifold. From UG1 metering valve station manifold load will be distributed with suitable size HDPE piping to change house – 90mm diameter HDPE; Offices – 60mm diameter HDPE; All pipes will be buried in the ground on designated routes. <u>Pollution water pipeline</u> A 100mm diameter pollution water pipeline of ±1 500m will be constructed from the Pollution Control Dam (PCD) to the Waterval West Plant, in order to re-use the water in the plant. <u>Sewer lines</u> All offices and change houses main effluent pipes will be of 100mm diameter PVC. These main lines will tie into a 250mm concrete sewer line – 850m long which in turn will tie into the re-routed 600mm Municipal sewer line.
Bulk storage for fuel	Fuel will mostly be obtained from the UG2 refuelling facilities at the Waterval West Plant. The following will be stored at the UG1 opencast project: • Diesel bowser – 2500L (2.5m^3) • Hydraulic oil – 840L (0.84m^3) • Transmission oil – 420L (0.42m^3)

Proposed infrastructure	Description
Fencing	The UG1 opencast area will have a razor wire and electric boundary fence. The Pollution Control Dam (PCD) will have a 1.8m high diamond wires security fence.
Berms	A 1.8 – 2 m high berm will be established along perimeter of the project area alongside the R24 and D108 roads. The width at the base of the berm will be approximately 10m wide and the slopes of the berm will have an angle of at least 1(V): 2(H).
Buildings	<u>Offices</u> Two prefabricated site offices will be built with an area of 24m^2 each. These offices will be built to the southeast of the pits. These facilities will be non-permanent, pre-fabricated structures and will be placed on hard standing. <u>Changehouse</u> Prefabricated changehouses will be built with an area of 156m^2. The change house will be built to the southeast of the pits adjacent to the site offices. These facilities will be non-permanent, pre-fabricated structures and will be placed on hard standing. <u>Workshops</u> No workshops will be required. The current Waterval East workshops will be utilised. <u>Wash bays:</u> No washbays will be required. The current Waterval East washbay will be utilised. <u>Parking areas</u> A brick-paved carport (1.5 ha) will be constructed within a minimum of 30 carports. <u>Explosive storage:</u> No explosive storage areas will be required. Explosives for the UG1 opencast project will be stored at the current magazine at Waterval East.
Laydown area	A laydown area will be required during the construction phase. The laydown area will not require earthworks, berms, clean and dirty water separation as it will be refurbished structures for offices and changehouse. The only earthworks that will be required will be for water, electrical and sewage reticulation. The laydown area will be of steel re-enforced concrete for placement of refurbished offices and change houses.
Stockpiles	
Topsoil stockpile	Topsoil will be removed and stockpiled separately from the overburden and used to rehabilitate the area at a later stage. Approximately 80 000m^3 of topsoil will be stockpiled during the Life of Mine. The footprint of the topsoil stockpile will be ±1.5 ha without paddocks and will have a height of ±10m.
Overburden stockpile	Overburden material will be removed for roll-over method of mining. The Boxcut area will be used to access the opencast area to the north and south

Proposed infrastructure	Description
	of the boxcut. The first section to be removed will be stockpiled until end of LoM and then backfilled with an option to allow for rehabilitation of the stockpile and not backfill to the open pit. Approximately 620 000m^3 of overburden will be stored on the overburden stockpile. The overburden stockpile with have a footprint of ~10 ha with a height of 20m. Once mining of the bench is completed, the overburden of the next bench will be used to backfilled into the excavation, and covered with topsoil.
Waste rock stockpile	The proposed UG1 opencast project **does not require** a waste rock dump. All blasted material will be excavated and hauled to the operating Waterval West Plant.
Run of mine stockpile	A run of mine (RoM) and muck stockpile area will be required, with a capacity of approximately 20 000tonnes. The ROM stockpile will have a footprint area of 0.5 ha with a height of 4m.
Waste management facilities	
General waste	General waste (including domestic waste, paper, plastic and scrap steel) will be stored in skips to be placed on a concrete bunded area. It is planned to have two 6m^3 skips for general waste. A contracted service provider will remove and empty skips regularly. Skips will be located at the changehouse/offices area.
Hazardous waste	Hazardous waste will be temporarily stored in covered skips to be placed on a concreted bunded area. It is planned to have two 6m^3 skips for hazardous waste. A contracted service provider will remove and empty skips regularly. Skips will be located at the changehouse/offices area.
Water pollution management facilities	
Pollution Control Dam (PCD)	A pollution control dam (PCD) with a capacity of approximately 18 500 m^3 and an area of ±1.5ha will be constructed to contain dirty water from the UG1 opencast operation and run-off from the ROM/muck stockpile. The PCD will be sized to contain the 24 hour 1:50 year rainfall event. The PCD will be ±4.5m deep. Water from the PCD will be transported to the Waterval West plant to be used in processing.
Pollution water trench	A pollution water trench will be constructed to the north east of the opencast pits. The pollution water trench will drain into the PCD. In addition, a pollution water trench will be constructed from the RoM stockpile to the PCD. The pollution water trenches will be concrete or HDPE lined.
Sewage treatment plant	No sewage treatment plant will be required.
Ablution facilities	Prefabricated ablutions facilities will be constructed at the offices and changehouse.

Proposed infrastructure	Description
In pit storage of water	Water will not be stored in the opencast pits. Any water that accumulates/occurs within the pit will be pumped out to the PCD. No water will be generated by mining activity as all drilling will be done dry.

The construction phase will also the removal/clearance of vegetation from the opencast pit areas. The topsoil will also be removed and placed within the topsoil stockpile area.

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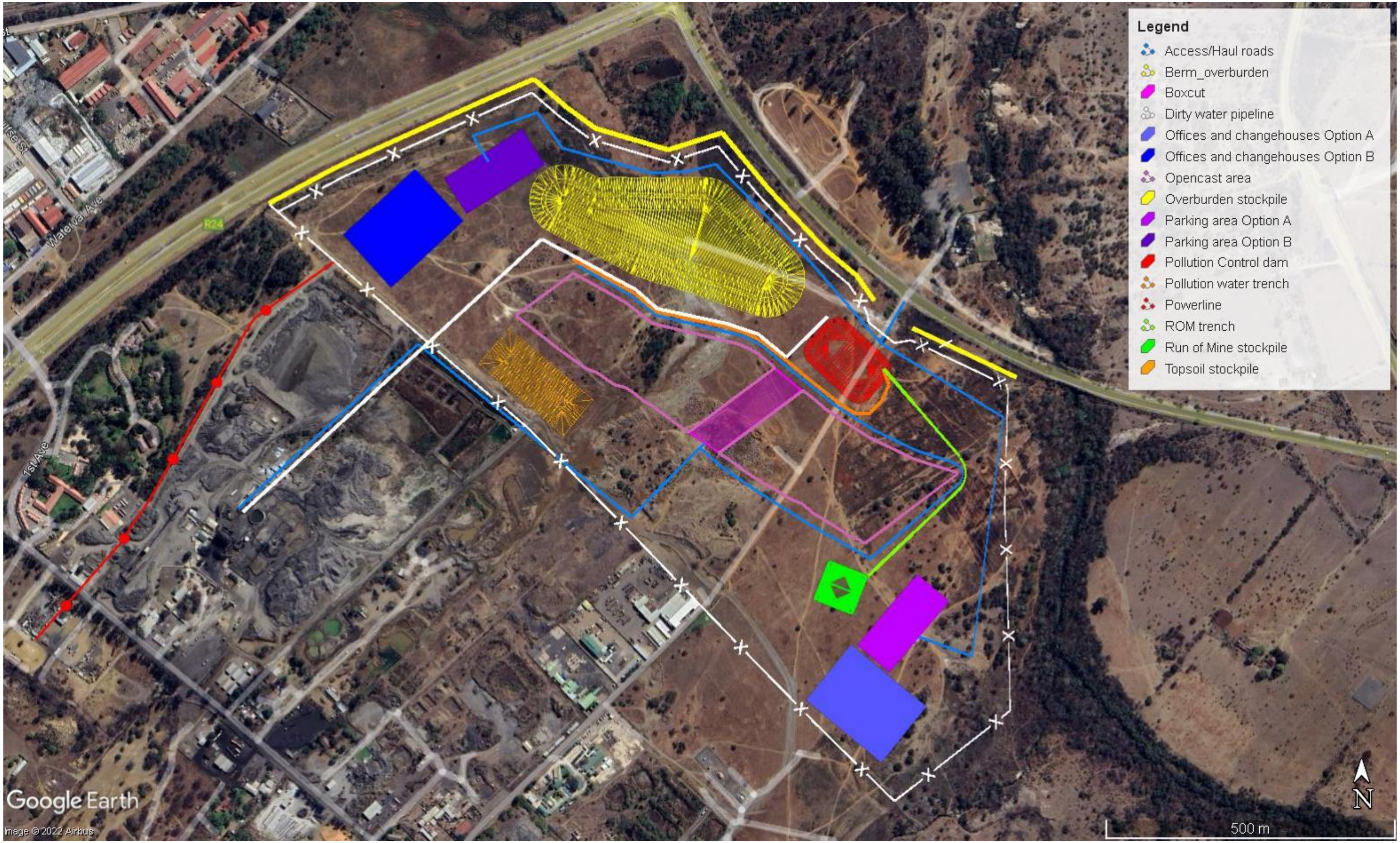


Figure 18: Proposed layout for the UG1 opencast project

4.3.2 Operational phase

The proposed opencast activities will include the development of a boxcut and opencast areas on either side of the boxcut (total area of ~12ha), to mine the UG1 reef to a maximum depth of approximately 45m.

After topsoil has been removed and stockpiled, overburden material will be blasted and placed on the overburden stockpile. This material will be used during rehabilitation of the opencast pit.

During the operational phase, drill and blast mining methods will be implemented. A pattern will be marked by the blaster/miner, using a burden that will be determined by the blasting specialist based on the rock strength and required fragmentation. The most efficient drilling pattern will be designed and used, which will also meet the minimum legal requirements in terms of fly rock, air and ground vibrations etc. A surface drill rig will be used to drill a number of vertical holes, at a specified depth as determined by the blasting specialist. The drilled holes will be charged up with explosives which may be in the form of drill type explosives, (expanfo); emulsion or a type as will be prescribed by the blasting specialist. The proposed mine plan is shown in Figure 19.

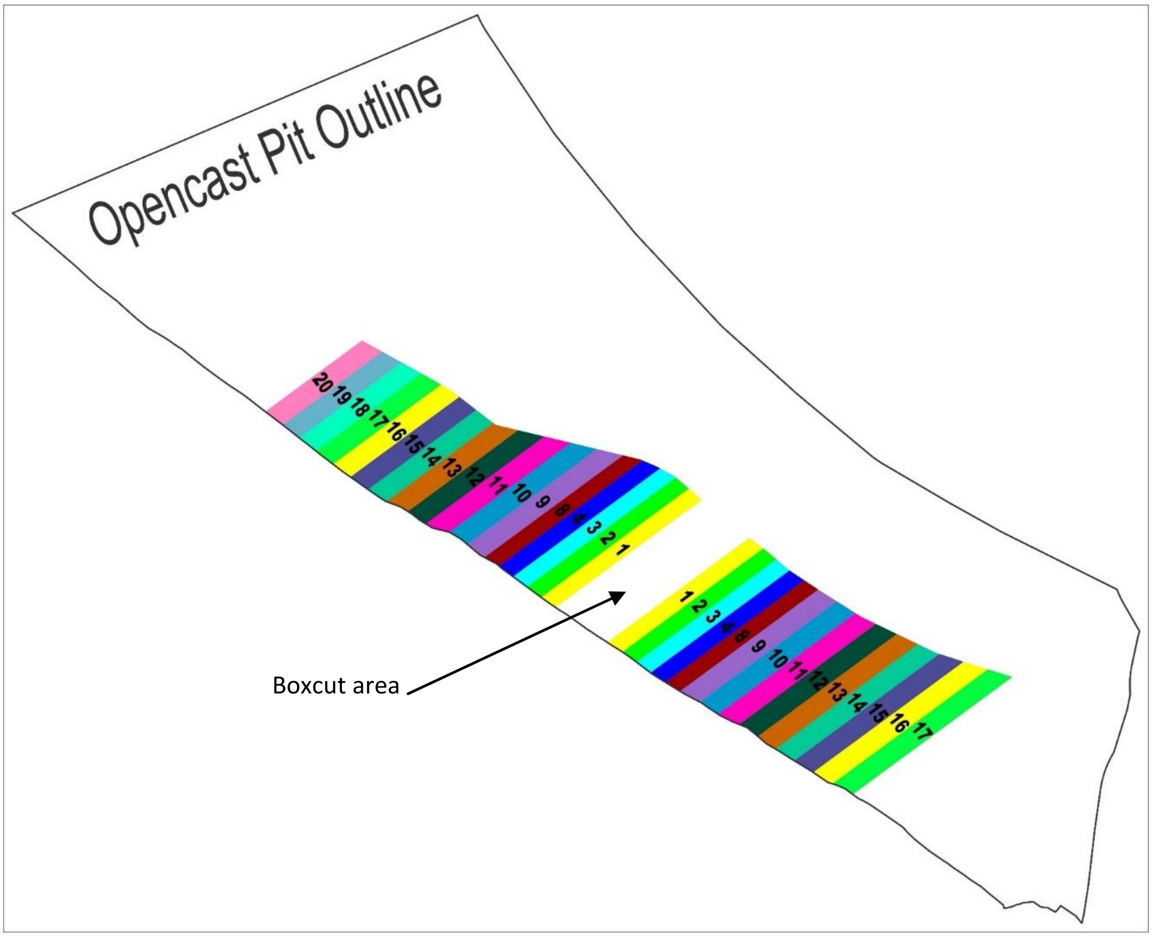


Figure 19: Proposed mine plan for UG1 opencast project

The average production profile is as follows:

- ~420 000 tonnes per annum for a period of two to three (2-3) years;
- ~40 000 tonnes per month;
- ~10 000 tonnes per week.

All blasted material from the opencast pits will be collected in 30t trucks and transported on the new haul road to the operating Waterval West Plant. It is estimated that approximately four trucks will be required to transport the material to the Waterval West plant daily. Each truck will take four return trips to the plant per shift on the dedicated haul road.

There will be overburden stockpiles and a RoM stockpile in the event of breakdowns where RoM cannot be immediately transported to the plant. There will be no waste rock stockpiles.

The opencast area will operate seven days a week on three (3) shifts (8hrs30 per shift).

Ore material will be processed in the existing Waterval West Plant.

Treated material (chromitite) will be sold to the smelters.

Filter cake will be transported to the Kroondal Mine for processing at the PGM Plant.

4.3.3 Closure phase

Concurrent rehabilitation will take place during the operational phase. Backfilling of benches with overburden material will take place as the mining benches are advanced. Each bench will be fully rehabilitated and covered with topsoil as backfilled.

The overburden stockpiles will be deposited to 18deg (1(H): 3(V)) for stability reasons and will be used for backfilling the opencast areas for concurrent rehabilitation.

At closure or at Life of Mine, a void will unavoidably form due to the material removed from the opencast pits to the plant. The voids will be safeguarded with fencing and safety berms at closure.

All infrastructure (canals, fences, roads, laydown area, pipelines) not issued to the community will be demolished and the area rehabilitated by ripping and revegetating to be able to deliver an area as close as possible to the natural state.

The PCD will be decommissioned as the liner could be a hazard for slipping and removal of the liner will leave the PCD permeable.

Closure Plan

Information for this section was obtained from Hydrological Environmental Engineering Solutions' Financial Provision and Closure Design Report (Appendix C12).

Two closure options were considered:

Option 1 included the total backfill of the open pit, no voids left. At Life of Mine (LoM), the remaining open voids will be backfilled with the overburden stockpile and imported waste material/dump rock. No security fence or berm will be required as there will be no voids left and the area will be shaped to be free draining.

Option 2 included the partial backfill of the open pit and safeguarding of the voids. The roll-over method will be used to place material inside the open pit in such a way that the ground level is the same as pre-mining conditions. The overburden stockpile will however not be backfilled into the remaining voids when Life of Mine is reached. The remaining void will be safeguarded by the construction of a 3m high rockfill berm with a security fence. Access for the community stock could be allowed at a safe entrance to the void through the access ramp. The construction of the security berm is considered as being part of the mining operations and are not part of the financial provisioning plan.

Option 1 is the preferred Option.

The advantages and disadvantages of each option is depicted in Table 26, with Option 1 being the preferred option.

Table 26: Motivation for the preferred closure option (HEES2, 2023)

Option	Advantage	Disadvantage
1	• Little visual impact and close to original land state. However, altered topography but with soil erosion reduction.	• High closure cost.
2	• Open pit will fill with water and community could have access to stock watering (Social impact). • Lower closure cost.	• The full backfilling will need to start only after two years and the stockpiles can therefore erode for a number of years. • Safety risk to people and animals and long term monitoring and maintenance required.

5 Policy and legislative context

Table 27 provides an overview of the policy and legislative context applicable to the proposed UG1 opencast project and will be considered during the assessment process.

Table 27: Policy and legislative context

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>Constitution of the Republic of South Africa (Act No. 108 of 1996)</u> Section 24 of the Constitution provides that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that – i. Prevent pollution and ecological degradation; ii. Promote conservation; Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.	The environmental management objectives of the project will be to protect ecologically sensitive areas and to support sustainable development and the use of natural resources, whilst promoting justifiable socio-economic development. The Constitution of South Africa is the overarching framework legislation driving the NEMA principles and therefore the S&EIR process. The proposed, mitigation and management measures to minimise and prevent negative impacts associated with the project are shown in Table 101 to Table 103.
<u>Mineral and Petroleum Resources Development Act (Act No. 28 of 2002) (MPRDA)</u> Section 102 of the MPRDA states that: A reconnaissance permission, prospecting right, mining right, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right and production right work programme; mining work programme, environmental management programme, and environmental management plan may not be amended or varied (including by extension of the area covered by it or by the addition of minerals or a share or shares or seams, mineralised bodies, or strata, which are not at the time the subject thereof) without the written consent of the Minister.	Glencore will undertake a Section 102 process in terms of the MPRDA to update the Mining Works Programme to include the proposed UG1 opencast project and to update Mining Right Area to include PR2060.
<u>National Environmental Management Act (Act No. 107 of 1998) (NEMA</u>) In terms of the section 24(5) read with section 44 of NEMA, Environmental Impact Assessment (EIA) Regulations have been published to provide lists of activities that require environmental authorisation before they may commence. There are three listings, each requiring a different type of environmental authorisation process. • Listing 1: Activities requiring a Basic Assessment process (approximately 197 days)	The proposed UG1 opencast project triggers listed activities contained in Listing Notice 1, 2 and 3 of the EIA Regulations, therefore requiring a S&EIR environmental authorisation process. This Scoping Report has been compiled in in accordance with the requirements of the NEMA EIA Regulations (2014) (as amended). Refer to Table 10 for the listed activities triggered by the proposed UG1 opencast project.

Applicable legislation and guidelines used to compile the report	Reference where applied
• Listing 2: Activities requiring a Scoping and Environmental Impact Reporting (S&EIR) process (approximately 300 days) • Listing 3: Activities within certain geographic areas requiring a Basic Assessment process (approximately 197 days)	
<u>National Environmental Management: Waste Act (Act No.59 of 2008) (NEM:WA)</u> NEM:WA aims to provide regulation for waste management in order to protect health and the environment, for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. NEM:WA has three categories of activities that require environmental authorisation. Category A: Activities requiring a Basic Assessment process Category B: Activities requiring a S&EIR process Category C: Activities that do not require an environmental authorisation process, but need adhere to the required Norms and Standards.	The proposed UG1 opencast project triggers Category B activities, and therefore requires a S&EIR environmental authorisation process. Refer to Table 10 for the Category B activities triggered by the proposed UG1 opencast project.
<u>National Heritage Resources Act (Act No. 25 of 1999) (NHRA)</u> The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa.	A Heritage Impact Assessment (HIA) in terms of the NHRA will be undertaken on the proposed project area to determine if any heritage resources are located on the project area. The HIA, Draft Scoping Report and Draft EIA/EMPR will be submitted to the South African Heritage Resources Agency (SAHRA) for comment.
<u>National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA)</u> According to the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) the Department of Forestry Fisheries and the Environment (DFFE), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS). These standards provide the goals for air quality	An Air Quality Impact Assessment will be undertaken as part of the S&EIR process. The findings of the specialist study will be included in the Draft EIA/EMPr. An Air Emissions Licence will not be required, as no Atmospheric Emissions listed activities are triggered by the proposed UG1 opencast project.

Applicable legislation and guidelines used to compile the report	Reference where applied
management plans and also provide the benchmark by which the effectiveness of these management plans is measured.	
National Ambient Air Quality Standard (NAAQS) The national ambient air quality standard for criteria pollutants consists of a limit value and a permitted frequency of exceedance. The limit value is the fixed concentration level aimed at reducing the harmful effects of a pollutant. The permitted frequency of exceedance represents the tolerated exceedance of the limit value annually and accounts for high concentrations as a result of process upsets and meteorological variation. Compliance with the ambient standard implies that the frequency of exceedance does not exceed the permitted tolerance.	The Waterval Mine implements a dust control programme. Dust fallout is measured at a number of sites around the mine area. Dust fallout may not exceed the limits as stipulated in the Dust Control Regulations. No. R. 827.
Dust Control Regulations The National Dust Control Regulations were published on 1 November 2013. It lists guidance on the requirements for monitoring dust fallout and provides limit values for acceptable dustfall rates for residential and non-residential areas.	
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The National Environmental Biodiversity Act, Act 10 of 2004 (NEMBA) provides for the management and conservation of South Africa's biodiversity within the framework of the NEMA. The Act relates to the protection of species and ecosystems that warrant national protection, among others	A terrestrial biodiversity assessment will be undertaken and will take into considerations the requirements of NEM:BA, NEM:PAA and the National Forest Act. The assessment will determine the presence of Critical Biodiversity Areas, Protected Areas and protected species/species of conservation concern. Should protected plant species be present on the proposed project footprint area, the required permits will be obtained for their removal, relocation or destruction.
The National Environmental Management: Protected Areas Act (Act No. 57 of 2003 (NEM:PAA) NEM:PAA is a complimentary act to NEMA. NEMPAA aims to provide for the protection and conservation of ecologically viable areas that are representative of South Africa's biological diversity. This objective is accomplished through the declaration and management and protected these identified areas (section 2).	

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>National Forestry Act (Act No. 84 of 198) (NFA)</u> The NFA protects against the cutting, disturbance, damage, destruction or removal of protected trees. During the specialist investigation phase it will be determined if a permit from the Department of Forestry, Fisheries and the Environment (DFFE) which authorises the removal and transplantation of trees, will be required.	
<u>National Water Act (Act No. 36 of 1998) (NWA)</u> NWA makes provision for water resource management, protection of the quality of water resources and recognising the need for the integrated management of all aspects of water resources to achieve sustainable use of water.	The proposed UG1 opencast activities will require a Water Use Licence Application (WULA) to authorise water uses in terms of Section 21 of the NWA. The following water uses are expected to be authorised: Section 21 (a) – taking water from a resource Section 21 (c) – impeding or diverting flow of water in a watercourse Section 21 (g) – disposing of waste or water containing waste in a manner which may detrimentally impact on a water resource Section 21 (i) – altering the bed, banks course or characteristics of a watercourse Section 21 (j) – removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people
<u>Mine Health and Safety Act (Act No. 29 of 1996) (MHSA)</u> The Mine Health and Safety Act (Act No. 29 of 1996) (MHSA) aims to provide for protection of the health and safety of all employees and other personnel at the mines of South Africa.	The purpose of the MHSA is to provide for protection of the health and safety of employees and other persons at mines and, for that purpose to promote a culture of health and safety; to provide for the enforcement of health and safety measures.

6 Need and desirability of the proposed activities

Information on this section was obtained from the approved 2021 Consolidated EMPr, compiled by Shangoni.

As per the Waterval Mine's Social and Labour Plan (SLP) (2016 - 2020), Rustenburg Local Municipality is reputed to be one of South Africa's fastest growing urban areas. This significant growth is largely attributed to the impact of the world's four largest mines in the immediate vicinity of the town, namely, Anglo American Platinum, Impala Platinum, Glencore and Sibanye-Stillwater. The mining sector providing around 50% of all formal employment within Rustenburg Local Municipality.

The National Spatial Development Perspective emphasizes the need for infrastructural development in high development corridors and areas of latent potential, and investment in people in these areas has been considered as one of the guiding development perspectives used in the Rustenburg Local Municipality Integrated Development Plan (IDP). The Rustenburg Local Municipality IDP indicated that the municipality faces many challenges which include a lack of availability to land, insufficient quality and quantity of water, lack of electricity, a declining agricultural sector and the general level of education of most of the locals.

Through the Social and Labour Plan, Waterval Mine aims on developing and implementing comprehensive Human Resources Development Programmes, a Mine Community Development Plan, a Housing and Living Conditions Plan, an Employment Equity Plan, and Processes to save jobs and manage downscaling and/or closure. The above programmes are aimed at promoting employment and advancement of the social and economic welfare of all South Africans whilst ensuring economic growth and socio-economic development.

Waterval Mine will strive to fulfil the following objectives in developing and implementing the Social and Labour Plan:

a) Promote economic growth and mineral and petroleum resources development in the Republic;

b) Promote employment and advance the social and economic welfare of all South Africans;

c) Contribute towards the socio¬-economic development of the areas in which Waterval is operating as well as the areas from which the majority of the workforce is sourced; and

d) To utilize and expand the existing skills base for the empowerment of Historically Disadvantages South Africans (HDSA) and to serve the community.

The mine is aware of the socio - economic pressure on the hosting community and that alternative work in the surrounding area is limited as well as the additional need for municipal services and infrastructure. To limit the negative impact of the mining operation on the area, the mine has a resilient focus on local recruitment and undertakes to retain this focus.

The purpose of implementing the UG1 opencast project at the Waterval Mine, is to access the remaining chrome resource within the existing mining right area to provide ore material to the existing Waterval West processing plant. Currently, the only material processed by the Waterval West plant, is tailings material obtained from the Waterval East and West Tailings Storage Facilities. The opencast mining activities will provide additional material to be processed in the Waterval West processing plant, once the Waterval West TSF has been completely remined.

Therefore, the UG1 opencast project will ensure that Glencore's Waterval Mine West plant will continue to receive mineral-bearing material to ensure the continued operations at Waterval Mine and retain jobs.

7 Description of the process followed to reach the preferred site

The National Environmental Management Act (Act No. 107 of 1998) NEMA prescribes that every application for Environmental Authorisation (EA) must include, *inter alia*, an 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 (i.e. No-Go Alternative). "Alternatives", in relation to a proposed activity, are different ways of meeting the general purposes and requirements of the proposed activity, which may include alternatives to:

- the location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the technology to be used in the activity; and
- the option of not implementing the activity.

This section presents the various alternatives considered.

Table 28: Alternatives as provided through the NEMA

Alternative	Definition
Activity	Refers to alternatives in the nature of the proposed activity. Can be defined as project alternatives.
Location	Refers to alternatives in the location of the proposed activity. This can be considered for the entire proposal or for a component of the proposal. A distinction should be drawn between alternative locations that are geographically separate and alternative locations that are site layout alternatives.
Technology	Refers to alternatives in technology and equipment used. The aim of this is to reach the same goal by using different methods or processes.
Site Layout	Refers to alternatives in spatial configuration of an activity on a particular site.
Scale	Refers to activities that can be broken down into smaller units and undertaken at different scales.
Design	Refers to alternatives in design for aesthetic purposes or different construction materials in an attempt to optimise local benefits and sustainability.

8 Details of Alternatives considered

8.1 Property or location alternatives

The property for the preferred location has been selected as it is located within Glencore's existing mining right area on property owned by Glencore (remaining extent of Portion 82 of the farm Waterval 306 JQ).

The preferred location has also been constrained due to the location of the mineral resource and proven reserve, the shallowness of the reserve as well as the location of the site in relation to the Waterval West processing plant. The proposed location of the UG1 opencast project will allow Waterval Mine to continue with processing of ore at its existing Waterval West plant.

8.2 Type of activity

The activities to be undertaken will be the establishment of the UG1 opencast mine with a life of mine of approximately 3 years. Opencast mining on the mining right area will ensure continued supply of ore material to the existing Waterval West processing plant. These opencast operations will make use of the roll over mining method.

Due to shallowness of the reef, underground mining seems to be proven unsuitable for the area.

8.3 The design or layout of the activity

The following aspects were taken into consideration for the design/layout of the proposed UG1 opencast project:

- Location of Mining Right Area;
- Location of properties owned by Glencore;
- Position of the UG1 outcrop;
- Location of the proven reserve;
- Delineated wetlands;
- Critical Biodiversity Areas; and
- Proximity to the existing Waterval Mine infrastructure (specifically Waterval West beneficiation plant).

The layout of the opencast has limited alternatives as it is constrained to the location of the UG1 outcrop and proven reserve.

The layout was developed to place other surface infrastructure outside delineated wetlands as far as possible, to ensure the least environmental impact to these wetlands.

The layout was further developed to avoid the placement of infrastructure on Critical Biodiversity Areas, and to place surface infrastructure on areas that have been previously disturbed by farming practices (secondary grassland areas) and degraded bushveld areas. This will ensure that there is limited impact to undisturbed biodiversity areas.

8.4 Operational aspects of the activity

The application is for an opencast mining process in which: the topsoil is firstly removed and stockpiled for use during rehabilitation. Secondly, as much soft overburden material as possible is removed without the use of blasting techniques. This material is stockpiled separately from the topsoil.

Chromite mined will then be transported via an internal haul road to the existing Waterval West processing plant. Fissure water and rainwater that collects within the pit will be re-used at the Waterval West processing plant.

The above operational description is seen as the most effective way of operating as it makes use of existing processing infrastructure and facilities to cause the least possible environmental disturbance.

8.5 Option of not implementing the activity

The purpose of implementing the activity is for Waterval Mine to access the remaining chrome resource within the existing mining right area to provide ore material to the existing Waterval West processing plant. Currently, the only material processed by the Waterval West plant, is tailings material obtained from the Waterval East and West Tailing Storage Facilities. The opencast mining activities will provide additional material to be processed in the Waterval West processing plant, once the Waterval West TSF has been completely remined.

The no-go option will require a re-evaluation of the Waterval Mine business structure and may result in closure of the mine.

9 Details of the Public Participation Process followed

9.1 Objectives of public participation

The objectives of the public participation process are as follows:

- To introduce the proposed project to identified stakeholders/Interested and Affected Parties (I&APs) and to inform them of the environmental authorisation process to be followed;
- To provide sufficient and accessible information to identified stakeholders/I&APs; and
- To provide stakeholders/I&APs opportunities to provide comment, raise concerns or provide suggestions for enhanced benefits.

9.2 Public Participation Process

A public participation process has been undertaken in support of the environmental authorisation application, inclusive of site notices, newspaper advertisements, Background Information Document (BID), notification letters, an open day and making the Draft environmental authorisation documentation available for public comment.

A summary of the process followed to date and to be followed during the impact assessment phase is provided in Table 29.

Table 29: Summary of the Public Participation Process

Activity	Description
Pre-application phase	
Identification of stakeholders	• Waterval Mine's existing stakeholder database was utilised to commence with the identification of potential stakeholders to consult with during the public participation process. The following stakeholders were identified: o Department of Mineral Resources and Energy (DMRE) (competent authority); o Department of Water and Sanitation (DWS); o North West Department of Economic Development, Environment and Tourism (NW: DEDECT); o North West Department of Agriculture and Rural Development; o Department of Public Works; o South African Heritage Resources Agency (SAHRA); o Rustenburg Local Municipality; o Bojanala Platinum District Municipality; o Landowners and adjacent landowners; o Provincial roads department; and o Magalies Biosphere Reserve. • Refer to Appendix B1 for a list of identified stakeholders.
Pre-application meeting	• A pre-application meeting was held with the competent authority (DMRE) on 24 June 2022. Minutes of the meeting is available in Appendix B2. • A pre-application meeting was held with the Department of Water and Sanitation (DWS) on 14 October 2022. Minutes of the meeting is available in Appendix B2.
Site Notices	• English and Setswana site notices were placed around the proposed UG1 opencast project area and at Waterval Mine's entrance. Proof of placement of site notices are available in Appendix B3. • The site notices provide information on the project and details on how to register as an Interested and Affected Party.
Background Information Document	• A Background Information Document (BID) was compiled in English and Setswana and was distributed via email to identified stakeholders. A copy of

Activity	Description
	the BIDs is provided in Appendix B4. Proof of distribution is available in Appendix B5. • The BID includes an introduction to the project, information on the proposed activities, details of the process to be followed, details of the public participation process and an invitation to register as an Interested and Affected Party.
Scoping Phase	
Newspaper Advertisement	• Newspaper advertisements were placed in the Rustenburg Herald and Platinum Weekly Newspapers in English on 2 September 2022. Refer to Appendix B6 for copies of the advertisements. • The newspaper advertisement contained a brief introduction to the project, the availability of the Draft Scoping Report for public comment, details of public participation process and a request to register as an Interested and Affected Party.
Notification letters	• A notification letter (Appendix B7) was distributed to all identified stakeholders informing them of the availability of the Draft Scoping Report for public comment, as well as inviting them to the public open day. Proof of the distribution of the notification letter is available in Appendix B8. • Stakeholders were encouraged to provide comments to the EAP for inclusion in the Final Scoping Report and Draft EIA/EMPr document.
Availability of Draft Scoping Report for public comment	• The Draft Scoping Report was made available for comment for 30 calendar days (2 September to 3 October 2022). • The Draft Scoping Report was made available for public comment at the following locations: ○ Waterval Mine Security Offices; ○ Rustenburg Public Library; ○ Offices of Alta van Dyk Environmental Consultants, 9 Mountain Sherman Crescent, Midlands Estate, Centurion, Gauteng; • An electronic copy of the Draft Scoping Report was placed on the AVDE website: https://www.altavandykenvironmental.co.za/public-documents/
Open day	• An open day was held during the public comment period of the Draft Scoping Report to obtain comments from stakeholders. The open day was held on 22 September 2022. Refer to Appendix B9 for attendance registers of the open day. • Comments received on the open day are included in Table 30.
Environmental Impact Assessment Phase	
Newspaper Advertisement	• Newspaper advertisements were placed in the Rustenburg Herald and Platinum Weekly Newspapers in English on 9 March 2023 Refer to Appendix B10 for copies of the advertisements. • The newspaper advertisement contained a brief introduction to the project, the availability of the Draft EIA/EMPr for public comment, details of public participation process and a request to register as an Interested and Affected Party.
Notification letters	• A notification letter was distributed to all registered stakeholders informing them of the availability of the Draft EIA/EMPr for public comment, as well as inviting them to the open day. Refer to Appendix B11. Proof of the distribution of the notification letter is available in Appendix B12.

Activity	Description
	• Stakeholders were encouraged to provide comments to the EAP for inclusion in the Final EIA/EMPr document to be submitted to the DMRE.

Availability of Draft EIA/EMPr for public comment	• The Draft EIA/EMPr is currently available for public comment for 30 calendar days (10 March – 12 April 2023).
	• The Draft EIA/EMPr is available for public comment at the following locations:
	    o Waterval Mine Security Offices;
	    o Rustenburg Public Library;
	    o Offices of Alta van Dyk Environmental Consultants, 9 Mountain Sherman Crescent, Midlands Estate, Centurion, Gauteng.
	• An electronic copy of the Draft EIA/EMPr is available on the AVDE website: https://www.altavandykenvironmental.co.za/public-documents/

Open day	• An open day will be held during public comment period of the Draft EIA/EMPr to obtain comments from stakeholders. • Comments received will be included in the Final EIA/EMPr to be submitted to the DMRE.
Decision making phase	
Notification letter	• A notification letter will be distributed to all registered stakeholders informing them of the decision made by the DMRE. • The notification letter will provide details on the appeal process and the associated timeframes, should thy wish to appeal the decision.

9.3 Summary of comments received by I&APs

All comments received from I&APs are included in Table 30.

Communication with stakeholders and comments received are available in Appendix B13.

Table 30: Comments raised to date by I&APs during the stakeholder engagement process

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
Department of Mineral Energy and Resources (DMRE) Thilivhali Meregi	24/06/2022	Minutes of meeting	Public participation material should also be made available in Setswana.	Site notices and BIDs were made available in English and Setswana. Refer to Appendix B3 and B4.	Completed
			Public meetings should be undertaken as part of the public participation process.	An open day was held on 22 September 2022. Refer to invitation to open day in Appendix B7, and Appendix B9 for attendance registers of the open day. Comments received on the open day are included and addressed in Table 30.	Completed
Department of Public Works & Roads Keoagile Sitase	03/08/2022	Email	Could you please provide us with the Kmz files as illustrated by "Figure 2: Proposed Layout for the UG1 Opencast project" *(of the Background Information Document).*	The kmz files were sent via an email to Keoagile Sitase on 15 August 2022.	Completed
Department of Public Works & Roads Keoagile Sitase	25/08/2022	Email/letter	Your Notice dated 29 July 2022 has reference. This permission is issued in terms of the Advertising on Roads and Ribbon Development Act, Act No 21 of 1940 and Roads Ordinance No 22 of 1957 as amended. There is no objection to the proposed development, subject to the strict adherence of the attached Specific and Special Conditions and should form part of the proposed planning/development, also that the conditions/requirements listed below are imposed and met in all respects by the applicant. A written confirmation of acceptance of the attached conditions is required. In the event of not receiving a written acceptance of conditions, the approval is withdrawn and this approval is cancelled Route 24 form part of the National Road Network, you therefore been advised to consult SANRAL on the following:	The Department's comments have been noted and sent to Glencore for review. Once Glencore has reviewed and agreed to the conditions, a letter of acceptance will be submitted to the Department of Public Works. Mr Jan Oliver has been added to the list of stakeholders. Please refer to Appendix B1.	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
			Mr Jan Oliver Statutory Control Section		
Servest Andre van Tonder	13/09/2022	Email	What is this about, as I am not sure what I should submit to you?	Glencore Waterval Mine is planning an opencast mine on the remaining extent of portion 82 of the farm Waterval 306 JQ. I have attached a Background Information Document for further information. An environmental authorisation process is currently being undertaken for the proposed project, and is currently in the Scoping Phase. The Draft Scoping Report is currently available for comment and can be downloaded here: https://www.altavandykenvironmental.co.za/public-documents/ A hard copy of the Draft Scoping Report is also available at the Rustenburg Public Library as well as at Glencore Waterval West Mine Security until 3 October 2022. If you have any queries about the proposed project, or have any comments you would like to raise, please send them to me by 3 October 2022.	Completed
Sitona Charlene Frieslaar	15/09/2022	Email	I refer to your email below regarding the Invitation Public Open Day Held on 22 September 2022. Sitona has no objection the mining operation, please advise if its necessary for us to attend the above mentioned meeting in this case.	Thank you for your email. The public open day is not compulsory – it is in opportunity for stakeholders to gain more information on the project and to ask questions. We will keep on informing you about the progress of the project and when the Draft Environmental Impact Assessment Report and Environmental Management Programme will be made available for public comment.	Completed
Ward 42 Lebo Ntsekeletsa	22/09/2022	Public Open Day: Scoping Phase	Lebo Ntsekeletsa asked Suzanne van Rooy to explain the purpose of the open day and the process that will be followed for the environmental authorisation process.	Suzanne van Rooy explained that the purpose of the open day was as follows: Introduce and present project to stakeholders:	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
				• Provide information about the proposed UG1 opencast project. • Provide information on the environmental authorisation process. • Provide feedback on findings of the Draft Scoping Report. • Explain way forward in Impact Assessment Phase. • Explain how stakeholders are involved. • Obtain comments from stakeholders. She further explained that before Glencore may continue with the proposed UG1 Opencast project, environmental authorisation in terms of the National Environmental Management Act was required. A full Scoping and Impact Assessment Reporting environmental authorisation process was required, and the project was currently in the Scoping Phase. She added that the competent authority for this environmental authorisation process was the North West Department of Mineral Resources and Energy.	
Stilotex JC Jacob Nyelonko	22/09/2022	Public Open Day: Scoping Phase	Jacob Nyelonko asked what specialist studies have been undertaken and what results have been obtained.	The following specialist studies have been commissioned: • Groundwater and surface water assessments; • Agricultural and Vegetation compliance statements; • Freshwater assessment; • Air Quality; • Noise assessment; • Blast impact; • Heritage impact assessment; • Visual impact assessment;	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
				• Closure Plan and Financial Provision. The impact assessment is available in Part A Section 10.4.	
Ward 42 Lebo Ntsekeletsa	22/09/2022	Public Open Day: Scoping Phase	Lebo Ntsekeletsa enquired regarding the construction of a road on the proposed opencast area. He stated there was a road already but that the environmental authorisation process was not competed yet.	The planned access roads to the UG1 Opencast project are shown on the proposed layout plan. Refer to Figure 18.	Completed
Ward 42 Lebo Ntsekeletsa	22/09/2022	Public Open Day: Scoping Phase	Lebo Ntsekeletsa stated that the picture on the front page of the BID is old.	Suzanne van Rooy confirmed that the picture on the front page of the BID was taken in March 2022.	Completed
Ward 35 Modise Mokoena	22/09/2022	Public Open Day: Scoping Phase	Modise Mokoena stated that the community wants to work with the mine/Glencore, but the mine does not want to work with them as a community. He further stated that they do not receive any communication from the mine. In addition, Modise said that the community never benefit from projects as stakeholders. The mine appoint external contractors, who appoints employees that are not from the local communities.	Communication to the community is facilitated through the quarterly community meetings. The recognised community structures and the counsellor sit in this meeting and engagements between Glencore and the community representative take place. The community representatives and the counsellor are then responsible to convey the message/discussions to the community at large. The last quarterly meeting for Waterval was held in August 2022.	Completed
Stilotex JC Jacob Nyelonko	22/09/2022	Public Open Day: Scoping Phase	Jacob Nyelonko stated that the most members of the community are not empowered, and he further asked how will they be empowered if they are not provided with the opportunity. He suggested that the mine hire local companies, train them and in that manner leave skilled individuals behind. The community wants to be heard, their concerns noted and taken into consideration.	Glencore Procurement Procedures are diligently followed in the appointment of vendors/contractors. All candidates are measured against a criterion and need to meet the necessary requirements. Each project will have its own set criteria in terms of community participation etc. depending on the scope of work required and the size of the project. Projects are availed to the community and public through advertisement and via the hub. Members of the community have been advised to ensure that they are registered with the hub as this platform is available to assist community members/companies from the community in	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
				preparing a profile and in becoming business ready. Unfortunately, Waterval East was placed on care and maintenance in 2019, making Waterval West plant the only operational site on Waterval. There have therefore not been many opportunities available in this area due to the extent of operations.	
Business Forum Elias Mosehla	22/09/2022	Public Open Day: Scoping Phase	Elias Mosehla stated that the community is more than capable to run an opencast themselves, they don't want a lot of things, they just want to run it themselves. He added that the host community wants to run the entire opencast project.	The opportunities that will emerge from the UG1 project will be advertised as per Glencore Procurement Procedure. All interested and qualifying companies will be given the opportunity to tender for the opportunities that Glencore will be awarding to external service providers. Should Glencore decide to outsource the mining of the opencast mine, then they will award the tender to the successful candidate, who has demonstrated through the procurement process that they meet the necessary requirements. Glencore supports community participation and development.	Completed
Ikemeleng Youth Group Clarence Mmolotsu	22/09/2022	Public Open Day: Scoping Phase	Clarence required details on the tender process.	The tender process are as follows: 1. Task or activity is identified which Glencore has decided to outsource. 2. Scope of work is drawn up and signed. 3. Expression of Interest is sent out in the form of an advertisement. 4. A tender briefing is then scheduled and communicated to the public. 5. Interested parties then attend the tender briefing. 6. Interested parties then submit their application forms with required supporting documents.	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
				7. Long list, short list is then created, and short-listed candidates are invited for interviews and site visits etc. 8. Due diligence is done on all shortlisted candidates. 9. The successful candidate is selected based on the ability to meet the requirements. 10. Tender is awarded to the successful candidate.	
Ward 42 Lebo Ntsekeletsa	22/09/2022	Public Open Day: Scoping Phase	Lebo Ntsekeletsa stated that there is a rumour that two companies have already been hired to run the opencast, they want clarification regarding this matter.	A company has been hired to undertake geotechnical investigations. The geotechnical investigation was undertaken on 6 September 2022. The results of the investigation will inform the engineering designs of the overburden stockpile, the run of mine stockpile and the pollution control dam. No contractors have been appointed to undertake the mining aspects of the UG1 opencast project.	Completed
Ward 42 Pleasure Bakae	22/09/2022	Public Open Day: Scoping Phase	Pleasure Bakae stated that Glencore is a shame in the business world. They are shielding the community. He asked if there is a way to make the process equal. He further stated that Glencore is not open towards the community, and do not provide the community with opportunities. Glencore's tender process is not transparent.	Glencore procurement procedures are diligently followed in the appointment of vendors/contractors. All candidates are measured against a criterion and need to meet the necessary requirements. Each project will have its own set criteria in terms of community participation etc. depending on the scope of work required. Projects are availed to the community and public through advertisement and via the hub. Members of the community have been advised to ensure that they are registered with the hub as this platform is available to assist community members/companies from the community in preparing a profile and in becoming business ready. Unfortunately, Waterval East was placed on care and maintenance in 2019, making Waterval West plant the only operational site on Waterval. There have therefore not been many opportunities available in this area due to the extent of operations.	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
Business Forum Phenyo Ngwako	22/09/2022	Public Open Day: Scoping Phase	Phenyo stated that they are not concerned for the environmental part of the process, their concern is with the procurement process. He wants mineral rights to be distributed to the community 60/40.	The purpose of the open day was to address environmental concerns or any concerns that need to be taken into consideration during the EIA stages. The quarterly community meeting is scheduled to address all other concerns the community may have with regards to projects, procurement and development. The mining right cannot be distributed 60/40. Glencore is currently the mining right owner for the area.	Completed
Stilotex JC Jacob Nyelonko	22/09/2022	Public Open Day: Scoping Phase	Jacob Nyelonko wanted clarity on project, skills empowerment.	Projects, skills, and empowerment are items that are discussed in the quarterly community meetings. The Environmental authorisation only deals with the Environmental aspects of the project.	Completed
Ward 42 Pleasure Bakae	22/09/2022	Public Open Day: Scoping Phase	Pleasure Bakae stated that the DMRE is failing them as a community. He further stated that he tried to engage with them. He requested the environmental consultants to provide the DMRE with their concerns.	All comments received during this open day will be included in the Final Scoping Report that will be submitted to the Department of Mineral Resources and Energy.	Completed
South African Heritage Resources Agency Elijah Dumisani Katsetse	28/09/2022	Letter	The SAHRA APM Unit notes that there are known cultural and/or heritage resources in the project area and there is potential impact on these resources. Therefore, the following needs to be undertaken in terms of section 38(3) of the National Heritage Resources Act (25 of 1999) as part of the EA application process. As the previously undertaken HIA assessment study was undertaken more than 10 years age (2010), SAHRA request that an updated heritage impact assessment be conducted for the proposed expansion of mining activities for. A field-based assessment of the	Beyond Heritage (Pty) Ltd has been appointed to undertake a heritage impact assessment for the proposed project. The findings of the assessment have been included in the Draft EIA/EMPr which is currently available for public comment, and will also be made available to SAHRA for comment. Refer to Appendix C10 for the heritage impact assessment and Part A Section 11.12 for the findings of the heritage impact assessment.	Completed.

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
			impact to archaeological resources must be conducted by a qualified archaeologist. The report must comply with section 38(3) of the NHRA and the SAHRA 2006 Minimum Standards: Archaeological and Palaeontological Component of Impact Assessments, and the 2012 Minimum Standards: Archaeological Component of Heritage Impact Assessments. The Minimum Standards provides allowance for a Letter of Recommendation for Exemption that can be submitted by a qualified archaeologist should they deem it appropriate. The assessment should include any other heritage resources that may be impacted such as built structures over years old, sites of cultural significance associated with oral histories, burial grounds and graves, graves of victims of conflict, and cultural landscapes or viewscapes must also be assessed. Further comments will be issued upon receipt of the above requested report and the submission of the draft EIA with appendices.		
Department of Water and Sanitation Vongani Mhing	14/10/2022	Minutes of meeting	Is this project for a new mine or an expansion of an existing mine.	Waterval Mine is an existing mine with two shaft areas, aEast and West shafts. The shafts are currently on care and maintenance. The mine is currently reclaiming the Waterval West TSF. The proposed UG1 opencast project is a new project adjacent to the current operations. It will be an opencast operation with its own infrastructure; however the mine will be utilising the existing plant at Waterval West for processing.	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
Department of Water and Sanitation Vongani Mhing	14/10/2022	Minutes of meeting	What infrastructure is within a wetland.	The following infrastructure will be located within an artificial wetland: • Opencast pit • Pollution water trench • Haul Road • Dirty water pipeline	Completed
Department of Water and Sanitation Palesa Mohajane	14/10/2022	Minutes of meeting	What will happen with the water that will be dewatered from the opencast area	Water from the opencast area will be transported via a pipeline and re-used in the Waterval West Plant.	Completed
Department of Water and Sanitation Palesa Mohajane	14/10/2022	Minutes of meeting	Was a waste classification was undertaken?	Yes. Refer to the Geohydrological Report in Appendix C6.	Completed
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	1. Following the receipt of the above mentioned, the Department has evaluated the submitted Scoping Report and the Plan of Study for the Environmental Impact Assessment and is satisfied that the documents comply with the minimum requirements as prescribed by Appendix 2(2) of the National environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations, 2014. The Scoping Report is hereby accepted by the in terms of regulation 22 (a) of the NEMA EIA Regulations.	It is noted that the Scoping Report submitted on 14 October 2022 has been accepted by the DMRE.	Completed
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	2. You may proceed with the Environmental Impact Assessment process in accordance with the tasks contemplated in the Plan of Study as required in terms of the NEMA EIA Regulations, 2014 and must cover	It is noted that the Environmental Impact Assessment process may commence as was indicated in the Plan of Study in the Draft and Final Scoping Reports. The results of the environmental impact assessment are contained in this Draft Environmental Impact	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
			the scope of assessment and content of the environmental impact assessment reports as stipulated on appendix 3(30 of NEMA: EIA Regulations, 2014).	Assessment and Environmental Management Programme report (EIA/EMPr).	
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	3. Comments from all the relevant stakeholders must be submitted to the Department together with the Environmental Impact Assessment Report (EIAR) This includes but is not limited to the Provincial Heritage Resources Authority, Provincial Environmental Department, Department of Forestry, Fisheries and the Environment (DFFE), Department of Water and Sanitation (DWS) and the local municipality. Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain such comments should be submitted to the Department.	The following departments have been informed of the proposed UG1 project and can currently review the Draft EIA/EMPr for comments: • DEDECT; • DWS; • SAHRA; • DFFE; • Rustenburg Local Municipality Proof of communication is available in Appendix B13.	Completed
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	4. In addition, the following amendments and additional information are required for the EIR: (a) Should a Water Use Licence be required, proof of application for a licence needs to be submitted; (b) A construction and operational phase EMP to include mitigation and monitoring measures. (c) Appropriate mitigation measures for blasting activities must be clearly indicated.	<u>Water Use Licence Application:</u> A Water Use Licence Application (WULA) has been initiated with the Department of Water and Sanitation (DWS). A pre-application meeting has been held with the DWS. Refer to Appendix B2 for minutes of the meeting. <u>Construction and Operational Phase EMP mitigation measures</u> Refer to Part A Section 10.4. <u>Mitigation measures for blasting activities</u> Refer to Part A Section 10.4	Completed

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	5. The applicant is hereby reminded to comply with the requirements of regulation 3 of the EIA Regulations, with regards to the time period allowed for complying with the requirements of the Regulations.	The applicant is aware that the Final EIA/EMPr must be submitted within 106 days of approval of the Final Scoping Report. The Final Scoping Report was approved by the DMRE on 13 January 2023, therefore the Final EIA/EMPr must be submitted to the DMRE by 28 April 2023.	Ongoing
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	6. Please ensure that the EIAR includes an A3 size locality maps of the area and illustrates the exact location of the proposed development. The maps must be of acceptable quality and as a minimum, have the following attributes: • Maps relatable to one another • Co-ordinates • Legible legends • Scale of 1:50 000 • Indicates of alternatives	Refer to Part A Section 4.	Completed
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	7. Further, it must be reiterated that, should and application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provision of any Specific Environmental Management Acts (SEMAs), proof of such application will be required.	The following applications (in addition to the environmental authorisation application) has been initiated: • Water Use Licence Application with the Department of Water and Sanitation. Refer to Appendix D.	Ongoing
Department of Mineral Resources and Energy Neo Nthoesane	13/01/2023	Letter/email	8. Your are requested to submit two (2) hard copies of the EIAR and EMPr and at least one electronic copy (CD/DVD) and to upload the same on the SAMRAD portal online system within 106 days of the acceptance of the scoping report to this office.	The Final Scoping Report accepted by the DMRE on 13 January 2023. Therefore, the Final EIA/EMPr report must be submitted to the DMRE by 28 April 2023. The Draft EIA/EMPr is currently available for public comment. Once the public comment period has lapsed, comments received will be incorporated into the Final EIA/EMPr to be submitted to DMRE. It	Ongoing

Interested and affected party	Date comments received	Source	Comment raised	EAP's response to comments as mandated by the applicant	Consultation status
				is noted that the Final EIA/EMPr needs to be submitted to the DMRE prior to 28 April 2023.	
Department of Mineral Resources and Energy	13/01/2023	Letter/email	9. Your attention is brought to Section 24F of the NEMA which stipulates "That no activity may commence prior to an environmental authorisation being granted by the competent authority".	It is noted that Glencore may not commence with the proposed UG1 opencast project until such time that the environmental authorisation has been granted by the competent authority (i.e. DMRE). The proposed project has not commenced to date.	Completed
Neo Nthoesane	13/01/2023	Letter/email	10. Ensure that the above-mentioned file reference numbers are indicated on all correspondence and documents submitted in relation to this application to aid ease of tracking.	It is noted that the file reference numbers must be included in all communication with the DMRE. The file number has been indicated on the front page of this Draft EIA/EMPr.	Completed

10 The environmental attributes associated with the existing Waterval Mine site

Information for this Section was obtained from the 2021 Consolidated EMPr, compiled by Shangoni Management Services, unless otherwise indicated.

10.1 Geology

10.1.1 Regional geology

The Glencore Alloys Waterval Mine and environs are underlain by layered sequence of mafic rocks, referred to as the Rustenburg Layered Suite of the Bushveld Igneous Complex. The suite was emplaced near the top of the older, predominantly sedimentary Transvaal Supergroup. Quartzite and shales (Magaliesberg Formation) of the Transvaal Supergroup form the floor rocks of the Bushveld Complex and build the prominent range of hills immediately west and to the south of Rustenburg. Norites, which form the Chill Zone of the Complex lie in contact with metamorphosed quartzite and shales and are overlain in the vicinity of Rustenburg and to the south and south east of Rustenburg by a sequence of bronzities and minor hartzburgites. These form the Basal Zone of the Complex. Refer to Figure 20.

The succeeding Critical Zone rocks are of more varied composition and contain economically important layers which are mined for their chrome and Platinum Group Metals (PGM). A prominent pyroxinite layer which contains the economically important Merensky Reef mined for its PGM to the north of the former Rustenburg Chrome mine, marks the top of the Critical Zone. A thick sequence of gabbro-norite assigned to the Main Zone of the Bushveld Complex overlies the Merensky Reef to the north and north east of Rustenburg.

Chrome ore is mined and occurs as layers in the host rock pyroxenite, in the lower critical zone of the Bushveld Igneous Complex. The Bushveld Complex occurs as younger intruded series into the older Transvaal Sequence sediments as an elliptical basin shaped layered mass, outcropping 61 000km². The Bushveld Complex is a layered mafic to ultramafic sequence and granitic units. The mafic to ultra-mafic layered sequence, the Rustenburg Layered Suite, is a younger intruded series and is part of the Bushveld Complex.

The Suite is subdivided into 5 zones:

- Upper zone;
- Main zone;
- Critical zone;
- Lower zone; and
- Marginal zone.

Chromitite is present in chromitite seams in the lower part of the Rustenburg Layered suite in the northern and south eastern belts as well as in the western lobe. The chromitite layers are confined to the critical zone and were grouped from the bottom upwards, into lower, middle and upper groups.

10.1.2 Site specific stratigraphy

Pyroxenites with minor anorthosite layers overlie the bronzitite/hartzburgite sequence and are succeeded by a thick sequence of interlayered norites and anorthosites. It is within this zone that the LG6 chrome seam occurs, which is mined underground at the Xstrata Waterval Mine.

The UG1 Chromitite Layer is developed stratigraphically above the LG6 Chromitite Layer and approximately 35m below the UG2 Chromitite Layer. The UG1 vary from a composite layer to a bifurcating layer comprising of several 'split' layers. The UG1 strike northwest to south east across the Xstrata property of Waterval West Mine and dips 10° – 14° to the north east. The sub-outcrop of the UG1 is covered by a sandy soil layer of at least 5m thick, which probably increases in thickness towards the Hex River. At an average dip of 120 and a highwall of 30m at 700 the strike distance (width) of the open pit on the UG1 layer will be 147m.

10.1.3 Site specific structural geology

The Bushveld Complex layers strike south-east to north-west across the whole of the mining area. The layers dip towards the northeast at an estimated average dip of 10° – 14°. The tabular Chromitite layers are interlayered by mainly pyroxenites, norites and anorthosites. This layering is occasionally interrupted by transgressive dykes and IRUPS (Iron Rich Ultramafic Replacement Pegmatoids). The layering is further interrupted by faults and potholing of the layers, causing discontinuities and mining losses within the ore body.

The silicate packages between the Chromitite layers increase in thickness with depth forcing the Chromitite layers further apart with depth. The Chromitite layers vary in thickness from 0.30m - 1.2m and are usually developed as composite Chromitite layers. The LG6, MG2 and MG4 are made up of packages containing up to three or more sub-layers.

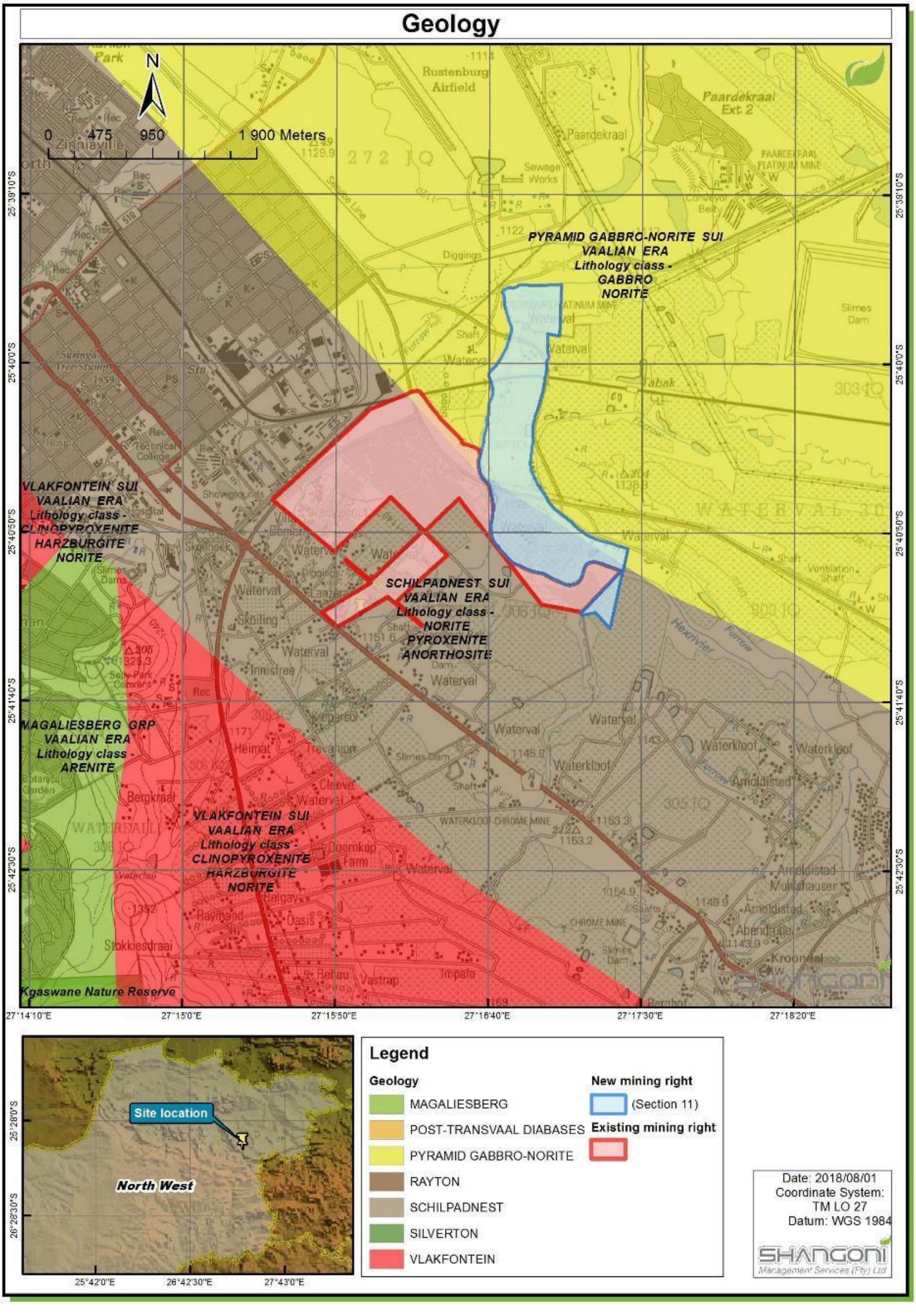


Figure 20: Map depicting the geology of the area associated with Waterval Mine (Shangoni, 2021)

10.2 Climate

10.2.1 Temperature

The monthly distribution of average daily maximum temperatures (refer to Figure 21 and Figure 22) shows that the average midday temperatures for Rustenburg range from 19.3°C in June to 29.4°C in January. The region is the coldest during July when the mercury drops to 1.7°C on average during the night.

Table 31: Average midday and nigh time temperatures in °C (Shangoni, 2021)

	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Midday	29	29	27	25	22	18	19	22	26	28	28	29
Night time	16	16	14	10	5	2	1	4	9	13	14	15

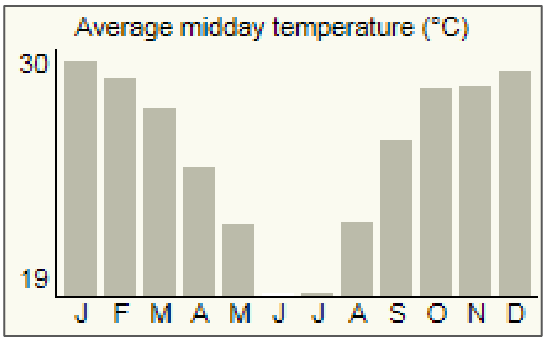


Figure 21: Average midday temperature per month for Rustenburg (source: http://www.saexplorer.co.za/ south-africa/climate/rustenburg_climate.asp)

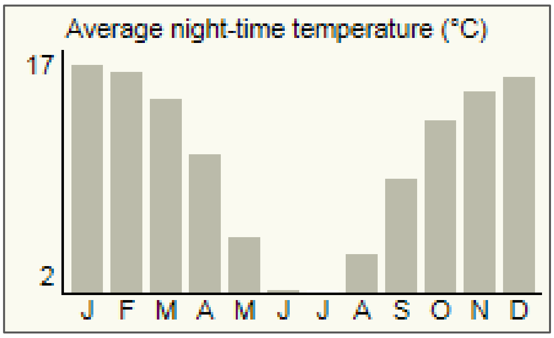


Figure 22: Average night-time temperature per month for Rustenburg (source: http://www.saexplorer.co.za/ south-africa/climate/rustenburg_climate.asp)

10.2.2 Rainfall

The Mean Annual Precipitation for Rustenburg ranges between 500-600mm per year, with most rainfall occurring during mid-summer. The Table 32 and Figure 23 show the average rainfall values for Rustenburg per month with the lowest rainfall in June, July and August (during the winter months) and the highest in January.

Table 32: Average rainfall per month (mm) (Shangoni, 2021)

Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
101	80	75	29	6	0	0	0	7	40	80	95

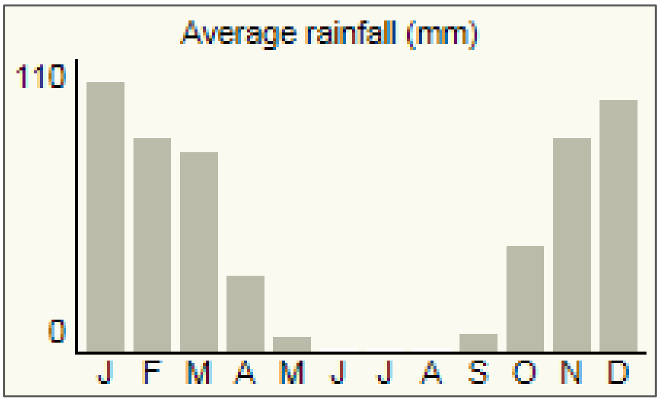


Figure 23: Average rainfall per Month in Rustenburg (source: http://www.saexplorer.co.za/south-africa/climate/rustenburg_climate.asp) (Shangoni, 2021)

10.2.3 Extreme weather conditions

Incidents of extreme weather conditions recorded at Rustenburg weather station (number 05115234) are frost, hail, drought, and high winds. Hail can be expected on an average 4 times a year. The rainfall is somewhat unreliable and in about 12% of all years rather severe drought conditions occur. The incidence of high winds is low. Frost can occur during cold winters when temperatures drop below 0°C.

10.2.4 Evaporation

The closest, reliable evaporation station is situated at Kroondal (WB station A2E08). The average monthly values for evaporation are presented in Table 33. The values show that a net water loss prevails in the region.

Table 33: Evaporation data for Rustenburg region (Shangoni, 2021)

Month	Evaporation (mm)	
	A-pan	S-pan
January	225	184
February	189	151
March	187	149
April	148	112
May	129	95
June	113	80
July	123	90
August	154	119
September	192	154
October	215	175
November	213	173
December	223	182
Total	**2 110**	**1 663**

A correlation exists between the temperatures and the evaporation rate, therefore the highest temperatures and evaporation occurs during the summer.

10.2.5 Wind direction and speed

The wind data for Rustenburg shows that the prevailing wind directions are north-east (2.5 $m.s^{-1}$) for the months January to April, south-west (2.5 $m.s^{-1}$) for May to September and north-west (2.3 $m.s^{-1}$) for October to December.

Table 34: Average wind data for Rustenburg

	N	NE	E	SE	S	SW	W	NW
%	0.0	23.0	16.0	4.0	9.0	6.0	10.0	32.0
Speed	0.0	2.5	2.2	2.2	2.4	2.5	2.5	2.3

10.2.6 Topography

10.2.6.1 Regional

The hydrographic basin of the area is almost entirely formed by the northern slopes of the Magaliesberg mountain range. Four main streams and their tributaries drain the area northwards to the low-lying areas where the whole drainage system enters the Crocodile River. These four streams are the Crocodile River itself (across the area of Brits), the Elandspruit, and the Sterkstroom (across the area of Mooinooi/Marikana) and the Hex River (across the area of Kroondal/Rustenburg). This whole drainage system cuts across, perpendicularly, the narrow and elongated strips of the geological, edaphic and vegetation formations of the area.

10.2.6.2 Site specific

The altitude of the area varies from ± 1160m at the south western corner of the property and slopes downward towards the north west and east reaching altitudes of 1140m in the vicinity of the Hex River. The natural topography of the Waterval mining area is relatively flat with a gentle, even slope from south to north, with the natural vegetation existing being savannah grasslands. Agricultural farming is temporarily sterilised due to mining activities although agricultural farming is minimised in this area due to a lack of groundwater.

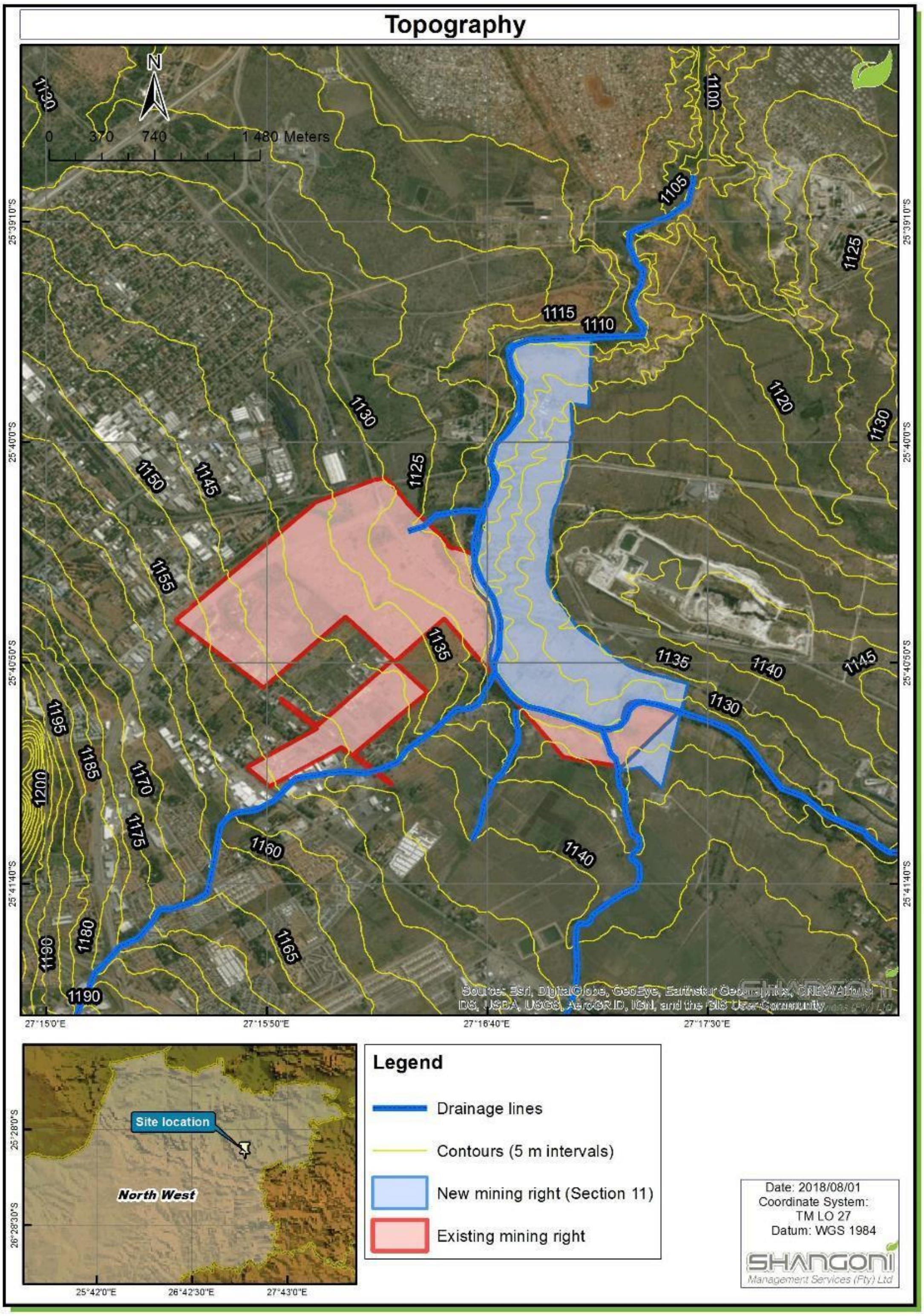


Figure 24: Map depicting the topography of the area associated with Waterval Mine (Shangoni, 2021)

10.3 Soils

The majority of the Glencore: Waterval Mine to the south is situated within landtype BA8 comprised of mainly loamy soils of the Hutton (34%) and Mispah (20%) series with a low clay content (6-34 %) while the northern parts of Waterval closer to the Hex are zoned under the EA3 landtype which is comprised mainly of black turf soils of the Arcadia (70%) soil series. These are black to dark brown, swelling soils with high clay content (43-

68 %) and are classified as vertisols due to their tendency to continuously invert themselves as a result of shrinking, cracking and swelling as moisture content changes. These turf soils also known as cracking clays are commonly associated with the ultramafic rocks of the platinum-bearing geology in this case norite and gabbro (Shangoni, 2021).

10.3.1 Soil analysis

The south-eastern portion of Waterval Mine comprises deep soils that are predominantly reddish with light textured (15-20% clay) A horizons and medium textured (20-25% clay) B horizons (Institute of Soil, Climate and Water, 2007) (refer also to Table 35 and Figure 26). The central zone predominantly consists of shallow duplex soils, having light textured A horizons on strong textured (30% or more clay) B horizons with varying degrees of wetness in the underlying horizons. The rest of the area has moderately deep, light textured soils with a zone on the northern boundary comprising a shallow, heavy textured B horizon that is wet for the better part of the year. The analysis results show the medium texture of the soils, as well as the neutral pH and low degree of leaching. The evidence of previous fertilization is the higher level of P in the topsoil horizons.

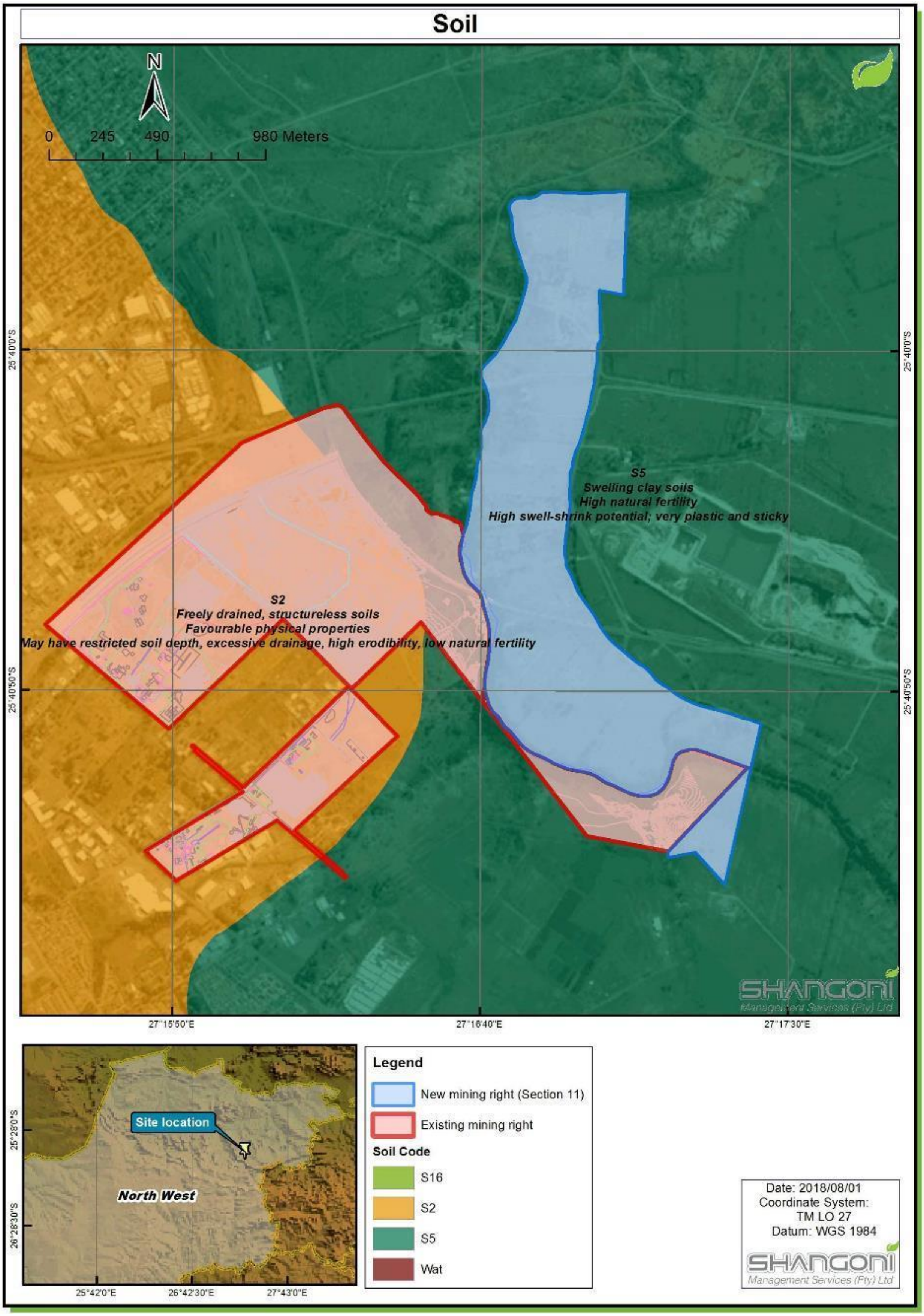


Figure 25: Map depicting the soils of the area associated with the Waterval Mine (Shangoni, 2021)

Table 35: Soil Legend

Map Unit	Depth (mm)	Soil characteristics	Area (ha)
sKa (l)	300-400	Brownish-yellow, moderately structured, sandy clay loam topsoils on brownish, mottled clayey subsoil, usually wet. Mainly soils of the *Katspruit* form.	2
mAv (m)	600-900	Yellowish-brown, weakly structured, sandy clay loam topsoils on moderately structured, yellowish sandy clay loam subsoils on mottled soft plinthite. Mainly soils of the *Avalon* and (occasionally) *Hutton* form.	10
sSe (l)	200-400	Yellowish-brown, weakly structured, sandy clay loam topsoils on moderately structured, yellowishbrown, clay subsoils with signs of wetness. Mainly soils of the *Sepane* form.	8
sVa (l)	200-400	Yellowish-brown, weakly structured, sandy clay loam topsoils on moderately structured, brown subsoils without signs of wetness. Mainly soils of the *Valsrivier* form.	5
dHu (h)	700-1200	Reddish-brown, weakly structured, sandy clay loam topsoils on reddish, weakly structured, sandy clay loam topsoils on rock. Mainly soils of the *Hutton* and (occasionally) *Avalon* form.	12
Total:			37

Source: Institute of Soil, Climate and Water, 2007

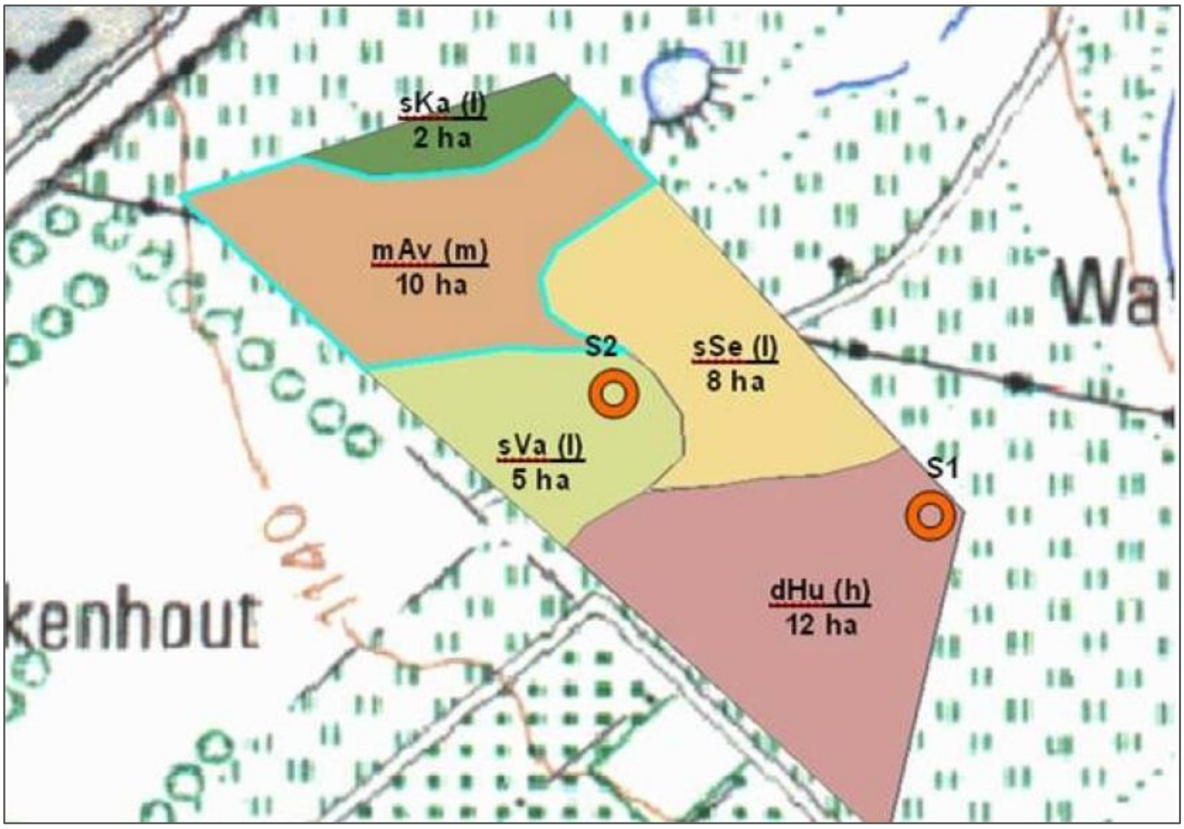


Figure 26: Soil Map (source: Institute of Soil, Climate and Water, 2007) (Shangoni, 2021)

10.3.2 Agricultural potential

The soil units as listed above were allocated to a relevant class of agricultural potential. The second part of the symbol (in brackets) refers to the potential class. The limitations are given in Table 36.

Table 36: Soil limitations (Shangoni, 2021)

Potential Class	Map Unit(s)	Soil limitations	Area
Low (l)	sKa sSe sVa	Occurs in low lying area and is prone to flooding. Shallow soil with structured layer restricting water infiltration. Shallow soil with structured layer restricting water infiltration.	15ha
Medium (m)	mAv	Moderately deep with water restricting layer further down.	10ha
High (h)	dHu	Deep soil with good permeability	12ha
Total:			37ha

Source: Institute of Soil, Climate and Water, 2007

In summary, the area mostly has soils of high and moderate agricultural potential due to sufficient depth with good to moderate permeability.

10.4 Vegetation

10.4.1 Regional vegetation

Glencore: Waterval Mine falls within Mucina & Rutherford's (2006) Moot Plains Bushveld (MPB)(SVcb8) and Marikana Thornveld (SVcb6) vegetation types. The Moot Plains Bushveld (MPB) is an open to closed, low, often thorny savanna dominated by various species of *Acacia* in the bottomlands and plains as well as woodlands of varying height and density of the lower hillsides. The Marikana Thornveld (MT) extends over North West and Limpopo Provinces, occurring on the plains from the Rustenburg area in the west, through Marikana and Brits, to the Pretoria area in the east, and forms part of the Savanna Biome[4] in South Africa. MT consists of open *Acacia* karroo-dominated woodland, occurring in valleys and slightly undulating plains, and some lowland hills. An increased density of shrubs (and often alien vegetation) occurs along drainage lines, on termitaria, and rocky outcrops or other habitats protected from fire (Mucina & Rutherford, 2006).

The MPB is considered Vulnerable with only 13% statutorily conserved mainly in the Magaliesberg Nature Area. The MT regional vegetation type is classified as Endangered with less than 1% statutorily conserved in reserves (i.e. the Magaliesberg Nature Area). This vegetation unit is highly impacted, and as much as 48% of the vegetation type has been transformed as a result of agriculture and urban development. Most agricultural development of this unit is in the western regions towards Rustenburg, while in the east (near Pretoria) industrial development is a greater threat of land transformation. (Mucina & Rutherford, 2006).

10.4.2 Site specific

10.4.2.1 Vegetation communities

The Waterval Mine area has been considerably transformed and very little viable land remains between infrastructure, roads and stockpile areas. The small pockets of natural to semi-natural vegetation in Waterval West constitute less than 20% of the site, Waterval East is almost completely transformed and Waterval North is largely rehabilitated areas (*Heteropogon - Melinis* Transformed Grassland).

Due to the disturbances within the area and its transformed nature, 22 vegetation sampling points were recorded. These were located within the remaining natural and semi-natural areas as well as within the rehabilitated areas. These points were analysed using TWINSPAN. Three floral communities (Units A-C) with Unit

[4] The Savanna biome covers the northern and eastern parts of South Africa where a continuously shifting balance occurs between the woody and herbaceous vegetation.

A and B covering wooded communities including the mixed alien and indigenous bushclumps, and C covering the open grasslands (previously transformed). A gradient of structure (dense woodland to open areas) is evident from this ordination. The identified communities are listed in Table 37 and mapped in Figure 28 *(Broad vegetation communities within Waterval).*

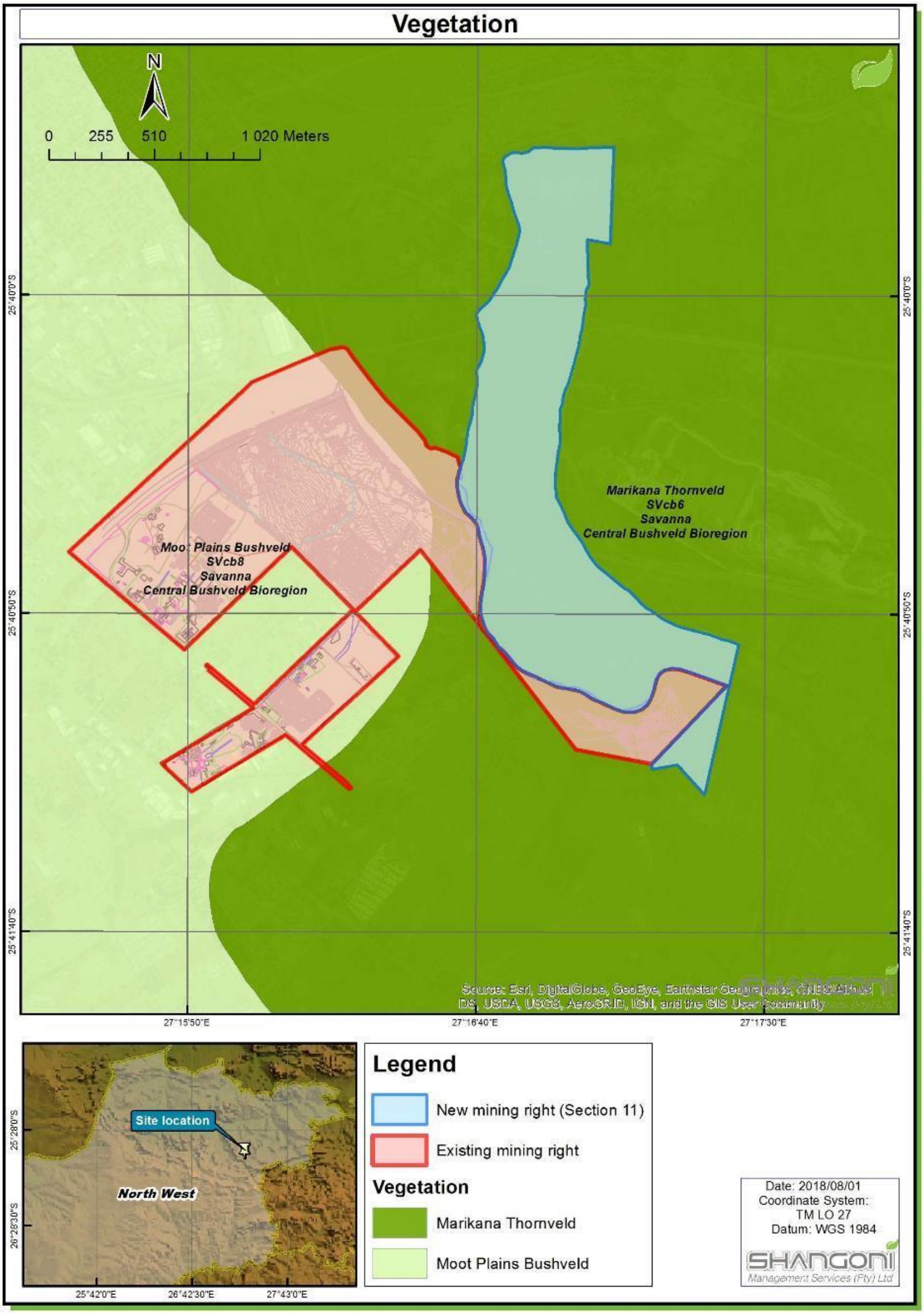


Figure 27: Vegetation map for Waterval Mine (Shangoni, 2021)

Table 37: Broad Habitat/Vegetation communities (Shangoni, 2021)

Unit	Habitat – Vegetation unit	AoC Ranking	% Cover
Moot Plains Bushveld / Marikana Thornveld Habitats			
A	*Acacia - Searsia* Bushclumps	Medium	2.09
A	- Mixed Woodland & Alien Bushclumps		4.38
C	*Heteropogon - Melinis* Transformed Grassland	Medium – Low	39.18
Wetland / Riparian Habitats			
B	*Celtis - Searsia - Ziziphus* Riparian Community	Very High	1.84
	Artificial Drainage	Medium	0.41
Transformed Habitats			
	Rehabilitated Open Pit Area	Medium – Low	1.60
	Alien Bushclumps	Low	4.40
	Landscaped & Mowed Areas	Low	2.74
	Mixed Alien & Disturbed Areas	Low	8.46
	Mining and Related Infrastructure	Low – None	24.27
	Recently Cleared	Low – None	2.68
	Dumping Areas	Low – None	3.42
	TSF and RWDs	Low – None	4.53

* AoS: Areas of Significance (Fauna; Flora; Wetland Importance)

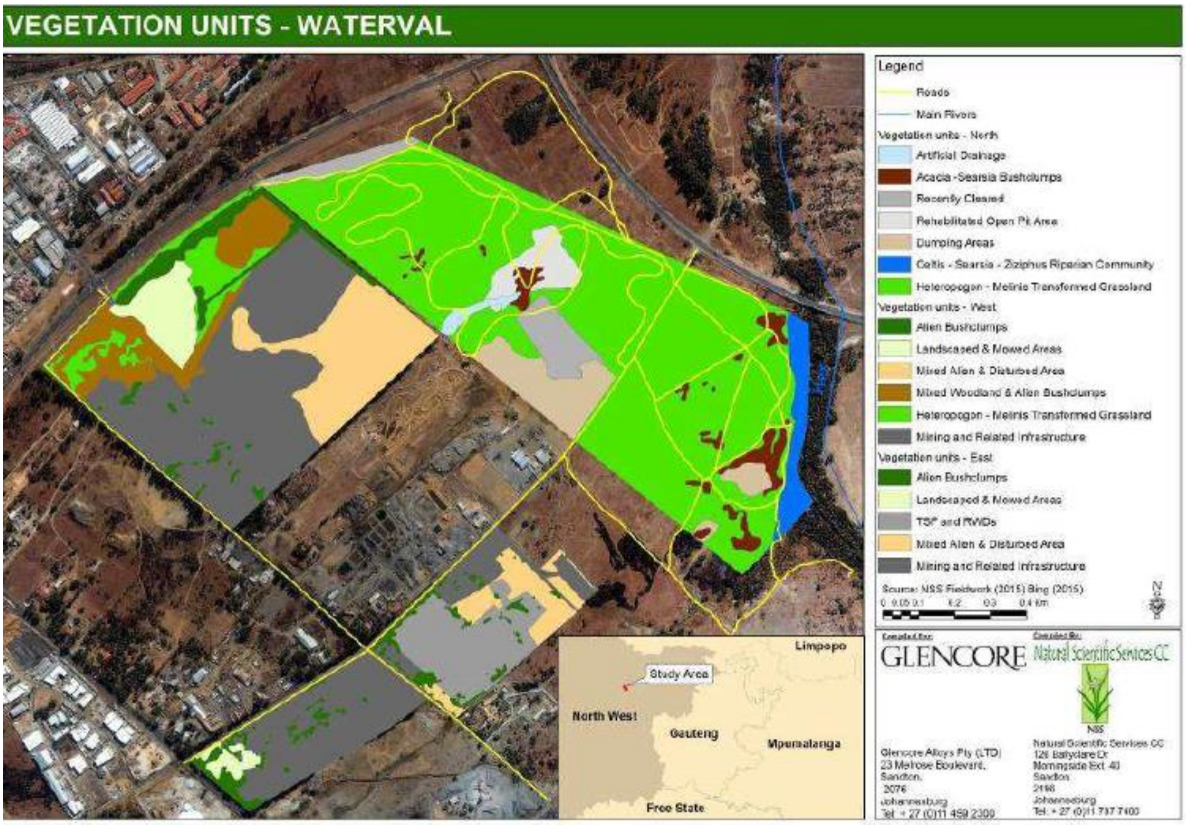


Figure 28: Broad Vegetation communities within Waterval (NSS, July 2015) (Shangoni, 2021)

A brief description on the natural / semi-natural vegetation communities is highlighted in Table 38 to Table 40. The remaining vegetated areas of the site are highly transformed areas, either landscaped or dominated by alien species.

Table 38: Unit A - Acacia - Searsia and Mixed Bushclumps Description (Shangoni, 2021)

Acacia - Searsia and Mixed Bushclumps		
Photographic representation		
National Zones	High Biodiversity Zone- MBG; MPB Vulnerable Habitat; SANBI Bushveld Bankenveld Priority Area; Critical Biodiversity Area (CBA) 2.	
Veg Structure	Height of Graminoid layer: 25cm – 1.5m (Variable) Shrub-Tree Height: 2-5m	
Units and % Site Coverage	*Acacia -Searsia* Bushclumps – 2.09% Mixed Woodland & Alien Bushclumps – 4.38%	
Condition/ Description	This habitat is very limited within the Study boundary. A number of bushclumps have established within the old pit area in the Waterval North section. The bushclumps within Waterval West are largely infested with alien species specifically Category 1b species. Fire and grazing has not occurred within Waterval West, which has probably assisted in alien growth within the site. The objective of fire is to remove moribund grass material and combat bush encroachment. There is, however, limited maintenance in the form of cutting that has occurred. Dumping of organic garden waste is also evident in this area.	
		Garden waste within the open areas of Waterval West
CI Species	*Bonatea antennifera (P)* *Huernia cf transvaalensis (P)* *Scadoxus puniceus (P)*	
Alien species	*Agave sisalana* [2]	*Macfadyena unguis – cati* [1b]

Acacia - Searsia and Mixed Bushclumps		
	Argemone mexicana [1b] *Arundo donax* [1b] *Bauhinia purpurea* [3] *Canna indica* [1b] *Caesalpinia ferrea* *Datura ferox* [1b] *Datura stramonium* [1b] *E. calmaldulensis* [2] *Grevillea robusta* [3] *Ipomeoa purpurea* [1b] *Jacaranda mimosifolia* [1b] *Lantana camara* [1b] *Leucaena leucocephala* [2] *Ligustrum spp* [1b]	*Melia azedarach* [1b] *Morus alba* [3] *Opuntia ficus-indica* [1b] *Pennisetum setaceum* [1b] *Pinus spp* [2] *Ricinus communis* [2] *Senna didymobotrya* *Solanum mauritianum* [1b] *Tecoma stans* [1b] *Tipuana tipu* [3] *Tithonia rotundifolia* [1b] *Xanthium strumarium* [1b]
Common species	*Acacia erubescens Welw. ex Oliv.* *Acacia karroo Hayne* *Acacia mellifera (Vahl) Benth. subsp. mellifera* *Acacia sieberiana DC. var. woodii (Burtt Davy) Keay & Brenan* *Aloe greatheadii Schonland var. davyana (Schonland) Glen & D.S.Hardy* *Aristida spp* *Asparagus spp Burch.* *Cenchrus ciliaris* *Commelina africana L. var. krebsiana (Kunth) C.B.Clarke* *Crabbea hirsuta Harv.* *Cynodon dactylon (L.) Pers.* *Dicerocaryum eriocarpum (Decne.) Abels* *Dichrostachys cinerea (L.) Wight & Arn. subsp. africana Brenan & Brummitt var. africana* *Ehretia rigida (Thunb.) Druce subsp. rigida* *Enneapogon cenchroides (Licht. ex Roem. & Schult.) C.E.Hubb.*	*Euclea crispa (Thunb.) Görke subsp. crispa* *Heteropogon contortus (L.) Roem. & Schult.* *Hyperthelia dissoluta (Nees ex Steud.) Clayton* *Lantana rugosa Thunb.* *Leucosidea sericea Eckl. & Zeyh.* *Melinis repens (Willd.) Zizka subsp. repens* *Panicum maximum Jacq.* *Peltophorum africanum Sond.* *Pogonarthria squarrosa (Roem. & Schult.) Pilg.* *Polydora (Vernonia) poskeana (Vatke & Hildebr.) H.Rob.sens.lat.* *Searsia lancea (L.f.) F.A.Barkley* *Searsia pendulina (Jacq.) Moffett* *Searsia pyroides (Burch.) Moffett var. pyroides* *Urochloa panicoides P.Beauv.* *Wahlenbergia (caledonica) undulata (L.f.) A.DC.* *Ziziphus mucronata Willd. subsp. mucronata*

Acacia - Searsia and Mixed Bushclumps		
Species Examples		
	Euphorbia heterophylla	*Acacia tortilis*

MBG - Mining and Biodiversity Guidelines; CBA – Critical Biodiversity Area; MPB – Moot Plains Bushveld; P – Protected under the relevant Ordinance; 1b Category 1b Alien Invasive; 2Category 2 Alien Invasive; 3Category 3 Alien Invasive

Table 39: Unit B Celtis - Searsia - Ziziphus Riparian Community Description (Shangoni, 2021)

***Celtis - Searsia - Ziziphus* Riparian Community**		
Photographic representation		
National Zones	High Biodiversity Zone- MBG; MT Threatened Ecosystem; SANBI Bushveld Bankenveld Priority Area; CBA 2; Unclassified FEPA	
Veg Structure	Height of herbaceous layer: 75cm – 1.2m (Variable) Tree Height: > 7m Coverage: 20-30% herbaceous cover in understory	
% Site Coverage	9.36%	
Condition/ Description	The tree layer within this unit is a mix of alien and indigenous species. Human movement through the understory is evident as well as harvesting of certain woody species. Riparian vegetation regulates river flow, improves water quality, provides habitats for faunal species and corridors for their movement, controls river temperatures, provides nutrients and maintains bank stability. A study was conducted on the Hex River by du Plessis (2008) and findings indicated that the current status of the Riparian Vegetation of the Hex River was rated as GOOD, indicating that the ecosystem is in a good state and biodiversity is largely intact (du Plessis, 2008).	
CI Species	*Scadoxus puniceus (P)*	
CI Faunal Species	*Half-collared Kingfisher (NT)*	
Alien species	*Bidens pilosa* *Cardiospermum grandiflorum* [1b]	*Jacaranda mimosifolia D.Don* [1b outside urban] *Melia azedarach L.* [1b outside urban]

Celtis - Searsia - Ziziphus Riparian Community		
	Dolichandra (Macfadyena) unguiscati (L.) A.H.Gentry [1b] *Eucalyptus camaldulensis* [1b wet]	*Solanum mauritianum (edges)* [1b] *Zinnia peruviana (L.).*
Common species	*Asparagus spp* *Celtis africana Burm.f.* *Clematis brachiata Thunb.* *Diospyros lycioides Desf. subsp. lycioides* *Grewia flava* *Melinis repens (Willd.) Zizka subsp. repens*	*Panicum maximum Jacq.* *Rhoicissus spp* *Searsia lancea (L.f.) F.A.Barkley* *Setaria lindenbergiana (Nees) Stapf* *Ziziphus mucronata Willd. subsp. mucronata*
Species Examples		
	Setaria lindenbergiana	***Celtis africana***

MBG - Mining and Biodiversity Guidelines; CBA – Critical Biodiversity Area; MT - Marikana Thornveld; P – Protected under the relevant Ordinance; 1b Category 1b Alien Invasive; NT – Near Threatened

Table 40: Unit C Heteropogon - Melinis Transformed Grassland Description (Shangoni, 2021)

Heteropogon - Melinis Transformed Grassland	
Photographic representation	 
National Zones	High Biodiversity Zone- MBG; MT Threatened Ecosystem; MPB Vulnerable Habitat; SANBI Bushveld Bankenveld Priority Area; CBA 2.
Veg Structure	Height of herbaceous layer: 15cm – 1m (Variable) Coverage: Refer to the Landscape Function Assessment (LFA) for a detailed % cover
% Site Coverage	39.18% of the Study Area
Condition/ Description	From the LFA conducted by NSS for the site (NSS, 2015), overall, with the exception of trees which are still sparse, the area under rehabilitation has recovered well with a good mix of grasses of differing heights and structure with the old pit area barely visible in current Google Earth imagery. Patch dynamics and soil surface functionality have increased slightly. The low PAI in both years indicates, however, that grass cover is far from its theoretical maximum.

***Heteropogon - Melinis* Transformed Grassland**		
	Historical imagery (below) indicated that prior to the open pit, the northern area was under extensive agriculture, which contributes to the current transformed nature and limited diversity of this unit. Within the small pockets in Waterval West, species richness was considered slightly improved as opposed to the grasslands in Waterval North.	
Cultural Importance (CI) Species	No CI species detected	
Alien species	*Bidens pilosa L.* *Campuloclinium macrocephalum*[1b] *Conyza bonariensis (L.) Cronquist* *Gomphrena celosioides Mart.* *Hibiscus trionum L.* *Pennisetum setaceum (Forssk.) Chiov.* [1b] *Portulaca oleracea L.*	*Paspalum urvillei Steud.* *Richardia brasiliensis Gomes* *Schkuhria pinnata (Lam.) Kuntze ex Thell.* *Sesbania bispinosa (Jacq.) W.Wight var. bispinosa* *Tagetes minuta L.* *Zinnia peruviana (L.) L.*
Common species	*Acacia karroo Hayne* *Aristida congesta Roem. & Schult. subsp. congesta* *Cynodon dactylon (L.) Pers.* *Dicerocaryum eriocarpum (Decne.) Abels* *Dicoma macrocephala* *Dichrostachys cinerea (L.) Wight & Arn. subsp. africana Brenan & Brummitt var. africana* *Eragrostis rigidior Pilg.* *Heteropogon contortus (L.) Roem. & Schult.* *Hyperthelia dissoluta (Nees ex Steud.) Clayton* *Kalanchoe paniculata Harv.*	*Melinis repens (Willd.) Zizka subsp. repens* *Neorautanenia ficifolia* *Nidorella anomala Steetz* *Nidorella hottentotica DC.* *Perotis patens Gand.* *Pogonarthria squarrosa (Roem. & Schult.) Pilg.* *Searsia lancea (L.f.) F.A.Barkley* *Sesbania bispinosa (Jacq.) W.Wight var. bispinosa* *Sida dregei Burtt Davy* *Themeda triandra Forssk.* *Tribulus terrestris L.* *Triumfetta sonderi* *Urochloa panicoides P.Beauv.*
Species Examples		
	Dicoma macrocephala	***Triumfetta sonderi***

*MBG - Mining and Biodiversity Guidelines; CBA – Critical Biodiversity Area; MPB – Moot Plains Bushveld; MT - Marikana Thornveld; [1b] Category 1b Alien Invasive; P – Protected under the relevant Ordinance; [*1]-Category 1 species; PAI - Patch Area Index*

10.4.2.2 Conservation Important Flora

Within this section the Conservation Important (CI) species are discussed. These include the National Threatened Plant Species Programme (TSP) lists, any Protected species according to the Nature Conservation Ordinance (12 of 1983) and any specific Endemic or Rare species. The Threatened Plant Species Programme (TSP) is an ongoing assessment that revises all threatened plant species assessments made by Craig Hilton-Taylor (1996), using IUCN Red Listing Criteria modified from Davis et al. (1986). According to the TSP Red Data list of South African plant taxa (POSA, June 2015), there are 46 Red Data listed species (Table 41) within the North West Province (including Data Deficient species) of which 2 species are Critically Endangered (CR), 4 Endangered (EN) and 8 are Vulnerable (VU) (Shangoni, 2021).

Table 41: Numbers of Conservation Important plant species per Red Data category within South Africa and North West (updated June 2015) (Shangoni, 2021)

THREAT STATUS	SOUTH AFRICA	NORTH WEST	2527CB
EX (Extinct)	28	0	0
EW (Extinct in the wild)	7	0	0
CR PE (Critically Endangered, Possibly Extinct)	57	2	0
CR (Critically Endangered)	332	0	0
EN (Endangered)	716	4	0
VU (Vulnerable)	1 217	8	0
NT (Near Threatened)	402	8	0
Critically Rare (known to occur only at a single site)	153	1	0
Rare (Limited population but not exposed to any direct or potential threat)	1 212	4	1
Declining (not threatened but processes are causing a continuing decline in the population)	47	7	0
LC (Least Concern)	13 856	1 935	248
DDD (Data Deficient - Insufficient Information)	348	0	0
DDT (Data Deficient - Taxonomically Problematic)	904	12	0
Total spp (including those not evaluated)	**23 399**	**2 416**	**260**

From the Plants of Southern Africa (POSA) website (QDS 2527CB) only 1 species has been recorded in the Study Region, *Frithia pulcha*. The conservation status of this species is considered Rare. Although the sampling was conducted outside of the flowering time for this species, the probability of it occurring on site is extremely low. During the site visit CI species within Waterval West were identified, *Huernia transvaalensis* and *Bonatea antennifera* (Figure 29). *Scadoxus puniceus* was identified along the Riparian zone within Waterval North. These three species are considered Protected species under the Nature Conservation Ordinance, 12 of 1983. Protected Species may not be cut, disturbed, damaged, and destroyed without obtaining a permit from North West Province or a delegated authority.

The past studies also yielded limited results in terms of CI species. Within 2007, no CI species were recorded and during the 2011 survey only the then Protected *Pellaea calomelanos* and the current Protected *Scadoxus puniceus* were noted. In addition to species that are considered Protected, special mention must be given to *Celtis africana*, a tree species that under serious threat in certain parts of South Africa due to, amongst others, hybridisation with alien species, *C. sinensis* and *C. australis*. Large individuals were located within Waterval West and along the Hex River. These trees along with others in the riparian zone regulates river flow, improves water quality, provides habitats for CI fauna and corridors for their movement, controls river temperatures, provides nutrients and maintains bank stability. The small, round fruits are mass produced and are eaten by numerous bird species, as well as by vervet monkeys. The species is also the host tree for the larvae of the African snout butterfly (*Libythea labdaca*). This species also has cultural value.

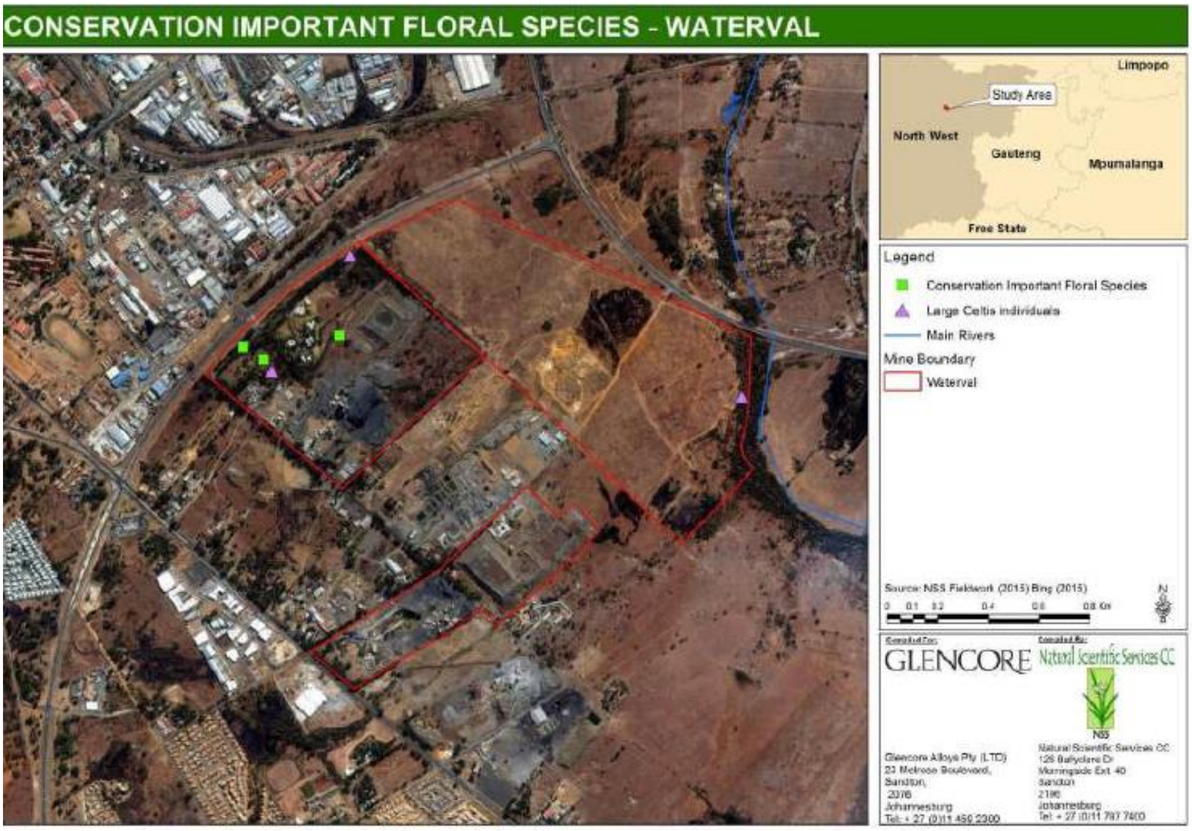


Figure 29: Locations of observed Conservation Important floral species (NSS, July 2015) (Shangoni, 2021)

10.4.2.3 Alien Invasive vegetation

NSS conducted an Alien Invasive Plan for Glencore Alloy Operations in 2009, which included Waterval East and West. A large number of alien species were recorded (cover and frequency), with the Top 6 species being:

- *Arundo donax* (Giant reed);
- *Conyza bonariensis* (Flax-leaf Fleabane);
- *Flaveria bidentis* (Smelter's bush (Yellow flower));
- *Lantana camara* (Common Lantana);
- *Melia azedarach* (Syringa); and
- *Tagetes minuta* (Khakibos).

These species are scattered throughout the Waterval West and East sites, but are dominant along the fence of the Tailings Storage Facility (TSF). Arundo donax is located in the northern section of Waterval West and along the settling ponds/RWDs to the north of the TSF, this is still evident in the 2015 study. Lantana camara was prolific and still is abundant along the fence lines as well as in the semi-natural pocket of vegetation in the western corner of the study area.

Combined surveys show approximately 50 species of aliens and 42% of these being Category 1b species that require immediate control and eradication (Table 42). One species not detected in the previous surveys within Waterval North was the Pom Pom Weed (*Campuloclinium macrocephalum*). This is an aggressive invader and should be eradicated on immediate detection. Currently the Category 2 species *Eucalyptus camaldulensis* as well as *Casuarina cunninghamiana* and the *Pinus* species are found mainly along the boundaries of the study area and are serving as a visual barrier as well as protection against wind-blown dust during operations and on the TSF. These will require permits if they are to remain.

NSS highlighted in 2009 that in the northern corner of the mine, there was evidence of dumping specifically large Granite slabs and boulders. A number of alien species are growing in between these boulders and in terms of successful removal and control, it was recommended that either the building material was sold off or removed off site to a designated landfill site. In the 2015 study, these were still present within the northern section of Waterval West.

Table 42: The main observed alien invasive plant species within Waterval East, West and North (Shangoni, 2021)

Family	Scientific Name	Survey	Conservation of Agricultural Resources Act 43 of 1983 (CARA)	NEM: BA
AGAVEACEAE	*Agave sisalana Perrine*	2011/2015	2	2
PAPAVERACEAE	*Argemone mexicana / ochroleuca*	2011/2015	1	1b
POACEAE	*Arundo donax L.*	2011/2015	1	1b
FABACEAE	*Bauhinia purpurea*	2011/2015	3	3 in NW
ASTERACEAE	*Bidens pilosa L.*	2015	Weed	Weed
MYRTACEAE	*Callistemon rigidus*	2011/2015	3	-
CANNACEAE	*Canna indica*	2011/2015	1	1b
ASTERACEAE	*Campuloclinium macrocephalum*	2015	1	1b
CASUARINACEAE	*Casuarina cunninghamiana*	2011/2015	2	
SAPINDACEAE	*Cardiospermum grandiflorum Sw.*	2015		1b
CACTACEAE	*Cereus jamacaru DC.*	2015	1	1b
ASTERACEAE	*Conyza bonariensis (L.) Cronquist*	2015	Weed	Weed
SOLANACEAE	*Datura ferox*	2011/2015	1	1b
SOLANACEAE	*Datura stramonium*	2011/2015	1	1b
ROSACEAE	*Eriobotrya japonica*	2011/2015	3	1b in W Cape & Forest only
MYRTACEAE	*Eucalyptus camaldulensis Dehnh.*	2011/2015	2	2** and 1b in wetlands
MYRTACEAE	*Eucalyptus grandis*	2011/2015	2	1b in riparian areas
EUPHORBIACEAE	*Euphorbia heterophylla L.*	2015	Weed	Weed
APOCYNACEAE	*Gomphocarpus fruticosus (L.) Aiton f. subsp. fruticosus*	2015		SA Weed
AMARANTHACEAE	*Gomphrena celosioides Mart.*	2015	Weed	Weed

Family	Scientific Name	Survey	Conservation of Agricultural Resources Act 43 of 1983 (CARA)	NEM: BA
PROTEACEAE	*Grevillea robusta*	2011/2015	1	3
MALVACEAE	*Hibiscus trionum L.*	2015	Weed	Weed
CONVOLVULACEAE	*Ipomoea purpurea*	2011/2015	3	1b
BIGNONIACEAE	*Jacaranda mimosifolia D.Don*	2011/2015	3	1b
VERBENACEAE	*Lantana camara L.*	2011/2015	1	1b
FABACEAE	*Leucaena leucocephala*	2011/2015	1	2 in NW
OLEACEAE	*Ligustrum spp*	2011/2015	3	1b
BIGNONIACEAE	*Macfadyena unguis – cati*	2011/2015	1	1b
MELIACEAE	*Melia azedarach L.*	2011/2015	3	1b (3 in urban areas)
MORACEAE	*Morus alba*	2011/2015	3	3
APOCYNACEAE	*Nerium oleander*	2011/2015	1	1b
SOLANACEAE	*Nicotiana glauca Graham*	2011/2015	1	1b
CACTACEAE	*Opuntia ficus-indica (L.) Mill.*	2011/2015	1	1b
POACEAE	*Pennisetum setaceum (Forssk.) Chiov.*	2011/2015	1	1b
POACEAE	*Paspalum urvilli*	2015	Weed	Weed
PHYTOLACCACEAE	*Phytolacca dioica*	2011/2015	3	3
PINACEAE	*Pinus spp*	2011/2015	2	
PORTULACACEAE	*Portulaca oleracea L.*	2015	Weed	Weed
RUBIACEAE	*Richardia brasiliensis Gomes*	2015	Weed	Weed
EUPHORBIACEAE	*Ricinus communis L. var. communis*	2011/2015	2	2
ASTERACEAE	*Schkuhria pinnata (Lam.) Kuntze ex Thell.*	2015	Weed	Weed
FABACEAE	*Senna didymobotrya*	2011/2015	1	1b in E & W Cape; KZN, L, M only
FABACEAE	*Sesbania bispinosa (Jacq.) W.Wight var. bispinosa*	2015	Weed	Weed
SOLANACEAE	*Solanum mauritianum*	2011/2015	1	1b
SOLANACEAE	*Sorghum halepense*	2011/2015	2	2
ASTERACEAE	*Tagetes minuta L.*	2015	Weed	Weed
TAMARICACEAE	*Tamarix ramossisima*	2011/2015	3	1b

Family	Scientific Name	Survey	Conservation of Agricultural Resources Act 43 of 1983 (CARA)	NEM: BA
BIGNONIACEAE	*Tecoma stans (L.) Juss. ex Kunth var. stans*	2011/2015	1	1b
FABACEAE	*Tipuana tipu*	2011/2015	3	3
ASTERACEAE	*Tithonia rotundifolia (Mill.) S.F.Blake*	2011/2015	Weed	1b
ASTERACEAE	*Xanthium strumarium*	2011/2015	1	1b
ASTERACEAE	*Zinnia peruviana (L.) L.*	2015	Weed	Weed

** Highlights in grey represent Category 1 species through either CARA or NEMBA; L = Limpopo; M = Mpumalanga; KZN = Kwa Zulu Natal; E & W Cape = Eastern & Western Cape; ** Category 2 for plantations, woodlots, bee-forage areas, wind-rows and the lining of avenues.*

10.5 Fauna

10.5.1 Mammals

Five mammals, 59 bird, four reptiles, nine butterfly and six dragonfly species have been observed during all the NSS surveys at Waterval. Context for these figures is provided in Table 43 which compares observed species richness on site with that expected for the site, for the QDS and the greater region.

Table 43: Summary of faunal species richness on site as compared to a regional scale (Shangoni, 2021)

FAUNAL GROUP	POTENTIAL			OBSERVED		
	REGION*	QDS**	SITE***	2007 & 2011	2015	TOTAL
Mammals	142	27	49	4	4	7
Birds	402	331	252	39	33	59
Reptiles	73	31	37	2	2	4
Frogs	24	12	15	0	0	0
Butterflies	188	43	149	0	9	9
Dragonflies & Damselflies	42	0	36	0	6	6
Megalomorph Spiders		0		0	0	0
Scorpions	12	0	5	0	0	0
KEY						
**Species whose distribution ranges overlap the greater region (2526BB, 2527AC, 2527CA, 2527CB)* ***Species that have been recorded during attlassing projects within the QDS 2526 BB (ADU, 2015)* ****Species that are likely to occur on site (LoO of 2 or 3)*						

The Marikana Thornveld regional vegetation unit supports a moderate diversity of mammals (78 spp.), but at low densities (0.02 spp./km^2) and with few (0.05%) game species (Mucina & Rutherford, 2006; Power, 2014). Species richness within this vegetation type has decreased by 23% in recent times based on historical data (Power, 2014). MammalMap (2015) lists 27 species for the QDS 2527CB covering the study area. Based on distribution and habitat just over 61 species are considered likely to occur. These include mostly hardy and adaptable species that are tolerant of high levels of habitat transformation and disturbance. A total of seven species of mammals have been recorded by NSS to date at Waterval. These include Common Mole-rat, Namaqua Rock Mouse, Red Veld Rat, Scrub Hare, Slender Mongoose, Kudu (habituated individual observed with cows during 2011 visit) and Steenbok.

The lack of rocky outcrops precludes numerous ripicolous species (e.g. Rock Hyrax and Klipspringer). Given the extent to which the soil profile has been transformed no golden moles are considered likely to occur. The Hex River that borders the study area to the east provides a valuable corridor for dispersal and genetic exchange of a wide range of locally occurring fauna. The river is of a significant size and more than likely supports Cape Clawless Otter and Water Mongoose. The adjacent open veld west of the river and north of the operations likely supports hardy and ubiquitous species with the exception of a few potentially occurring CI species.

Eight mammal species of Conservation Importance ("CI") are likely to occur, none were observed on site. Suitable habitat exists at Waterval, specifically within the office gardens and adjacent veld, for the Southern African Hedgehog (NT) which typically inhabits a diversity of habitats (including gardens) in the temperate to semi-arid interior of South Africa where there is thick, dry vegetation cover for nesting and an abundance of insects and other food items (Skinner & Chimimba 2005; Stuart & Stuart 2007). Hedgehogs are widespread but uncommon in North West Province. Questionnaire surveys yielded 23 records for this species within the Zeerust Thornveld vegetation type (Power, 2014). In terms of CI carnivores Serval (NT) and Cape Fox (PS) may also occur. Past NSS studies in a variety of locations have shown both these species to be fairly resilient to high levels of habitat transformation and human activity.

Table 44: Potentially occurring CI mammal species in the study area (Shangoni, 2021)

Order[1] & Species[2,4]	Common Name[2,4]	Conservation Status			LoO[2,4,6]	2527CA[6]
		Global IUCN[5]	**S.A. Red Data[2,4]**	**S.A. NEM:BA[3]**		
AFROSORICIDA (Golden moles)						
Chrysospalax villosus	Rough-haired Golden Mole	**VU (U)**	**CR**	**SCH**	4	
Neamblysomus julianae	Juliana's Golden Mole	**VU (U)**	**VU**	**VU**	4	
Neamblysomus julianae	Juliana's Golden Mole – Pretoria subpopulation	**VU (U)***	**CR**	**VU***	4	
EULIPOTYPHLA (Hedgehogs & shrews)						
Crocidura maquassiensis	Maquassie Musk Shrew	**LC (U)**	**VU**	**-**	4	
Atelerix frontalis	Southern African Hedgehog	**LC (S)**	**NT**	**PS**	2	
CHIROPTERA (Bats)						
Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	**LC (U)**	**NT**	**-**	4	
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	**LC (U)**	**NT**	**-**	3	
Rhinolophus darlingi	Darling's Horseshoe Bat	**LC (U)**	**NT**	**-**	3	
Rhinolophus blasii	Blasius's Horseshoe Bat	**LC (D)**	**NT**	**-**	4	
Rhinolophus simulator	Bushveld Horseshoe Bat	**LC (D)**	**NT**	**-**	3	
Cloeotis percivali	Percival's Short-eared Trident Bat	**LC (U)**	**VU**	**-**	4	

Miniopterus natalensis	Natal Long-fingered Bat	**LC (U)**	**NT**	**-**	3	
Pipistrellus rusticus	Rusty Pipistrelle	**LC (U)**	**NT**	**-**	3	
PHOLIDOTA (Pangolin)						
Manis temminckii	Pangolin	**LC (D)**	**VU**	**VU**	4	
RODENTIA (Rodents)						
Mystromys albicaudatus	*White-tailed Rat*	***EN (D)***	***EN***	**-**	*4*	
Dasymys incomtus	*Water Rat*	***LC (U)***	***NT***	**-**	*4*	
CARNIVORA (Carnivores)						
Hyaena brunnea	Brown Hyaena	**NT (D)**	**NT**	**PS**	4	
Crocuta crocuta	Spotted Hyaena	**LC (D)**	**NT**	**PS**	5	
Acinonyx jubatus	Cheetah	**VU (D)**	**VU**	**VU**	5	
Panthera pardus	Leopard	**NT (D)**	**LC**	**VU**	4	1
Panthera leo	Lion	**VU (D)**	**VU**	**VU**	5	
Felis nigripes	Black-footed Cat	**VU (D)**	**LC**	**PS**	4	
Leptailurus serval	Serval	**LC (S)**	**NT**	**PS**	3	
Lycaon pictus	African Wild Dog	**EN (D)**	**EN**	**EN**	5	
Vulpes chama	Cape Fox	**LC (S)**	**LC**	**PS**	3	
Lutra maculicollis	Spotted-necked Otter	**LC (D)**	**NT**	**PS**	4	
Mellivora capensis	Honey Badger	**LC (D)**	**NT**	**PS**	4	
PROBOSCIDEA (Elephants)						
Loxodonta africana	African Elephant	**VU (I)**	**LC**	**PS**	5	
Equus quagga	Plains Zebra	**LC (S)**	**LC**	**-**	5	
Ceratotherium simum	White Rhinoceros	**NT (I)**	**LC**	**PS**	5	
Diceros bicornis	Black Rhinoceros – Northeastern Race	**CR (I)***	**VU**	**EN***	5	
Diceros bicornis	Black Rhinoceros – Southwestern Race	**CR (I)***	**CR**	**EN***	5	
RUMINATA (Even-toed ungulates)						
Hippopotamus amphibius	Hippopotamus	**VU (D)**	**LC**	**-**	5	
Connochaetes gnou	Black Wildebeest	**LC (I)**	**LC**	**PS**	5	
Damaliscus lunatus	Tsessebe	**LC (D)**	**EN**	**EN**	5	
Hippotragus niger	Sable	**LC (S)**	**VU**	**-**	5	
Philantomba monticola	Blue Duiker	**LC (S)**	**VU**	**VU**	5	
Redunca arundinum	Reedbuck	**LC (S)**	**LC**	**PS**	5	
Ourebia ourebi	Oribi	**LC (D)**	**EN**	**EN**	5	
KEY						
Status: *CR = Critically Endangered; D = Declining; DD = Data Deficient; EN = Endangered; I = Increasing; LC = Least Concern; NT = Near Threatened; PS = Protected Species; S = Stable; U = Unknown; VU = Vulnerable.*						

Likelihood of Occurrence (LoO): *1 = Present; 2 = High; 3 = Moderate; 4 = Low; 5 = May occur as a managed population; a = previous survey only; b = both surveys c = current survey only.*

Sources: *[1]Stuart & Stuart (2007); [2]Friedmann & Daly (2004); [3]ToPS List (2007); [4]Monadjem et al. (2010); [5]IUCN (2013.1); [6]MammalMap (2015).*

Mine shafts in the vicinity may provide suitable habitat for a number of NT bat species that require subterranean roosts namely Geoffroy's Horseshoe Bat, Darling's Horseshoe Bat, Bushveld Horseshoe Bat and Natal Long-fingered Bat. The most likely to occur are Bushveld Horseshoe Bat and Natal Long-fingered Bat both of which have been recorded within the QDS (MammalMap, 2015). Another CI bat species that may occur with a moderate to low likelihood of occurrence is the Rusty Pipistrelle (NT) a small bat frequents savannah woodland and roosts in rock crevices and under tree bark (Stuart & Stuart, 2007). Although no bats were detected (due to the study being limited in time and night work being unfeasible) several widespread and adaptable species almost certainly occur such as Wahlberg's Epauletted Fruit Bat, Egyptian Free-tailed Bat, Yellow-bellied House Bat, Mauritian Tomb Bat and Cape Serotine.

10.5.2 Birds

Of the 402 regionally occurring bird species 331 have been recorded during SABAP 1 & 2 (2015) surveys in the Quarter Degree Square (QDS) (2627DB) and pentad (2540_2715) covering Waterval. Most of these species are likely to have been recorded at more significant habitat features in the area and only some 252 species are likely to occur on site. During all visits to Waterval NSS has recorded 59 species. Bird diversity is certainly highest near the main office where the lush setting attracts a wide array of garden birds and bushveld species alike (e.g. Acacia Pied Barbet, Violet-eared Waxbill, African Paradise-flycatcher, Palm Swift, Grey-backed Camaroptera, and Bronze Mannikin). Outside this area in the adjacent veld, diversity is significantly lower but increases towards the Hex River.

Four CI bird species may occur at Waterval. One of these species was detected at Waterval North, the Half-collared Kingfisher (NT). A single individual was observed flying down the Hex River during the current 2015 survey. Throughout its range, this uncommon species occurs at unusually low densities (even in prime habitat) and due to its strict reliance on fast flowing, clear, perennial streams and rivers with an abundance of marginal vegetation the species is highly susceptible to effects that compromise this habitat. Specifically declines in water quality from sedimentation, erosion, pollution and extraction but also from the removal of indigenous vegetation or alien encroachment (Barnes, 2000; Maclean, 1996).

The other potentially occurring species include Lanner Falcon, Lesser Kestrel and Peregrine Falcon. All three of these CI raptor species may occur based on distribution but would only utilise the site for foraging as the Lesser Kestrel is a non-breeding migrant while Lanner and Peregrine falcons typically nest on cliffs and high man-made structures.

All other regionally occurring CI water bird species are precluded by the lack of significant pans and dams. The large CI raptor species are all unlikely to occur based on a lack of suitable habitat and prey base in the form of large game which also precludes to Red-billed Oxpecker. The site is too small and active to support any of the CI large terrestrial bird species. African Grass Owl is unlikely to occur based on a lack of suitable breeding and foraging habitat in the form of sufficiently dense *Imperata cylindrica* or other rank grass. Melodious Lark is likely precluded by the lack of its preferred habitat open *Themeda* climax grassland. Yellow-throated Sandgrouse is unlikely to occur based on the extensive habitat transformation on site and nearby vicinity.

Table 45: Present and potentially occurring CI bird species in the study area (Shangoni, 2021)

Category[1] & Species[4]	**Common Name[4]**	**Conservation Status**			**LoO[5]**	**SABAP[4,5]**	
		Global IUCN[3]	**S.A. Red Data[6]**	**S.A. NEM:BA[2]**		**2527CB**	**2540_2715**
1. Ocean birds							
Pelecanus rufescens	Pink-backed Pelican	**LC (S)**	**VU**	**EN**	4	x	
2. Inland water birds							
Ciconia nigra	Black Stork	**LC (U)**	**NT**	**VU**	4	x	
Gorsachius leuconotus	White-backed Night-heron	**LC (S)**	**VU**	**-**	4		
Leptoptilos crumeniferus	Marabou Stork	**LC (I)**	**NT**	**-**	4		
Mycteria ibis	Yellow-billed Stork	**LC (D)**	**NT**	**-**	4	x	x
Phoeniconaias minor	Lesser Flamingo	**NT (D)**	**NT**	**-**	4	x	
Phoenicopterus roseus	Greater Flamingo	**LC (I)**	**NT**	**-**	4	x	
Rynchops flavirostris	African Skimmer	**NT (D)**	**EX (Vag)**		4	x	
3. Ducks & wading birds							
Oxyura maccoa	Maccoa Duck	NT (D)	LC	-	4		
Rostratula benghalensis	Greater Painted-snipe	LC (D)	NT	-	4		x
4. Large terrestrial birds							
Anthropoides paradiseus	Blue Crane	**VU (S)**	**VU**	**EN**	4	x	
Ardeotis kori	Kori Bustard	**NT (D)**	**VU**	**VU**	4		
Eupodotis senegalensis	White-bellied Korhaan	**LC (D)**	**VU**	**-**	4		
Sagittarius serpentarius	Secretarybird	**VU (D)**	**NT**	**-**	4	x	
5. Raptors							
Aquila rapax	Tawny Eagle	**LC (S)**	**VU**	**VU**	4		
Circus ranivorus	African Marsh-harrier	**LC (D)**	**VU**	**PS**	4	x	
Falco biarmicus	Lanner Falcon	**LC (I)**	**NT**	**-**	3		x
Falco naumanni	Lesser Kestrel	**LC (S)**	**VU (NB)**	**VU**	3	x	
Falco peregrinus	Peregrine Falcon	**LC (S)**	**NT**	**VU**	3		x
Gyps africanus	White-backed Vulture	**EN (D)**	**VU**	**EN**	4		
Gyps coprotheres	Cape Vulture	**VU (D)**	**VU**	**EN**	4	x	
Polemaetus bellicosus	Martial Eagle	**VU (D)**	**VU**	**VU**	4		

Torgos tracheliotos	Lappet-faced Vulture	**VU (D)**	**VU**	**EN**	4		
6. Owls & nightjars							
Tyto capensis	African Grass-owl	**LC (D)**	**VU**	**VU**	4		
7. Sandgrouse, doves etc							
Pterocles gutturalis	Yellow-throated Sandgrouse	**LC (D)**	**NT**	**-**	4	x	
8. Aerial feeders, etc							
Alcedo semitorquata	Half-collared Kingfisher	**LC (D)**	**NT**	**-**	1c		
Coracias garrulus	European Roller	**NT (D)**	**LC (NB)**	**-**	4	x	
9. Cryptic & elusive insect-eaters							
Certhilauda brevirostris	Agulhas Long-billed Lark	**LC (S)**	**NT (End)**	**-**	4	x	
Mirafra cheniana	Melodious Lark	**NT (D)**	**NT (End)**	**-**	4		
11. Oxpeckers & nectar feeders							
Buphagus erythrorhynchus	Red-billed Oxpecker	**LC (D)**	**NT**	**-**	4	x	
KEY							
Status: *D = Declining; EN = Endangered; I = Increasing; LC = Least Concern; NT = Near Threatened; PS = Protected Species; S = Stable; U = Unknown; VU = Vulnerable.* ***Likelihood of Occurrence (LoO):*** *1 = Present; 2 = High; 3 = Moderate; 4 = Low; 5 = May occur as a managed population; a = previous survey only; b = both surveys c = current survey only.* ***Sources:*** *[1]Newman (2002); [2]ToPS List (2007); [3]IUCN (2013.1); [4]SABAP 1 (2013); [5]SABAP2 (2015); [6]Barnes (2000)*							

10.5.3 Reptiles

Some 70 reptile species may occur in the region. Of these, 31 species have been recorded within the QDS covering the study area (ReptileMap, 2015). On site, only 37 common and widespread species are considered likely to occur based on distribution and the availability of suitable habitat.

Reptile abundance is likely to be concentrated within the lush gardens and buildings of the main mine office. Two species were detected here during the brief site visit Common Dwarf Gecko and Variable Skink. Species not detected but that are highly likely to around the main offices include Speckled Rock Skink, Rhombic Night Adder, Common House Snake, Snouted Cobra, Mozambique Spitting Cobra, Red-lipped Snake, Boomslang, Spotted Bush Snake, Common Tropical House Gecko, Puff Adder, Transvaal Gecko, Peter's Thread Snake, Tree Agama, and Turner's Gecko. In the adjacent open veld, particularly closer to the Hex River, species such as Brown Water Snake and Savanna Lizard were detected but all of the above mentioned species including several others (e.g. Nile Monitor, Yellow-throated Plated Lizard, Cape Skink, Nile Monitor and Common Flap-neck Chameleon) may well occur.

No CI reptiles were observed during the site visit. Of the two regionally occurring CI species, neither Southern African Python nor Nile Crocodile are likely to occur. The former is precluded by a lack of suitable rocky and wetland habitat but also by the perimeter fences and high activity levels while the latter is only likely to occur in reserves and breeding ranches in the greater area.

Table 46: Potentially occurring CI reptile species in the study area (Shangoni, 2021)

Family & Species[1]	Common Name[1]	Status			LoO[1,4]	2527CA[4]
		Global IUCN[3]	S.A. Red Data[1]	S.A. NEM:BA[2]		
CROCODYLIDAE (Crocodile)						
Crocodylus niloticus	Nile Crocodile	**LC**	**2VU**	**PS**	4	
PYTHONIDAE (Python)						
Python natalensis	Southern African Python	**-**	**2LC**	**PS**	4	
KEY						
Status: *LC = Least Concern; PS = Protected Species; VU = Vulnerable.* ***Likelihood of Occurrence (LoO):*** *1 = Present; 2 = High.* ***Sources:*** *[1]Bates et al. (2014); [2]ToPS List (2007); [3]IUCN (2013.1); [4]ReptileMap (2014)*						

10.5.4 Frogs

Of the 24 regionally occurring frog species 12 species have been recorded during atlassing surveys in the QDS (FrogMap, 2015). Based on distribution and the availability of suitable habitat around 15 species may occur at Waterval. No frog species have been recorded during any of the NSS site visits.

One small shallow artificial depression was encountered in the adjacent open veld that showed signs of holding water for extremely brief periods of time. This habitat is likely to support only those frog species that are capable of breeding in small highly ephemeral, rain-filled puddles such as Tremolo Sand Frog, Natal Sand Frog, Tandy's Sand Frog and Boettger’s Caco. Rain permitting the depression may also support Broad-banded Grass Frog, Plain Grass Frog, Bubbling Kassina and Banded Rubber Frog. This depression appears too vegetated, artificial and ephemeral to support either of the two regionally occurring CI frog species (Table 47) namely Giant Bullfrog (NT) and African Bullfrog (PS) and no suitable habitat for these was encountered elsewhere on site.

Other species that may occur include Bushveld Rain Frog (which is not dependant on standing water to breed as tadpoles develop within a burrow kept moist by unfertilized egg capsules) as well as the hardy and ubiquitous species Common River Frog, Platanna, Guttural Toad, Eastern Olive Toad, Raucous Toad and Red Toad.

Table 47: Potentially occurring CI frog species in the study area (Shangoni, 2021)

Family[4] & Species[4]	Common Name[4]	Status			LoO[3,5]	2527CA[5]
		Global IUCN[2]	S.A. Red Data[3]	S.A. NEM:BA[1]		
PYXICEPHALIDAE (River, stream, moss & sand frogs)						
Pyxicephalus adspersus	Giant Bullfrog	LC (D)	NT	PS	3	
Pyxicephalus edulis	African Bullfrog	LC (U)	LC	PS	3	
KEY						
Status: *D = Declining; LC = Least Concern; NT = Near Threatened; PS = Protected Species; U = Unknown.* ***Likelihood of Occurrence (LoO):*** *3 = Moderate.* ***Sources:*** *[1]ToPS List (2007); [2]IUCN (2013.1); [3]Minter et al. (2004); [4]Du Preez & Carruthers (2009); [5]FrogMap (2015)*						

10.5.5 Terrestrial Macro-invertebrates

10.5.5.1 Butterflies

Atlas records from the ADU's LepiMap (2015) list 43 species for the QDS covering the study area and some 150 species are considered likely to occur. No CI butterfly species are likely to occur on site. The only regionally occurring butterfly of conservation importance, the Marsh Sylph butterfly (RHS), is unlikely to occur based on a lack of habitat and presence of its larval host plant Swamp Rice Grass (*Leersia hexandra*). In total nine species have been observed on site and include Common Blue, Topaz-spotted Blue, Painted Lady, Bushveld Orange Tip, Citrus Swallowtail, Common Bush Brown, Brown-veined White, Broad-bordered Grass Yellow and African Monarch.

10.5.5.2 Dragonflies and Damselflies

Analysis of distribution data provided in Samways (2008) suggests that some 42 species have the potential to occur in the region. None of these species have been assigned a Red List status (Samways, 2006). Of these some 36 species may occur on site based on distribution and habitat. In total 6 dragonfly species have been observed at Waterval. Of greatest significance to the presence of dragonflies is the Hex River, which provide a variety of microhabitats in the form of fast flowing shallow riffles (limited), deep pools with overhanging vegetation, quiet backwaters and shady riparian thicket. During the current 2015 survey this habitat was briefly sampled (ca. 1 hour) in the late afternoon and yielded five species Red-veined Dropwing, Slate Sprite, Machado's Skimmer, Forest Malachite and Dancing Jewel. Certainly more species occur. One of these species Forest Malachite (*Chlorolestes tessellatus*) although not red-listed does has a Dragonfly Biotic Index ("DBI") rating of 4. The DBI is based on three criteria: geographical distribution, conservation status and sensitivity to change in habitat and ranges from a minimum of 0 to a maximum of 9. Very common, hardy and widespread species score 0 while a range-restricted, threatened and sensitive endemic species scores 9. Searches in the office gardens yielded Phantom Flutterer and Red-veined Dropwing.

10.5.5.3 Scorpions

Eight of the 12 regionally occurring scorpion species are likely to occur on site based on habitat suitability and distribution. Of these two species are of conservation importance, listed as nationally PS (ToPS, 2007) the burrowing scorpions *Opistophthalmus glabifrons* and *Opistophthalmus carinatus*. The lack of prime rocky outcrops on site precludes the presence of *Hadogenes gunning* and *Uroplectes planimanus*. Additionally, the site lies within an area of range overlap of three stinger scorpion species namely *Uroplectes carinatus*, *Uroplectes vittatus* and *Uroplectes traingulifer*. Both *U. carinatus* and *U. triangulifer* are common and widespread and may be found in a variety of habitats while *U. vittatus* is more likely to be encountered under tree bark and in logs (Leeming, 2003). Other scorpions that may occupy this type of microhabitat are the thick-tailed scorpions. These species are of greater medical importance with a particularly potent venom. Two species may occur at Waterval namely *Parabuthus mossambicensis* and *Parabuthus transvaalicus*.

10.5.5.4 Megalomorph Spiders

These include baboon and trapdoor spiders. Certain members of the baboon spider group (family Theraphosidae) are listed as nationally PS on the ToPS (2007) List. Three genera may occur on site. These include horned baboon spiders (*Ceratogyrus sp.*), common baboon spiders (*Harpactira sp.*) and Golden Brown Baboon Spiders (*Pterinochilus sp.*). No baboon spiders or their burrows were detected during site visits.

Table 48: Potentially occurring CI terrestrial macro-invertebrate species in the study area (Shangoni, 2021)

SPECIES	COMMON NAME	LoO	STATUS
Butterfly			
Metisella meninx	Marsh Sylph	4	RHS

SPECIES	COMMON NAME	LoO	STATUS
Beetles			
Manticora spp.	Monster Tiger Beetles	2	PS
Oonotus spp.	Stag Beetles	3	PS
Scorpions			
Hadogenes gunningi	Flat rock scorpions	4	PS
Hadogenes troglodytes	Flat rock scorpions	4	PS
Opistophthalmus glabifrons	Burrowing scorpions	2	PS
Opistophthalmus carinatus	Burrowing scorpions	3	PS
Spiders			
Ceratogyrus sp.	Horned Baboon Spiders	3	PS
Harpactira sp.	Common Baboon Spiders	3	PS
Pterinochilus sp.	Golden Brown Baboon Spiders	3	PS
KEY			
Status: *NT = Near-threatened; PS = Protected Species; RHS = Rare Habitat Specialist; VU = Vulnerable.* ***Likelihood of Occurrence (LoO):*** *2 = High; 3 = Moderate; 4 = Low* ***Sources:*** *ToPS (2007); Leeming (2003); Dippenaar-Schoeman (2002); Mecenero et al. (2013)*			

10.6 Surface water

10.6.1 Catchment and general hydrology

Waterval Mine falls within the Sandspruit Catchment (A22H Quaternary Catchment of the Crocodile (West) Marico Water Management Area (WMA) 3, that is part of the Elands Sub-management Area. The catchment is illustrated in Figure 30.

The only stream in the immediate vicinity of the mine is a small non-perennial tributary to the Hex River, which flows in a north easterly direction between Waterval East and old Waterval sections. The only perennial watercourse in the area is the Hex River. The Hex River (situated approximately 1km and 700m from Waterval Mine West and Waterval Mine East, respectively, flows north-westwards into the Elands River and further downstream into the Crocodile River (sub-drainage region A2). The Crocodile River flows north-westwards into the Marico River and becomes the Limpopo River at their confluence.

10.6.2 Mean annual runoff

Table 49 indicates the Mean Annual Runoff (MAR) particulars of the primary sub-catchment (A22H).

Table 49: Mean Annual Runoff (MAR) (Shangoni, 2021)

Catchment	Gross area (km^2)	Net area (km^2)	Forest area (km^2)	Irig. area (km^2)	Evap. zone	MA E (mm)	Rain Zone	MAP (mm)	MAR (mm)	MAP-MAR Resp.	Net MAR (10^6m^3)	Gross MAR (10^6M^3)
A22H	579	579	-	0.8	3B	1700	A2F	658	24	8	13.7	13.7

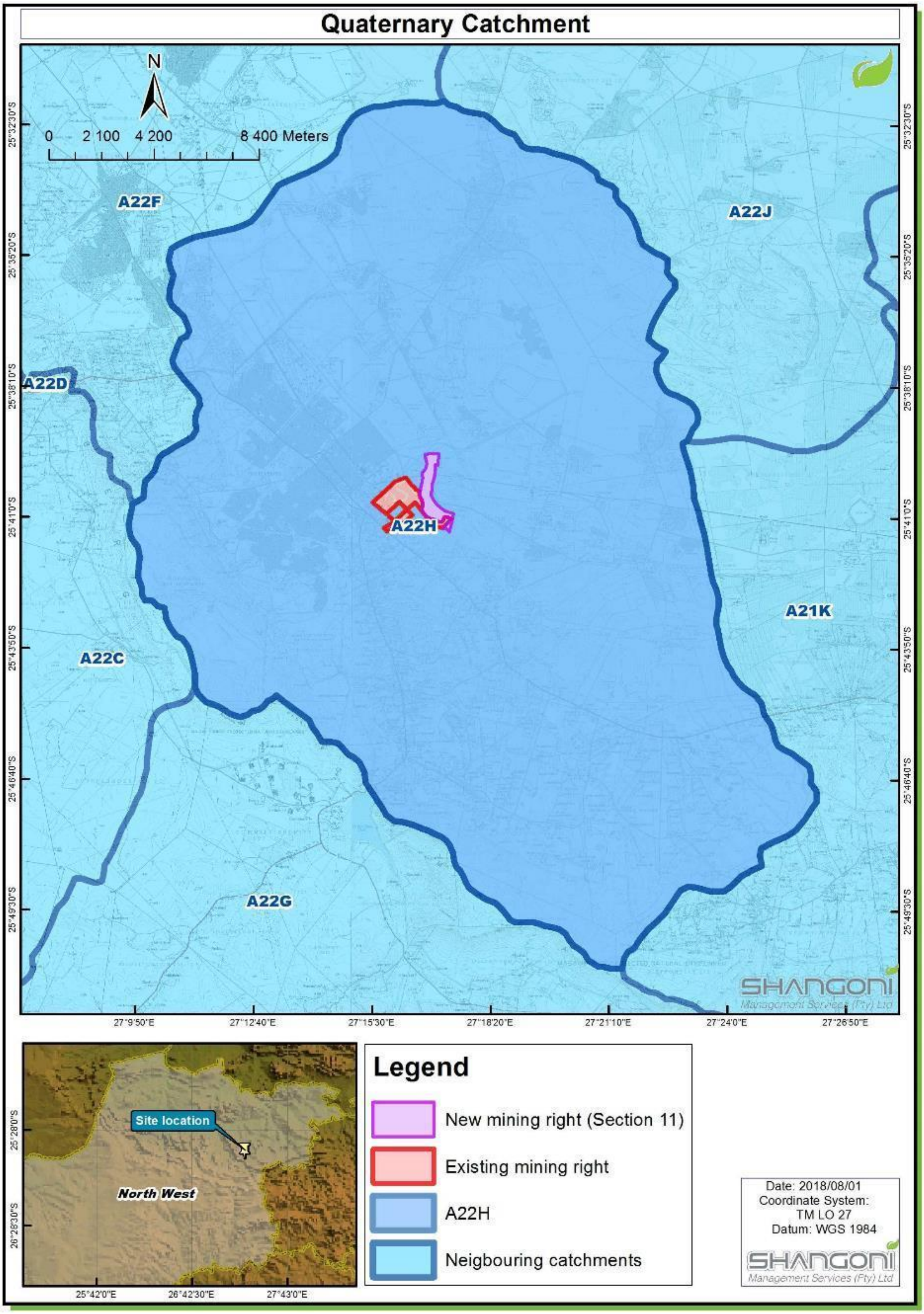


Figure 30: Map depicting the catchment associated with the Waterval Mine

10.6.3 Flood peaks

The peak flow of the affected sub-catchment was determined using the Rational Method, selected to be the most appropriate method for these specific catchment characteristics (refer to Table 50).

Table 50: Flood peaks and volumes (Eko Rehab, 2002) (Shangoni, 2021)

Flood Peaks and Volumes for Waterval Spruit							
Recurrence	**Area m²**	**Area km²**	**Intensity (mm/h)**	**Run-off Factor**	**Modification Factor**	**Peak flow Q=CIA/3.6 (m³/s)**	**Flood volume (m³)**
1:20	48310000	48.31	48.6	0.47	0.9	276	2347866
1:50			56.6	0.47	0.95	339	2734346
1:100			61.5	0.47	1	388	2971065
RMF			55	0.58	1	428	2657050

The maximum estimated peak flow that can occur in the closed system for a return period of 100 years with a point intensity of 61.5 mm/h is approximately 338 m^3/s. The calculated peak flow for the Regional Maximum Flood (RMF) is thus 428 m^3/s. The flood peaks for the recurrence intervals of 1:20 and 1:50 years for the Hex River is as follows:

- 1:20 years: 400 m^3/s
- 1:50 years: 875 m^3/s

10.6.4 Surface water use

Water from the stream located in the area is primarily used by farmers for stock watering. In certain areas, in-formal settlements use the water for washing and domestic purposes (updated EMPR, 2009).

10.6.5 Surface water quality

Glencore Alloys: Waterval Mine has a surface water monitoring programme in place. Surface water quality monitoring is conducted on a monthly basis by a contractor.

The surface water monitoring points either serve the purpose of monitoring process water or the impacts of the mining activities on the receiving environment.

10.6.5.1 Surface water quality monitoring localities

Table 51 provides the detail of the surface water monitoring localities at Waterval Mine. Refer also to Figure 31.

Table 51: Surface water monitoring locality details (Aquatico2, 2022)

Locality	**Description**	**Coordinates**	
		Latitude	**Longitude**
Receiving Environment Monitoring Localities			
XMS02	Tributary at low water bridge, upstream of Waterval East Tailings Facility	S25.6873	E27.27049
XMS07	Upstream of Hex River	S25.68368	E27.28160
XMS08	Downstream of Hex River	S25.67654	E27.27778
XMS13	Spruit Upstream of Mine at Kroondal Road Bridge	S25.68910	E27.26491

Locality	Description	Coordinates	
		Latitude	Longitude
XMS14	Spruit Downstream of Mine	S25.68383	E27.27568
Process water monitoring localities			
XMS04	Return Water Dam (Waterval East)	S25.68296	E27.27057
XMS06	Licenced discharge point in tributary	S25.68467	E27.27364
XMS09	Return Water Dam (Waterval West)	S25.67772	E27.26858
XMS11	Erickson Dam in Waterval-West Shaft Area	S25.67967	E27.26171
XMS12	Erickson Dam in Waterval-East Shaft Area	S25.68633	E27.26667

10.6.5.2 Surface water quality monitoring results

Receiving Environment Water Quality

The water use licence of Glencore Waterval Chrome Mine (Licence Number 03/A22H/ABFGJ/2749, issued 11 January 2015)) makes specific reference to the water Resource Quality Objectives (RQO) which may not be exceeded by the in-stream Hex River quality as a result of mining impacts. As such the water use licence RQO was set as a compliance limit for the impact of the mining activities on the Hex River (localities XMS07 and XMS08). The remaining in-stream water will also be compared to water use licence RQO limits but is only for comparative purposes. It is suggested however that the in-stream water quality of the surrounding streams not exceed the water use licence RQO as the monitored streams eventually confluence with the Hex River and may result in the exceedance of the in-stream Hex River water quality in comparison to the IWUL RQO (Aquatico2, 2022).

Waterval East Unnamed Tributary (XMS13, XMS02, XMS14)

The general water quality for the Waterval East Unnamed Tributary can be described as neutral (pH: 6.0 – 8.5) to alkaline (pH: >8.5), non-saline (TDS < 450 mg/l) and to hard (Total hardness: 200 - 300 mg CaCO3/l). Low to moderate nutrient concentrations were recorded for all of the monitoring localities. The metal concentrations remained low to below the detection limit. The IWUL Resource Quality Objectives limits were exceeded at all the localities in terms of the Dissolved Oxygen. Exceeding Ammonia (NH3) concentrations were also recorded at XMS02 and XMS13 (Aquatico2, 2022).

Hex River (XMS07, XMS08)

The general water quality of the Hex River localities can be described as neutral (pH: 6.0 - 8.5), non-saline (TDS < 450 mg/l) and slightly hard (Total Hardness: 100 - 150 mg $CaCO_3$/l) to moderately hard (Total Hardness: 150 - 200 mg $CaCO_3$/l). Low to moderate nutrient concentrations were recorded for both upstream and downstream monitoring localities. Metal concentrations remained low and mostly below detection limits. Locality XMS07 and XMS08 did not fully comply with the set IWUL RQO conditions for December 2022, with the Dissolved Oxygen concentrations recorded to exceed the limits. A slight increase in the variable concentrations between the up and downstream monitoring localities of the Hex River were noted (Aquatico2, 2022).

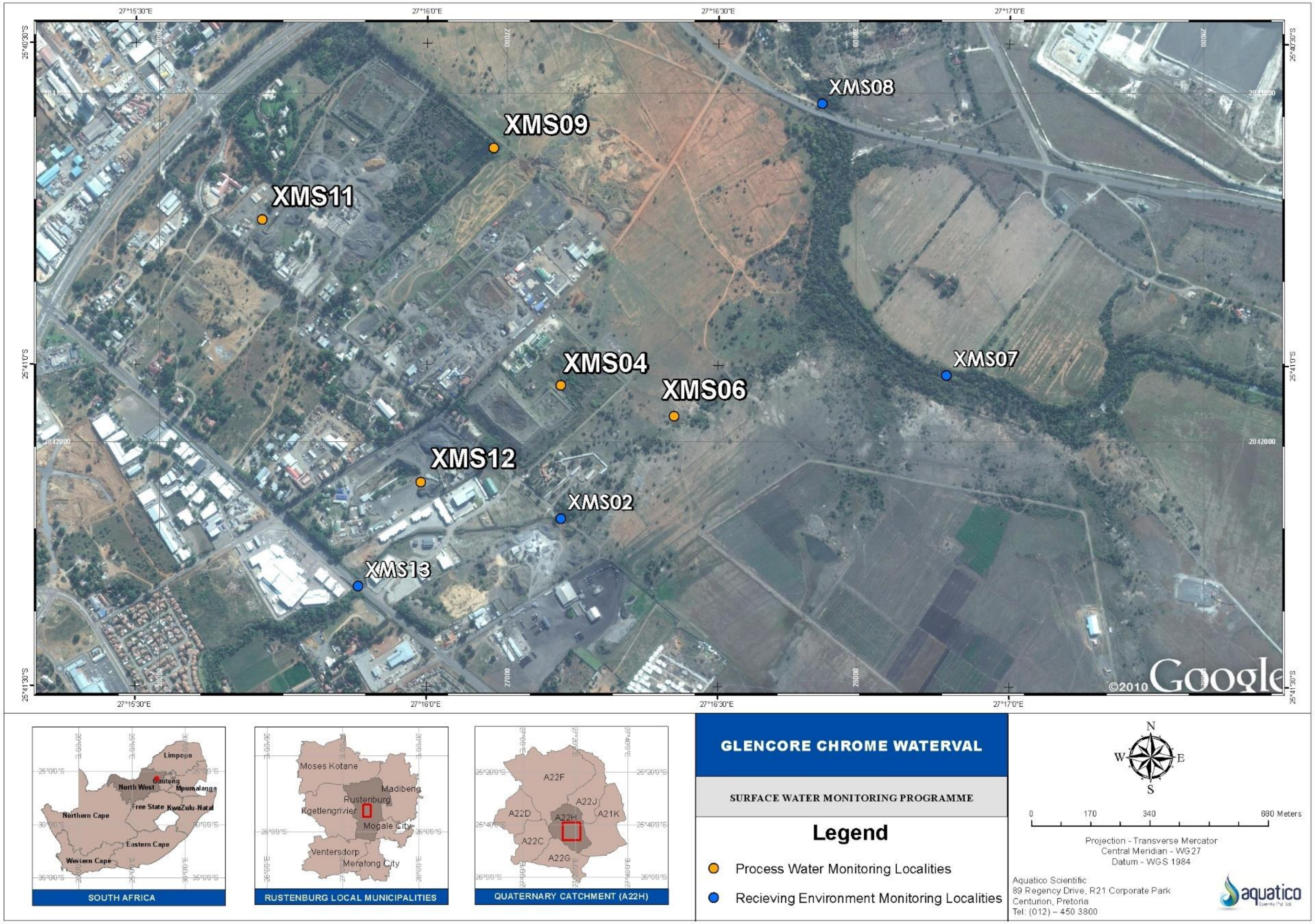


Figure 31: Map showing the surface water monitoring localities (Aquatico2, 2022)

10.7 Aquatic Environment

Biomonitoring is conducted at Waterval Mine on a bi-annual basis (in April and October). Information for this section was obtained from Clean Stream Biological Services' Glencore Western Chrome Mines – Waterval: Biomonitoring of the Hex River Catchment – October 2022 Survey (Reference Number: GCW/B/22. October 2022) (Clean Stream, 2022).

10.7.1 Biomonitoring sites

Biomonitoring sites were selected to be easily accessible, comparable and representative of as many habitats in the upstream and downstream environments, as possible. Two biomonitoring sites were selected within the Hex River (receiving water body). One site (X3) was selected to be upstream and another downstream (X4) of the confluence of the stream that may receive impacts from Glencore Waterval (Table 52 and Figure 32).

Table 52: Latitude / longitude of sampling sites for the purpose of biomonitoring (Clean Stream 2022)

Monitoring site	Description	Biomonitoring protocols		Coordinates	
		Protocol	Frequency per annum	Latitude (South)	Longitude (East)
X3	Hex River, upstream of stream draining potential mining impacts derived from Glencore Chrome Waterval	In-situ water quality, South African Scoring System Version 5 (SASS5)	Twice	25.6835	27.2812
		Fish Assemblage Integrity Index (FAII)	Once		
X4	Hex River, downstream of stream draining potential mining impacts derived from Glencore Chrome Waterval	In-situ water quality, SASS5	Twice	25.6765	27.2777
		FAII	Once		

Figure 32: Map indicating the biomonitoring localities (Clean Stream, October 2022)

10.7.1.1 In-situ water quality measurements

Surface flow was low at both monitoring sites in the Hex River at the time of the October 2022 survey. During the previous survey (July 2022), moderate surface flow was present at site X3 while surface flow was low at site X4. A slight increase in turbidity was seen between site X3 (clear) and site X4 (slightly turbid) in July 2022. The opposite trend was seen in October 2022, when the water was slightly turbid at site X3, but turbidity decreased towards site X4 where the water was clear. High turbidity can negatively impact on biotic integrity by clogging the gills of filter feeders and hampering visual predators.

Electrical conductivity (EC) remained fairly stable (decreased marginally) from site X3 (96.8 mS/m) to site X4 (92.4 mS/m), and activities (mining and or other) between these sites (or along the unnamed stream) did not lead to a detectable increase in dissolved salts in this section of the Hex River in October 2022. The findings are in contrast to the spatial deterioration (increase) in salinity (EC) noted between these sites in the July 2022 survey, but are in line with the November 2021 survey which similarly reflected spatial stability. Although most previous surveys have reflected a downstream improvement in salinity, downstream deterioration has been observed during some past surveys (e.g., November 2020, June 2020, and March 2019), indicating that activities along this reach (or the unnamed stream) are impacting on the salinity of the Hex River, from time to time. Close monitoring remains prudent to timeously identify and mitigate any contributions from Glencore Waterval, should these occur.

On a temporal scale, the EC had increased at the upstream site, X3, between the July 2022 (56.8 mS/m) and October 2022 (96.8 mS/m) surveys. Lower surface flow (less dilution) in October 2022 may have contributed to the increase in salinity, as may the increase in turbidity (clear to slightly turbid) over this period, but increased impacts from upstream activities (non-Waterval) cannot be altogether ruled out. Site X3 is situated upstream of the unnamed stream carrying potential Glencore Waterval impacts and changes in water quality at this site are therefore unrelated to Waterval activities. An increase in salinity was also noted at site X4 between the July 2022 (78.8 mS/m) and October 2022 (94.2 mS/m) surveys, but is likely a response to the upstream increase in salinity, especially as the increase was more pronounced at the upstream site and no spatial increase in salinity was recorded towards site X4.

The pH values at both sites, as measured in October 2022, fell within the target water quality pH ranges for fish health, which is between 6.5 and 9.0 (DWAF, 1996), and would not be limiting to aquatic biota. However, the pH was fairly high at both sites, decreasing (improving) marginally from site X3 (8.7) to site X4 (8.4). An increase in pH was observed from November 2022 (6.7 at both sites) to July 2022 (8.1 at both sites), and a slight increase was again observed towards the October 2022 survey, however pH remained within the target range at both sites during all three these surveys. It is noted that the recent increase in pH is unrelated to Waterval activities as it was already observed at the upstream site (X3). Nonetheless, close monitoring is warranted.

Dissolved oxygen (DO) levels fell above the guideline minimum level (> 5 mg/l, as set by Kempster *et.al.*, 1980) at site X3 (5.1 mg/l), but decreased to below the guideline level at site X4 (4.6 mg/l) and may be limiting to the aquatic biota of this site if persistent or frequently occurring (Table 3; Figure 4). Low surface flow, and thus limited physical aeration, likely contributed to the low DO levels recorded. The findings reflect a deterioration at site X4 since July 2022, when DO levels measured above the lower guideline level. The DO level at site X4 similarly fell below the guideline level during the November 2021 survey. Low DO levels have also been recorded along this reach during some previous surveys. However, nutrient loading due to organic pollution, and not mining, is likely underlying the low DO levels noted at site X4 from time to time.

10.7.2 Aquatic invertebrate assessment: South African Scoring System 5

The South African Scoring System (Version 5) is a site-specific index, which, together with an associated habitat index (biotope suitability index) gives a general perspective of the biotic integrity (based on macroinvertebrates) and the impact of water quality on the biotic integrity of the specific sites (Thirion et.al., 1995; Dickens and Graham, 2001). The biotope suitability index takes into account the suitability of the different sampled biotopes in terms of quality and availability. It thereby firstly assesses whether the total SASS5 scores of two sites are directly comparable by matching the total biotope suitability scores. In the event that the total biotope suitability scores are largely different this would imply that the total SASS5 scores should not be compared, but instead the most comparable SASS biotope scores. The most comparable SASS biotope scores are identified by comparing the various individual biotope suitability scores. In addition to the biotope suitability index, the

Integrated Habitat Assessment System, Version 2 (IHAS) was also applied and included for the purpose of macroinvertebrate specific habitat description.

Average score per taxon (ASPT) values are also very useful in the assessment and comparison of biotic conditions at different sites. According to field trials assessed by Dickens and Graham (2001), the ASPT score was less variable than total SASS5 scores when conducted within a given river reach by different operators, considering all biotopes. Average score per taxon scores are therefore included in the discussion below.

The integrated habitat assessment system (IHAS) scores were fairly similar (improved marginally) at site X3 (61%) and X4 (64%) in October 2022. The IHAS scores were below 65%, indicating that habitat was below optimal for macroinvertebrates at both sites. Total biotope availability and suitability scores was lower at the upstream site, X3 (8), than at the downstream site, X4 (11), at the time of the present survey. The GSM (gravel, sand, and mud) biotope received fairly similar biotope availability and suitability scores at site X3 (5) and X4 (4), and was thus the most comparable biotope6.

Macroinvertebrate diversity (on the family level) consisted of 15 taxa sampled at site X3 and 12 taxa sampled at site X4 during the October 2022 survey. Both sites were dominated by hardy taxa with a low to very low requirement for unmodified water quality, and no taxa with a high or moderate requirement for unmodified water quality were recorded at either site. These findings show that conditions along this reach of the Hex River are in a seriously modified state.

The total SASS5 score decreased very slightly while the ASPT remained fairly stable from site X3 (58 & 3.9) to site X4 (48 & 4.0), located in the Hex River respectively upstream and downstream of the inflow of the stream carrying potential Waterval impacts. As taxa diversity was fairly low, the SASS5 score is considered a better indicator than the ASPT. The absence of a downstream increase in total SASS5 score despite better biotope availability and suitability at the downstream site point to possible water quality impacts along this reach.

The specific SASS5 score of the most comparable biotope, GSM, decreased only slightly from site X3 to X4 and is likely attributable to a corresponding slight decrease in the availability and suitability of this biotope. Assessment of the most comparable biotope, therefore, did not reflect downstream water quality deterioration, however the low diversity of taxa sampled reduces confidence in biotope-specific comparisons. In-situ water quality measurements did not reflect major differences in salinity or pH between these sites, however, DO levels decreased to below the guideline level at site X4 (unlikely related to mining activities) and could have contributed to the spatial decrease in total SASS5 score (section 3.2).

The SASS5 findings of the October 2022 survey reflected a very slight downstream deterioration in macroinvertebrate-based biotic integrity, and although not definitive, water quality impacts could not be ruled out. Further monitoring is required to verify this spatial trend. The July 2022 survey did not reflect notable impacts on macroinvertebrate-based biotic integrity along this reach of the Hex River (or via the unnamed stream), although a spatial increase in salinity indicated that water quality impacts could not be ruled out.

The total SASS5 score had increased marginally at site X3 between the July 2022 (51) and October 2022 surveys (58), while the ASPT remained stable (3.9 on both occasions). As explained above, the total SASS5 score is considered the better indicator. Biotic conditions (based on macroinvertebrates) therefore do not appear to have changed markedly at the upstream site between the two most recent surveys. A marginal decrease in total SASS5 score and ASPT were observed at site X4 between the July 2022 (55 & 4.2) and October 2022 (48 & 4.0) surveys, however, given that the decrease was only marginal, further monitoring is needed to verify this trend

It is again noted that a downstream decrease in biotic integrity was observed during the June 2021, November 2020, June 2019, June 2020, and several earlier surveys (see temporal trends – next section). It therefore remains clear that spatial deterioration often occurs between sites X3 and X4 and Glencore environmental staff are urged to closely monitor the matter and ensure Glencore Waterval activities are not contributing to the scenario, or to timeously employ mitigation measures if needed. The findings also indicate the importance of continued monitoring and temporal analyses to detect any changes in trends. Toxicity analyses of possible impacts arising from the Glencore Chrome Waterval activities showed some potential hazards during various previous surveys (see also September 2009 and December 2010 toxicity reports), although significant improvement has been observed since 2017. Although the risks were mostly observed to be only “slight”, the October 2016 dataset revealed higher hazards (up to Class IV – high acute/chronic ecological hazard). Toxicity testing reflected a slight sub-lethal environmental toxicity hazard (Class II) for three of the samples tested in December 2022 (section 3.3), however, toxicity testing provides only a snapshot of the prevailing conditions and do not allude to hazards prior to or after sampling. It is again noted that continued and regular toxicity analyses of possible Glencore Chrome Waterval effluents/discharges are important to determine its potential risk and possible contribution to observed changes in biotic integrity.

10.7.3 Fish Assemblage Integrity Index (FAII)

Fish sampling is only scheduled once per annum and previously took place during the first of the bi-annual monitoring surveys. However due to Covid-19 Lockdown regulations, the 2020 fish survey, originally scheduled for March, was postponed to November 2020. The new surveying schedule was again followed during the 2021 biomonitoring period to maintain consistency in terms of survey intervals. Fish sampling therefore took place during the November 2021 survey. To revert back to the original surveying schedule, fish sampling will again be conducted during the first survey of 2023.

Fish species expected to occur at the sites under investigation is based on information from Skelton (1993) and Le Roux & Steyn (1968) as well as experience from previous surveys (this biomonitoring programme and various other mining related biomonitoring programmes; also, research and Department of Water Affairs reserve determination studies). The expected species list is also updated with the knowledge gained as a result of continuation of this biomonitoring programme. This expected list may vary from previous surveys due to changes in habitat diversity at a site which is the template that determines, together with water quality, the fish community at any given site.

The composition of the fish community and the relative FAII (Fish Assemblage Integrity Index) are based on the last two fish surveys. This is done to increase the accuracy of the results and to avoid the co-incidental miss-sampling of a particular species at a particular site. It is furthermore acceptable to use this approach as fish generally take longer to react (as compared to macroinvertebrates) to stressors and is therefore more applicable as an indicator over a period of time (as compared to a snapshot at any given time).

10.7.3.1 2020/2021 period (spatial variation)

Four naturally occurring (native) fish species (*Clarias gariepinus*; *Pseudocrenilabrus philander*, *Labeobarbus marequensis* and *Tilapia sparrmanii*) were sampled at the upstream Hex River site (X3) during the 2020/2021 period, while only two indigenous species (*C. gariepinus* and *P. philander*) were sampled at the downstream site (X4) (Table 53). Two exotic/invader species (*Gambusia affinis* and *Cyprinus carpio*) were sampled at site X3 during the 2020/2021 period. *Cyprinus carpio* is a habitat altering species as a result of its bottom feeding habits, while *G. affinis* is an aggressive predator (feeding on the eggs and fry of other species). Both species furthermore compete with indigenous species for habitat and food. The exotic species *Micropterus salmoides* (Largemouth bass), was sampled in the study area in 2018, but not during the 2019, 2020, or 2021 surveys. *Micropterus salmoides* is an aggressive predatory species feeding on native macroinvertebrates and other fish species, often leading to serious reduction of biotic integrity. The observed fish species diversity was lower than can be expected under natural conditions at both of the sampling sites, indicating lowered biotic integrity. The reasons for lowered species diversity are outlined in the paragraphs below, which deal with the Fish Assemblage Integrity Index (FAII) results.

The FAII scores (biotic integrity based on fish) deteriorated from site X3 (27%) to site X4 (26%) (Table 54). This contrasts with several previous surveys that indicated a downstream improvement in fish-based biotic integrity, however is in line with the 2018/2019 and 2019/2020 surveys which similarly reflected deterioration between sites X3 and X4. Of further concern is that the 2020/2021 fish survey results delivered the lowest FAII scores (X4

=6%) recorded since the inception of the fish monitoring surveys in April 2007. Low health ratings have previously (2019/2020) been recorded for *Pseudocrenilabrus philander* and *Barbus unitaeniatus* specimens sampled at the site downstream of potential Glencore impacts (X4), and remains of concern.

The above findings likely indicate that activities taking place between sites X3 and X4 (potentially including Glencore mining) are adversely impacting the integrity of fish assemblages. The macroinvertebrate assessment has also reflected lowered biotic integrity between sites X3 and X4 during most recent surveys, and although conditions seemed to remain fairly stable during the present survey, possible water quality impacts could not be definitively excluded). In-situ measurements reflected a notable decrease in dissolved oxygen levels to below the minimum guideline at site X4, with organic pollution (and not mining), likely underlying this. Low dissolved oxygen levels have also been recorded along this reach during some previous surveys, and will impact on the biotic integrity (represented by both fish and macroinvertebrates) of the Hex River. The Class II (slight acute/short-chronic) and Class III (acute) toxicity hazards recorded for multiple sources sampled in December 2021 are also of some concern. This is especially so considering that, despite reflecting only slight hazard, no safe dilution factor could be established for samples XMS06, XMS11, and XMS12. It is reiterated that measures should be taken to ensure that these sources are not impacting on the natural environment.

Table 53: Naturally occurring indigenous fish species expected and observed during 2020/2021 (Clean Stream, 2022)

Species	**Common name**	**Native / Exotic**	**Sites**			
			X3		**X4**	
			Exp.	**Obs.**	**Exp.**	**Obs.**
Amphillius uranoscopus	Stargazer	Native				
Barbus paludinosus	Straightfin barb	Native				
Barbus trimaculatus	Threespot barb	Native				
Barbus unitaeniatus	Longbeard barb	Native				
Chiloglanis pretoriae	Shortspine suckermouth	Native				
Clarias gariepinus	Sharptooth catfish	Native				
Cyrpinus carpio	Common carp	Exotic				
Gambusia affinis	Mosquitofish	Exotic				
Labeo molybdinus	Leaden labeo	Native				
Labeobarbus marequensis	Largescale yellowfish	Native				
Mesobola brevianalis	River sardine	Native				
Micropterus salmoides	Largemouth bass	Exotic				
Oreochromis mossambicus	Mozambique tilapia	Native				
Pseudocrenilabrus philander	Southern mouthbrooder	Native				
Tilapia sparrmanii	Banded tilapia	Native				
No. of indigenous species present			11	4	11	2
% expected/observed			36		18	

Table 54: Relative FAII scores calculated at different sampling sites (Clean Stream, 2022)

Locality	Relative FAII (%)
X3	27
X4	6

10.7.3.2 Long-term trends (Temporal variation)

Polynomial regression for the FAII scores at each site is calculated and plotted to determine temporal trends. These trends can now be regarded with higher confidence as sufficient datasets have been populated up to date.

The overall temporal trend reflects deterioration in fish-based biotic integrity at the downstream site (X4) while the trend at the upstream site (X3), although previously also reflecting deterioration, appears to be stabilizing (Figure 9). The biotic integrity was higher at the downstream site (X4) over most of the study period, indicating that the impacts on fish assemblage originated from the upstream (non-Glencore) impacts and that impacts between these two sites had generally not led to a further decrease in biotic integrity. In contrast, the 2018 to 2021 surveys showed a noticeable downstream deterioration towards site X4, potentially indicating adverse impacts originating between sites X3 and X4.

The temporal trends of the macroinvertebrate assessments have often been in contrast to that of the fish assessments, with the former showing that the upstream site (X3) generally had higher scores over the first half of the study period but thereafter a deteriorating trend was reflected for site X3, while biotic conditions at site X4 reflected an improving trend, and since March 2018 or surpassed that of X3. However, the three preceding surveys have, similar to the fish assessment, reflected a spatial decrease in macroinvertebrate-based biotic integrity towards site X4, pointing to adverse impacts from activities along this reach, and although conditions appeared to remain fairly stable during the present survey, possible water quality impacts could not be definitively excluded. The often-opposing trends are likely resulting from the fact that fish assemblages generally take longer to respond to environmental stressors and therefore show delayed responses in comparison with macroinvertebrates, which as an indicator, react more rapidly. This illustrates the value of using a suite of monitoring indicators to assess biotic reactions (SASS5 and FAII) in response to environmental stressors (water quality and toxicity testing).

10.8 Sensitive Landscapes (including Wetlands)

Ecological sensitivity of a system is based on the determination of the sensitivity of the driving force of the ecosystem to change, and in particular human-induced change (Cowling et al., 1994). Ecological sensitive areas include wetlands, rocky ridges etc.

10.8.1 National Freshwater Ecosystem Priority Areas (NFEPA)

The NFEPA project has been a multi-partner project between the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI), Water Research Commission (WRC), DWS, Department of Environmental Affairs (DEA), Worldwide Fund for Nature (WWF), South African Institute of Aquatic Biodiversity (SAIAB) and South African National Parks (SANParks). According to Driver et al. (2011), the NFEPA project provides strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources in South Africa.

Freshwater Ecosystem Priority Areas (FEPAs) were identified using 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. The NFEPA guidelines state that FEPAs should be regarded as ecologically important, and as generally sensitive to changes in water quality and quantity, owing to their role in protecting freshwater ecosystems and supporting sustainable use of water resources. FEPAs that are in a good condition should remain so, and FEPAs that are not in a good condition should be rehabilitated to their best attainable ecological condition. Land-use practices or activities that will lead to deterioration in the current condition of a FEPA as well as land-use practices or activities that will make rehabilitation of a FEPA difficult or impossible are considered unacceptable (Driver et al., 2011).

For the study area, the NFEPA project does not recognise the Hex River or any wetlands in the vicinity of Waterval Mine as FEPA's. Only the Waterkloofspruit 5km upstream of the mine, is classified as a NFEPA river. Refer to Figure 33.

10.8.2 Ecological state, Importance and Sensitivity of the Hex River

The Hex River is situated approximately 1km and 700m from Waterval Mine West and Waterval Mine East, respectively. A summary of the Present Ecological State (PES), Ecological Importance (EI), Ecological Sensitivity (ES) and impacts on the Hex River is presented in Table 55 (DWS, 2014). According to DWS (2014) the PES of the Hex River is seriously modified (E category). According to the RHP (2005), the instream habitat integrity is influenced by channel modifications caused by diversions for mining as well as water abstractions for irrigation purposes. The riparian habitat has some vegetation clearing for sand winning activities and some pockets of Sesbania sp. and Blue gums, both of which are very localised. The water quality has between low and intermediate levels of nutrients but is largely free of significant organic pollution. However, high conductivity and salinity levels were recorded due to mining discharges and seepages. The cumulative impacts of reduced water quality, flow and habitat modifications have large impacts on the macro-invertebrate diversity and abundance. The sensitive fish species are lost due to flow modifications and instream obstructions and the water quality problems originating from the mines and agricultural activities also created stress conditions for the fish species (RHP, 2005).

The Hex River, adjacent to Waterval Mine, is a Lower Foothill and Critically Endangered (Driver & Nel, 2012; Driver et al. 2011). The EI of the Hex River is moderate and includes three wetlands and seven riparian habitat types, with 14 different types of vegetation cover, three protected and five endemic species in this Sub-Quaternary (SQ). The size of stream, morphology and geomorphic habitat units determine the ES. The Hex River has a moderate sensitivity to modified flow conditions and water level changes (DWS, 2014).

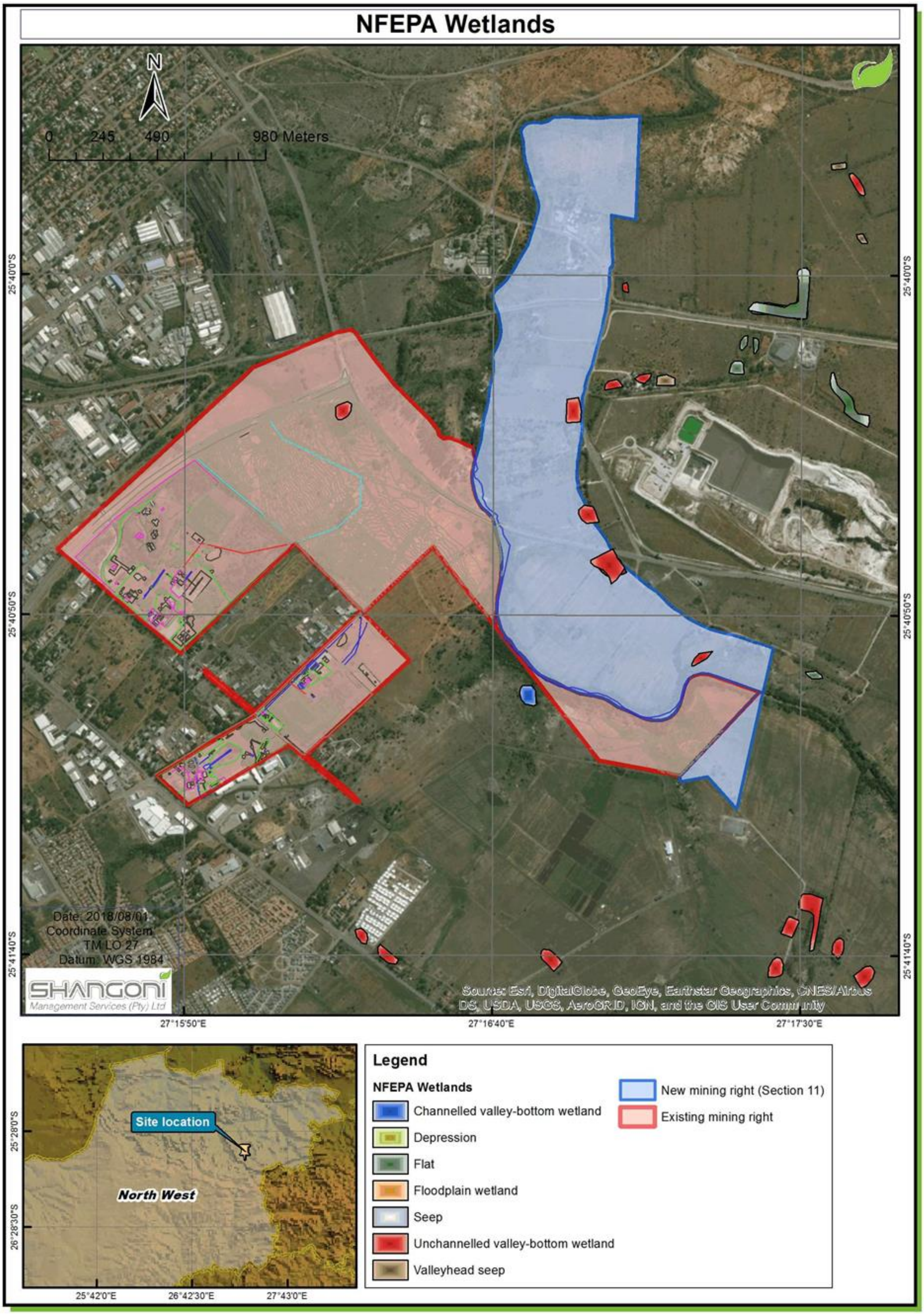


Figure 33: Status of wetlands and rivers in the area according to the NFEPA

Table 55: Summary of the Presence Ecological State ("PES"), Ecological Importance ("EI") and Ecological Sensitivity ("EIS") and impacts on the Hex River (DWS, 2014) (Shangoni, 2021)

Quaternary Catchment	Water Resource	PES	EI	ES	Impacts
A22H	Hex River	E	Moderate	Moderate	SERIOUS: Mining and mining runoff/effluent, water abstraction and inundation. LARGELY: Bed and channel disturbance, small (farm) dams, roads, overgrazing and trampling, runoff from urban areas and sedimentation. MODERATE: Algal growth, low water crossings, large dams, erosion alien aquatic macrophytes, alien vegetation and vegetation removal. SMALL: Agricultural fields, recreation and grazing (land use).

10.9 Groundwater

The geohydrology of the site associated with Waterval Mine is that of an intergranular and fractured aquifer type, namely the Rustenburg layered suite to the north of the Magaliesberg. Groundwater occurrence is associated mainly with deeply weathered and fractured mafic rocks. More than 80% of the boreholes yield less than 2l/s. This is a result of the low permeability (±10-6 cm/s) of the clay rich soils (i.e. black turf soils) that reduce recharge to underlying aquifers. The depth to groundwater rest level typically occurs between 5m and 40m below surface. The mean water quality for this aquifer type shows that salinity can be a problem in these aquifers (average EC values of 105mS/m).

10.9.1 Aquifer classification and description

Recharge

There is groundwater recharge of 992.77 Ml/year, calculated as a recharge of rainfall at 3% per year to the groundwater system.

Permeability of the aquifer

The area is underlain by geological formations which have a low permeability. Groundwater therefore moves slowly. The area is very flat (low gradient) which further causes the groundwater to move more slowly.

10.9.2 Groundwater levels

Waterval West

Overall deeper groundwater levels were measured in monitoring borehole XMB22 with an average of 15 meters below surface (mbs) respectively. The deeper static level in this borehole is considered to be a direct result of limited dewatering effects since the boreholes are situated within close proximity of the Waterval West decline shaft. An average of ±6 mbs was measured in monitoring borehole XMB30 (refer to Figure 34).

Waterval East

Groundwater levels were only measured in XMB09 and XMB27. Average groundwater levels vary between ± 4 and 9 meters below surface (refer to Figure 34).

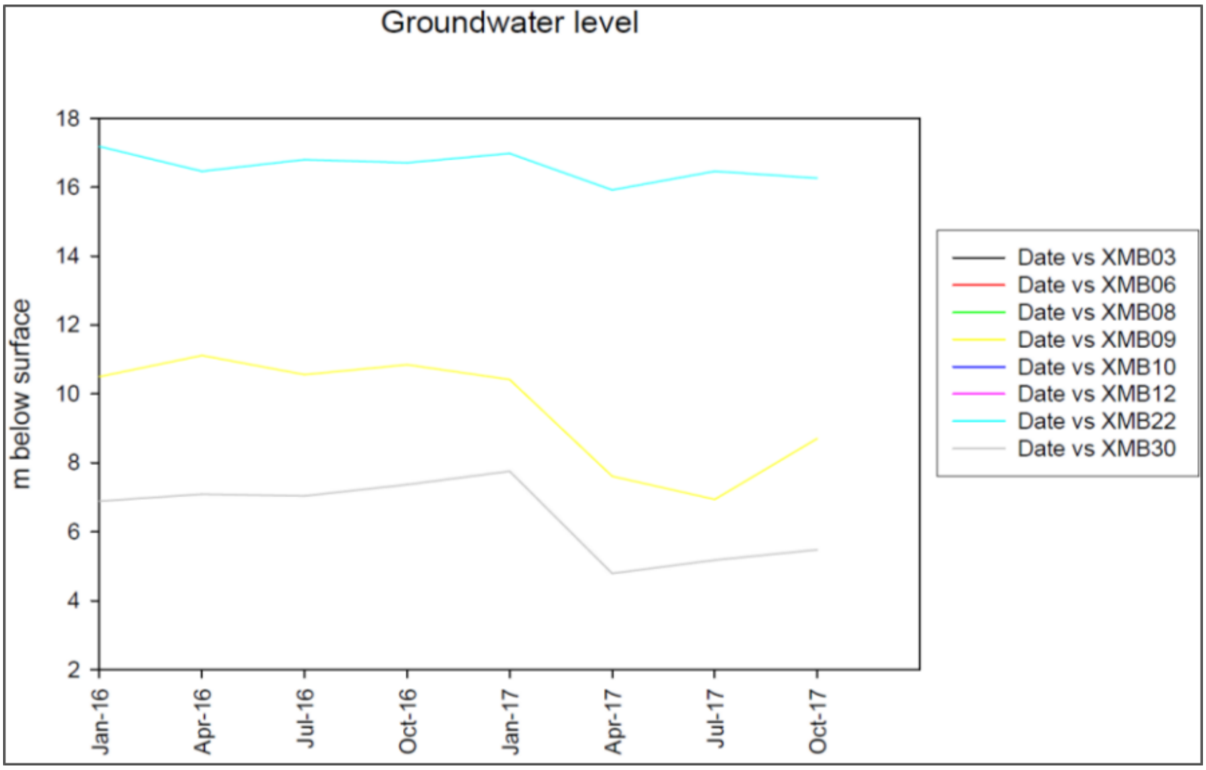


Figure 34: Groundwater level depth below surface for boreholes (Shangoni, 2021)

10.9.3 Presence of boreholes and springs

As per the updated EMPR, dated 2009, a total of 27 boreholes were identified in the hydrocensus that was conducted for the mine. The area is densely occupied with production boreholes. The reason therefore is due to the small size of plots and the intensive agricultural activities. The 27 identified boreholes thus represent a small quantity of existing boreholes in the area.

No springs were identified during the field visit (hydrocensus survey conducted).

10.9.4 Groundwater quality

Groundwater monitoring points are shown in Table 56 and Figure 35.

Table 56: Groundwater quality monitoring points (Aquatico 3, 2022)

Locality	Description	Latitude	Longitude
XMB03	Borehole behind Waterval East training centre on Orange cage behind parking lot (Pumping Into Pond On Law n)	S25.68302	E27.26956
XMB08	Borehole on property of Workshop, behind workshop area under jojo tank	S25.68502	E27.26526
XM09	Borehole in centre of law n behind offices of Waterval-East complex	S25.68736	E27.26322

Locality	Description	Latitude	Longitude
XMB10	Borehole south of mine offices in western corner of premises - pumping to Waterval East rondawel dam	S25.68721	E27.26291
XMB22	Borehole In Waterval-West Plant Area, North Of Offices Under Tree Next To Road	S25.67952	E27.26307
XMB30	Northern Corner Of Waterval West	S25.67502	E27.26559
XMB UD	underground mine workings dewatering for safety purposes	S25.67964	E27.27064
XMB24	Upstream of Waterval East Tailings Dam	S25.68616	E27.26916
XMB25A	North-Eastern Corner of Waterval East Black Dams	S25.68406	E27.27231
XMB26A	Upstream Of Waterval West Mining Complex	S25.68062	E27.26148
XMB29A	North of Waterval West Pollution Control Dam	S25.67686	E27.26897

The general water quality for the groundwater monitoring localities can be described as neutral (pH: 6.0 – 8.5), non-saline (TDS < 450 mg/l) to saline (TDS: 450 - 1000 mg/l) and hard (Total hardness: 200 – 300 mg $CaCO_3$/l) to very hard (Total hardness: 300 – 600 mg $CaCO_3$/l). None of the monitoring localities fully complied with the set water use licence groundwater quality limits, with Electrical conductivity (EC), Magnesium (Mg), Chloride (Cl), Sulphate (SO_4) and Nitrate (NO_3) for all the monitoring localities recorded to exceed the limits. The metal concentrations for all the monitoring localities remained low and mostly below detection limits.

10.9.5 Groundwater use

Groundwater in the area surrounding the mine is mainly used for domestic supply, watering of gardens and livestock. Groundwater is the sole source of water for many of the surrounding households on farms.

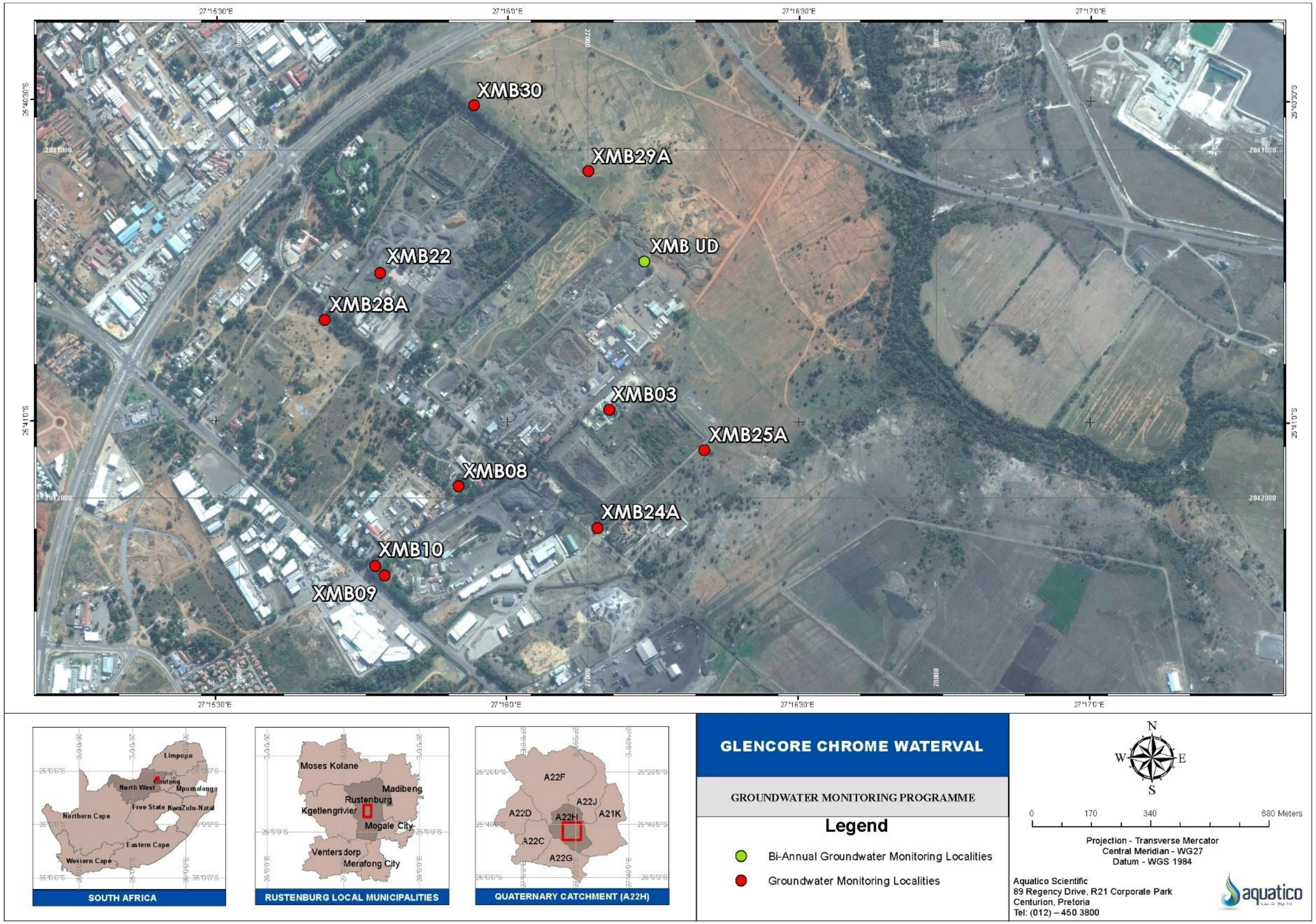


Figure 35: Positions of monitoring boreholes in the Waterval mining area (Aquatico3, 2022)

10.10 Air Quality

Air quality in the Rustenburg area is generally poor, a problem which is intensified by the local topography and climatic conditions. Major contributors to air pollution in the area include mine tailings, scheduled processes, domestic fuel burning, transportation, landfills, smaller industrial sources, agriculture and other sources.

Dust monitoring points were established to be sufficient in number to establish the contribution of the mine to dust fall in residential and non-residential areas in the vicinity of the premises, to monitor identified or likely sensitive receptor locations, and to establish the baseline dust fall for the district.

The following aspects were taken in consideration:

- The prevailing winds of that specific area – light to moderate and from the north-east direction in summer and from the north-east to north-west direction in winter;
- The windy season – August – October;
- The locality of the site;
- The size of the site – ha; and
- Areas where the most dust is visible.

10.10.1 Acceptable dust fallout rates

A standard for the acceptable dust fall rate for residential and non-residential areas is set out in the National Dust Control Regulations under the National Environmental Management: Air Quality Act 39 of 2004. Refer to Table 57.

Table 57: Acceptable dust fall rates (Shangoni, 2021)

Restriction Areas	Dust fall Rate (D) (mg/m^2 /day, 30-day average)	Permitted frequency of exceeding dust fall rate
Residential Area	D < 600	Two within a year, not sequential months.
Non-Residential Area	600 < D < 1200	Two within a year, not sequential months.

10.10.2 Airborne particulate sampling results

Table 58 provides the sampling results for both the Waterval East and Waterval West sections. Refer to Figure 36 for a map showing the localities of the dust monitoring positions.

Table 58: Airborne particulate sampling results (Aquatico, 2022)

Locality	Description	Coordinates	Classification	Dustfall December 2022 ($mg/m^2/day$)
Waterval East				
XWDS 3	Stand at training centre	S25.68321 E27.26996	Non-residential	111
XWDS 4	Stand at irrigation dam	S25.68707 E27.26294	Non-residential	829
XWDS 5	Stand opposite Sitona offices	S25.68026 E27.26994	Non-residential	457
XWDS 7	Stand at orbit FET college - RDB (c)	S25.67688	Non-residential	175

Locality	Description	Coordinates	Classification	Dustfall December 2022 (mg/m²/day)
		E27.25020		
Waterval West				
XWDS 6	Bucket opposite stop and stay on 2nd Avenue	S25.69308 E27.26332	Non-residential	53
XWDS 13	Bucket on Hefer Street	S25.67055 E27.26220	Non-residential	25
XWDS 15	Bucket at Farmers gate on the R104	S25.68370 E27.25958	Non-residential	101
XWDS 16	Bucket at Shingwezi	S25.67443 E27.27619	Residential	-

Non-Residential Dust Fallout Monitoring Stations for Waterval West

None of the monitored dust localities exceeded the non-residential guideline for the 02 November 2022 to 01 December 2022 monitoring period. None of the non-residential localities have exceeded the respective guideline in the past 12-month monitoring period (January 2022 – December 2022) (Aquatico, 2022).

Residential Dust Fallout Monitoring Stations for Waterval West

Dust Fallout monitoring station XWDS16 was stolen during the assessment period. No dust data is available for the 04 November 2022 to 01 December 2022 monitoring period. None of the residential localities have exceeded the respective guideline in the past 12-month monitoring period (January 2022 – December 2022) (Aquatico, 2022).

Non-Residential Dust Fallout Monitoring Stations for Waterval East

None of the monitored dust localities exceeded the non-residential guideline for the 02 November 2022 to 01 December 2022 monitoring period (Aquatico, 2022).

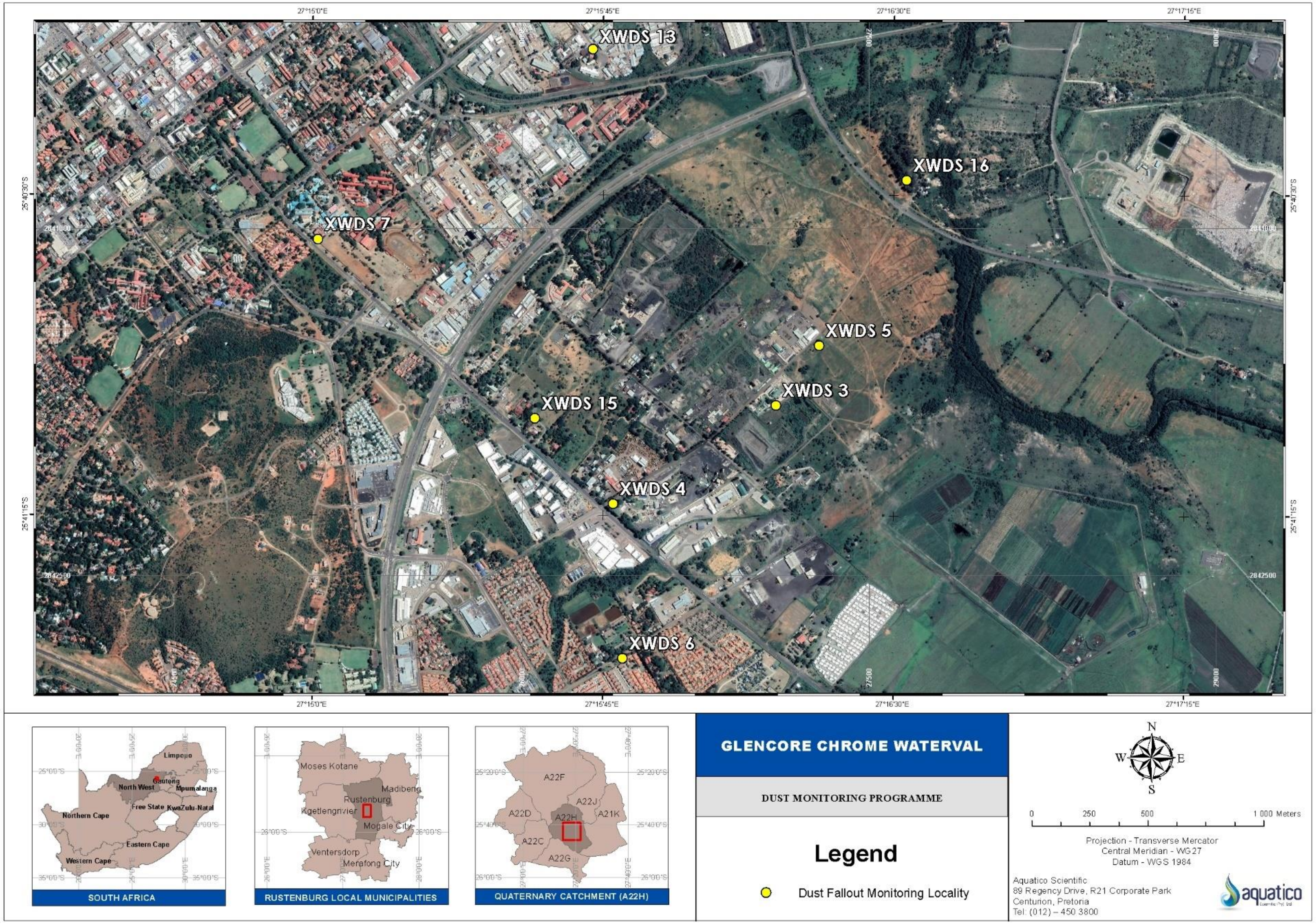


Figure 36: Dust fallout monitoring localities at Waterval Mine (Aquatico, 2022)

10.11 Noise

An environmental noise monitoring survey was conducted for the Waterval West Mine in July 2012 by Ashreq Environmental and Occupational Hygiene Consultants. The environmental noise survey was conducted according to the following legal requirements and associated standards: SANS 10103:2003, the Code of Practice for The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication recommends maximum noise levels for residential and non-residential areas as reflected in Table 59.

Table 59: Acceptable rating levels for noise in districts (Ashreg, 2012) (Shangoni, 2021)

1	2	3	4	5	6	7
Type of district	**Equivalent continuous rating level ($L_{Req.T}$) for noise** dBA					
	Outdoors			**Indoors, with open windows**		
	Day-night $L_{R,dn}$ [a]	**Day-time** $L_{Req,d}$ [b]	**Night-time** $L_{Req,n}$ [b]	**Day-night** $L_{R,dn}$ [a]	**Day-time** $L_{Req,d}$ [b]	**Night-time** $L_{Req,n}$ [b]
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table may result.

NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken, and specialist advice should be obtained. In this case the indoor sound levels may significantly differ from the values given in columns 5 to 7. See also annex B.

NOTE 3 Residential buildings, e.g. dormitories, hotel accommodation, residences etc. should only be allowed in non-residential districts on condition that the calculated or anticipated indoor $L_{Req,T}$ values given in column 3 of table 1 are not exceeded.

a The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.

b The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise.

Figure 37: Noise monitoring points on site location at Waterval West Mine

10.11.1 Results

Table 60 provides the daytime environmental noise results (winter) and Table 61 provides the night time environmental noise results.

Table 60: Day time environmental noise results (winter) (Ashreq, 2012) (Shangoni, 2021)

Sampling point	GPS coordinates	Sample A (LAleq)	Sample B (LAleq)	Sample C (LAleq)	Point Average (dBa)
Point 1	25°40'47.22"S 27°15'33.64"E	54.5	54.6	55.1	54.7
Point 2	25°40'55.24"S 27°15'52.72"E	52.8	53.2	53.5	53.2
Point 3	25°40'58.64"S 27°15'34.37"E	45.9	45.8	46.2	46.0
Overall Day Time Average LAleq for Site					51 dBA

Table 61: Night time environmental noise results (winter) (Ashreq, 2012) (Shangoni, 2021)

Sampling point	GPS coordinates	Sample D (LAleq)	Sample E (LAleq)	Point Average (LAleq)
Point 1	25°40'47.22"S 27°15'33.64"E	48.9	50.2	49.6
Point 2	25°40'55.24"S 27°15'52.72"E	50.8	51.5	51.2
Point 3	25°40'58.64"S 27°15'34.37"E	46.1	45.8	46.0

Sampling point	GPS coordinates	Sample D (LAleq)	Sample E (LAleq)	Point Average (LAleq)
Overall Night Time Average LAleq for Site				**49 dBA**

The premise around Point no. 1-3 may be classed as an industrial district in accordance with SANS 10103:2003 Table 2. As a result, a 70dBA limit and 60dBA limit apply for the control of noise during the day and night-time respectively, in this area.

The main sources of noise may be attributed to the processing activities at the plant (including a surface fan) and intermittent vehicles passing on the main roads.

The results of day and night-time levels measured during this survey were as follows:

- Day Time LAIeq: 51dBA (-19).
- Night-Time LAIeq: 49dBA (-11).

It may therefore be concluded that both the day and night time levels were well below the noise control limits as set out in SANS 10103:2003. Both levels were similar to that of levels obtained in the summer.

10.12 Visual

Rustenburg is located approximately 3km east and Kroondal 5km west of the Waterval Mine. The shaft, plant structures and some of the dumps are visible from the main road (N4). There is however a strand of trees along the road, which lessens the impact marginally. The Waterval West section is not situated directly next to the road and is not as visible (Updated EMPr, 2009).

10.13 Protected areas and conservation planning

10.13.1 National Terrestrial Priority Areas (NPAs)

The National Terrestrial Priority Areas (NPA) assessment was based on integrating data on species, habitats and ecological processes to identify areas of greatest biodiversity significance. This resulted in the identification of nine spatial priority areas for terrestrial biodiversity (Driver et al. 2004). These priority areas represent areas with high concentrations of biodiversity features and/or areas where there are few options for meeting biodiversity targets (Rouget et al. 2004). Waterval Mine and its associated infrastructure is situated in the Bushveld-Bankenveld Priority Area (Figure 38), which faces the highest pressure of the nine identified national Priority Areas (NBI, 2004).

10.13.2 NEM:BA National Threatened Terrestrial Ecosystems

A list of Threatened Ecosystems within each Priority Area was gazetted on 9 December 2011 under the National Environmental Management: Biodiversity Act (NEM: BA) (Act No. 10 of 2004). The Threatened Ecosystems occupy 9.5% of South Africa, and were selected according to six criteria which included: (1) irreversible habitat loss; (2) ecosystem degradation; (3) rate of habitat loss; (4) limited habitat extent and imminent threat; (5)

threatened plant species associations, and (6) threatened animal species associations. Waterval Mine is situated in the Endangered Marikana Thornveld Ecosystem (refer Figure 38).

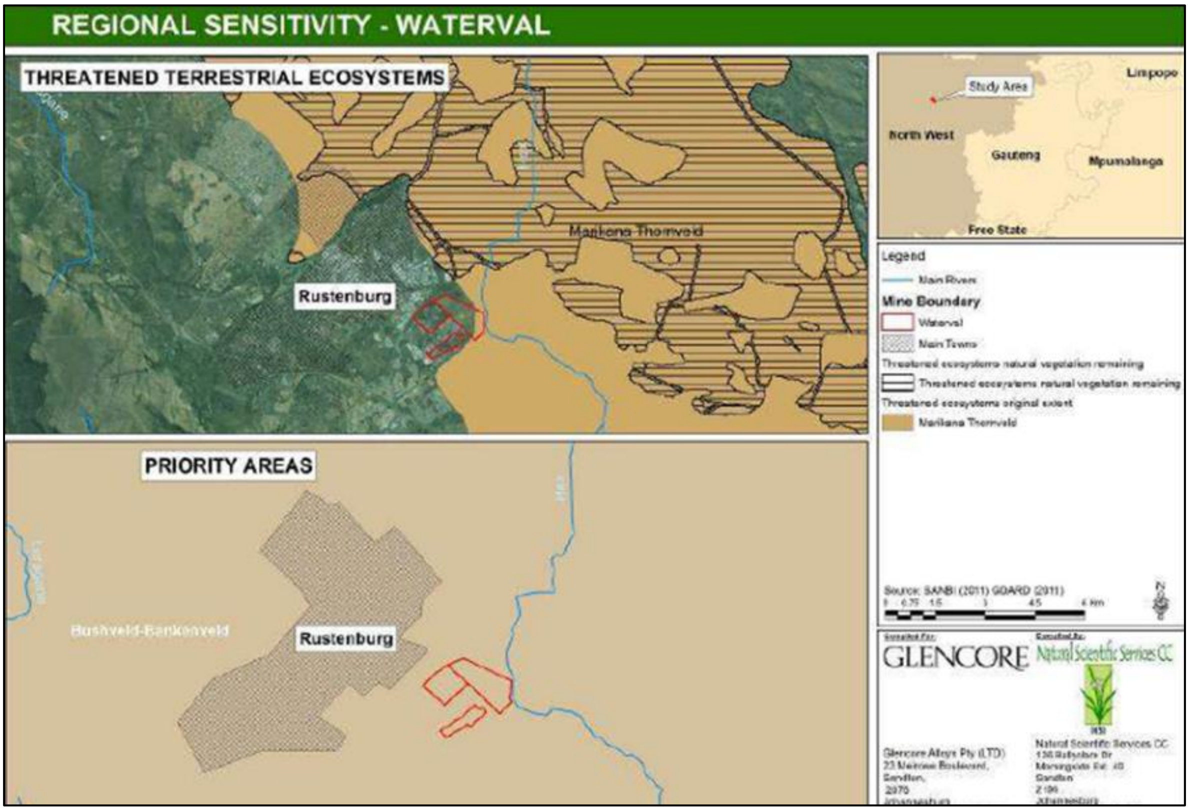


Figure 38: Waterval Mine in relation to national terrestrial Priority Areas and Threatened Ecosystems (NSS, July 2015) (Shangoni, 2021)

10.13.3 Mining and Biodiversity Guideline

The mining industry plays a vital role in South Africa's growth and development. But if mining is not strategically planned and carefully implemented, it has significant negative impacts on biodiversity and ecosystems, in particular, catchments, rivers and wetlands that support water-related services. The Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector (DEA et al., 2013), interprets the best available Biodiversity knowledge and science in terms of the implications and risks for mining in a practical and user-friendly guideline for integrating relevant biodiversity information into decision making. The development of this guideline was initiated by the Chamber of Mines and the SAMBF, in partnership with the DEA, the Department of Mineral Resources (DMR) (at the time), and with technical input and co-ordination by the SANBI Grasslands Programme.

The northern half of Waterval is classified as having a High biodiversity importance and risk of mining (Figure 39). The Mining and Biodiversity Guideline stipulates the following in areas of High importance for Biodiversity:

"*These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and limitations for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into licence agreements and/or authorisations.*"

Mining Biodiversity Guideline areas of High Biodiversity Importance include:

- Buffers around World Heritage sites and other protected areas;
- High water yield areas; and
- Other identified priorities from provincial spatial biodiversity plans

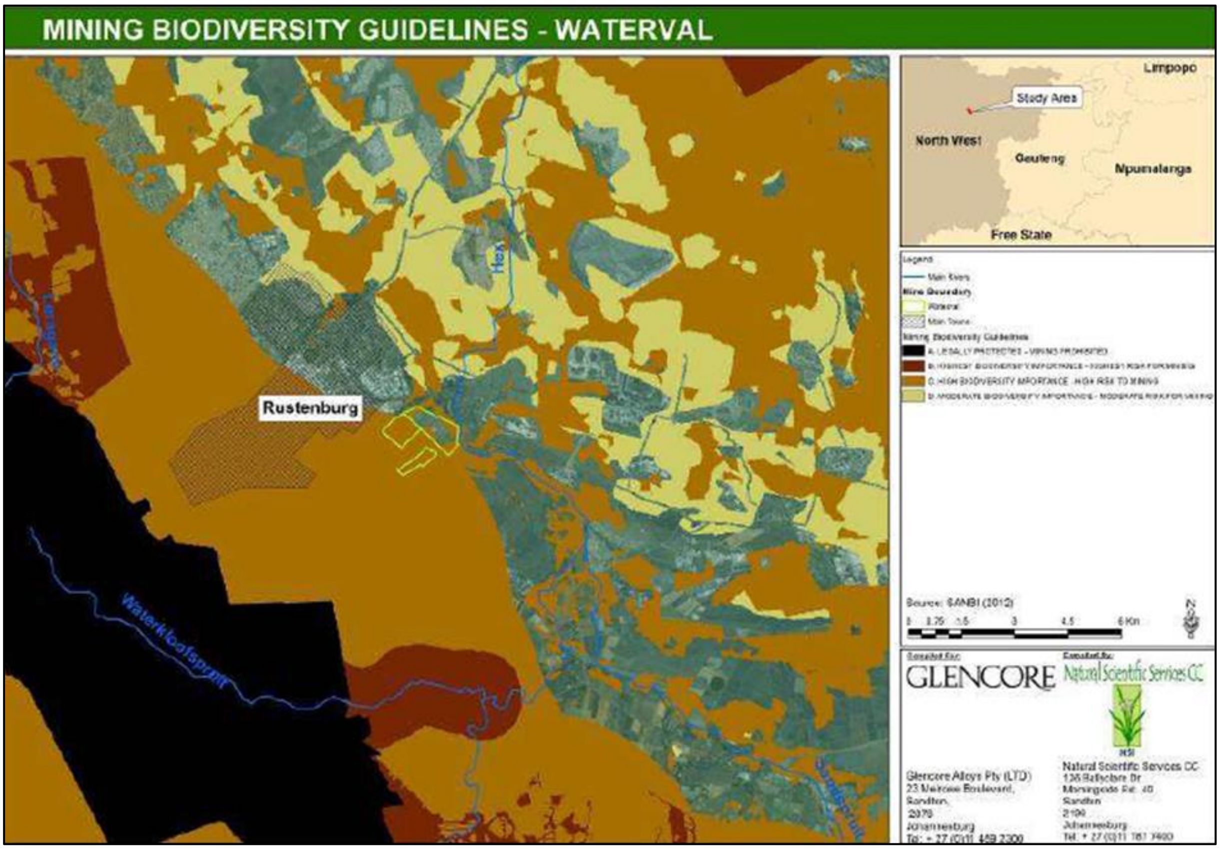


Figure 39: Mining and Biodiversity Guideline Atlas data for the region (NSS, July 2015) (Shangoni, 2021)

10.13.4 North West Conservation Plan

The North West Conservation Plan (NW: C Plan) is based on a provincial Biodiversity Assessment (Desmet *et al*., 2009), and provides important guidance for biodiversity conservation and sustainable development in the province. Among other things, the C Plan will be used to inform the development of provincial biodiversity Sector Plans, bioregional plans, Spatial Development Frameworks (SDFs), Environmental Management Frameworks (EMFs), Strategic Environmental Assessments (SEAs) and the Environmental Impact Assessment (EIA) process in the province.

According to the NW: C Plan, Waterval Mine (Figure 40) and its associated infrastructure is situated in a Category 2 Critical Biodiversity Area (CBA 2). CBAs are areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems, and the delivery of ecosystem services. If these areas are not maintained in a natural or near-natural state, then biodiversity conservation targets cannot be met.

Maintaining an area in a natural state can include a variety of biodiversity-compatible land uses and resource uses. In contrast to Protected Areas which include “natural” landscapes, Category 2 CBAs include “near-natural” landscapes where:

- Ecosystems and species remain largely intact and undisturbed;
- Local biodiversity has intermediate irreplaceability or some flexibility in terms of area required to meet biodiversity targets;

- The limit of “acceptable change” is being approached, but has not yet been surpassed; and
- 60-90% of original vegetation / resources should remain intact following development.

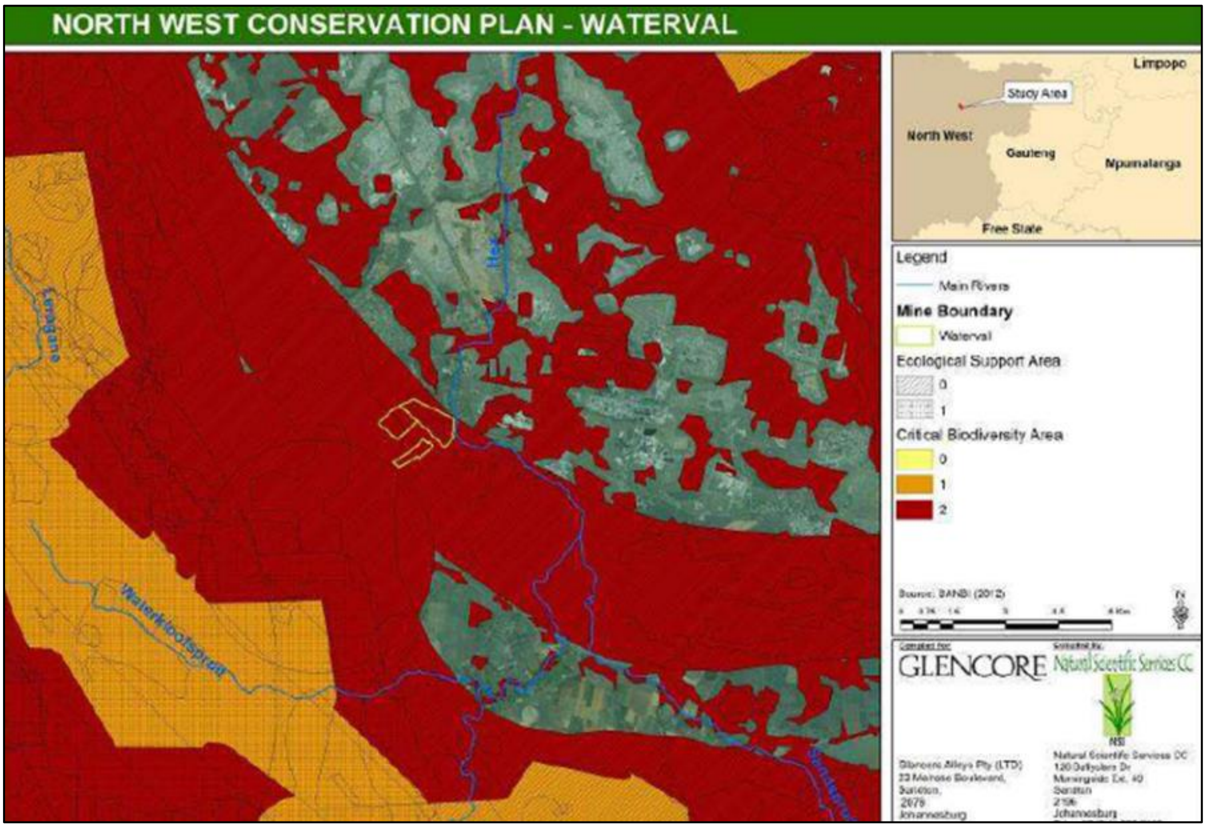


Figure 40: North West Boundary Conservation Plan (NSS, July 2015) (Shangoni, 2021)

10.13.5 Municipal area challenges and objectives

According to the Bojanala District Municipality Integrated Development Plan (IDP), 2012-17, large parts of the District Municipality are characterised by high levels of biodiversity as determined in the North West Biodiversity database. These include the areas along the Magaliesberg stretching from the southern parts of Madibeng Local Municipality in the east to Rustenburg and further north westwards up to the north western parts of the Rustenburg Local Municipality. It also includes areas in the central parts of the Kgetlengrivier local municipality, as well as large parts of the Moses Kotane Local Municipality west of the Pilanesberg National Park.

In response to the importance of the Bojanala Platinum District as far as biodiversity is concerned, the North West Parks and Tourism board is also considering the extension of a number of existing nature reserves and conservation areas. The most notable of these include the existing Heritage Park development which is envisaged to link the Madikwe Game Reserve in the west with the Pilanesberg National Park in the east.

Other proposed initiatives include the possible expansion of the Vaalkopdam nature reserve to link up with the Pilanesberg National Park as well as the expansion of the Borakalalo nature reserve to link up with Vaalkop. This will create a conservation corridor stretching from the Borakalalo nature reserve in the east through Vaalkopdam, Pilanesberg up to the Madikwe Game Reserve in the west.

Other areas of conservation include the Magaliesberg area as well as some of the Norite hills not influenced by mining and quarrying activities.

An aspect of specific concern within the district is that as much as 10% of the land area is classified as degraded.

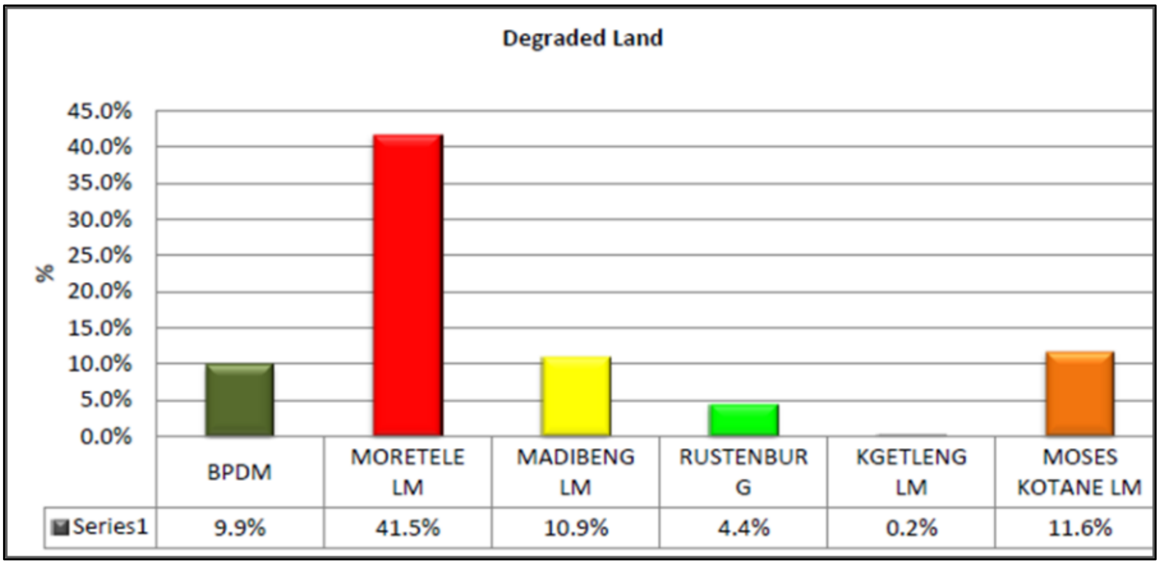


Figure 41: Percentage of total municipal area degraded (Bojanala DM IDP, 2012-17) (Shangoni, 2021)

10.13.5.1 Key issues/challenges

- Protection of natural vegetation and ecosystems and ecologically sensitive zones;
- Protection and development of cultural heritage sites;
- Protection of unique geological features such as Pilanesberg and the Magaliesberg Mountain Range;
- Protection of Red Data fauna and flora species that occur in the district; and
- The need for improved air and water quality in the district.

10.13.5.2 Objectives

In terms of the District Environmental Management Policy, council commits itself to continually improve its environmental performance, beyond the requirements of current legislation or regulation. In this respect, it will specifically endeavour to:

- Encourage the reduced consumption of water, energy and other natural resources;
- Pursue progressive waste reduction, reuse and recycling initiatives to reduce the amount of waste generated from Council activities and within the District;
- Ensure and encourage the provision of effective waste management services to all the communities within the District area of jurisdiction;
- Encourage the prevention and minimisation of environmental pollution to air, water and land within the District to maintain and improve the health and welfare of the public;
- Support the rehabilitation of polluted water and land areas within the District;
- Support sustainable agricultural practices within the District;
- Safeguard natural habitats and species and preserve the nature and character of the rural areas as well as preserve cultural heritage;
- Balance the need to enhance the built environment with measures which reduce the environmental impact of development;
- Promote sustainable public transport; and
- Provide environmental education and training within the Council and its staff on the implementation of the Policy and promote environmental education within the whole community.

10.14 Heritage

A Phase I Heritage Impact Assessment was undertaken for the Waterval Chrome Mine in 2010. Areas to the north and to the south of the mine have been surveyed by the author in the past. Numerous sites have been recorded and at least twenty sites have been excavated. The Phase I HIA study for the Waterval Chrome Mine revealed none of the types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (No 25 of 1999).

10.15 Social

Waterval Mine falls within the jurisdiction of the Bojanala District Municipality and the Rustenburg Local Municipality. Rustenburg Local Municipality is one of five municipalities within the Bojanala District Municipality in the North West Province and is divided into 38 wards. The significant growth in Rustenburg is largely attributed to the impact of the world's four largest mines in the immediate vicinity of the town, namely, Anglo American Platinum, Impala Platinum, Xstrata (Glencore) and Sibanye-Stillwater. The mining sector providing around 50% of all formal employment.

10.15.1 Population

With 719 000 people, the Rustenburg Local Municipality (RLM) housed 1.2% of South Africa's total population in 2020. Between 2010 and 2020 the population growth averaged 3.03% per annum which is about double than the growth rate of South Africa as a whole (1.59%). Compared to Bojanala Platinum's average annual growth rate (2.42%), the growth rate in Rustenburg's population at 3.03% was slightly higher than that of the district municipality (RLM IDP, 2022).

In 2020, the Rustenburg Local Municipality's population consisted of 90.32% African (649 000), 7.65% White (55 000), 0.92% Coloured (6 630) and 1.11% Asian (8 000) people. The largest share of population is within the young working age (25-44 years) age category with a total number of 299 000 or 41.6% of the total population. The age category with the second largest number of people is the babies and kids (0-14 years) age category with a total share of 23.4%, followed by the older working age (45-64 years) age category with 122 000 people. The age category with the least number of people is the retired / old age (65 years and older) age category with only 26 700 people (RLM IDP, 2022).

10.15.2 Education

Within Rustenburg Local Municipality, the number of people without any schooling decreased from 2010 to 2020 with an average annual rate of -1.43%, while the number of people within the 'matric only' category, increased from 108,000 to 178,000. The number of people with 'matric and a certificate/diploma' increased with an average annual rate of 5.43%, with the number of people with a 'matric and a Bachelor's' degree increasing with an average annual rate of 5.59%. Overall improvement in the level of education is visible with an increase in the number of people with 'matric' or higher education (RLM IDP, 2022).

10.15.3 Unemployment

In 2020, there were a total number of 94 600 people unemployed in Rustenburg, which is an increase of 43 300 from 51 300 in 2010. The total number of unemployed people within Rustenburg constitutes 38.41% of the total number of unemployed people in Bojanala Platinum District Municipality. The Rustenburg Local Municipality experienced an average annual increase of 6.31% in the number of unemployed people, which is worse than that of the Bojanala Platinum District Municipality which had an average annual increase in unemployment of 5.29% (RLM IDP, 2022).

10.15.4 Household infrastructure

Rustenburg Local Municipality had a total number of 74 400 (30.13% of total households) very formal dwelling units, a total of 109 000 (44.26% of total households) formal dwelling units and a total number of 39 400 (15.95% of total households) informal dwelling units (RLM IDP, 2022).

10.15.5 Sanitation

Rustenburg Local Municipality had a total number of 153 000 flush toilets (61.92% of total households), 29 700 Ventilation Improved Pit (VIP) (12.02% of total households) and 57 900 (23.47%) of total households pit toilets (RLM IDP, 2022).

10.15.6 Access to water

Rustenburg Local Municipality had a total number of 76 800 (or 31.14%) households with piped water inside the dwelling, a total of 130 000 (52.66%) households had piped water inside the yard and a total number of 1 700 (0.69%) households had no formal piped water (RLM IDP, 2022).

10.15.7 Electricity

Rustenburg Local Municipality had a total number of 2 300 (0.93%) households with electricity for lighting only, a total of 212 000 (86.06%) households had electricity for lighting and other purposes and a total number of 32 100 (13.01%) households did not use electricity (RLM IDP, 2022).

10.15.8 Refuse removal

Rustenburg Local Municipality had a total number of 179 000 (72.44%) households which had their refuse removed weekly by the authority, a total of 8 640 (3.50%) households had their refuse removed less often than weekly by the authority and a total number of 19 000 (7.71%) households which had to remove their refuse personally (own dump) (RLM IDP, 2022).

10.15.9 Local Economic Development Opportunities

The following sub-section provides an overview of the opportunities identified within the RLM. The opportunities are identified within their ability to develop the economy of the local municipality and improve the socio-economic conditions of residents within the municipality. This sub-section covers the following economic sectors:

- Agriculture;
- Mining;
- Manufacturing;
- Utilities;
- Trade;
- Transport, Storage and Communication;
- Finance;
- Community and Personal services;
- General Government Services; and
- Tourism.

11 The environmental attributes associated with the proposed UG1 opencast project

11.1 Topography

Information for this section was obtained from Geostratum's Glencore Waterval UG1 Opencast Project – Hydrogeological Investigation report (Report No. Report No. KT202211. January 2023). Refer to Appendix C6 for the full report.

Regionally, the project area is located on the northern toe-slope of the Magasliesberg and is characterised by a gently northwards sloping and slightly undulating topography. Undulations are created by watercourses/drainage lines which give rise to local, linear depressions separated by relatively elevated areas. Drainage is directed towards the north (Geostratum, 2023).

The topography of the project site is quite flat with a slightly less-elevated section in the central portion of the site occupied by a wetland-area. The site elevation ranges from ±1 136 mamsl at its western corner to about ±1 127 mamsl at its eastern boundary with the Hex River. Overall, the site is gently sloping downwards towards the adjacent Hex River to the east and northeast. Surface drainage is directed towards the Hex River which is the primary drainage feature near the site. The river drains towards the north (Geostratum, 2023).

11.2 Geology

Information for this section was obtained from Geostratum's Glencore Waterval UG1 Opencast Project – Hydrogeological Investigation report (Report No. Report No. KT202211. January 2023). Refer to Appendix C6 for the full report.

11.2.1 Regional Geology

The project area is located within the domain of the western limb of the Rustenburg Layered Suite, which forms part of the Bushveld Igneous Complex. The Rustenburg Layered Suite consists primarily of a series of layered mafic units, being composed of lithologies such as norite, gabbro, pyroxenite, anorthosite and dunite (Cawthorn *et al*., 2006). The Rustenburg Layered Suite hosts mineralized reefs rich in chromium and platinum-group metals (Geostratum, 2023)

11.2.2 Local Geology

According to the 1:250 000 Geological Map 2526 Rustenburg, the project site is underlain by norite and a northwest-southeast trending unit of anorthosite. Both lithologies belong to the Mathlagame unit (Figure 42). Regionally, the Mathlagame unit exists as a roughly northwest-southeast oriented body extending in a north-westerly and easterly direction from the site. Isolated dunite, harzburgite and pyroxenite pipes have been emplaced in this unit. Situated northeast of the site, beyond and adjacent to the Mathlagame unit, is the Pyramid gabbro-norite terrane. Progressing towards the southwest from the site and beyond the Mathlagame unit, the local geology is characterized by the Ruighoek pyroxenite followed by the Kolobeng Norite and followed by the Magaliesberg Quartzite (Geostratum, 2023).

Figure 42: Geological setting of the proposed UG1 opencast project – 2526 Rustenburg (Geostratum, 2023)

11.3 Climate

Information for the climate section was obtained from uMoya-NILU Consulting's Air Quality Specialist Study for the Proposed Waterval UG1 Opencast Project (Report Number: uMN153-22. October 2022). Refer to Appendix C7 for the full report.

The predominant factors that influence the climate of a location are latitude, elevation and the distance from the ocean. Latitude relates to the amount of radiation that is received with lower latitudes receiving more than high latitudes. Temperature decreases with increasing height hence the climate relationship to elevation. The ocean has a moderating effect on temperature range and coastal areas are cooler and generally wetter than inland areas. Other factors that influence climate are topography and local winds. The Waterval UG1 Opencast Project is situated at 1 130 m above sea level and at a latitude of 25˚40' S. The area experiences a humid subtropical climate with hot summers with the average summer maximum temperatures exceeding 29˚C from November to February (Table 62). The winter temperatures are mild and nights are cold with the average minimum temperature below 10˚C from May to September. Rustenburg receives an annual average rainfall of 663 mm with more than 550 mm falling in summer between November and March (Table 62) (uMoya, 2022).

Table 62: Average monthly temperatures and rainfall at Rustenburg (Rustenburg Local Municipality, 2007, (uMoya, 2022)

	Monthly average			
Month	**Maximum (°C)**	**Daily mean (°C)**	**Minimum (°C)**	**Rainfall (mm)**
Jan	30.3	23.8	17.1	117
Feb	29.4	23.1	16.8	100
Mar	28.3	21.7	15.0	95
Apr	25.5	18.3	11.2	37
May	21.6	14.9	6.5	18
Jun	20.4	11.8	3.2	9
Jul	20.9	11.8	2.8	7
Aug	23.7	14.4	5.1	8
Sep	27.3	18.5	9.6	18
Oct	28.7	20.8	12.9	55
Nov	29.4	22.1	14.9	86
Dec	30.1	23.1	16.1	113
Annual average	**26.5**	**18.7**	**10.9**	**663**

The hourly wind speed and direction data at Rustenburg are presented in the annual windrose in Figure 43. A windrose illustrates the frequency of hourly wind from the 16 cardinal wind directions, with wind indicated from the direction it blows, i.e. easterly winds blow from the east. It also illustrates the frequency of average hourly wind speed in six wind speed classes in m/s. The predominant wind directions are northwesterly (NW), northerly (N) and northeasterly (NE) to east-northeastly (ENE). Generally winds in these directions are light with the majority of hourly winds less than 3.4 m/s. Stronger winds reaching more than 8 m/s do occur, mostly from the northwest (NW) through to east-northeast (ENE). Winds from the sector east-southeast (ESE) to south are light and generally less than 1.6 m/s. Winds rarely occur from the sector south-southwest (SSW) to west-southwest (WSW) (uMoya, 2022).

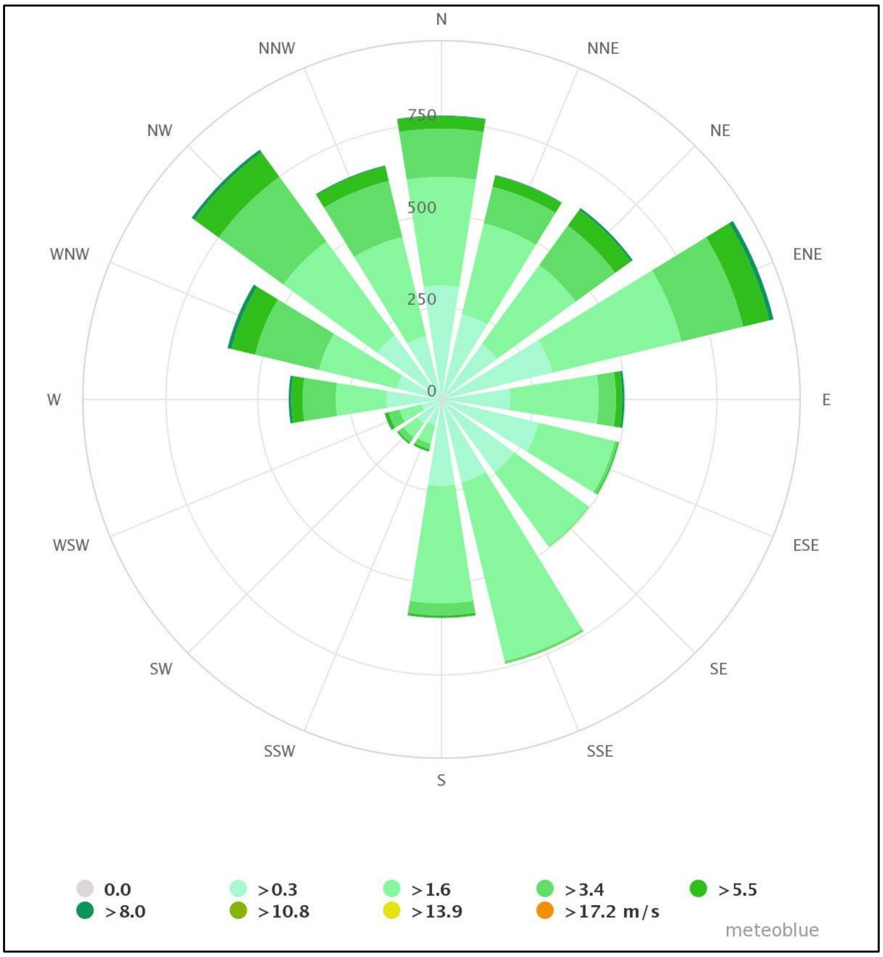


Figure 43: Annual windrose at Rustenburg with wind speed in m/s and frequency bands of 250 hours (uMoya, 2022).

11.4 Soils

Information for this section was obtained from The Biodiversity Company's Soil Pedology Baseline and Impact Assessment for the Waterval Mine Project report (Reference Number: UG1/Soil/10/2022. December 2022). Refer to Appendix C1 for the full report.

11.4.1 Description of soil profiles

Soil profiles were studied up to a depth of 1.2 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. The following diagnostic horizons were identified during the site assessment:

- Orthic topsoil;
- Melanic topsoil;
- Alluvial deposits;
- Pedocutanic horizon;
- Red apedal horizon; and
- Yellow-brown apedal horizon.

Orthic Topsoil

Orthic topsoils are mineral horizons that have been exposed to biological activities and varying intensities of mineral weathering. The climatic conditions and parent material ensure a wide range of properties differing from one Orthic A topsoil to another (i.e. colouration, structure etc.) (Soil Classification Working Group, 2018) (TBC1).

Stratified Alluvium

The stratified alluvium horizon is formed via alluvial or colluvial processes. This soil type is stratified and closely resembles the parent material of this soil type. Stratified alluvium generally is fertile and is often therefore used for cultivation purposes.

Melanic Topsoil

A Melanic topsoil is characterised by dark colours and well-structured blocky peds which is common in young landscapes. The parent geology of this soil horizon is intermediate or basic and can be very similar to Vertic clay due to a high clay percentage. Melanic clays distinctly have a high percentage of mica-like vermiculite and coalite clays rather than swelling smectic clays.

Red Apedal Horizon

The red apedal diagnostic soil horizon has no well-formed peds, but rather small porous aggregates. The poor structure associated with this diagnostic profile is a result of weathering processes under well drained oxidising conditions. Iron-oxide precipitations form on the outside of soil particles (hence the red colour) and non-swelling clays dominate the clay particles. This diagnostic soil horizon is widely spread across South Africa and can be associated with any parent material expected (Soil Classification Working Group, 1991).

Yellow-Brown Apedal Horizon

The Yellow-Brown Apedal horizon is similar to that of the Red Apedal horizon in all aspects except for the colour and the iron-oxide processes involved with the colouration thereof. This diagnostic soil horizon rarely occurs in parent rock high in iron-oxides and will rather be associated with Quartzite, Sandstone, Shale and Granites (Soil Classification Working Group, 1991).

Pedocutanic Horizon

A Pedocutanic horizon has a well-developed blocky structure as well as a high concentration of clay due to illuvial processes leaching clay particles to the horizon. For red pedocutanic horizons, an abrupt transition between the sub soil horizon and the topsoil can be expected (Soil Classification Working Group, 1991).

11.4.2 Soil forms

During the site assessment various soil forms were identified. These soil forms have been delineated and are illustrated in Figure 44 and is described in Table 63 according to depth, clay percentage, indications of surface crusting, signs of wetness and percentage rock. The soil forms are followed by the soil family and in brackets the maximum clay percentage of the topsoil. Soil family characteristics are described in Table 64.

The Avalon soil form consist of an orthic topsoil with a yellow-apedal horizon underlain by a soft plinthic horizon below. The Bonheim soil form has a melanic topsoil above a thick pedocutanic horizon below. A Dundee soil from consist of an orthic topsoil underlain with a thick subsurface alluvial horizon. A Hutton soil form has an orthic topsoil horizon above a thick red apedal subsurface horizon. Hydromorphic soils are profiles which are subjected to periodical or permanent saturation conditions.

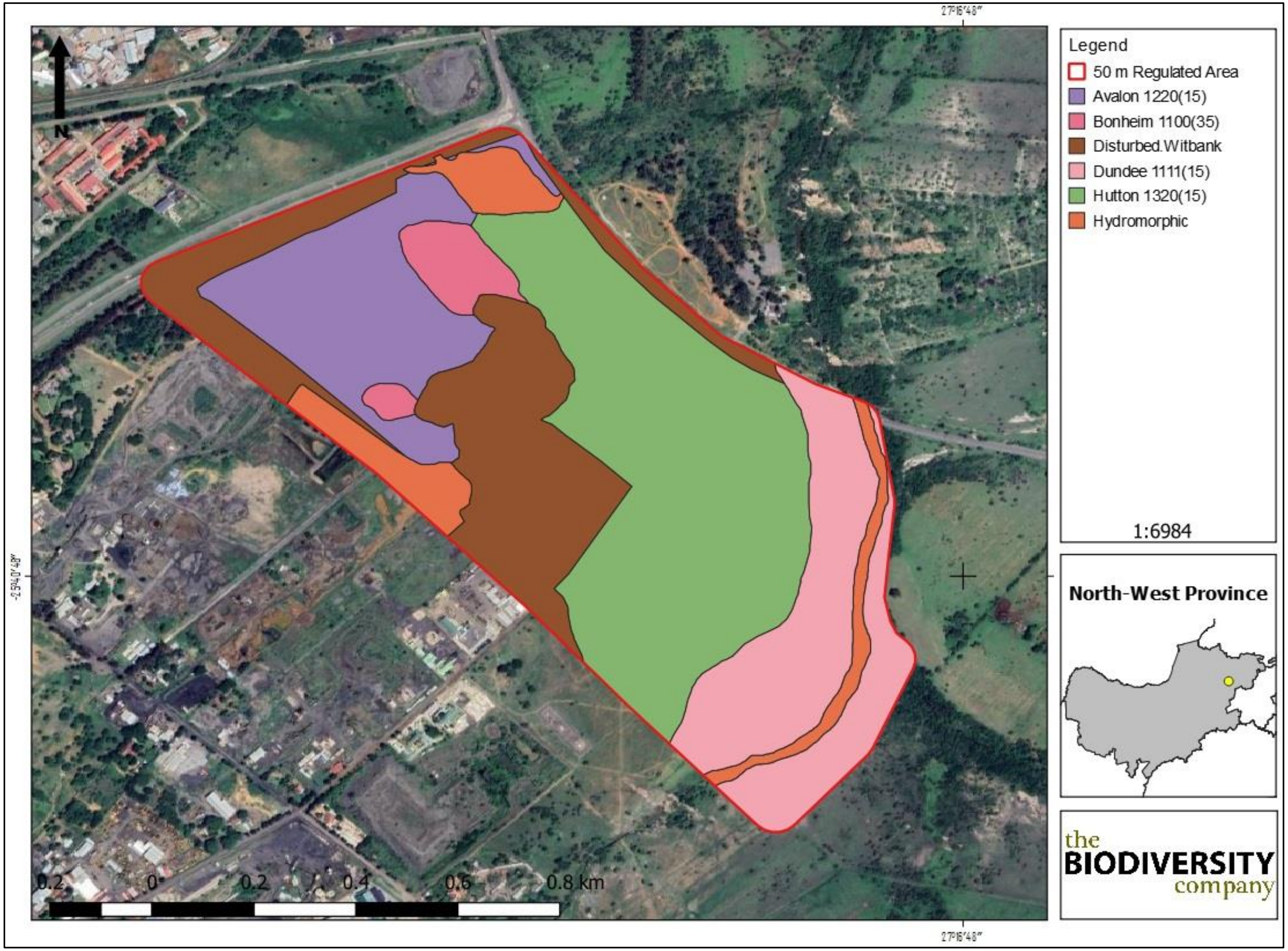


Figure 44: Soil delineations within the UG1 opencast project area (TBC1, 2022)

Table 63: Summary of soils identified within the UG1 opencast project area (TBC1, 2022)

Soil	Topsoil					Subsoil A				Subsoil B			
	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Depth (mm)	Clay (%)	Signs of wetness	Rock %
Avalon 1220(15)	0-300	0-15	None	0	Slight	300 to 700	15-30	None	0	700 to 1 200+	>35	Interflow Based	0
Bonheim 1100(35)	0-300	0-15	None	0	Slight	300 to 800	>35	None	0	800 to 1200+	>35	None	0
Dundee 1111(15)	0-200	0-15	None	0	None	200 to 1200+	0-15	None	0	N/A			
Hutton 1320(15)	0-300	0-15	None	0	None	300 to 1200+	0-15	None	0				
Hydromorphic	N/A					N/A				N/A			
Witbank/Disturbed	N/A					N/A				N/A			

Table 64: Description of soil family characteristics (TBC1, 2022)

Soil Form/Family	Topsoil Colour	Vertic Properties	Colour of Alluvial	Occurrence of Lime	Alluvial Wetness	Base Status	Textural Contrast	Base Status of Apedal Horizon	Textural Contrast
Avalon 1220(15)	Dark Topsoil	N/A	N/A	N/A	N/A	Mesotrophic	Luvic	N/A	N/A
Bonheim 1100(35)	N/A	Absent	N/A	Lime Absent	N/A	N/A	N/A	N/A	N/A
Dundee 1111(15)	Dark Topsoil	N/A	Brown	Lime Absent	Absent	N/A	Luvic	N/A	N/A
Hutton 1320(15)	Dark Topsoil	N/A	N/A	N/A	N/A	N/A	N/A	Eutrophic	Luvic
Hydromorphic	N/A								
Witbank/Disturbed	N/A								

11.4.3 Agricultural Potential and Climate Capability

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions.

The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

The climatic capability has been determined by means of the Smith (2006) methodology, of which the first step includes determining the climate capability of the region by means of the Mean Annual Precipitation (MAP) and annual Class A pan (potential evaporation) (see Table 65).

Table 65: Climatic capability (step 1) (TBC1, 2022)

Central Sandy Bushveld region				
Climatic Capability Class	**Limitation Rating**	**Description**	**MAP: Class A pan Class**	**Applicability to site**
C1	None to Slight	Local climate is favourable for good yields for a wide range of adapted crops throughout the year.	0.75-1.00	
C2	Slight	Local climate is favourable for a wide range of adapted crops and a year-round growing season. Moisture stress and lower temperature increase risk and decrease yields relative to C1.	0.50-0.75	
C3	Slight to Moderate	Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops.	0.47-0.50	
C4	Moderate	Moderately restricted growing season due to the occurrence of low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3.	0.44-0.47	
C5	Moderate to Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops at risk of some yield loss.	0.41-0.44	
C6	Severe	Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops that frequently experience yield loss.	0.38-0.41	
C7	Severe to Very Severe	Severely restricted choice of crops due to heat and moisture stress.	0.34-0.38	
C8	Very Severe	Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss.	0.30-0.34	✔

According to Smith (2006), the climatic capability of a region is only refined past the first step if the climatic capability is determined to be between climatic capability 1 and 6. Given the fact that the climatic capability has been determined to be “C8” for the project area, no further steps will be taken to refine the climate capability.

11.4.4 Land capability

The capability of land concerns the wise use of land to ensure economical production on a sustained basis, under specific uses and treatments. The object of land classification is the grouping of different land capabilities, to indicate the safest option for use, to indicate permanent hazards and management requirements. These land capability classes decrease in capability from I to VIII and increase in risk from I to VIII. DAFF (2017) further defines land capability as "the most intensive long-term use of land for purposes of rainfed farming, determined by the interaction of climate, soil and terrain. The land capability was determined by using the guidelines described in "The farming handbook" (TBC1, 2022).

The land capabilities for the project area are described in Table 66 and illustrated in Figure 45.

Table 66: Land capability for the soils within the UG1 opencast project area (TBC 1, 2022)

Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage of Land Capability within Project Area	Land Capability Group	Sensitivity
III	Moderate limitations. Some erosion hazard	Special conservation practice and tillage methods	Rotation crops and ley (50%)	69.4	Arable	High
IV	Severe limitations. Low arable potential.	Intensive conservation practice	Long term leys (75%)	1.4	Arable	Moderate
V	Water course and land with wetness limitations	Protection and control of water table	Improved pastures, suitable for wildlife	7.4	Grazing	Low
Disturbed	**N/A**			21.8	Wildlife	None

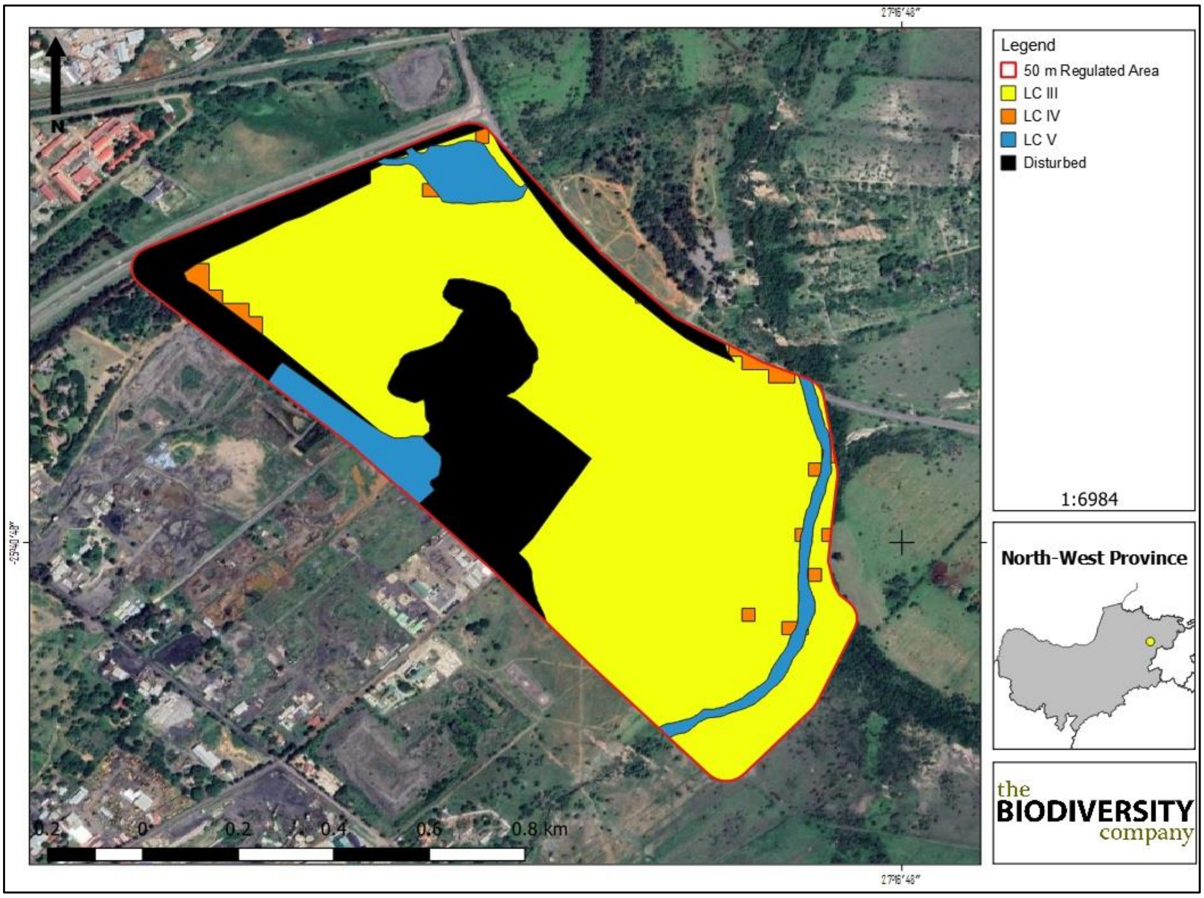


Figure 45: Land capability classes for the UG1 opencast project area (TBC1, 2022)

11.4.5 Land capability sensitivity

According to DAFF (2017), two classes of land capability sensitivity are located within the project area, namely a class comprising of land capability 6 to 8 (low/moderate to moderate sensitivity) and land capability 9 to 10 (moderate to moderately high sensitivity) (see Figure 46).

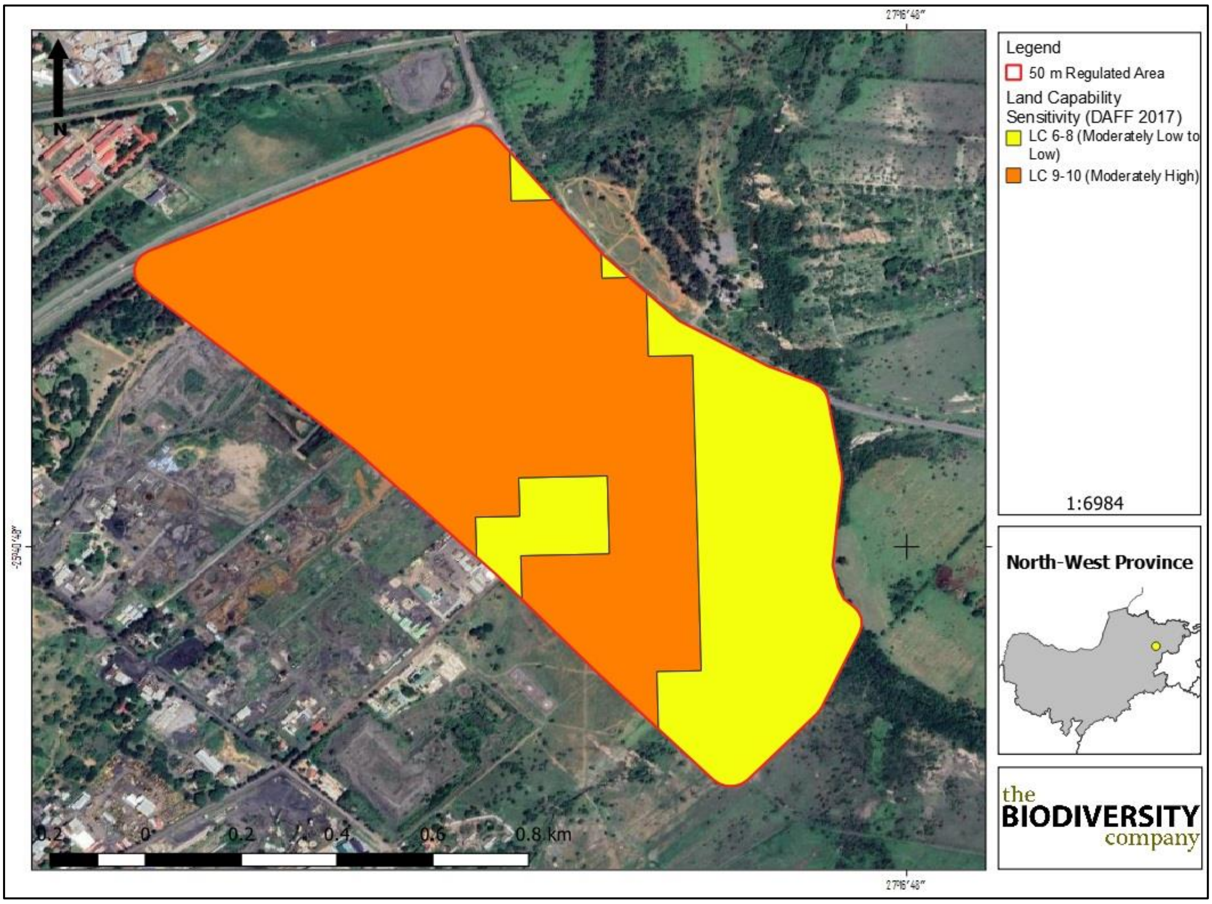


Figure 46: Land capability sensitivity of the project area (TBC1, 2022)

11.5 Biodiversity

Information for this section was obtained from The Biodiversity Company's Proposed Waterval Mine UG1 Opencast project in Rustenburg – Vegetation Compliance Statement (updated February 2023). Refer to Appendix C2 for the full report.

The following features describe the general area and habitat. This assessment is based on spatial data that are provided by various sources such as the provincial environmental authority and SANBI. The desktop analysis and its relevance to this project are listed in

Table 67: Desktop spatial features examined (TBC2, 2022)

Desktop Information Considered	Relevance
Vegetation Type	The project area lies in the Marikana Thornveld (Vulnerable) and the Moot Plains Bushveld (Endangered).
Ecosystem Threat Status	Overlaps with a Vulnerable (VU) Ecosystem and an Endangered (EN) ecosystem.
Ecosystem Protection Level	Overlaps mainly with a Poorly Protected Ecosystem.
Protected Areas	The project area is located 5.42 km away from the Kgaswane Nature Reserve, thus lying within the 10 km Protected Area Buffer Zone.
National Protected Areas Expansion Strategy (NPAES)	The project area does not traverse any NPAES area

North-West Biodiversity Sector Plan	The project area overlaps with a Critical Biodiversity Area, as listed in the NWBSP
National Biodiversity Assessment (NBA) Wetlands	The project area traverses an NBA wetland.
National Freshwater Ecosystem Priority Areas (NFEPA) Rivers and Wetlands	The NFEPA spatial data indicates the project area traverses an NFEPA wetland.
Strategic Water Source Areas (SWSA)	The project area does not traverse any SWSA and there is no SWSA in close proximity to the project area.

11.5.1 Regional vegetation type

The project area is situated within the Savanna Biome. It is the most widespread biome in Africa and the largest biome in South Africa, extending throughout the eastern and north-eastern areas of the country. The Savanna vegetation of South Africa represents the southernmost extension of this biome. Most savanna vegetation communities are characterised by a dominant grass layer, over-topped by a discontinuous, but distinct woody plant layer. Major macroclimatic traits that characterise the Savanna Biome include seasonal precipitation and a subtropical thermal regime with no or usually low incidence of frost.

At a structural level, African savannas can be broadly categorised as either fine-leaved (microphyllous) savannas or broad-leaved savannas. Fine-leaved savannas typically occur on nutrient-rich soils and are dominated by microphyllous woody plants of the Mimosaceae family and a generally dense herbaceous layer. On a fine-scale vegetation type, the project area overlaps with two vegetation types, namely the Marikana Thornveld and Moot Plains Bushveld (Figure 47).

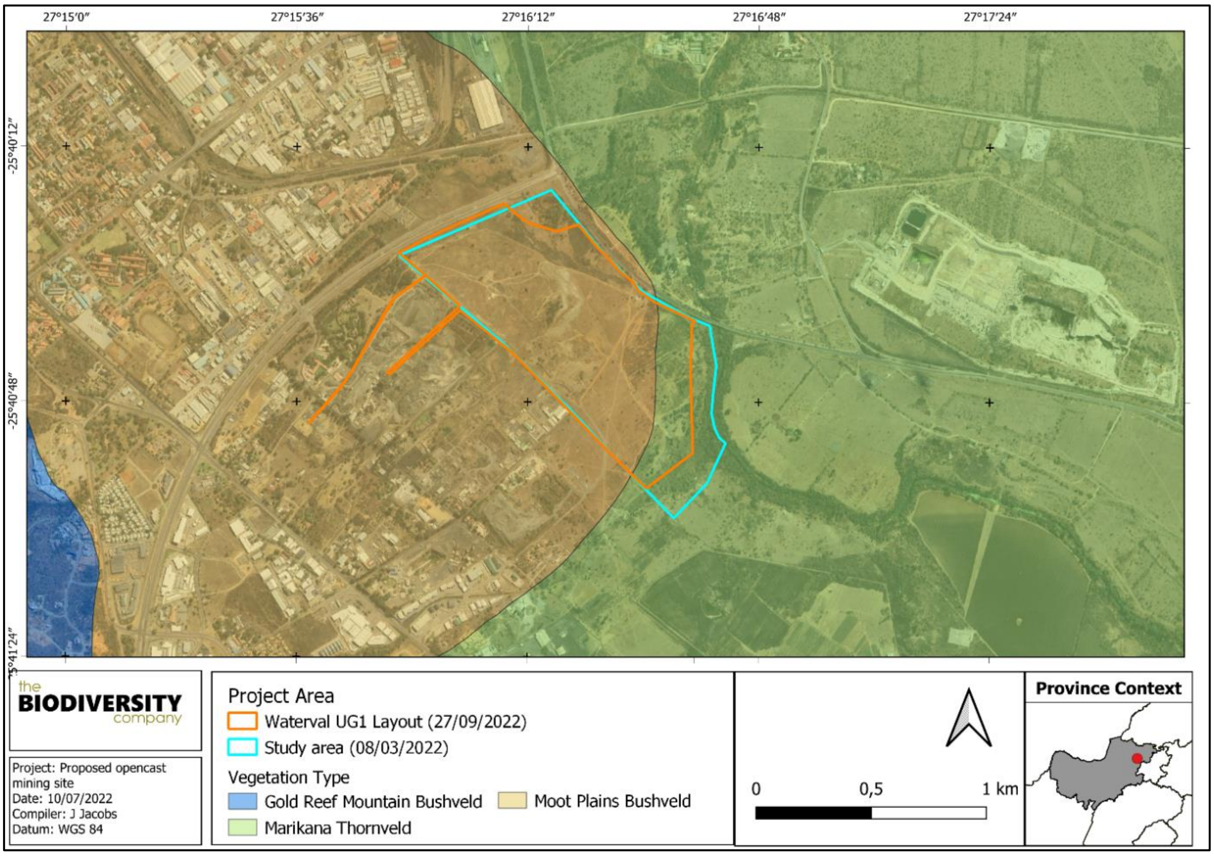


Figure 47: Vegetation type associated with the proposed UG1 opencast project (TBC2, 2022)

11.5.2 Flora assessment

A total of 41 woody, graminoid, shrub and herbaceous plant species belonging to 15 different families were recorded in the project area during the field assessment (Table 68). This includes 15 exotic invasive species, nine of which have been assigned alien invader plant categories under the National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEM:BA). Plants listed in Category 1b appear in green and those classified as 'not indigenous' or 'naturalised' according to NEM:BA, appear in blue text.

Table 68: Trees, shrub, graminoid and herbaceous plant species recorded in the UG1 opencast project area (TBC2, 2022)

Family	*Scientific Name*	Common Name	Threat Status (SANBI, 2017)	SA Endemic	Alien Category	Veld Ecological Status
Asphodelaceae	*Aloe greatheadii* var. *davyana* Schönland.	Common Soap Aloe	LC	Indigenous, Not Endemic		
Papaveraceae	*Argemone mexicana*	Mexican Prickly Poppy	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	
Poaceae	*Aristida bipartita*	Rolling grass	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Aristida congesta* subsp. *barbicollis*	Spreading Three-awn	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Aristids congesta* subsp. *congesta*	Tassel Three-awn	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Arundo donax*	Giant Reed	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	
Asparagaceae	*Asparagus laricinus* Burch.	Cluster-leaf asparagus	LC	Indigenous, Not Endemic		
Asteraceae	*Bidens pilosa*	Blackjack	NE	Not Indigenous; Naturalized exotic weed		
Poaceae	*Bothriochloa insculpta*	Pinhole Grass	LC	Indigenous, Not Endemic		Increaser II
Cannabaceae	*Celtis africana*	White Stinkwood, Witstinkhout	LC	Indigenous, Not Endemic		
Poaceae	*Cenchrus ciliaris*	Foxtail Buffalo Grass, African Foxtail	LC	Indigenous, Not Endemic		
Poaceae	*Cenchrus setaceus* (*Pennisetum setaceum*)	Fountain Grass	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	
Poaceae	*Chloris gayana*	Rhodes grass	LC	Indigenous, Not Endemic		Increaser II

Family	*Scientific Name*	Common Name	Threat Status (SANBI, 2017)	SA Endemic	Alien Category	Veld Ecological Status
Asteraceae	*Conyza bonariensis*	Flax-leaf Fleabane	NE	Not Indigenous; Naturalized exotic weed	-	
Poaceae	*Cynodon dactylon*	Couch gras	LC	Indigenous, Not Endemic		Increaser II
Solanaceae	*Datura ferox*	Large Thorn Apple	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	-
Fabaceae	*Dichrostachys cinerea* subsp. *nyassana*	Sickle Bush, Kalahari Christmas Tree	LC	Indigenous, Not Endemic	-	
Poaceae	*Digitaria eriantha*	Finger Grass	LC	Indigenous, Not Endemic		Decreaser
Poaceae	*Eragrostis chloromelas*	Blue Love Grass	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Eragrostis curvula*	Weeping Love Grass	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Eragrostis lehmanniana* var. *lehmanniana*	Eastern Province Vlei Grass, Land-Grass, Lehman Love Grass	LC	Indigenous, Not Endemic		Increaser II
Myrtaceae	*Eucalyptus grandis*	Saligna Gum	NE	Not Indigenous; Naturalized exotic weed		-
Asteraceae	*Flaveria bidentis*	Speedyweed	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	
Apocynaceae	*Gomphocarpus tomentosus* Burch. subsp. *tomentosus*	Woolly Milkweed	LC	Indigenous, Not Endemic	-	
Poaceae	*Heteropogon contortus*	Tanglehead, Spear Grass	LC	Indigenous, Not Endemic		Increaser II
Poaceae	*Hyparrhenia hirta*	Common Thatching Grass, Blougras (a)	LC	Indigenous, Not Endemic		Increaser I
Verbenaceae	*Lantana camara*	Lantana	NE	Not Indigenous; Naturalized exotic weed	NEM: BA Category 1b.	Are these all unclassified?
Asparagaceae	*Ledebouria revoluta*	Common African Hyacinth	LC	Indigenous, Not Endemic	-	
Meliaceae	*Melia azedarach*	Chinaberry	NE	Not Indigenous;	NEM: BA Category 1b.	

Family	*Scientific Name*	Common Name	Threat Status (SANBI, 2017)	SA Endemic	Alien Category	Veld Ecological Status
				Naturalized exotic weed		
Poaceae	*Melinis repens*	Natal Red Top	LC	Indigenous, Not Endemic		Increaser II
Nyctaginaceae	*Mirabilis jalapa*	Marvel of Peru	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b.	
Poaceae	*Panicum maximum*	Guinea Grass	LC	Indigenous, Not Endemic		None
Poaceae	*Panicum natalense*	Natal Buffalo Grass	LC	Indigenous, Not Endemic		
Euphorbiaceae	*Ricinus communis* var. *communis*	Castor Bean, Castor Oil Plant	NE	Not Indigenous; Naturalized exotic weed		
Asteraceae	*Schkuhria pinnata*	Dwarf Marigold	NE	Not Indigenous; Naturalized exotic weed		
Fabaceae	*Senegalia mellifera* (Vahl) Seigel & Ebinger subsp. *detinens*	Black Thorn	LC	Indigenous, Not Endemic		
Fabaceae	*Sesbania bispinosa* (Jacq.) W.Wight var. *bispinosa*	Spiny Sesbania	NE	Indigenous, Not Endemic		
Poaceae	*Setaria sphacelata* var. *sphacelata*	Common bristle grass; Golden Timothy Grass	LC	Indigenous, Not Endemic		Decreaser
Solanaceae	*Solanum sisymbriifolium*	Wild Tomato, Dense; Thorned Bitter Apple	NE	Not Indigenous; Naturalized exotic weed	NEMBA Category 1b.	
Poaceae	*Sporobolus africanus*	Ratstail Dropseed; Rush Grass	LC	Not Endemic		
Asteraceae	*Tagetes minuta*	Khaki Bush, Khaki Weed, African Marigold	NE	Not Indigenous; Naturalized exotic weed		
Poaceae	*Themeda triandra*	Angle Grass	LC	Indigenous, Not Endemic		Decreaser
Poaceae	*Urochloa brachyura*	Annual tail grass	LC	Indigenous, Not Endemic		
Fabaceae	*Vachellia karroo*	Sweet Thorn, Cape Gum	LC	Indigenous, Not Endemic		

Family	*Scientific Name*	Common Name	Threat Status (SANBI, 2017)	SA Endemic	Alien Category	Veld Ecological Status
Fabaceae	*Vachellia sieberiana* var. *woodii*	Paperbark Thorn	LC	Indigenous, Not Endemic		
Fabaceae	*Vachellia tortilis* (Forssk.) Gallaso & Banfi subsp. *heteracantha*	Curly-pod Acacia	LC	Indigenous, Not Endemic		
Rhamnaceae	*Ziziphus mucronata* subsp. *mucronata*	Buffalo Thorn, Wait-a-bit	LC	Indigenous, Not Endemic		

11.5.3 Species of Conservation Concern

The species list from the site/field survey was assessed against the South African Red Data List, according to specific scientifically researched criteria and administered by the South African National Biodiversity Institute (SANBI), species listed as protected trees by the National Forests Act (NFA) (Act No. 84 of 1998), or as Protected Trees and Plants by the NEM:BA Threatened or Protected Species Regulations 152 of 2007 (TOPS Regulations) and the Lists of Critically Endangered, Endangered, Vulnerable and Protected Species (TOPS Lists) and the provincial nature conservation legislation, in the context of this report the North West Biodiversity Management Act (Act No. 4 of 2016) (NWB: MA) as well as the Transvaal Nature Conservation Ordinance (Ordinance 12 of 1983). None of the species found to occur on the project area is listed on NEMBA and DAFF's protected tree list, species listed as species of conservation concern nationally under the NWBMA (2016) nor globally.

11.5.4 Habitat summary and sensitivity

Five Habitat Units have been identified, namely Secondary Grassland, Transformed Area, Bushveld, Degraded Bushveld, and Riparian Zone. Refer to Figure 48.

- Secondary Grassland is dominated by secondary grasses, of which the most dominant species are *Heteropogon contortus* and *Hyparrhenia hirta.* Basal ground cover is low with little to no moribund material on the ground. This indicates that the area was historically a bushveld habitat that was cleared to establish a livestock grazing area. Cattle were seen grazing in this area, and goat dung was also seen on the ground.
- Transformed Area has been completely transformed by human activities. (Transformed refers to a habitat that has been converted into a human development, with little to no natural features left). Current land uses include rock dumping pits, slurry ponds and a fenced-off construction site. Such extensive alterations to the natural topsoil have resulted in this area being dominated by alien invasive plant species, including *Datura ferox*, *Flaveria bidentis*, *Tagetes minuta*, *Bidens pilosa*, *Ricinus communis* and *Arundo donax*.
- Bushveld is dominated by several indigenous tree species namely *Vachellia karroo*, *Vachellia sieberiana* var. *woodi* and *Vachellia tortilis* subsp. *heteracantha* and *Searsia lancea*, with a grass layer dominated by *Themeda triandra*. This area is considered "natural" or due to very limited human disturbance, with only two ruins of man-made structures seen. Historically, the endangered Marikana Thornveld occurred in the area occupied by Natural Bushveld.
- Degraded Bushveld has a secondary herbaceous layer, and alien invasive woody plant species such as *Eucalyprus grandis* and *Melia azedarach*. Indigenous woody plant species include *Dichrostachys cinerea*, *Vachellia* sp. and *Searsia lancea*. (Degraded refers to a habitat that is heavily reduced in terms of natural habitat quality due to human activities).
- The Riparian Zone is a riverine thicket on the banks of the Hex River. Anthropogenic disturbances include soil erosion, garbage pollution and alien plant invasion.

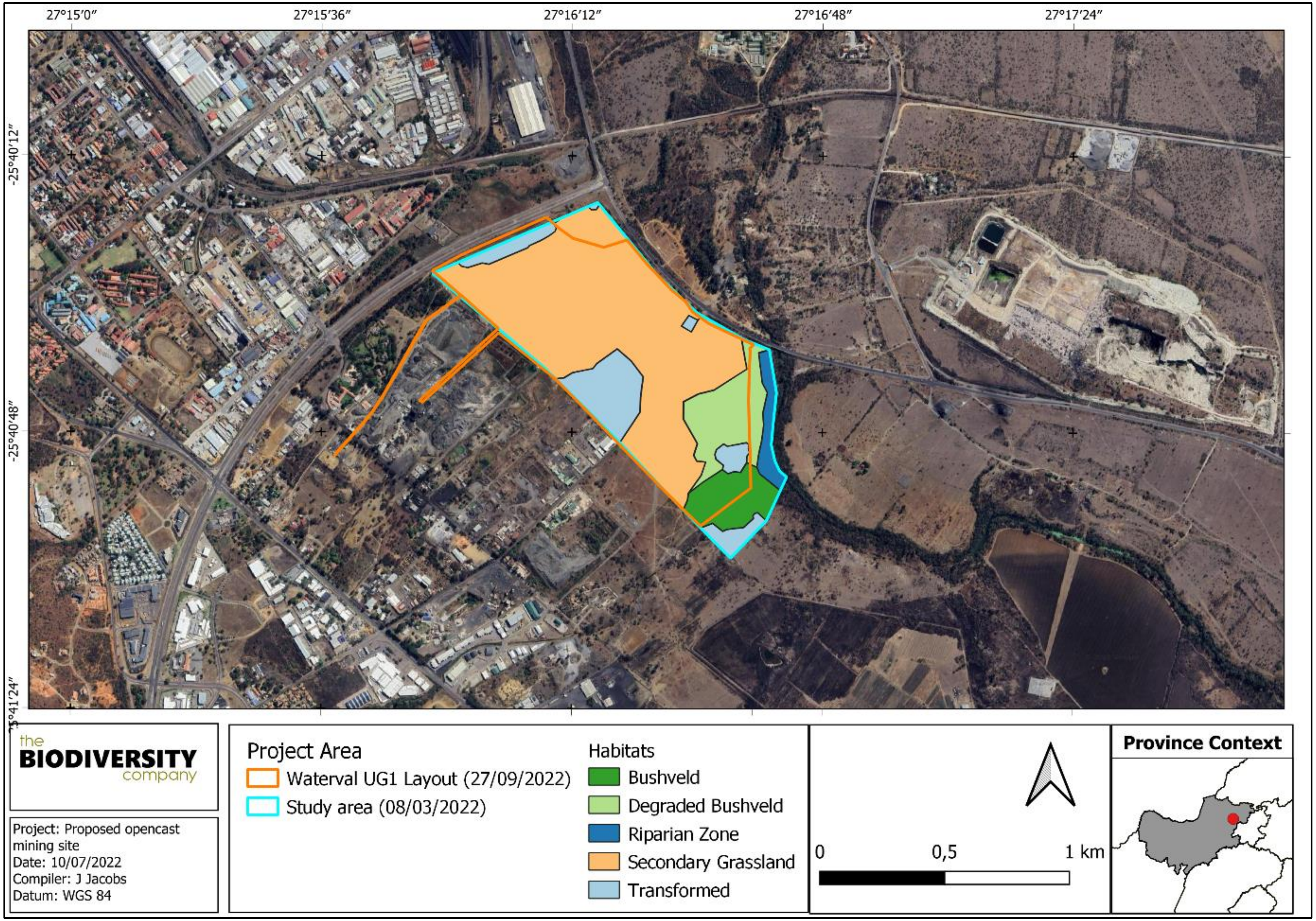


Figure 48: Habitat units identified within the UG1 opencast project area (TBC2, 2022)

11.5.5 Field sensitivity

Although the project area still contains natural vegetation, it has been either transformed or degraded from its historical natural state. A look at the surrounding vegetation that is close to the proposed opencast mining development indicates that the project area and its surroundings have been severely degraded in their entirety. These observations concur with the “Low Plant Species Theme Sensitivity” as suggested by the Screening Tool, and therefore has no particularly high botanical/conservation value.

Although not completely transformed, ecological processes on the project areas have been significantly impacted by livestock trampling, rock dumping, pollution, invasion of alien invasive plants and weeds and habitat fragmentation. Many of these impacts are associated with the establishment of mining activities.

The indigenous species that are present are opportunistic and do not constitute a recognizable plant community that may be described as ‘indigenous vegetation’ or as an ‘ecosystem’.” As such it is the specialists’ opinion that the area for the proposed opencast mining development is considered to have a Low Plant Species Sensitivity and all of the Habitat Units except for Bushveld have a Very Low Site Ecological Importance” (Table 69 and Figure 49). Bushveld has a “Low Site Ecological Importance”.

Table 69: Summary of habitat types delineated within field assessment area of the project area (TBC2, 2022)

Habitat	Conservation Importance	Functional Integrity	Biodiversity Importance	Receptor Resilience	Site Ecological Importance
Transformed	Low	Very Low	Very Low	Very high	Very Low
Degraded Bushveld	Low	Medium	Low	High	Very Low
Bushveld	Low	Medium	Low	Medium	Low
Secondary Grassland	Low	High	Low	High	Very Low
Riparian Zone	Low	Low	Low	Very High	Very Low

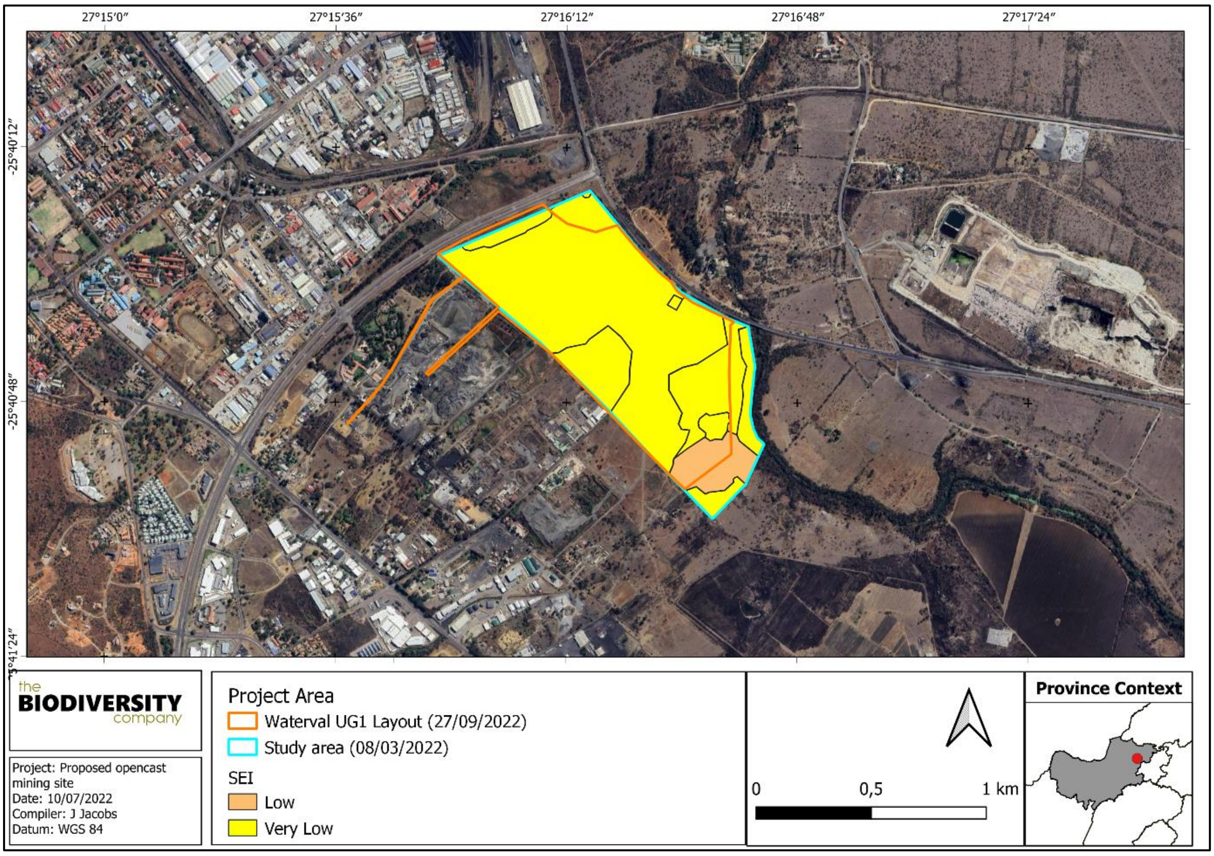


Figure 49: Habitat sensitivity of the proposed UG1 opencast project area (TBC2, 2022)

11.6 Surface Water

Information for this section was obtained from Hydrological Environmental Engineering's (HEES) Waterval UG1 Opencast Project Surface Water Management Plan (Ref No. EES18_2022. February 2023). Refer to Appendix C4 for the full report.

Overland flow from the UG1 opencast project drains eastwards into the Hex River and eventually reports to the Bospoort dam within A22H tertiary catchment area which is part of the Crocodile/Limpopo Rivers drainage region.

Two major drainage lines are evident (the Hex River and its tributary), and the proposed UG1 opencast project will operate outside this drainage line as the delineation of the 1:100 flood line shows. The mine will also operate outside the 100m distance from these major drainage lines.

Figure 50: 1:100 year floodline for the Hex River and Hex River tributary (HEES1, 2023)

11.7 Wetlands

Information for this section was obtained from The Biodiversity Company's Wetland Baseline and Impact Assessment for Waterval Mine UG1 Opencast Project (Reference Number: UG1/Wet/10/2022. October 2022). Refer to Appendix C3 for the full report.

11.7.1 Wetland delineation and description

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. One hydrogeomorphic (HGM) unit has been identified within the 500m regulated area, which has been classified as an Unchanneled Valley Bottom (UVB) Wetland. In addition, several other water resources were identified, namely riparian zone, drainage features, artificial wetland and artificial wetland inputs. These features are described below. Refer to Figure 51.

Unchanneled Valley Bottom Wetland

This system crosses underneath a local road by means of various culvert systems and is then channelled into an artificial drain to direct flows to a large portion of wetland where flows are diffusely distributed. In addition, various other artificial wetland systems were identified. These systems aren't classified by typical hydromorphic soils and are also clearly formed by means of artificial inputs. Therefore, these systems will be disregarded from the assessment. A riparian system is also located to the east of the 500 m regulated area.

Riparian zone

A riparian zone is commonly characterised by alluvial soils and by vegetation that is distinct from that of adjacent land areas. Many riparian areas are well drained and would not be defined as wetlands (according to the South African NWA). The riparian zone was characterised by robust vegetation comprising woody / tree species and the Dundee soil form. Riparian areas commonly reflect the high-energy conditions associated with the water flowing in a water channel, whereas wetlands generally display more diffuse flow and are lower energy environments (DWAF, 2005).

Artificial wetland

The delineated artificial system for the area is centrally located and has formed due to seepage outflow from historical workings in the area. The drainage of this artificial system is towards the west, contributing a saturated landscape west of the project area. The overall sensitivity of the artificial system is low.

Drainage features

The drainage features are referred to as 'A' Section channels that convey surface runoff immediately after a storm event and are not associated with a baseflow (DWAF, 2005). These systems are not characterised by riparian vegetation and grasses, these systems represent bare surfaces with evidence of surface run-off. The overall sensitivity of the drainage feature low. This system crosses underneath a local road by means of various culvert systems and is then channelled into an artificial drain to direct flows to a large portion of wetland where flows are diffusely distributed. In addition, various other artificial wetland systems were identified. These systems aren't classified by typical hydromorphic soils and are also clearly formed by means of artificial inputs. Therefore, these systems will be disregarded from the assessment. A riparian system is also located to the east of the 500m regulated area.

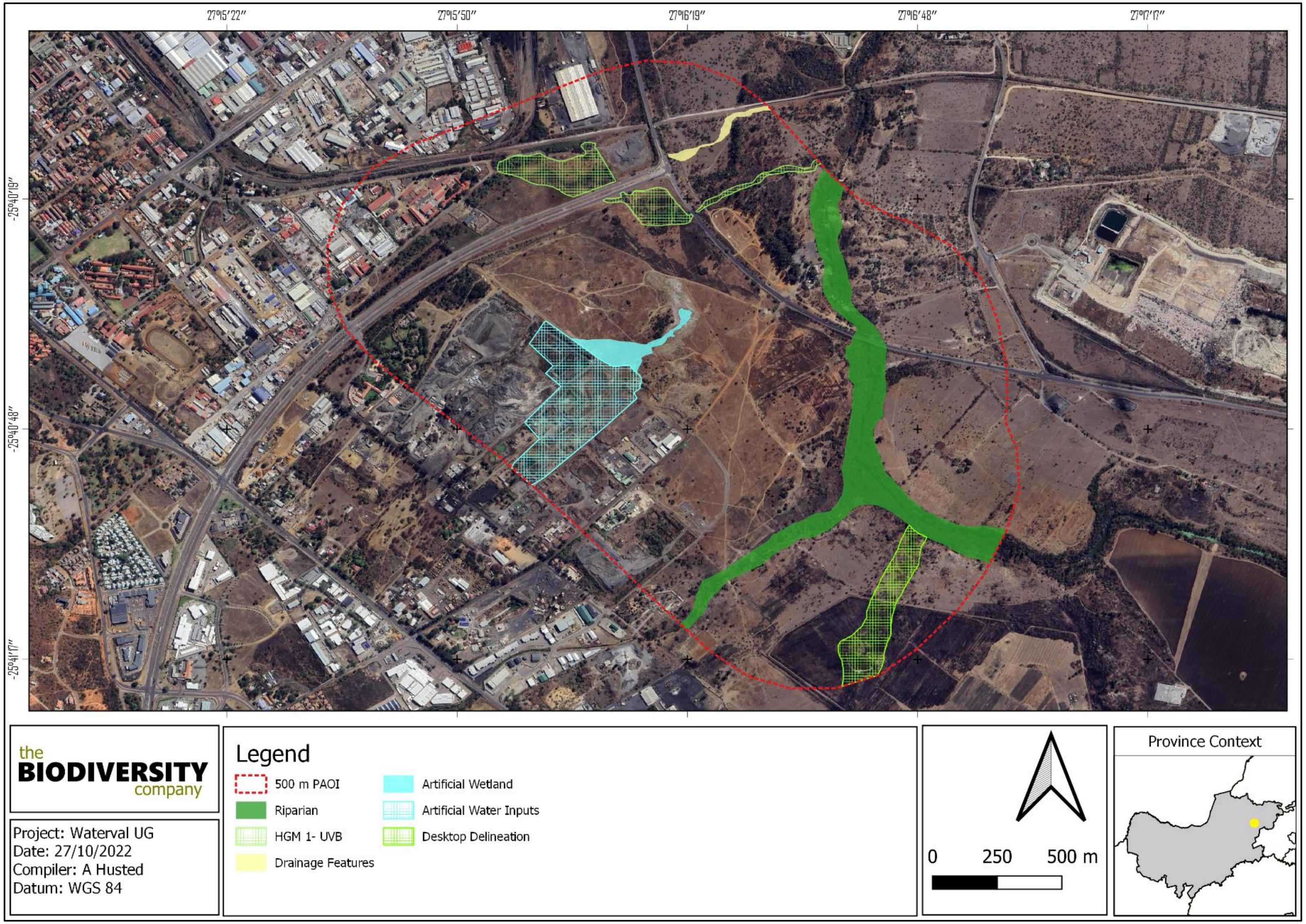


Figure 51: Delineation of wetlands within project area (TBC3, 2022)

11.7.2 Wetland unit identification

The wetland classification as per SANBI guidelines is presented in Table 70.

Table 70: Wetland classification for the UG1 opencast project area as per SANBI guideline (TBC3, 2022)

Wetland System	Level 1	Level 2		Level 3	Level 4		
	System	DWS Ecoregion/s	NFEPA Wet Veg Group/s	Landscape Unit	4A (HGM)	4B	4C
HGM 1	Inland	Bushveld Basin	Central Bushveld Group 2	Valley Bottom	UVB	N/A	N/A

11.7.3 General functional description

Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes. The shallow depths of surface water within this system adds to the degradation of toxic contaminants by means of sunlight penetration.

It is however important to note that the descriptions of the above-mentioned functions are merely typical expectations. All wetland systems are unique and therefore, the ecosystem services rated high for these systems on site might differ slightly to those expectations.

11.7.4 Ecological Functional Assessment

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method. The summarised results for HGM 1 are shown in Table 71. The average ecosystem score for HGM 1 has been scored "Intermediate". The indirect benefits associated with this score includes flood attenuation, sediment trapping, the assimilation of toxicants, nitrates and phosphates as well as erosion control.

The flows in some areas of the wetland are rather diffuse, which ensures the trapping of sediments as well as the assimilation of contaminants. High concentrations of sediments were identified throughout the extent of this HGM units, which verifies sediment trapping abilities. As for the direct benefits, no aspects were determined to be high. The reason for these low scores are attributed to the fact that the system isn't directly utilised by humans for drinking water or for provisioning of harvestable resources.

Table 71: Ecosystem services provided by HGM units identified within the UG1 opencast project area (TBC3, 2022)

Wetland Unit					HGM 1
Ecosystem Services Supplied by Wetlands	**Indirect Benefits**	**Regulating and supporting benefits**	Flood attenuation		**2.4**
			Streamflow regulation		**1.8**
			Water Quality enhancement benefits	Sediment trapping	**3.3**
				Phosphate assimilation	**2.4**
				Nitrate assimilation	**2.0**
				Toxicant assimilation	**2.4**
				Erosion control	**2.7**
			Carbon storage		**1.7**
	Dire ct Ben	**Biodiversity maintenance**			**0.9**

Wetland Unit				HGM 1
		Provisioning benefits	Provisioning of water for human use	0.6
			Provisioning of harvestable resources	0.0
			Provisioning of cultivated foods	0.0
		Cultural benefits	Cultural heritage	0.0
			Tourism and recreation	0.7
			Education and research	0.5
Average Eco Services Score				1.4

11.7.5 Ecological Health Assessment

The Present Ecological State (PES) for the assessed HGM units is presented in Table 72. The overall PES score for HGM 1 has been calculated to be "Moderately Modified". The hydrology of the system has been scored "Largely Modified" due to the presence of some alien invasive tree species within the wetland (i.e. *Populus alba*) as well as the extent of hardened surfaces within the wetland's catchment.

The geomorphology component (Moderately Modified) is affected by the excavation of the main trench feeding surface water into the wetland system. Additionally, erosion has taken place within the latter mentioned which has resulted in an increase of sediment inputs into the main wetland.

The vegetation component has been scored "Largely Modified" due to competition to the growth of indigenous vegetation from alien invasive infestation. Additionally, erosion has disrupted the topsoil in portions of the wetland which has resulted in a loss of vegetation growth in the given area.

Table 72: Summary of the scores for the wetland PES (TBC3, 2022)

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	D: Largely Modified	4.0	C: Moderately Modified	2.0	D: Largely Modified	4.9
Overall PES Score	3.7		**Overall PES Class**		C: Moderately Modified	

11.7.6 Importance and Sensitivity Assessment

The results of the Ecological Importance and Sensitivity (EIS) assessment are shown in Table 73. Various components pertaining to the protection status of a wetland is considered for the IS, including Strategic Water Source Areas (SWSA), the NFEPA wet veg protection status and the protection status of the wetland itself considering the NBA wetland data set. The EIS for HGM 1 has been calculated to be "High", which combines all parameters listed in Table 73. The wetlands in question have been determined to have a "High" importance and sensitivity.

It is worth noting that the DEA Screening Tool (2022) was used to further refine the sensitivity of wetland features by means of the aquatic biodiversity theme. The wetland in question is associated with "Inland Water Aquatics CBA" areas as well as "Inland Waters Wetland and Estuaries", which have both been allocated "Very High" sensitivities. The inland waters SWSA associated with the project area is classified as having "Very High" sensitivity.

Table 73: EIS results for the delineated HGM unit (TBC3, 2022)

HGM Type	Wet Veg			NBA Wetlands		SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018		
HGM 1	Central Bushveld Group 2	Vulnerable	Moderately Protected	D/E/F Seriously Modified	Critically Endangered	Y	**High**

11.8 Groundwater

Information for this section was obtained from Geostratum's Glencore Waterval UG1 Opencast Project – Hydrogeological Investigation report (Report No. Report No. KT202211. January 2023). Refer to Appendix C6 for the full report.

11.8.1 Regional hydrogeological character

According to the Groundwater Resource Directed Measures (GRDM) database of the Department of Water and Sanitation, the project site is located within the quaternary catchment A22H. Hydrological information obtained from the database is presented in Table 74.

Table 74: Summarised quaternary catchment information (Geostratum, 2023)

Quaternary Catchment ID		**A22H**
Total Area	[km^2]	578.7
Average Groundwater level	[mbgl]	14.8
Recharge	[mm/a]	23.7
Current Groundwater Use	[l/s]	36.4
Mean Annual Precipitation	[mm/a]	657.7
Groundwater Contribution to Baseflow	[mm/a]	1.75

Note(s): km^2 - squared kilometer
mm/a - millimeter per annum
mbgl - meters below ground level

11.8.2 Hydrocensus

A hydrocensus survey was undertaken in the immediate vicinity of the proposed UG1 opencast project area. In addition to the field survey, information from the water quality monitoring programme conducted by Aquatico Scientific in April 2022 as well as data from the Water use Authorization & Registration Management System (WARMS) of the Department of Water and Sanitation were consulted in order to identify additional groundwater receptors.

11.8.2.1 Hydrocensus results

Two boreholes were identified during the field survey – one within the Waterval project area and the other at a neighbouring property (Figure 52). The information captured is presented in (Table 75).

Borehole HBH1 is located near the eastern boundary of the project site and is not equipped for abstraction purposes. HBH2 is privately owned and used as a production borehole for general water supply for the property and the car wash facility. The estimated abstraction rate from the borehole is about 5m^3/day.

The water levels in the boreholes are 5.20 and 4.44 mbgl for HBH1 and HBH2, respectively. Field water quality measurements of both boreholes indicate natural pH conditions (7 and 7.2) and low electrical conductivity (salinity) (58 and 60 mS/m).

11.8.2.2 Aquatico monitoring boreholes

During the monitoring programme conducted by Aquatico Scientific (Aquatico, 2022a), nine monitoring boreholes on the Waterval Mine property were visited (Table 76 and Figure 52). Five of the boreholes are also being used for abstraction by the mine. The groundwater level in four of the boreholes could be measured and ranged from 3.29 to 8.96 mbgl (average of 5.56 mbgl).

11.8.2.3 WARMS boreholes

According the WARMS database DW760 North West Office QA Data Report 2019/10/28, there are 26 registered boreholes within 5km of the project site. Nine of the boreholes (WBH10-WBH18) are located within the Glencore Waterval property (shaded grey in Table 77). It should be noted that these boreholes are not registered to Glencore Waterval Mine on the WARMS database, and may still be reflecting the owners dating back to heir initial registration. The current owners of these boreholes are unknown.

When excluding the boreholes on the Glencore Waterval property, the groundwater abstraction rate from individual boreholes in the area ranges from about 2.7 to 608.2 m^3/day (average of 78.7 m^3/day). The total daily abstraction amounts to approximately 1338.7 m^3/day and is divided among water use sectors as follows:

- Industry: ±690.4 m^3/day (51.6%)
- Agriculture (irrigation): ±575.7 m^3/day (43%)
- General water supply: ±72.6 m^3/day (5.4%)

Table 75: Hydrocensus boreholes (Geostratum, 2023)

BH ID	Latitude	Longitude	Depth (m)	SWL (mbgl)	Collar height (magl)	Yield (litre/hour)	Pump type	Field pH	Field EC (mS/m)	Volume of water abstracted (m^3/day)	Comments
Glencore Waterval											
HBH1	-25.679958°S	27.276894°E	unknown	5.20	0.35	Not equipped	Not equipped	7	58	none	Open borehole on Waterval Site
Shingwezi Club – 014 940 6631											
HBH2	-25.674611°S	27.275778°E	unknown	4.44	0.30	Unknown	Submersible	7.2	60	5	Borehole used by the Club and for its car wash.

Table 76: Aquatico monitoring boreholes (Geostratum, 2023)

BH ID	Latitude	Longitude	SWL (mbgl)	Use
XMB03	-25.683°S	27.26956°E		Monitoring, abstraction
XMB08	-25.685°S	27.26526°E		Monitoring, abstraction
XMB09	-25.6874°S	27.26322°E	6.49	Monitoring
XMB10	-25.6872°S	27.26291°E		Monitoring, abstraction
XMB22	-25.6795°S	27.26307°E		Monitoring, abstraction
XMB24A	-25.6862°S	27.26916°E	8.96	Monitoring
XMB25A	-25.6841°S	27.27231°E	3.48	Monitoring
XMB28A	-25.6806°S	27.26148°E		Monitoring, abstraction
XMB29A	-25.6769°S	27.26897°E	3.29	Monitoring

Table 77: WARMS boreholes within 5 km of the UG1 opencast project area (Geostratum, 2023)

BH ID	WARMS registration no	Latitude	Longitude	Water use sector	Owner	Abstraction (m^3/d)
WBH1	10203790	-25.6991°S	27.27286°E	Agriculture: irrigation	Bouwer Family	68.4
WBH2	26002307	-25.7184°S	27.30257°E	Industry (non-urban)	Kroonvestment	41.1
WBH3	26002646	-25.7205°S	27.30227°E	Agriculture: irrigation	Rothof Eiendomme	27.2

BH ID	WARMS registration no	Latitude	Longitude	Water use sector	Owner	Abstraction (m^3/d)
WBH4	26003869	-25.719°S	27.29887°E	Agriculture: irrigation	Dr Penzhorn	68.1
WBH5	26006811	-25.7187°S	27.30517°E	Agriculture: irrigation	S Jordt	67.7
WBH6	26008123	-25.7192°S	27.30437°E	Agriculture: irrigation	Ermont	94.8
WBH7	26012172	-25.7228°S	27.25196°E	Agriculture: irrigation	Mr Reyneke	45.3
WBH8	26012207	-25.6807°S	27.29389°E	Water supply service	Swiss Paradise Guest Farm	9.6
WBH9	26022269	-25.7146°S	27.30237°E	Agriculture: irrigation	Ro Harms	62.5
WBH10	26031936	-25.6789°S	27.26296°E	Mining	Xstrata Alloys	110.0
WBH11	26032196	-25.6834°S	27.26986°E	Mining	Xstrata / SA Chrome Venture	81.2
WBH12	26044735	-25.6795°S	27.26966°E	Mining	Rhovan PSV	1315.1
WBH13	26044735	-25.6773°S	27.26744°E	Mining	Rhovan PSV	89.3
WBH14	26044735	-25.6764°S	27.25966°E	Mining	Rhovan PSV	
WBH15	26044735	-25.677°S	27.26216°E	Mining	Rhovan PSV	0.1
WBH16	26044735	-25.6795°S	27.26272°E	Mining	Rhovan PSV	0.1
WBH17	26044735	-25.6875°S	27.26216°E	Mining	Rhovan PSV	0.2
WBH18	26044735	-25.6836°S	27.26911°E	Mining	Rhovan PSV	0.2
WBH19	26049160	-25.7167°S	27.29347°E	Agriculture: irrigation	Me Muhl	31.2
WBH20	26052949	-25.7126°S	27.30507°E	Agriculture: irrigation	WH Mahnecke	33.5
WBH21	26053528	-25.7132°S	27.30647°E	Agriculture: irrigation	WH Mahnecke	33.5
WBH22	26056632	-25.6658°S	27.22716°E	Industry (urban)	Rustenburg Golf Club	608.2
WBH23	26064062	-25.7233°S	27.25956°E	Agriculture: irrigation	AGS Waterval Gemeente	2.7
WBH24	26068898	-25.7099°S	27.28316°E	Agriculture: irrigation	Ottermann Farm	40.8
WBH25	26069717	-25.717°S	27.29997°E	Industry (urban)	Kroonvestment	41.1
WBH26	26071713	-25.6626°S	27.25166°E	Urban (excluding industrial &/or domestic)	Rotabrite	63.0

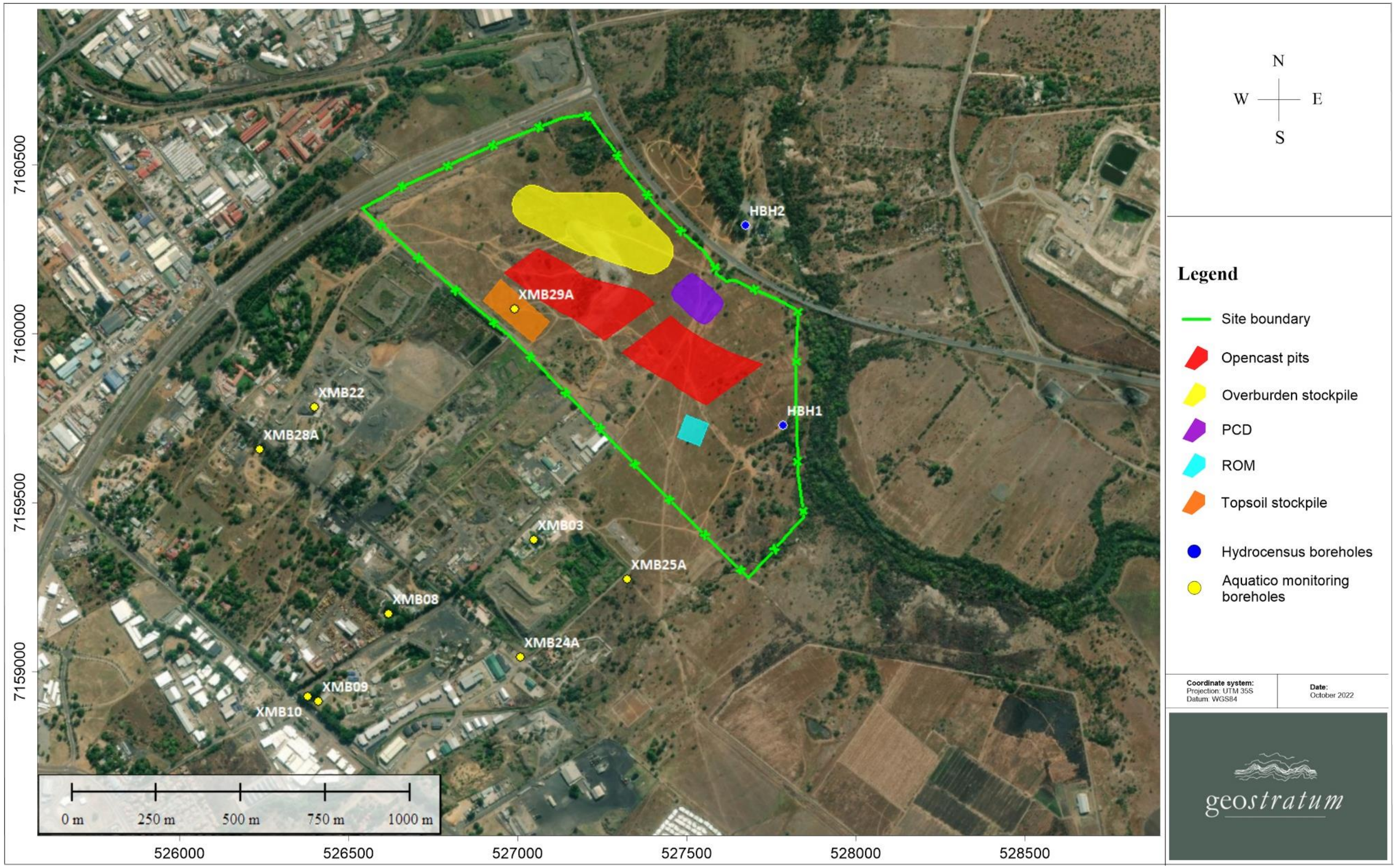


Figure 52: Hydrocensus and Aquatico monitoring boreholes (Geostratum, 2023)

11.8.3 Groundwater levels

The groundwater levels at the UG1 opencast project area range between 3.29 and 8.96 mbgl, with an average depth of about 5.31 mbgl. Plotting the groundwater levels against the topographical elevation at each observation point yields a 97 % correlation. Because a linear correlation exists, it implies that the groundwater table roughly mimics the topography. This indicates that there are currently no external influences such as large-scale abstraction or dewatering in the vicinity of the site.

Figure 53 below depicts the groundwater levels around the project area as interpolated from the available water level data. Within the project site, groundwater flow is directed to the northeast towards the Hex River.

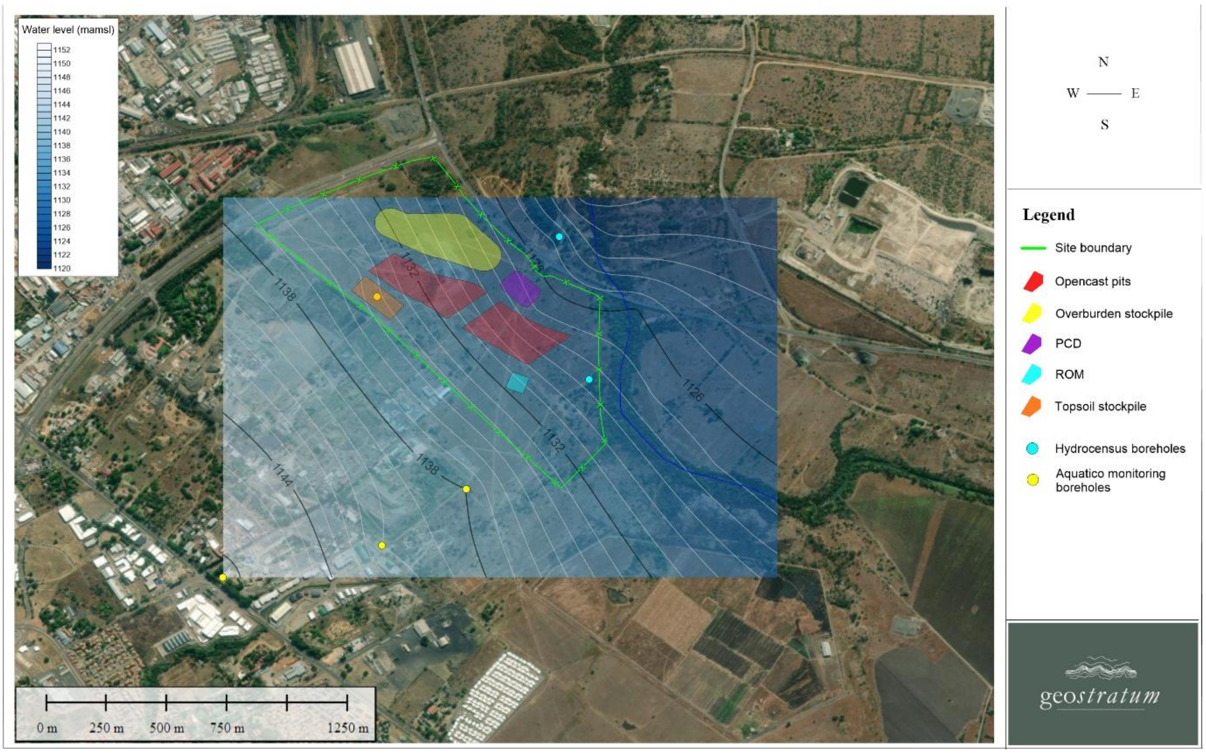


Figure 53: Groundwater level map (Geostratum, 2023)

11.8.4 Monitor borehole drilling and testing

A total of four (4) boreholes were drilled and subjected to short duration aquifer testing in order to characterise the aquifer in the immediate vicinity of the mining operation and to serve as ongoing monitoring boreholes.

11.8.5 Groundwater quality

Water samples were collected from the hydrocensus boreholes and from newly drilled monitoring boreholes. The samples were submitted to Aquatico Scientific for quality analysis. In addition to the abovementioned samples, groundwater quality results from the water quality assessment conducted by Aquatico Scientific in April 2022 were also consulted to gain a more complete picture of the groundwater quality around the site. The laboratory results were compared to the following quality objectives:

- Integrated Water Use License Groundwater Quality Objectives (IWUL GQO).
- Waterval Environmental Management Program Report Baseline Average – Groundwater (EMPR).

11.8.5.1 Hydrocensus and Drilled Monitoring Boreholes

The groundwater quality results of the hydrocensus (HBH1 and HBH2) and newly drilled monitoring boreholes (BH WV1-4) are presented in Table 78.

The general groundwater quality in the vicinity of the hydrocensus and monitoring boreholes can be described as near-neutral (pH: 7.16-7.61), non-saline (TDS: <450 mg/l) to saline (TDS: 450-1000 mg/l) and very hard (Total hardness: 381-527 mg $CaCO_3$/l).

The EC detected in all of the boreholes (66.5-106 mS/m) exceed the IWUL GQO value. Only the EC values of HBH2 and BH WV3 exceed the Waterval EMPR value.

The chloride (65.5-133 mg/l), sulphate (55.5-104 mg/l) and nitrate (0.51-17 mg/l) concentrations detected in all of the boreholes exceed the IWUL GQO values. The EMPR threshold for chloride is exceeded in all of the boreholes, while only boreholes HBH2, BH WV1 and BH WV2 exceed the nitrate threshold.

In terms of base cation concentration, the IWUL GQO value for magnesium is exceeded in all of the boreholes with the value for calcium only exceed in boreholes HBH2, BH WV2 and BH WV3. The EMPR threshold for calcium is, however exceeded in all of the boreholes. The sodium concentration detected in all the boreholes, except BH WV1, exceed the EMPR threshold.

The metal concentrations in all of the samples are low and mostly below detection limit.

11.8.5.2 Aquatico Monitoring Boreholes

The groundwater quality results from the monitoring programme conducted by Aquatico Scientific are presented in Table 79.

The general groundwater quality can be described as near-neutral (pH: 7.22-8.31), mostly saline (TDS: 450-1000 mg/l, except XMB10) and hard to very hard (Total hardness: 250-567 mg $CaCO_3$/l).

The EC detected in all of the boreholes (50-109 mS/m), except XMB10, exceed the IWUL GQO value. The Waterval EMPR value is exceeded in boreholes XMB09, XMB24A, XMB28A and XMB29A.

The chloride (29.2-165 mg/l) and sulphate (33.1-91 mg/l) concentrations detected in all of the boreholes exceed the IWUL GQO values. The nitrate value is exceeded in all the boreholes (2.99-6.86 mg/l), except XMB03. The EMPR threshold for chloride is exceeded in all of the boreholes, excluding XMB08 and XMB10.

The magnesium concentration detected in all of the boreholes exceed the IWUL GQO value, while only borehole XMB09 exceeds the EMPR threshold. The sodium IWUL GQO value is exceeded in boreholes XMB03, XMB24A, XMB25A, XMB28A and XMB29A, while the EMPR value is exceeded in all but borehole XMB08. The calcium concentration detected in XMB09 and XMB29A exceed the EMPR value. The potassium concentration of XMB03, XMB08 and XMB10 also exceed the EMPR value.

The metal concentrations in all of the samples are low and mostly below detection limit.

Table 78: Groundwater quality results of the hydrocensus and drilled monitoring boreholes

Parameter	Unit	IWUL GQO	EMPR	HBH1	HBH2	BH WV1	BH WV2	BH WV3	BH WV4
pH @ 25°C	pH	6.0-9.5	6.0-8.5	7.16	7.61	7.46	7.43	7.28	7.32
Electrical conductivity (EC) @ 25°C	mS/m	63.86	96	**79.4**	**106**	**71.8**	**83.2**	**96.7**	**66.5**
Total dissolved solids (TDS)	mg/l	-	-	430	591	436	486	548	387
Total alkalinity	mg CaCO3/l	-	-	234	243	209	223	269	207
Chloride (Cl)	mg/l	20.49	38	**80.3**	**96.3**	**65.5**	**91.1**	**133**	**72.1**
Sulphate (SO_4)	mg/l	28.59	121.7	**60.5**	**104**	**55.5**	**78.5**	**93.8**	**56.6**
Nitrate (NO_3) as N	mg/l	0.26	8.2	**4.81**	**17**	**15.5**	**9.23**	**0.513**	**5.34**
Ammonium (NH_4) as N	mg/l	-	-	0.118	0.078	0.051	0.044	0.083	0.058
Orthophosphate (PO_4) as P	mg/l	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Fluoride (F)	mg/l	0.53	-	<0.263	<0.263	<0.263	<0.263	<0.263	<0.263
Calcium (Ca)	mg/l	48.13	38.5	44.5	**55.1**	44.4	**51.5**	**61.3**	39.1
Magnesium (Mg)	mg/l	22.81	108.8	**69.9**	**94.4**	**65.5**	**77.3**	**81.3**	**58.7**
Sodium (Na)	mg/l	31.1	8.4	9.58	16.8	8.01	8.77	12.3	9.19
Potassium (K)	mg/l	-	1.74	1.13	0.665	1.44	1.58	0.176	1.26
Aluminium (Al)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	0.029	<0.002
Iron (Fe)	mg/l	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Manganese (Mn)	mg/l	-	-	0.092	<0.001	0.003	0.007	0.175	0.017
Chromium (Cr)	mg/l	-	0.16	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc (Zn)	mg/l	-	-	<0.002	<0.002	<0.002	0.003	<0.002	<0.002
Cobalt (Co)	mg/l	-	-	<0.003	-	<0.003	<0.003	<0.003	<0.003
Cadmium (Cd)	mg/l	-	-	<0.002	-	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	-	-	<0.004	-	<0.004	<0.004	<0.004	<0.004
Total hardness	mg $CaCO_3$/l	-	-	399	527	381	447	488	339
Total oxidised nitrogen as N	mg/l	-	-	4.81	17.0	15.5	9.23	0.513	5.34
Anions	meq	-	-	8.55	10.96	8.29	9.32	11.11	7.74
Cations	meq	-	-	8.43	11.28	7.99	9.35	10.3	7.22

IWUL GQO = Integrated Water Use License Groundwater Quality Objectives
EMPR = Waterval Environmental management Program Report Baseline Average - Groundwater
X = parameter exceeds IWUL GQO value
Parameter exceeds EMPR value
\- = no standard

Table 79: Groundwater quality results from Aquatico (Geostratum, 2023)

Parameter	Unit	IWUL GQO	EMPR	XMB03	XMB08	XMB09	XMB10	XMB24A	XMB25A	XMB28A	XMB29A
pH @ 25°C	pH	6.0-9.5	6.0-8.5	7.62	7.85	7.22	8.31	7.54	8.2	7.5	8.18
Electrical conductivity (EC) @ 25°C	mS/m	63.86	96	**91.4**	**81.6**	**101**	50	**109**	**88.1**	**98.6**	**103**
Total dissolved solids (TDS)	mg/l	-		510	451	597	299	607	455	530	583
Total hardness	mg CaCO3/l	-		381	404	567	250	476	335	397	468
Calcium (Ca)	mg/l	48.13	38.5	30.4	32.8	46.4	22.9	37.6	16.6	27.4	48.4
Magnesium (Mg)	mg/l	22.81	108.8	**74.2**	**78.2**	**110**	**46.8**	**92.7**	**71.2**	**79.8**	**84.3**
Sodium (Na)	mg/l	31.1	8.4	**49.1**	7.55	15.5	13.7	**46.4**	**39.8**	**40.9**	**34.1**
Potassium (K)	mg/l	-	1.74	2.57	5.01	0.479	2.74	0.71	0.736	0.609	0.221
Total alkalinity	mg CaCO3/l	-	-	350	330	436	224	265	168	228	348
Chloride (Cl)	mg/l	20.49	38	**82.6**	**32.6**	**62**	**29.2**	**165**	**150**	**151**	**93.6**
Sulphate (SO_4)	mg/l	28.59	121.7	**56.3**	**80**	**80.7**	**33.1**	**91**	**56.8**	**73.2**	**79.9**
Fluoride (F)	mg/l	0.53	-	<0.263	<0.263	<0.263	<0.263	<0.263	<0.263	<0.263	<0.263
Nitrate (NO_3) as N	mg/l	0.26	8.2	0.205	**2.99**	**3.66**	**3.08**	**2.66**	**3.92**	**3.95**	**6.86**
Ammonium (NH_4) as N	mg/l	-	-	0.096	0.059	<0.008	0.078	0.304	0.052	0.251	<0.008
Aluminium (Al)	mg/l	-	-	<0.002	<0.002	<0.002	0.057	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/l	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Manganese (Mn)	mg/l	-	-	<0.001	<0.001	0.022	<0.001	0.336	0.002	0.198	<0.001
Chromium (Cr)	mg/l	-	0.16	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	-	-	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Zinc (Zn)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel (Ni)	mg/l	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium Adsorption Ratio	SAR	-	-	1.1	0.16	0.28	0.38	0.93	0.95	0.89	0.69
Temperature	°C	-	-	21.9	21.9	21.9	21.9	21.9	21.9	21.8	21.7

IWUL GQO = Integrated Water Use License Groundwater Quality Objectives
EMPR = Waterval Environmental Management Program Report Baseline Average - Groundwater
X = parameter exceeds IWUL GQO value
Parameter exceeds EMPR value
\- = no standard

The EC of the groundwater in the vicinity of the project site ranges from ±50 to ±110 mS/m. The EC values detected are relatively high towards the northern side of the Waterval property (XMB28A to HBH2) and towards the southwest side (XMB09 and XMB24A) – except for XMB10. Within the opencast project site, higher EC values were detected at the western side than the eastern side – with the exception of HBH2 that has high EC compared to the localities directly south of it. When considering the variation in EC down the groundwater gradient (directed roughly towards the east-northeast), the EC generally decreases along the southern series of localities (XMB09 to BH WV1). Along the northern series of localities (XMB28A to HBH2), the EC remains high.

The groundwater nitrate concentrations are low towards the southwestern part of the Waterval property and generally more elevated at the northeastern part of the property, at the opencast project site. Significantly elevated nitrate concentrations were detected in boreholes BH WV1 and HBH2 (15.5 and 17 mg/l). Therefore, the nitrate concentrations generally increase down the groundwater gradient, indicating the presence of a contamination source(s) that affects the groundwater tapped by the boreholes down gradient. Within the opencast project site, the nitrate concentrations are generally greater at the eastern then the western portion of the site.

The sulphate concentrations are the greatest at the localities of boreholes HBH2 and BH WV3 (north), and XMB24A and XMB09 (south). Markedly lower concentrations were detected at XMB03 and XMB25A, and at the eastern portion of the opencast project site (BH WV4, BH WV1 and HBH1). It seems that generally the sulphate concentration of the groundwater decreases down-gradient over most of the Waterval property. The opposite is true in the vicinity of boreholes BH WV3, XMB29A and HBH2.

11.8.6 Groundwater classification

A piper diagram represents the chemistry of a water sample graphically. It is a tri-linear diagram that implements major cations (calcium, magnesium, sodium and potassium) and anions (chloride, sulphate and bicarbonate) to reveal the chemistry of water samples. This is then used to characterize different types of water. The piper diagram is presented in Figure 54.

The Expanded Durov Diagram is a graphic representation similar to the Piper Diagram. The central plotting area is a square rather than a diamond, but the principal difference is that in the Expanded Durov Diagram the percentages of the individual ions are calculated as total ions (Cation + Anions). In the Piper Diagram the percentages of cations and anions are plotted separately. The nine blocks in the main square of the diagram represent the hydrochemical facies. These hydrochemical facies are used to distinguish one water type from another. The Durov diagram is presented in Figure 55.

The Piper diagram indicates the cation content of the local groundwater is dominated by magnesium while the anion content is dominated primarily by carbonates and notable abounds of chloride. The local groundwater is therefore predominantly of magnesium bicarbonate type, which is indicative of shallow and fresh groundwater.

The Durov diagram indicates that most of the groundwater samples represent fresh, clean, relatively young groundwater that has started to undergo Mg-ion exchange. Samples XMB24A, XMB25A, XMB28A, HBH2 and BH WV3 on the other hand represent groundwater that is a mix of different types of water, or water that has experienced some contamination. Thus, these samples likely represent fresh, clean groundwater (such as that represented by most of the samples) that has undergone SO_4 and NaCl mixing or slight contamination.

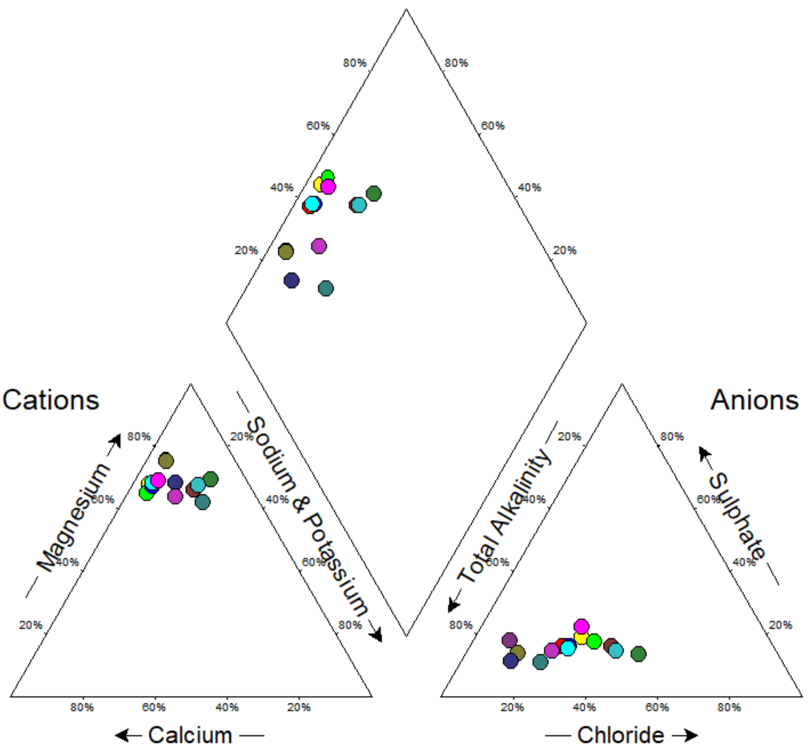


Figure 54: Piper diagram (Geostratum, 2023)

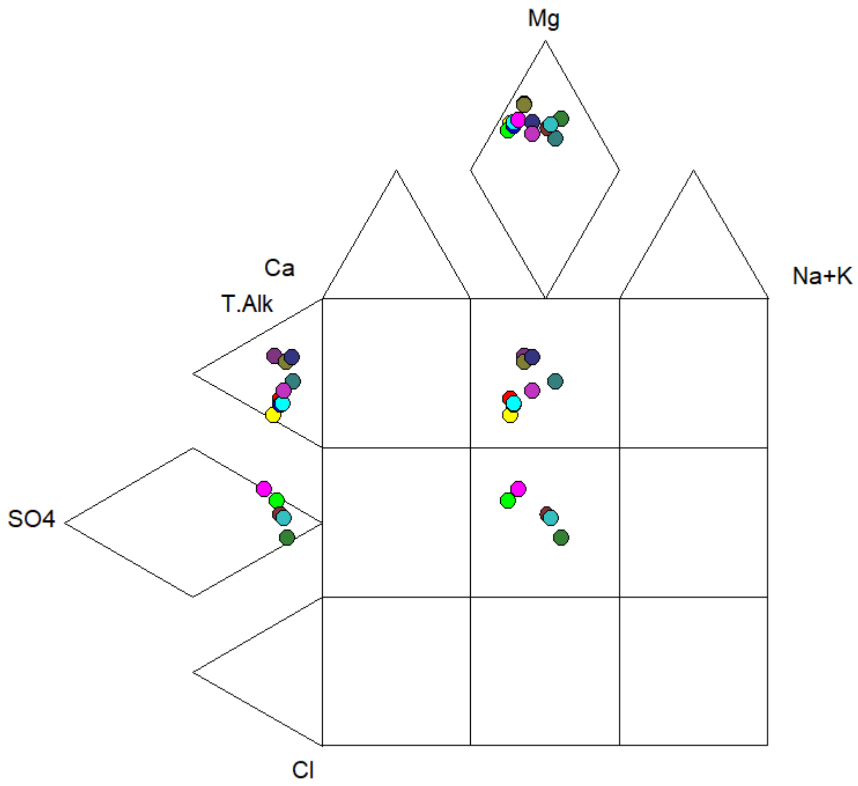


Figure 55: Durov Diagram (Geostratum, 2023)

11.8.7 Groundwater model

A schematic west- east cross section of the conceptual groundwater model is provided in Figure 56. The conceptual groundwater model could be summarised as follows:

- The average groundwater recharge for the Quaternary Catchment A 22H that includes the Waterval UG1 site, is given as 23.7 mm or 4.1% of the mean annual precipitation (MAP ≈ 658 mm/a) (DWAF, 2006). Recharge along the Magaliesberg quartzite is seen as high, reducing to the east over the Bushveld Complex. The average recharge for the project site is estimated to be 2 to 2.5% of MAP which is in line with other catchment areas in the area with similar geology.
- Groundwater flow over the project site is mainly west to east towards the Hex River. The groundwater table is relatively shallow, 1 to 9m deep. Groundwater levels in general mimic the topographic level with the groundwater gradient in the order of 0.0115m/m.
- Groundwater is contributing to stream baseflow. The Hex River system (and different tributaries and associated springs) is seen as the main natural groundwater sink in the area. The larger area is also impacted by mining activities.
- The Bushveld Complex aquifer could be subdivided into different hydrogeological or aquifer units with depth, based on the weathering profile:
    - Drilling of hydrogeological boreholes (BH WV series) at the Waterval UG1 site suggest a weathered aquifer unit up to a depth of about 20 m (highly to medium weathered or saprolite to saprock). Most of the groundwater intersected in the hydrogeological boreholes came from this unit and it is seen as the most productive aquifer zone at Waterval UG1 project site.
    - Drilling data from different sites in the area suggests that slight weathering could still occur up to a depth of 40m. Groundwater occurs in fractures that could have some weathering. This zone at the project site did not yield noticeable yields, however, it has in general a higher groundwater intersection frequency than the deeper fractured zone.
    - Groundwater is confined to fractures at depth (semi confined to confined aquifer features). No specific faults systems were identified over the project site by ore exploration drilling, geophysics and hydrogeological drilling.
- Alluvial deposits may be associated with the Hex River over the larger area. A site inspection of the Hex River, at the project site, suggest no major alluvial deposit with Bushveld Complex rock outcrop noticed in the riverbed and on the riverbanks.
- Site specific transmissivity values from pumping tests of BH WV series boreholes vary between 5 and 21m^2/d for the late test data. The mode value calculated from the constant discharge and recovery test data is 8 m^2/d and the geomean is 11 m^2/d. Transmissivity values for the numerical groundwater mine dewatering simulations (i.e. model hydraulic conductivity values for different layers, multiplied by the layer thicknesses) were varied between ≈ 5 and 11 m^2/d for different scenarios. This is in line with the work by (Titus R, 2009) that reported typical transmissivities of 3 to 8 m^2/d (with anomalies up to 50 m^2/d) for the weathered bedrock of the Bushveld Complex. The bulk hydraulic conductivity and porosity also generally decreases from the weathered aquifer unit to the fractured aquifer unit at depth, except where larger fault zones occur, which was not recorded at the Waterval UG1 site.
- A northwest-southeast tracing dolerite dyke, next to the proposed open pit highwall, was identified during ore exploration work. It is not anticipated that this intrusion is forming a flow barrier (for flow across the dyke) in the weathered aquifer unit, however, it could potentially impact on flow at depth.

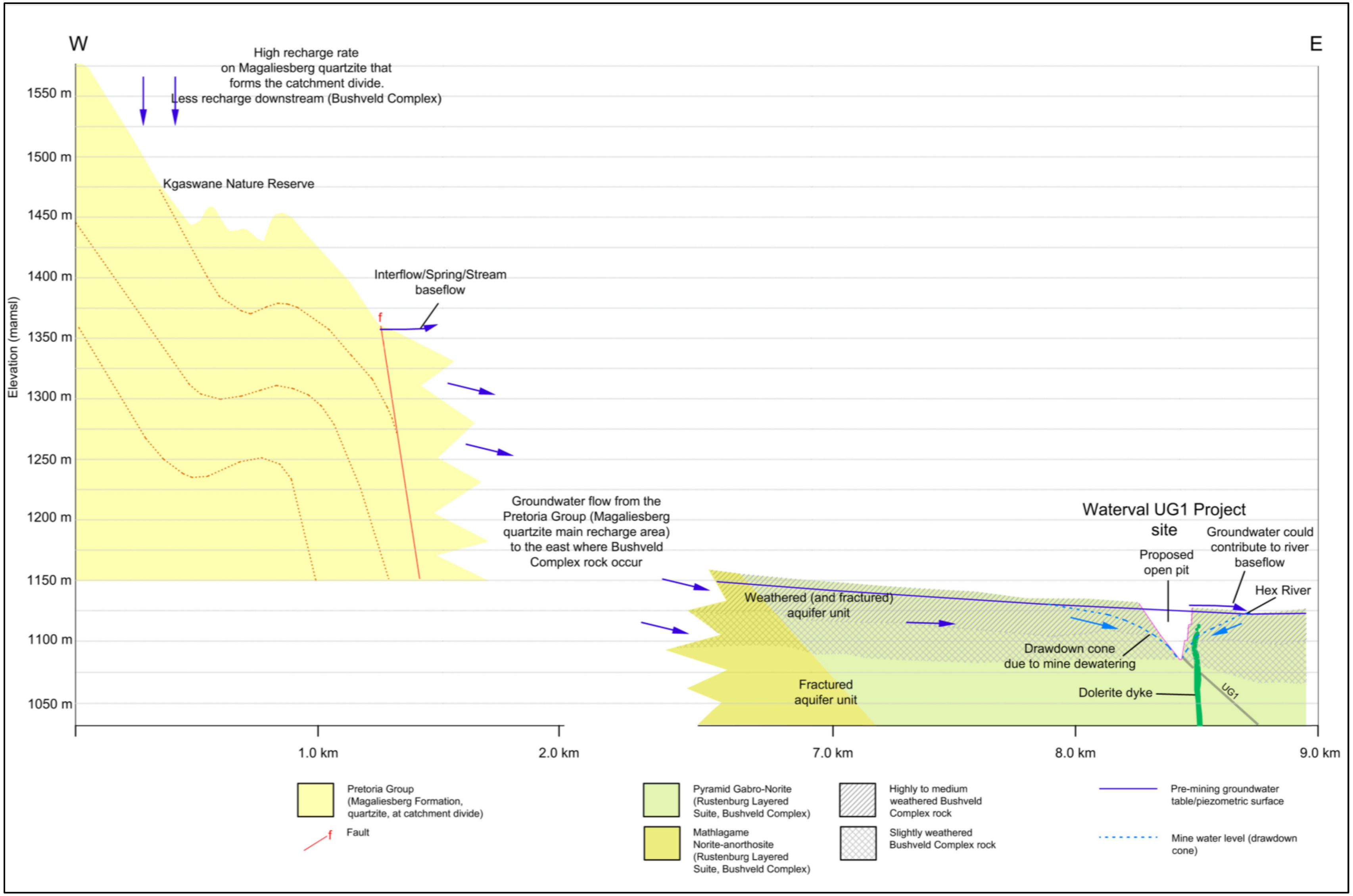


Figure 56: West-east cross section through the project site to illustrate the conceptual groundwater model

Simulated pre-mining groundwater levels are shown in Figure 57. Groundwater flow is towards the Hex River, east of the project site.

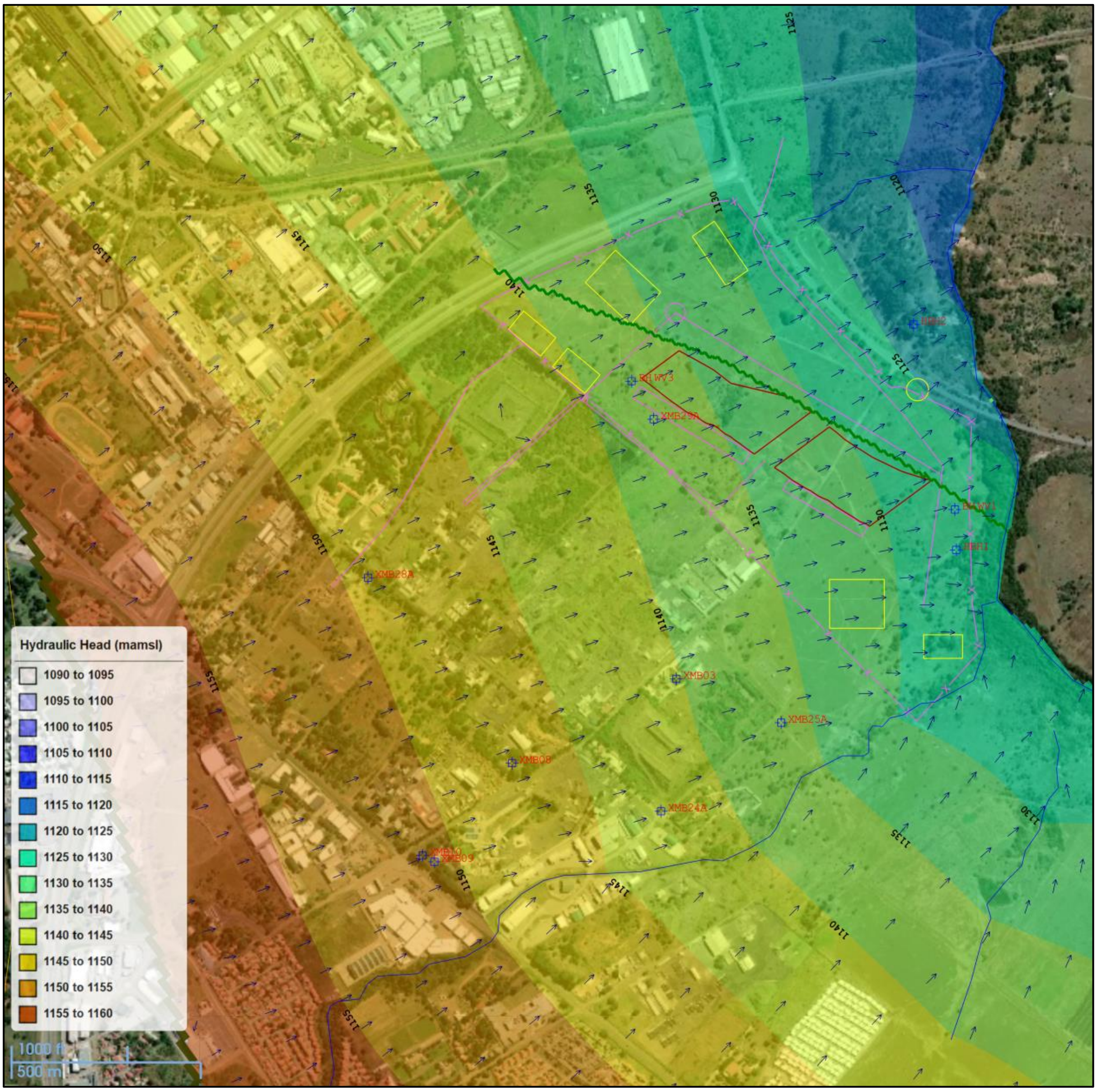


Figure 57: Pre-mining simulated groundwater level contours (weathered aquifer unit) and flow vectors (Geostratum, 2022)

11.9 Air Quality

Information for the air quality section was obtained from uMoya-NILU Consulting's Air Quality Specialist Study for the Proposed Waterval UG1 Opencast Project (Report Number: uMN153-22. October 2022). Refer to Appendix C7 for the full report.

All aspects of mining generate dust, referred to as particulate matter. The dispersion of dust in the atmosphere is a function of the particle size, shape and density, as well as wind speed and other climatic effects. Large dust particles (greater than 30 µm), which make up the greatest proportion of dust emitted from mining activities will largely deposit relatively close to the source. Intermediate-sized particles (10 - 30 µm) are likely to travel up to 200 - 500 m from the source. Smaller particles (less than 10 µm) which make up a small proportion of the dust emitted from mining activities, travel further from sources and deposit slowly (uMoya, 2022)).

Criteria pollutants occur ubiquitously in urban and industrial environments. Their effects on human health and the environment are well documented (e.g. WHO, 1999; 2000; 2005). They are also known to cause injury to vegetation and crops (Emberson *et al.*, 2003). The main air pollutants that result from activities at the Waterval UG1 Opencast Project is particulate matter (uMoya, 2022).

Particulate matter is a broad term used to describe the fine particles that occur in the atmosphere, including soil dust, dirt, soot, smoke, pollen, ash, aerosols and liquid droplets. The most distinguishing characteristic of particulate matter is the particle size and the chemical composition. Particle size has the greatest influence on the behaviour of particulate matter in the atmosphere with smaller particles tending to have longer residence times than larger ones. Particulate matter is categorised, according to particle size, into TSP, PM_{10} and $PM_{2.5}$ (uMoya, 2022).

Total suspended particulates (TSP) consist of all sizes of particles suspended within the air smaller than 100 micrometres (µm). TSP is useful for understanding nuisance effects of particulate matter, e.g. settling on houses, deposition on and discolouration of buildings, and reduction in visibility (uMoya, 2022).

PM_{10} describes all particulate matter in the atmosphere with a diameter equal to or less than 10 µm. Sometimes referred to simply as coarse particles, they are generally emitted from motor vehicles (primarily those using diesel engines), factory and utility smokestacks, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood. Natural sources include sea spray, windblown dust and volcanoes. Coarse particles tend to have relatively short residence times as they settle out rapidly and PM_{10} is generally found relatively close to the source except in strong winds (uMoya, 2022).

$PM_{2.5}$ describes all particulate matter in the atmosphere with a diameter equal to or less than 2.5 µm. They are often called fine particles, and are mostly related to combustion (motor vehicles, smelting, incinerators), rather than mechanical processes as is the case with PM_{10}. $PM_{2.5}$ may be suspended in the atmosphere for long periods and can be transported over large distances. Fine particles can form in the atmosphere in three ways: when particles form from the gas phase, when gas molecules aggregate or cluster together without the aid of an existing surface to form a new particle, or from reactions of gases to form vapours that nucleate to form particles (uMoya, 2022).

11.9.1 Ambient air quality

Ambient air quality monitoring is conducted in the North West Province. Monitoring stations within a radius of 20 km from the Waterval UG1 Opencast Project are listed Table 80. Ambient air quality monitored at these stations is influenced by the nearby sources and is therefore representative of air quality in the respective areas (uMoya, 2022).

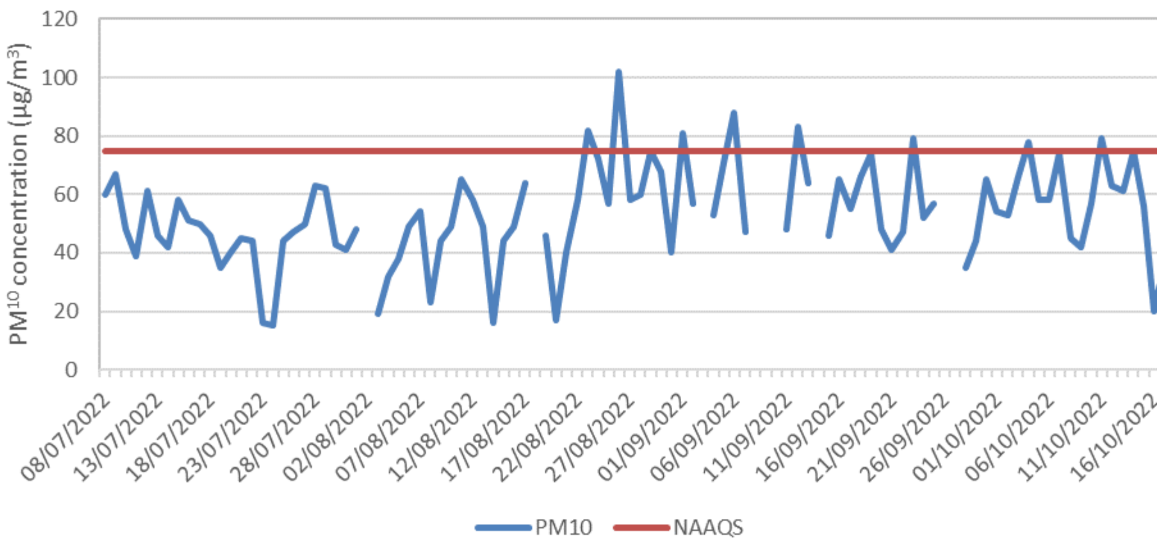
Table 80: Air quality monitoring stations within a radius of 20 km from the Waterval UG1 Opencast Project (uMoya, 2022))

Station	Owner	Location	Distance
Boitekong	Rustenburg LM	Residential low income	≈ 3 km NE
Phokeng	NW Dept Economic Development & Environment	Residential low income	≈ 3 km NW
Lebone	Impala Platinum Mine	Residential – mine background	≈ 4 km WNW
Luka	Impala Platinum Mine	Residential – mine background	≈ 20 km NW

Station	Owner	Location	Distance
Marikana	Rustenburg LM		≈ 20 km E

Boitekong, Phokeng and Lebone are relatively close to the Waterval UG1 Opencast Project site. Ambient PM_{10} and $PM_{2.5}$ monitoring data is available at Lebone from July 2022 and accessible from the South African Air Quality Information System (https://saaqis.environment.gov.za/). The ambient PM_{10} and $PM_{2.5}$ concentrations are presented in Figure 58: PM_{10} (top) and $PM_{2.5}$ (bottom) concentrations in µg/m^3 at Lebone from 08-07-2022 to 16-10-2022 (https://saaqis.environment.gov.za/) Figure 58 from 08-07-2022 to 16-10-2022 where they are compared with the 24-hour NAAQS limit values of 75 µg/m^3 and 40 µg/m^3, respectively (uMoya, 2022).

The average PM_{10} concentration for the period is 53 µg/m^3 with 9 exceedances of the limit value of 75 µg/m^3. The NAAQS provides for 4 exceedances of the limit value per year. PM_{10} concentrations at Lebone are therefore high as they exceed the NAAQS. The average $PM_{2.5}$ concentration for the period is 30 µg/m^3 with 11 exceedances of the limit value of 40 µg/m^3. The NAAQS does not provide for any exceedance of the limit value per year. $PM_{2.5}$ concentrations at Lebone are therefore also high as they exceed the NAAQS (uMoya, 2022).



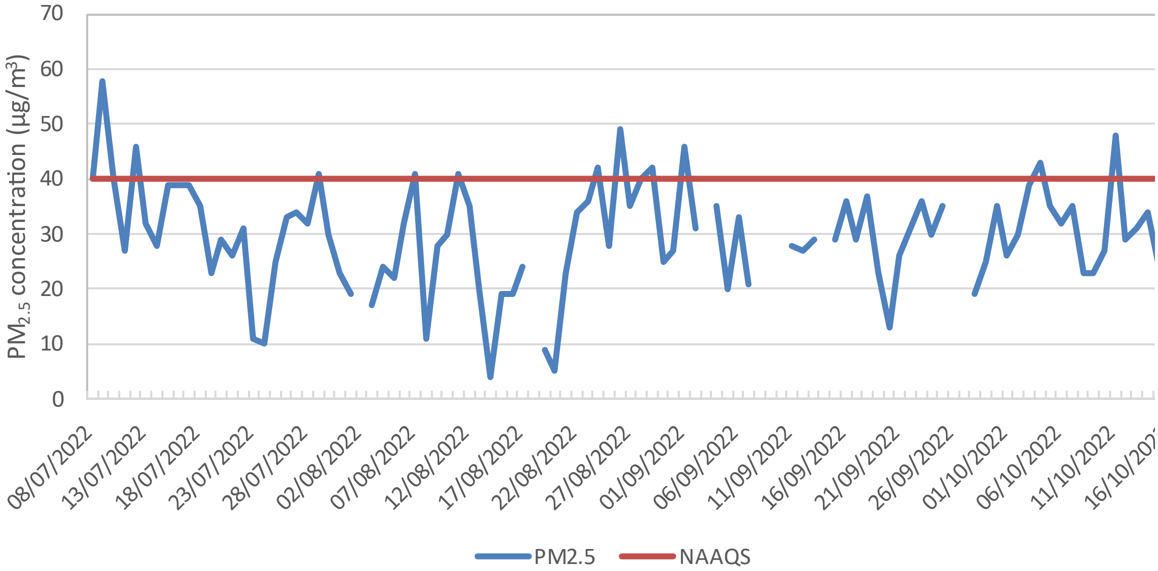


Figure 58: PM10 (top) and PM2.5 (bottom) concentrations in µg/m³ at Lebone from 08-07-2022 to 16-10-2022 (https://saaqis.environment.gov.za/) (uMoya, 2022)

Dust fallout (DFO) is undertaken at Glencore's Waterval-West Mine. DFO is measured in a network of eight single dust fallout buckets. The DFO monitoring is undertaken by Aquatico Environmental (Pty) Ltd on behalf of Waterval-West Mine. The monitoring is done according to the requirements of the national dust control regulations (DEA, DEA 2013) according to SANS 1929:2005 and American Society for Testing and Materials (ASTM) Standard, D1739-98: Standard Test Method for the Collection and Measurement of Dust fall (Settleable Particulate Matter). Dust fallout gauges are exposed for a month at a time, and the collected samples are weighed in the gravimetric laboratory and then converted to dust fallout in mg/m²/day. The location of the eight DFO monitoring points is shown in Figure 59 (uMoya, 2022).

Figure 59: Location of Waterval-West Mine DFO monitoring points (adapted from Aquatico Scientific, 2022) relative to the fenceline at UG1 Opencast Project (uMoya, 2022)

DFO monitoring points XWDS 3, XWDS 5 and XWDS 16 are relevant in describing the state of DFO at and close to the Waterval UG1 Opencast Project before construction and operations (uMoya, 2022).

- XWDS 3 is approximately 600m southwest from the centre of the proposed box-cut and approximately 300m from the fence line. XWDS3 is downwind of the proposed works under the prevailing northeastly wind.
- XWD 5 is approximately 300 m southwest from the centre of the proposed box-cut and on the fenceline. XWDS 3 is downwind of the proposed works under the prevailing northeastly wind.
- XWDS 16 is approximately 450 m northeast from the centre of the proposed box-cut and 180 m from the fenceline. Being northeast of the works, XWDS 16 is potentially a good background site considering the wind seldom blows from the Waterval UG1 Opencast Project towards the monitoring point.

DFO monitoring data from January 2020 to May 2022 was made available to uMoya-NILU for this assessment. The monthly DFO monitoring results at points XWDS 3, XWDS 5 and XWDS 16 are compared with the limit value of the National Dust Fallout Standards for non-residential areas of 1 200 mg/m^2/day in Figure 60. The DFO is relatively low at all three sites with only two exceedances of the limit value at XWDS 5 in May 2020 and May 2021. The standard provides a tolerance of four exceedances of the limit value per year. The DFO measured from January 2020 to May 2022 therefore complies with the national standard. The average DFO is highest at XWDS 5 and lowest at XWDS 3 (uMoya, 2022).

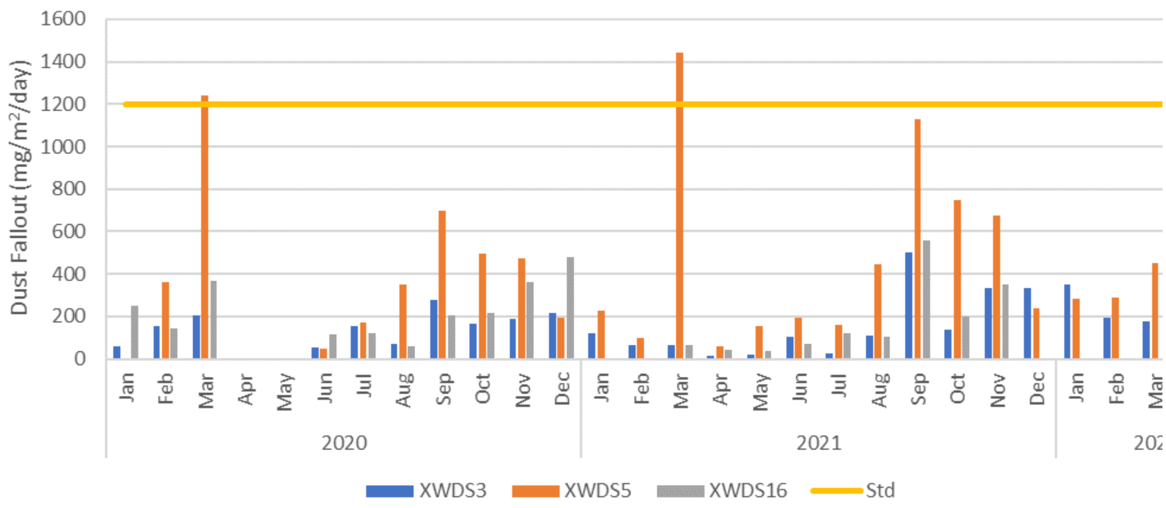


Figure 60: DFO monitoring results in mg/m2/day at XWDS 3, XWDS 5 and XWDS 16 (extracted from Aquatico, 2021 & 2022) (uMoya, 2022)

11.10 Noise

Information for this noise section was obtained from dBAcoustics' Glencore Waterval Chrome Mine Operations UG1 Opencast mining operations Environmental Noise Impact Assessment (Project No. 154/2022. August 2022). Refer to Appendix C8 for the full report.

The noise survey was conducted in terms of the provisions of the Noise Control Regulations, 1994 and the SANS 10103 of 2008 (The measurement and rating of environmental noise with respect to annoyance and to speech communication) using a digital Larson Davis 831 and Larson Davis LXT – Class 1 meter with Logging, Environmental 1/1, 1/3 Octave Band and percentiles Sound Level Meter (Class 1) (dBAcoustics, 2022).

11.10.1 Noise measuring points

The measuring points for the UG1 opencast project area were selected to be representative of the prevailing ambient noise levels for the study area and include all the noise sources such as distant traffic noise, agricultural activities but exclude traffic noise which was intermittent in the vicinity of the measuring points. The measuring points along the boundaries of the study area and inside the boundaries of the mining area and the physical attributes of each measuring point are shown in Table 81 (dBAcoustics, 2022).

Table 81 Noise measuring points and coordinates for the UG1 opencast project area (dBAcoustics, 2022)

Position	Latitude	Longitude	Remarks
1	25° 40.340’ S	027° 15.823’ E	Northern side at administrative buildings along Waterval Avenue. Traffic noise.
2	25° 40.465’ S	027° 15.868’ E	Western corner of the mining area opposite Offices and Change houses Option B. Traffic noise.
3	25° 40.672’ S	027° 16.127’ E	Southern side of the opencast pit and stockpile along the boundary fence. Distant traffic noise and mining activities.
4	25° 40.830’ S	027° 16.307’ E	Southern side of the opencast pit. Distant traffic noise and mining activities.
5	25° 40.589’ S	027° 16.491’ E	Northern side of the Pollution Control Dam. Distant traffic noise.
6	25° 40.315’ S	027° 16.258’ E	Northern corner of the fenced in area. Traffic noise.
7	25° 40.3505’ S	027° 16.542’ E	Entrance to Shingwezi Club. Traffic noise.
8	25° 41.262’ S	027° 16.343’ E	South of the mining area. Distant traffic and mining activity noise.
9	25° 41.262’ S	027° 16.343’ E	Southern side of the Offices and Changehouses Option A and Parking A. Distant traffic noise.

The following is of relevance to the ambient noise measurements:

- The LAeq was measured over a representative sampling period exceeding 10 minutes at each measuring point; and
- The noise survey was carried out during the day and night-time.

11.10.2 Site characteristics

The following observations were made in and around the study area (dBAcoustics, 2022):

- The proposed Waterval UG1 mine establishment will take place in an area where there is other mining activities;
- There was a constant to intermittent flow of traffic along the tarred/gravel feeder roads which run through the middle of the mining right area;
- There was an intermittent flow of traffic amongst the villages to the south of the mining area;
- Traffic noise contributes to the higher prevailing ambient noise level at some of the measuring points;
- The wind and weather conditions play an important role in noise propagation;
- Distant traffic noise, mining activity noise and domestic type noises contribute to a large portion of the prevailing ambient noise levels; and
- There was no blasting during the time of the noise survey.

11.10.3 Current noise sources

The following are noise sources in the vicinity of and the boundaries of the study area (dBAcoustics, 2022):

- Distant mining activities noise;
- Domestic type noise such as animals, people talking, amplified music;
- Traffic noise along the feeder roads in the vicinity of the Waterval UG1 and abutting noise sensitive areas;
- Distant traffic noise from the abutting feeder roads;
- Subsistence farming activities noise;
- Insects;
- Birds; and
- Wind noise.

11.10.4 Description of the receiving environment

Existing mining activities, traffic, seasonal agricultural, traffic, and domestic activities contributes to the prevailing ambient noise levels of the study area.

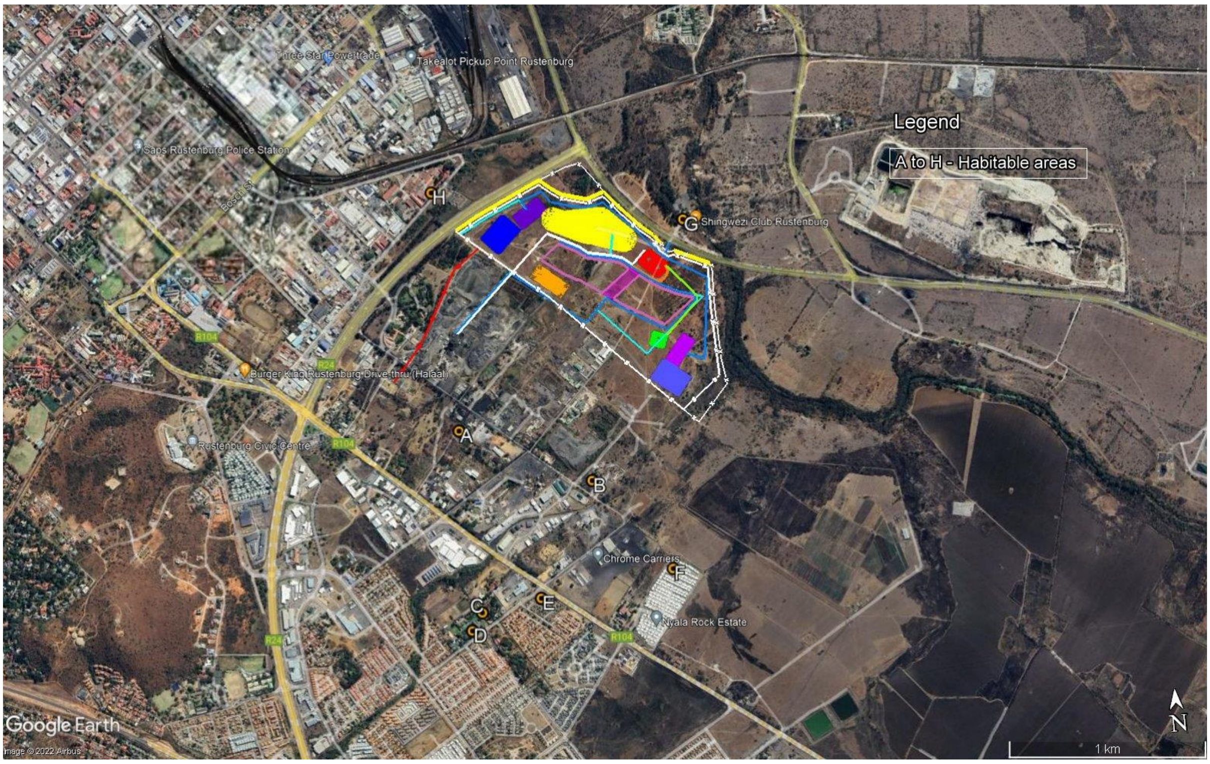


Figure 61: Residential areas in the vicinity of the proposed UG1 opencast project (dBAcoustics, 2022)

The distances between the different mine project areas and the residential properties are given in Table 82. This is for direct line of sight and vertical structures such as trees, topography between the source and receptors were not taken into consideration.

Table 82: Distances (in meters) between the mining activities and the residential areas (dBAcoustics, 2022)

Residential area	Change house A	Change house B	Opencast West	Box cut	Opencast East	Overburden East	Overburden West	Topsoil stockpile	RoM
A	967	1016	1018	1110	1245	1306	1173	1318	1100
B	1 241	1338	1150	1025	948	1258	1312	1158	794
C	1 832	1911	1 864	1816	1814	2031	2017	1947	1662
D	1 948	2005	1974	1920	1922	2142	2135	2106	1759
E	1 781	1854	1757	1655	1606	1869	1906	1810	1451
F	1 825	1904	1 704	1472	1296	1673	1868	1570	1170
G	882	950	687	448	468	284	640	267	619
H	386	386	700	1078	1378	1058	653	1181	1376

11.10.5 Results of the noise survey

In Table 83 are the prevailing ambient noise levels for the specific areas, which include all the noise sources currently in the area such as domestic, traffic noise, distant mine noise and natural noise sources. Leq is the average noise level for the specific measuring point over a period, the Lmax is the maximum noise level and the Lmin is the minimum noise level registered during the noise survey for the specific area in dBA.

Table 83 Noise levels for the day and night in the study area (dBAcoustics, 2022)

Measuring point	Daytime				Night 1				Night 2			
	LAeq-dBA	**Lmax - dBA**	**Lmin - dBA**	**Remarks**	**LAeq-dBA**	**Lmax - dBA**	**Lmin - dBA**	**Remarks**	**LAeq-dBA**	**Lmax - dBA**	**Lmin - dBA**	**Remarks**
1	**44.3**	55.5	39.7	Distant traffic, birds, HVAC, distant siren	**46.4**	59.1	41.7	Distant traffic	**47.6**	58.1	42.7	Distant traffic
2	**54.9**	61.1	46.2	Traffic	**56.4**	61.5	47.1	Traffic & insects	**55.2**	60.8	45.4	Traffic & insects
3	**47.8**	54.9	44.9	Insects, birds, pump station & distant traffic	**49.1**	54.4	46.2	Distant chrome plants, insects & distant traffic	**49.1**	54.2	46.6	Distant chrome plants, insects & distant traffic
4	**55.4**	75.0	41.8	Industrial activity, intermittent traffic, reverse signals	**47.1**	51.2	44.3	Distant mining activity, insects & frogs	**45.8**	58.1	42.9	Distant mining activity, insects & frogs
5	**48.5**	57.3	42.5	Traffic, insects, birds, distant exploration, intermittent aircraft & distant reverse signals	**54.0**	59.8	45.4	Traffic & insects	**53.6**	59.9	46.3	Traffic & insects
6	**67.9**	76.7	47.1	Traffic & insects	**57.8**	66.6	47.5	Traffic & insects	**57.4**	66.5	47.3	Traffic & insects
7	**53.4**	62.2	44.4	Traffic & intermittent aircraft	**57.1**	67.8	47.8	Traffic, insects & domestics	**56.5**	68.1	47.4	Traffic, insects & domestics
8	**44.0**	49.3	41.0	Distant mining, siren, birds & domestics	**47.0**	54.0	44.6	Distant mining, siren, birds, insects & domestics	**45.6**	51.7	43.2	Distant mining, insects & domestics
9	**48.5**	54.2	45.4	Distant traffic, insects & distant reverse signals	**49.5**	59.6	44.1	Distant mining & distant reverse signals	**48.7**	58.7	41.9	Distant mining & distant reverse signals

11.11 Visual

Information on visual aspects obtained from Scientific Aquatic Services' (SAS) Visual Impact Assessment as part of the environmental authorisation process for the proposed opencast mining on portion 82 of the farm Waterval for the Glencore Waterval Chrome Mine, North West Province (Reference Number: SAS 22-1045. November 2022). Refer to Appendix C9 for the full report.

11.11.1 Land use and visual receptors

The project area is situated in dense bushveld (Moot Plains Bushveld), with the most dominant land use in the surrounding area being urban build up including industrial areas (town of Rustenburg) various formal and informal settlements, cultivation and livestock grazing and mining. the industrial area of Rustenburg is located to the west and north of the project area.

The Kgaswane Mountain Nature Reserve is located approximately 6,2 km south west of the project area and the Magaliesberg Protected Natural Environment is located approximately 4,8 km south west of the study area. The Magaliesberg Biosphere Reserve is located approximately 2,8 km south of the project area. Due to the undulating topography and mountainous terrain of these protected areas, the relative distance toward the study area, and the dense bushveld vegetation of the environment, the proposed mining activities will not be visible from these protected areas. As such the proposed mining activities will not have a visual impact on the protected environment.

Permanent residents in the area, people at their place of work and motorists traveling along the roads are considered sensitive receptors. Due to the existing mining activities present in the area, the residents in Rustenburg have grown accustomed to the mining setting, therefore the sensitivity of these receptors may be considered moderate. People at their place of work are likely to focus on the activities at hand and not the surrounding environment as such workers are considered receptors of low sensitivity. Motorists traveling along the roads have momentary views of the surroundings thus these receptors are considered to have a moderately low sensitivity.

The R24 roadway in essence forms the northern boundary of the study area, an unnamed road forms the eastern boundary of the study area and the R104 is located approximately 1,4 km south west of the study area. With the project area located on the periphery of the town of Rustenburg there are numerous roads in the vicinity of the project area. None of these roads are, however a scenic or tourist route, therefore the sensitivity thereof is low.

11.11.2 Landscape character

The proposed mining project is located on the outskirts of town surrounded by industrial facilities, mining activities, informal settlements and open veld. The project area itself is gently sloping surrounded by mountainous terrain in the greater area, and dominated by bushveld vegetation where mining and cultivation activities are taking place. The landscape of the project area and immediate surrounds are considered enclosed since the project area is surrounded by mountainous terrain and existing waste rock dumps of mines within the immediate vicinity.

The existing mining activities present within the landscape, have altered the character of the landscape. As such, the visual impact associated with mining activities are already present in the area, therefore receptors within the vicinity thereof have grown accustomed to it. It should however be noted that the proposed mining activities will lead to an increase in the bulk appearance of mining infrastructure in the landscape and will be closer to the industrial area of Rustenburg, thus the landscape character is likely to be affected by the proposed mining activities.

11.11.3 Visual absorption capacity

The Visual Absorption Capacity (VAC) of the area is considered high, indicating that the proposed project will be absorbed in the area resulting in a low visual intrusion, thus the proposed project will blend in with the surroundings. The existing waste rock dumps and other mining infrastructure, as well as the surrounding mountainous terrain and dense vegetation of the area are the main contributing factors to the high VAC. Motorists traveling along the section of the R24 that forms the northern boundary of the study area will however experience a lower VAC, since the proposed mining activities will be within the foreground and thus briefly highly visible to motorists traveling along the R24. With the presence of the existing mining and industrial facilities, the proposed mining activities will be difficult to distinguish. As the landscape is already affected by mining activities and other anthropogenic activities, the proposed project will not degenerate the visual quality and overall change of the identified landscape character type.

11.11.4 Landscape quality

The landscape associated with the project area and surroundings provide topographical variety in the form of sloping topography, mountainous terrain, bushveld vegetation, freshwater ecosystems and anthropogenic structures; leading to increased visual interest. Adjacent scenery, with the same landscape character results in a cumulatively greater landscape viewing experience. Due to existing mining infrastructure and other anthropogenic structures such as industrial facilities, houses and schools, gravel roads, powerlines and fences, the proposed project will not introduce discordant elements into the environment or unacceptably alter the sense of place of the region.

11.11.5 Sense of place

Sense of place is the unique value that is allocated to a specific place or area through the cognitive experience of the user or viewer. It is created by the land use, character and quality of a landscape, as well as by the tangible and intangible value assigned thereto. The sense of place associated with the project area is related to the landscape character type, defined as peri-urban, gently sloping within the study area surrounded by mountainous terrain, dominated by bushveld vegetation where cattle grazing and mining activities are taking place. Even though the study area is situated directly adjacent to the existing mine the study area and immediate surrounds can further be described as calm, tranquil and peaceful, with limited development in the project area. The sense of place is however not unique to the study area as it extends to the larger North West region. As the landscape is already accustomed to mining and industrial activities, the proposed project will not have an unacceptable impact on the sense of place of the larger area.

11.11.6 Night time lighting

The project area in its current state contains no infrastructure and thus no lighting, however existing mining activities and industrial facilities adjacent thereto act as a source of high-level night-time lighting. Medium level light sources impacting on the study area also originate from roadways and the settlements within the vicinity of the study area. The lighting environment of the region is therefore considered Suburban with medium district brightness (Zone E3). According to Bortle's Scale the project area falls within a Class 5 area (suburban) where there is encircling light pollution. Furthermore, it is evident that on a cloudy night the lights will be visible in the distance and is brighter than the sky.

11.12 Heritage

Information on heritage was obtained from Beyond Heritage's Heritage Impact Assessment for the proposed Waterval UG1 Opencast Project, Rustenburg, North West Province (Project number 2237. October 2022). Refer to Appendix C10 for the full report.

The proposed UG1 opencast area used to be rural in character but is now located in an urban setting with industrial elements related to mining activities in the surrounding area (Beyond Heritage, 2022).

The proposed UG1 opencast area is without any major topographical features like pans or rocky outcrops that would be focal points for archaeological sites. Existing infrastructure includes a small site office towards the northern entrance to the area for the current drilling operations and a large pipeline. The study area has been transformed through these activities and historical cultivation from the 1980's onwards, that would also have destroyed surface indicators of heritage sites and the project area is considered to be of low heritage potential. This was confirmed during the survey and no heritage resources of significance were recorded (Beyond Heritage, 2022).

11.13 Paleontological Heritage

Based on the SAHRA sensitivity map the area is of insignificant paleontological sensitivity (Figure 62, legend in Table 84). No further palaeontolgical studies are required and as far as the palaeontology is concerned, the project can go ahead without further investigations (Beyond Heritage, 2022).

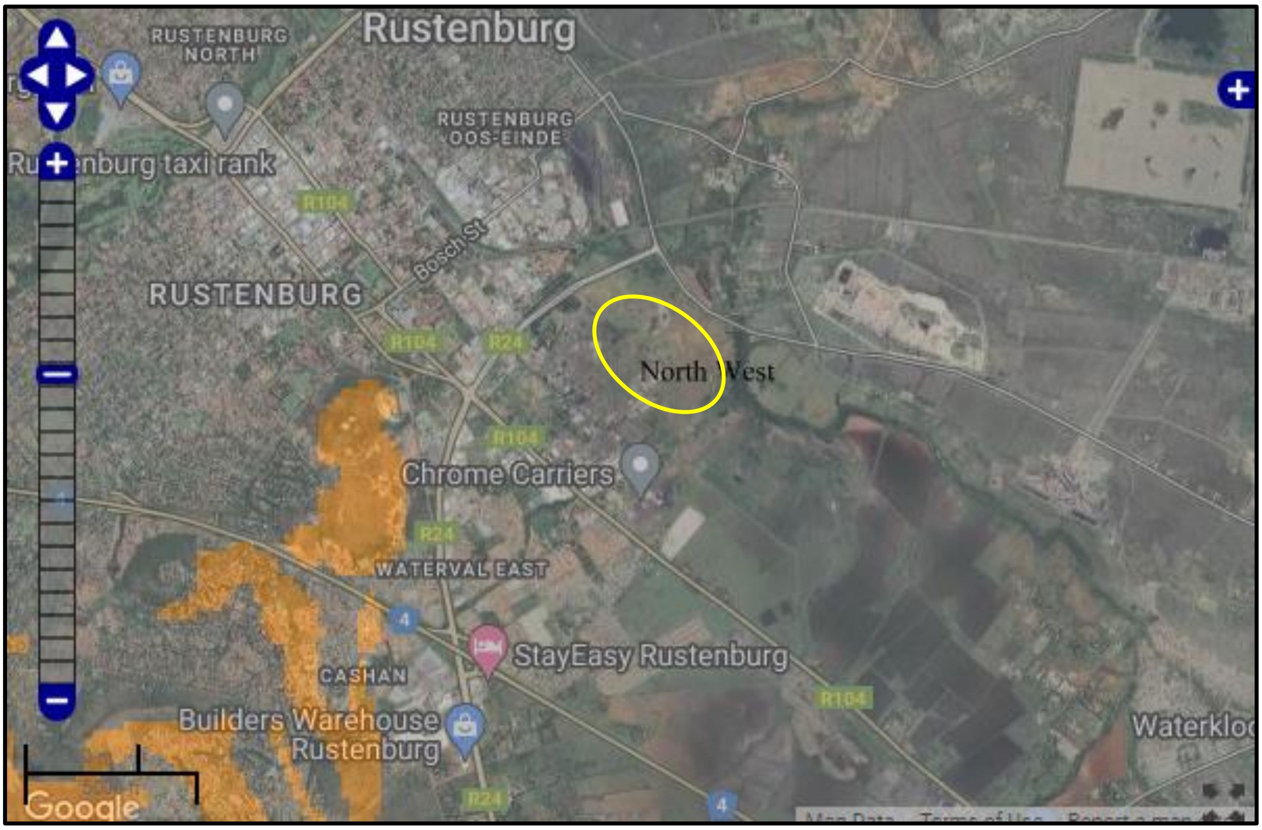


Figure 62: Paleontological sensitivity for the approximate study area (yellow polygon) as indicated by SAHRA (Beyond Heritage, 2022)

Table 84: Paleontological sensitivity legend (Beyond Heritage, 2022)

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study; a field assessment is likely
GREEN	MODERATE	Desktop study is required

Colour	Sensitivity	Required Action
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

11.14 Social

Refer to Part A Section 10.15.

12 Description of the current land uses

12.1.1 Land use

The majority of the surrounding land use is either arable or mining. Rustenburg town is situation 3km to the east of Waterval Mine and Kroondal 5km to the west.

The predominant pre-mining land use was natural grassland. Land on Waterval-West could have been used for arable land due to the present vegetation occurring on the land. Most of the present land uses are mine related quarries, discard dumps, tailings storage facilities, water retention dams, soils and waste rock stockpiles and shafts (Shangoni, 2021).

According to the 2009 SANBI land cover data the Farm Waterval has a number of classifications. It is classified as mining in the south-east, as urban built-up in the north-west and the remainder as a mix of natural and cultivated land (Figure 63). Waterval is discussed in this section as Waterval West, Waterval East and Waterval North (rehabilitated area north of Waterval Mine and Offices) (Figure 64).

Operations take place in two separate areas to the west (ca. 21 ha) and east (ca. 24 ha). Infrastructure within the operational areas include an office block (Glencore Alloy's head-office), mine training facilities, engineering and environmental offices, two Tailings Storage Facilities (TSFs), two Return Water Dams (RWDs), two explosive storage areas and two shaft complex sections as well as chrome and waste rock stockpiles. The perennial Hex River flows to the north east of the non-operational area, which has been subject to past mining, stockpiling and cultivation practices. Parts of this area especially along the Hex River are currently used as motorcycle track while other areas are used for dumping of building waste. Current land uses on and surrounding the site are summarised in Table 85.

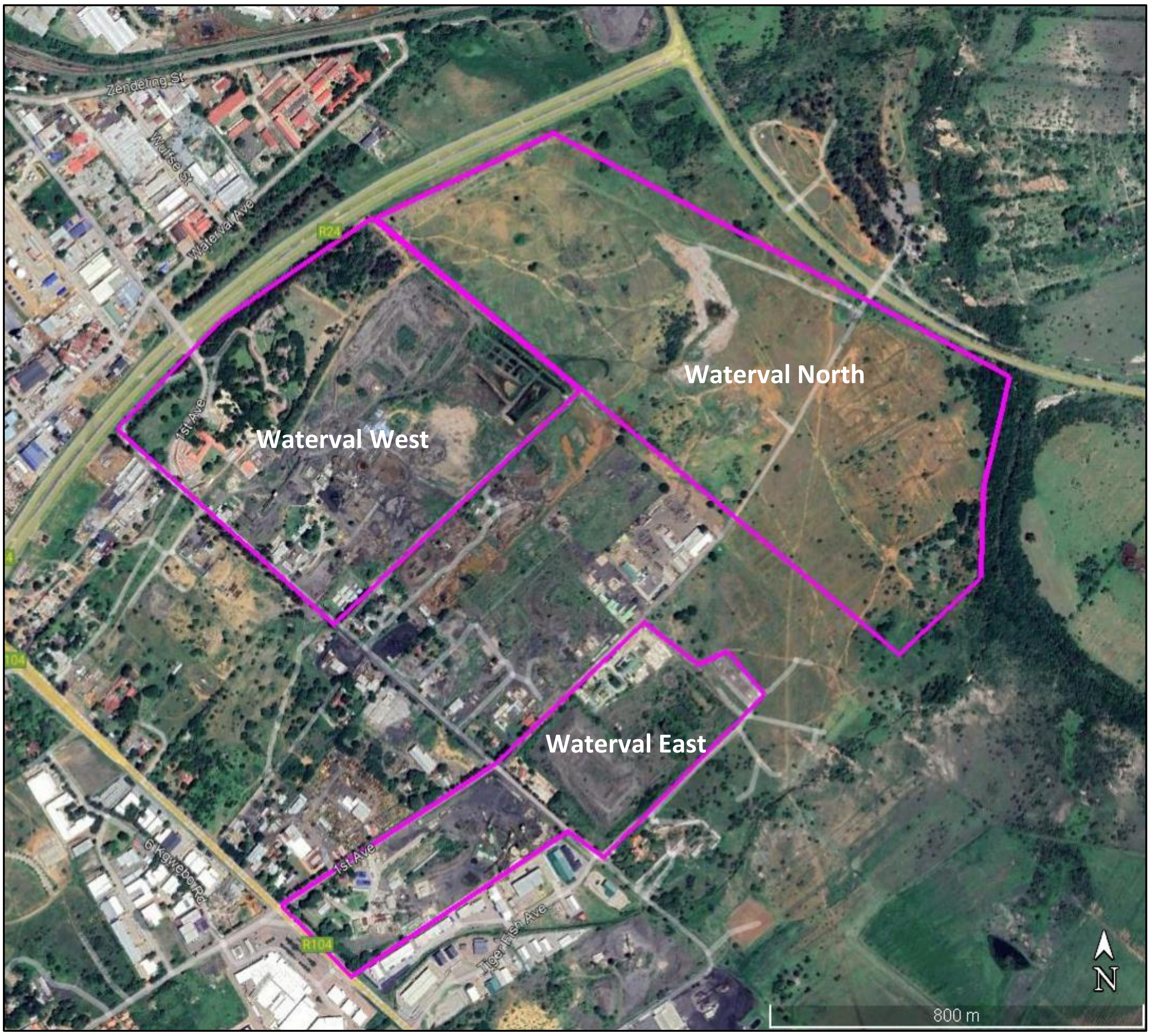


Figure 63: Positioning of Waterval East, West and North (Shangoni, 2021)

Table 85: Current land uses for the site associated with Waterval Mine and surrounds (Shangoni, 2021)

Direction	Land use	Fragmentation
The study site (Waterval Mine)	Chrome mining, processing and stockpiling. Waste dumping and motorcycle track.	Land in and amongst operations is highly fragmented and degraded, some viable habitat remains in the gardens around the main office block. Outside this area is a large (ca. 105ha) undeveloped stretch of rehabilitated fallow land that connects to a 770m reach of the Hex River which provides important corridor for biodiversity
Eastwards	Cultivation and natural.	Open land along Hex River, mostly cultivated but some natural areas remain. Extends for about 2.4 km to the start of the Waterkloof settlement.
South	Residential, Waterval East	Highly fragmented almost all natural habitat has been transformed.
Westwards	Industrial, Rustenburg	Highly fragmented almost all natural habitat has been transformed.

Direction	Land use	Fragmentation
North	Mining and tailings (Anglo Platinum) and past cultivation	Fair amount of open fallow and natural land remains but fragmented by several tar roads, railway lines and mines.

Office park gardens: (Waterval West)

Stockpiling area (Waterval West)

Rehabilitated area (Waterval North)

Motorcycle track along Hex River (Waterval North)

Figure 64: Current land use for the site and surround (NSS, July 2015) (Shangoni, 2021)

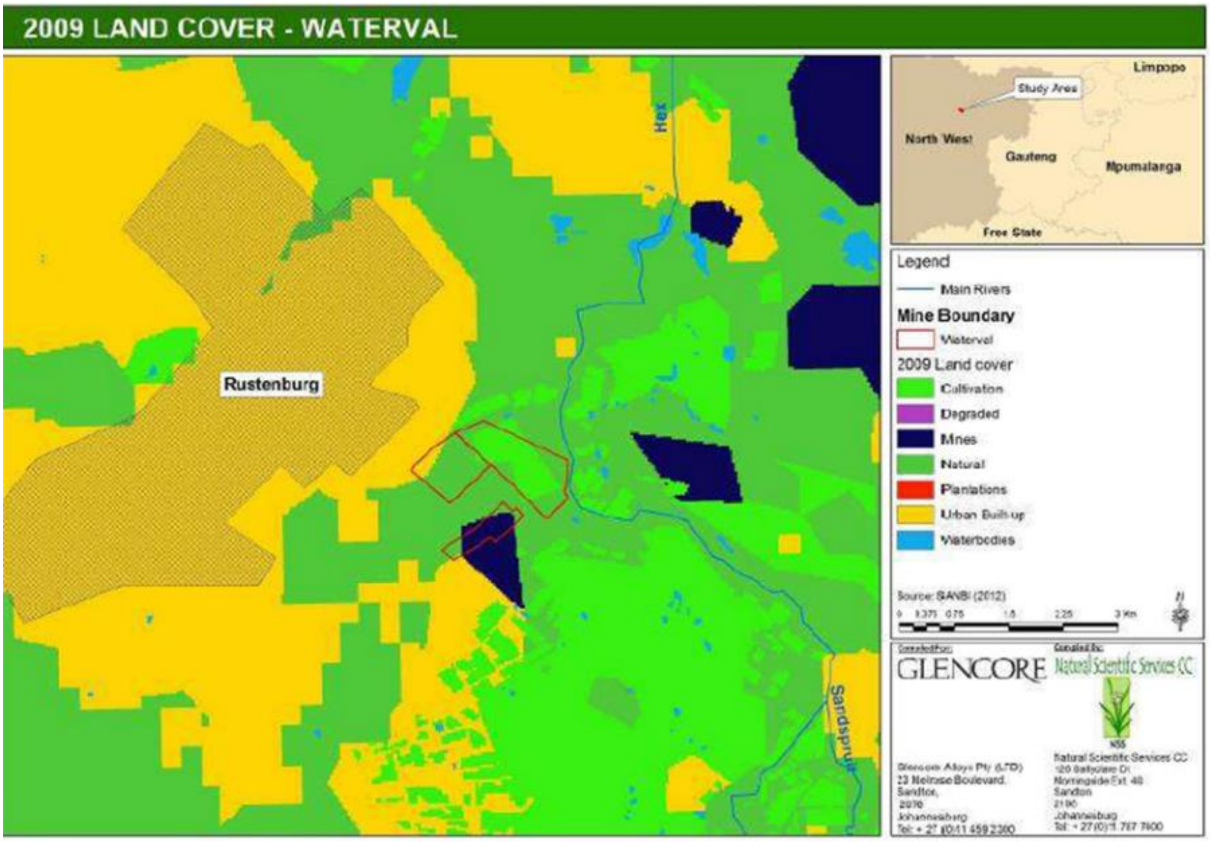


Figure 65: 2009 Land cover data for Waterval Mine and surrounds (NSS, July 2015) (Shangoni, 2021)

12.1.2 Agricultural potential

The soil units, were allocated to a relevant class of agricultural potential. The limitations are given in Table 86.

Table 86: Soil limitations (Shangoni, 2021)

Potential Class	Map Unit(s)	Main limiting factor(s)	Area (ha)
Low (l)	sKa sSe sVa	Occurs in low lying area and is prone to flooding. Shallow soil with structured layer restricting water infiltration. Shallow soil with structured layer restricting water infiltration	15 ha
Medium (m)	mAr	Moderately deep with water restricting layer further down.	10 ha
High (h)	dAr	Deep soil with good permeability	12 ha
Total:			**37 ha**

Source: Institute of Soil, Climate and Water, 2007

In summary, the area mostly has soils of high and moderate agricultural potential due to sufficient depth with good to moderate permeability.

12.1.3 Land use options

The study area comprises a small zone of moist duplex soils that could be prone to waterlogging due to the restricting layer in the subsoil (map units sSe and sKa). These soils have a low agricultural potential and should at best be left in their natural state.

The map unit sVa in the central part of the site comprises shallow soils with moderate structure in the subsoil and have a low potential for agriculture. These areas are, at best, suitable only for grazing.

Moderately deep soils of the Avalon and Hutton forms (map unit mAv) are found predominantly in the north-western zone of the property and have a slight depth restriction that places them in a moderate potential for agriculture.

The map unit dHu in the south-east corner of the site comprises deep, freely drained soils which have a high potential for agriculture. These soils should be retained as prime agricultural land.

It should, however, be borne in mind that the long-term average annual rainfall of 619mm is marginal for dryland cultivation, especially when coupled with the often intense nature of the precipitation and the variation between rainfall seasons. Without supplementary irrigation, this area should be considered as having a moderate to high risk for rain-fed agriculture.

12.1.4 Landscape Function Analysis

Natural Scientific Services cc conducted a Land Function Analysis for Waterval Mine (dated April 2015) (Shangoni, 2021).

The Landscape Function Analysis (LFA) seeks to assess the conservation or loss of vital resources such as soil, water, and nutrients from a landscape. Functional landscapes essentially conserve their resources and are self-sustainable. They typically support many vegetated patches, such as grass tufts, in an arrangement that allows for the effective trapping and infiltration of resources that are moving though the system, while dysfunctional landscapes are typically those characterised by numerous bare soil patches that provide little obstruction to the overland movement of water and soil resources which are thus effectively lost from the system (Tongway & Hindley, 2003; 2004).

Any changes to the composition, structure or appearance of a landscape will alter its functionality from that moment onwards. The Landscape Function Assessment used in the study provides a tool for monitoring the consequences of land management practices and the effects of mining activities on the functionality of landscapes. The LFA report seeks to draw comparisons and establish trends between the past (NSS, 2011a) and current landscape functionality of the rehabilitated areas at Waterval Chrome Mine.

As with the proceeding LFA field work took place in early summer (14 October 2014) when plants were in an active state of growth and many species were flowering or actively producing seed.

The LFA process involved four principal steps:

1. Description of the geographic setting of the site;
2. Characterising landscape organisation, the spatial distribution of the fertile-patches and inter patches;
3. The soil surface assessment (SSA) of each of the patch/inter-patch type;
4. Analysis of data.

The exact location and date of the LFA sampling points are provided in Table 87.

Table 87: Location and date of LFA sampling points at Waterval Mine (Shangoni, 2021)

Sampling Point	Location	Date	Sampling Point	Location	Date
Waterval-1 (Rehabilitated)	25.67511S; 27.27179E	07 Oct 2010	Waterval-1 (Rehabilitated)	25.720473S; 27.325085E	14 Oct 2014
Waterval-2 (Rehabilitated)	25.67953S; 27.27615E	07 Oct 2010	Waterval-2 (Rehabilitated)	25.722926S; 27.330507E	14 Oct 2014

Source: NSS LFA, 2015

Patch / inter-patch functionality has increased at both transect sites. Although soil functionality has increased at Waterval 2 it has decreased significantly at Waterval 1 thereby lowering the overall soil functionality of the premises since 2010. The increase in patchiness and landscape organisation index suggests the recruitment of new grass tufts while a higher total patch area means that more of the land is covered with grass than in 2010. The drop in soil functionality is mainly attributable to a lower nutrient and infiltration capacity of soils beneath grass tufts at Waterval 1. Despite this, soil stability has increased overall likely due to the increased recruitment of grasses. The low patch area index in both 2010 and 2014 means that grass cover is far from its theoretical maximum.

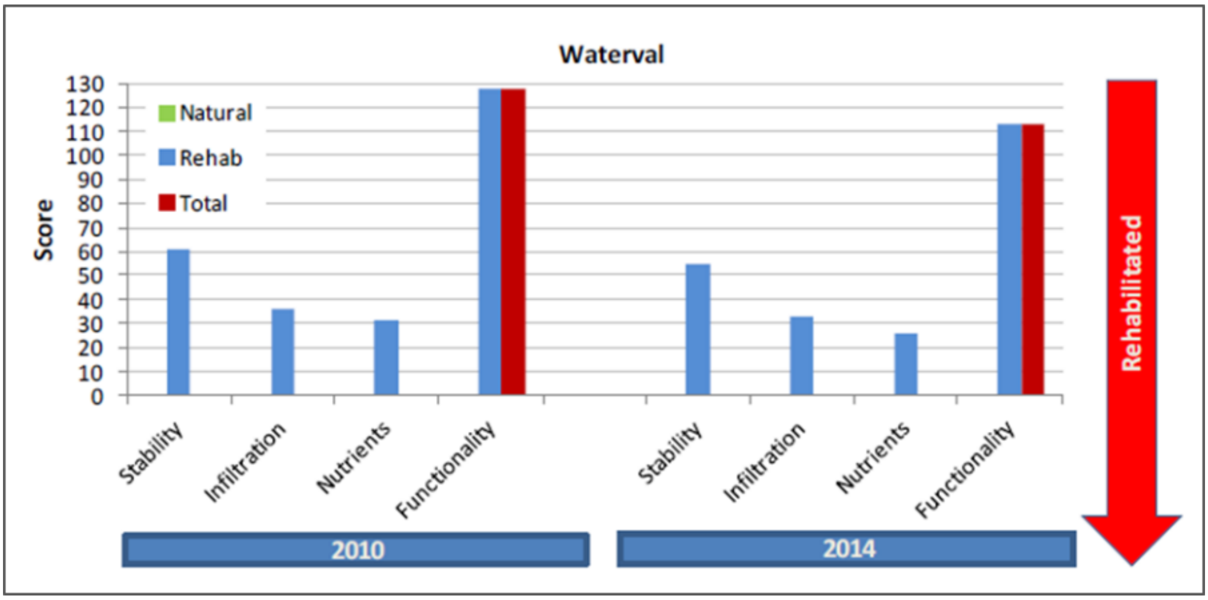


Figure 66: Changes in soil surface functionality at Waterval between sampling periods (NSS LFA, 2015) (Shangoni, 2021)

Although a good mix of grasses has established over the years within the rehabilitated area the woody component is still very low with only a few scattered bush clumps. The red sandy soil likely plays a role in the slower recovery as compared to the black turfs. Currently, however, the veld is underutilised and would benefit from grazing by bulk grazers such as cattle which, through trampling, would increase infiltration and the pressure on the grassy component thus favouring the recruitment of woody species. There are still a number of disturbances on site of most significance being the dumping of refuse in and around the riparian zone of the Hex River that borders the site to the east. Here there are also a number of old open trenches.

Overall, with the exception of trees which are still sparse, the area under rehabilitation has recovered well with a good mix of grasses of differing heights and structure with the old pit area barely visible in current Google Earth imagery (Figure 67).

A small stand of the highly invasive Pompom weed (*Campuloclinium macrocephalum*) was noticed and must be removed forthwith before it spreads.

Figure 67: Historical Google Earth imagery for Waterval (NSS LFA, 2015) (Shangoni, 2021)

13 Description of the specific environmental features and infrastructure on site

As described in the baseline and the current land use sections above, the major environmental features of the proposed UG1 opencast project area are as follows:

- Hex River; and
- Wetland areas (including riparian areas).

Existing infrastructure includes the R24 provincial road to the North West of the proposed UG1 opencast project, and the D108 road to north east of the proposed project.

14 Environmental and current land use map

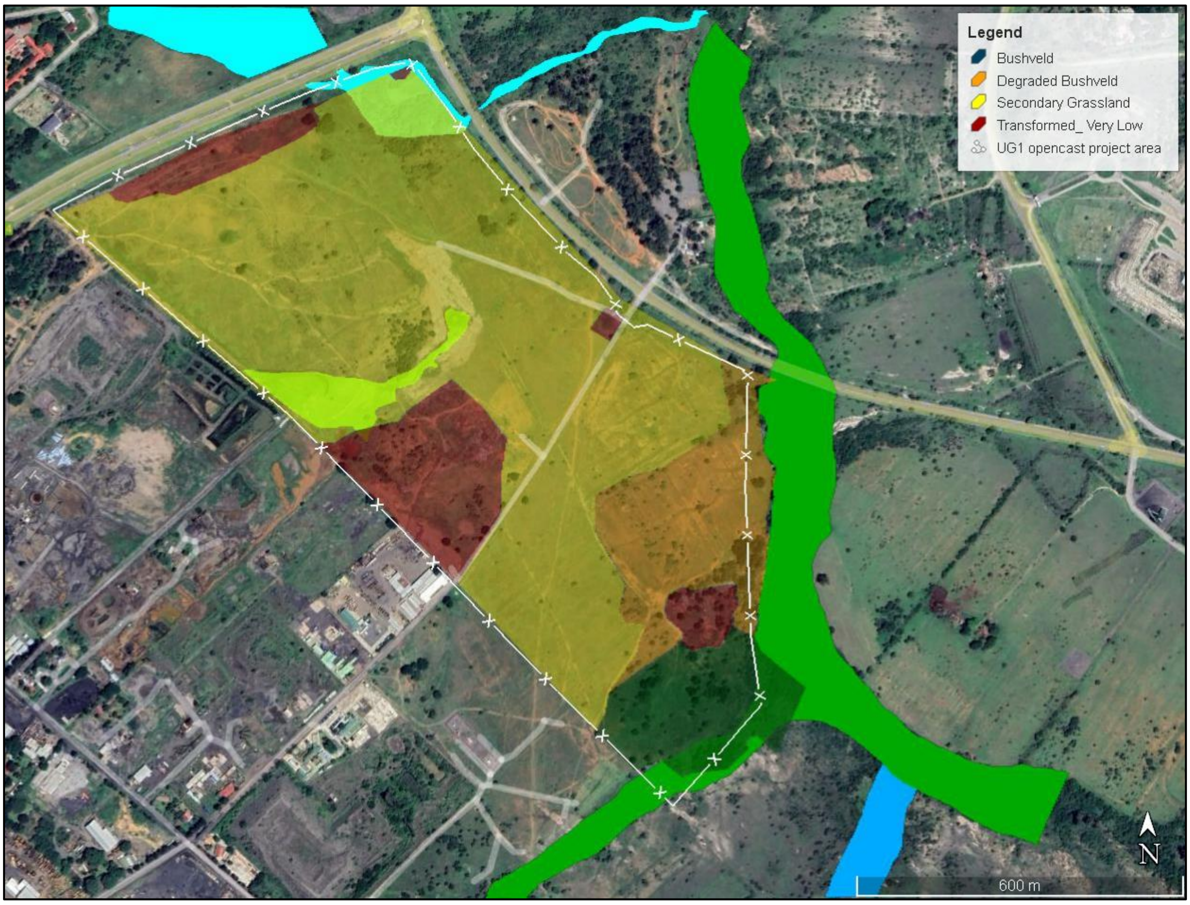


Figure 68: Environmental and current land use map at the UG1 opencast project area

15 Impacts and Risks Identified

15.1 Impacts and risks associated with the Updated EMPR, 2009

The following information was obtained from the approved *Environmental Management Programme report for the Xstrata Waterval Chrome Mine,* dated July 2009 and compiled by CHEMC environmental (Shangoni, 2021).

Table 88: Impacts and Risks identified including mitigation/management measures included in the Updated EMPR, 2009 (Shangoni, 2021)

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
1	Geology	Mining of non-renewable resources	Alteration of the geology due to underground mining and possible opencast mining	N	Y	Construction and Operational Phase	Site only Mining Right area	Definite	High	High	Control	Disruption of geology is expected during mining operations and no mitigation is possible.	Definite	High	Hight	To minimise the destruction of the geological strata and to prevent the unnecessary loss of geology	In compliance with the Mining Rights issued in terms of the MPRDA (2002) and the EMPr.	Operational Phase
2	Topography	Mine building infrastructure	Alteration of topography due to construction of mine infrastructure	Y	N	Construction and Operational Phase	Site only	Definite	Medium	Medium	Control	All mine infrastructure not required post closure be broken down and removed from site. Areas levelled to a free draining topography before being ripped, grassed and seeded as per the rehabilitation plan.	Probable	Low	Medium	To minimise impacts on topography	General implementation of activities taking Mining and Biodiversity Guidelines into account. Rehabilitation in terms of MPRDA and NEMA principles.	Decommissioning phase
3		Mine deposits and stockpiles	Alteration of topography due to construction of tailings dam & waste rock dumps, stockpiles etc.	N	Y			Definite	Medium	Medium	Control	Topsoil stockpiles are to be preserved in line with the closure plans. Stockpiles shaped to a natural angle of repose as per final closure designs. Dumps topsoiled and seeded to encourage natural sustainable vegetation cover. Correct shaping and placement of material in the tailings during the LOM will ensure the final closure topography is managed and closure is more sustainable. This aspect is to be controlled in the design and operation of the tailings dams as included in the closure plan.	Probable	Medium	Medium			Decommissioning phase
4		Rehabilitation	Removal of mine infrastructure and rehabilitation will alter the topography.	Y	N	Decommissioning and closure phase	Site only	Probable	Low	Medium	Control	All mine infrastructure not required post closure be broken down and removed from site. Areas levelled to a free draining topography before being ripped, grassed and seeded as per the rehabilitation plan.	Possible	Low	Low	To minimise impacts on topography		Decommissioning phase
4	Soil	Construction	Compaction and soil degradation due to construction of infrastructure, concrete foundations, roads etc	Y	Y	Construction and Operational Phase	Site only	Definite	Medium	Medium	Control	Topsoil initially removed to correct depth and stockpiled correctly. Topsoil replaced in areas to rehabilitation standards with correct ripping, fertilisers and seeding. Mining footprint and operation to be kept as small as possible as per the mining plan to reduce compaction. During rehabilitation where stockpiled topsoil is being used (i.e. at closure) topsoil placed must be ripped correctly prior to seeding and fertilization.	Probable	Medium	Medium	To minimise degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity	Decommissioning and Closure Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated Probability	Magnitude	Significance	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
																	Guidelines into account.	
5			Erosion and soil loss due to no stormwater controls around dumps.	N	Y	Construction and Operational Phase	Site only	Definite	Medium	Medium	Control	Long-term topsoil stockpiles (i.e. stockpiled greater than 2 years) should be correctly shaped and seeded to reduce erosion. Rehabilitated areas must make use of adequate water management canals and cut off trenches to prevent erosion. Final topsoil placement on rehabilitated areas should where possible be done in the winter early spring, to allow time for proper fertilization and seeding prior to the season's first rains. This will maximize seed growth throughout the summer and reduce long-term erosion. Rehabilitation designs should aim to maximize the 1:7 and 1:5 gradients to reduce overall erosion potential. All newly top soiled areas must ripped and then analysed for nutrient deficiencies and this corrected prior to seeding to maximize plant growth. Correct landscaping will be implemented to ensure that an acceptable slope gradient is used to minimize soil erosion.	Probable	Medium	Medium	To minimise and prevent degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational Phase
6			Compaction and soil degradation due to construction of stockpiles, waste dumps and slimes dams.	Y	Y	Construction and Operational Phase	Site only	Definite	Medium	Medium	Control	Mining footprint and operation to be kept as small as possible as per the mining plan to reduce compaction. During rehabilitation where stockpiled topsoil is being used (i.e. at closure) topsoil placed must be ripped correctly prior to seeding and fertilization.	Probable	Medium	Medium	To minimise degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
7			Loss of soil fertility due to construction, compaction and pollution potential	Y	Y	Construction and Operational Phase	Site only	Definite	High	Medium	Control	Demarcated areas for vehicles need to identified, to ensure no compaction of unnecessary areas. Limited movement and use of equipment onto of the soil stockpile should be allowed. Areas requiring soil stripping will be delineated. Stripping may only occur where soils are to be disturbed, and an end-use for the stripped soil needs to be identified. Stockpile areas must be clearly demarcated and sufficient stormwater controls need to be implemented. The stockpile areas must be designed in accordance with Government Notice 704.	Probable	Medium	Medium	To minimise degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
8			Loss of soil structure due to removal of topsoil	Y	Y	Construction and Operational Phase	Site only	Definite	High	Medium	Control	Topsoil will be stockpiled, and this will be done separately to subsoil. Stockpiles will be vegetated, and no waste material will be placed on these stockpiles. Equipment movement will be limited, so as to minimise compaction of the stockpiles.	Probable	Medium	Medium	To minimise degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
9			Chemical contamination due to pipeline spillages / breakdowns / diesel spillages / oil spillages	Y	Y	Construction and Operational Phase	Site only	Probable	Low	Medium	Control	Pollution resulting from spills/breakdowns will be cleaned-up immediately in accordance with the mine's incident reporting procedure. Adequate clean-up procedures will be implemented, according to the type of waste. All hazardous waste will be cleaned-up according to the relevant procedure. An oil absorbent fibre emergency kit will be issued to the site supervisor to clean accidental oil pollution. Oil spills will be removed and handled according to waste management procedure. Vehicles will only be permitted to be serviced on concrete floors, and drip trays used during repairs. Re-fuelling will be done in allocated areas (bunded with a concrete floor). Oils and hydrocarbons will be kept in bunded areas. Equipment containing oil and diesel must be stored on a concrete floor and drain to an oil trap. All spills from the explosives magazine should be cleaned-up with immediate effect.	Probable	Low	Medium	To minimise contamination of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
10	Land capability and land use	Construction	Disturbance of soils and vegetation due to Construction of mining infrastructure.	Y	Y	Construction and Operational Phase	Site only	Definite	Medium	Medium	Control	Rehabilitation plan to be drafted with end land use in mind, plan to include final slopes, free draining topography, water management structures (e.g. drains) and topsoil thicknesses. Plan also requires a schedule of activities to keep abreast with the mining operations. A topsoil layer of 300 mm or more will be used on rehabilitated areas. Rehabilitation designs of mine reside dumps to ensure effective final landform is obtained that is freed draining, manages surface water run-off, reduced infiltration and mitigates soil erosion.	Definite	Medium	Medium	To minimise disturbance of soils and vegetation	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
11		Construction and operation	Disturbance of soils and vegetation due to construction of tailings dams and waste rock dumps.	Y	Y	Construction and Operational Phase	Site only	Definite	High	High	Control	All residue dumps to be shaped, top soiled, fertilized and seeded as per rehabilitation plan. Where mine residue dumps are removed, the soil will be analysed to determine rehabilitation capability. Dumps to be operated during the LOM with final closure in mind where possible, in order to ensure minimal rehabilitation at the end of the LOM. Rehabilitation plan/designs to be implemented once closure of mine is finalised and no future commercial value of the dump is obtainable. Effective indigenous seed mixes should be used at all times. The seed mixtures used must take account the availability of seed, different soil situations and the prevailing climatic conditions of the area. Erosion control measures will be implemented in order to ensure that topsoil is not washed away and erosion gulleys do not develop in arable land. Rehabilitation monitoring and auditing will be implemented to ensure conformance with the rehabilitation plan on an annual basis. Rehabilitation plan must detail goals for slopes angles, species composition, topsoil thickness and basal cover per rehabilitation area of the mine. A post-closure monitoring programme will be instituted for a minimum period of 5 years in order to ensure that the area has been successfully rehabilitated and there are no latent impacts. As far as is practical, all of the rehabilitated areas will be grassed prior to the start of the rainy season. Should no topsoil be available for placement in residue or tailings dams then a tailings analysis will be performed prior to seeding and soil ameliorants and additives will be added accordingly. The seed mix will be evaluated, giving consideration to include indigenous grasses, herbaceous and bulbous species in order to restore to a diverse as possible state as per the closure plan objective. Protected plant species should be demarcated to prevent disturbance to the plants. Should avoidance of impact on the protected species not be possible, a permit for removal / relocation must be obtained from the responsible authority. The importance of conservation of protected plant species must be included in general awareness programmes for Waterval Mine. All employees should be trained on the importance of all aspects of the environment (including fauna).	Definite	High	High	To minimise disturbance of soils and vegetation	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
12		Operation	Change of land use due to the operation of the mine	N	Y	Construction and Operational Phase	Site only	Definite	High	High	Rectification		Definite	High	High	To prevent the loss of valuable land	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase

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												No employees will be allowed to hunt or poach animals within or around the Waterval Mine area. Prohibiting terrestrially-mobile fauna from accessing the operational areas, by upgrading the fencing around these areas to be as impermeable to fauna as possible (by e.g. using fine Bonnox mesh in addition to current fences). Conserving the physical habitat integrity of the Hex River. It is important that the dense riparian vegetation fringing the Hex be maintained along with the general geomorphology and hydrology of the river. Ideally the system should remain as a quiet, well wooded, slow flowing and clear river with the occasional riffle at rocky knick points. Alien vegetation should also be controlled in the riparian zone while being mindful not to open the riparian canopy too extensively. Conserving the water quality of the Hex River: Half-collared kingfishers are particularly susceptible to deterioration in water quality and rely heavily on the presence of clear water. As such efforts should be made to prevent the sedimentation, erosion or pollution (especially by chromium) of the Hex river. Water quality should be tested regularly especially for the following parameters, total dissolved solids, suspended solids, electrical conductivity, pH, oxygen reducing potential, heavy metals especially chromium (both total chromium and CrVI), aluminium, cadmium, manganese, lead, zinc) and E.coli. Snakes that are encountered on site should be safely captured and relocated away from working areas, by staff members who are appropriately trained and qualified to do so (for more information see www.africanreptilesvenom. co.za). Reducing road kill by restricting vehicle access to the non-operational operational areas.						
13	Biodiversity	Mining	Loss of ecosystems due to the removal of natural vegetation for plant, shaft, road and tailings dams construction.	Y	Y	Construction and Operational Phase	Site only	Definite	High	High	Control	Mine activities and development limited to as small a footprint as possible, hence reducing immediate impact on surrounding fauna and flora. This will include clearly designated roads, plants, mine offices/admin and residue deposits. Must be clearly indicated on a site plan, and activities outside of these areas must not be allowed. Mine to conduct regular ecological evaluations of the site to be used to monitor impacts on biodiversity. Mine to develop a biodiversity action plan to address the protection of the sensitive areas identified on the site, species composition on rehabilitated areas in relation to post mining land use and capability.	Probable	Medium	Medium	To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase

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14			Degradation of surrounding ecosystems due to the spillages and contamination	N	Y	Construction, Operational and Decommissioning Phase	Site only	Probable	Medium	Medium	Remedy	Spillages will be reported as per the incident reporting procedure and cleaned-up in accordance with the clean-up procedure as soon as practically possible in order to prevent damage to vegetation and compromise the functioning of ecosystems.	Probable	Medium	Medium	To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account.	Construction, Operational, Decommissioning and Closure Phase
15			Dust covering vegetation due to trucks and equipment on dirt roads as well as blasting.	N	Y	Construction, Operational and Decommissioning Phase	Site only	Probable	Low	Medium	Control	Water will be sprayed on the access roads (gravel) to reduce the amount of dust covering surrounding vegetation	Probable	Low	Medium	To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account.	Construction, Operational and Decommissioning Phase
16			Degradation of surrounding ecosystems due to the propagation of alien invaders	Y	N	Construction, Operational and Decommissioning Phase	Local	Probable	Medium	Medium	Control	An alien and invasive species eradication programme will be implemented, and progress monitored on a regular basis.	Possible	Medium	Medium	To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase
17	Surface water	Mining	Pollution due to polluted groundwater recharge into surface resources	N	Y	Construction and Operational Phase	Regional	Probable	Medium	Medium	Control	Mine to regularly update its mine water balance to ensure all uses and quantities are captured as mining plan changes. The mine will maximize return water use from tailings facilities and water from other dirty water storage facilities. The amount of water recycled must be in proportion to the water balance of the area The mine will ensure compliance with the National Water Act and GN 704 will be enforced at all times. Surface water quality and borehole quality and levels will be monitored in order to quantify the effect that mining and deposition has on the water quality. Total suspended solids will be added to the	Possible	Medium	Medium	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

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18			Chemical and physical contamination due to flash floods resulting in overflow of contaminants.	N	Y	Construction and Operational Phase	Regional	Possible	Medium	Medium	Remedy / Control	surface water quality monitoring programme, as silt is considered to be the most significant pollutant. The groundwater model will be updated in line with the Water Use Licence requirements. Extra monitoring boreholes will be drilled where and when required. Groundwater monitoring will be continued to determine the effects of the residue deposits on groundwater with the results of such monitoring submitted to the DWS, in accordance to the approved Water Use Licence ("WUL"). All water management systems (clean and dirty water) will be designed for the 1:50 year flood event to prevent dirty water spillages from the dirty water system to the clean water system and vice versa. Run-off from the tailings dams and waste rock dumps will be contained in order to decrease the silt-load from these areas into ground and surface water resources. Walls to be constructed around the base of all stockpiles, in order to achieve this. These trenches will accommodate all potential flow, without any spillage. These trenches will be inspected on a regular basis. Collection points (with a conveyance system) for standing surface/storm flow will be constructed, in order to ensure that the clean surface water is not directed into the dirty water system. Structures such as diesel storage tank etc. will be bunded with adequate capacity4. Oil traps and cut-off trenches to be constructed at the workshops, wash bays, brake test shop and stores. Pollution resulting from spills/breakdowns will be cleaned-up immediately in accordance with the mine's incident reporting procedure. The underground septic tanks located at the Waterval Mine are serviced by a contractor for safe disposal. Toe drains/paddocks around the tailings dam to be maintained in an acceptable condition, and to be inspected on a regularly for erosion/cracks The water levels in the return water dam, conservancy tanks and water storage dams will be monitored on a regular basis in order to ensure that there is sufficient capacity to prevent overflow. All storage dams will have a freeboard of 0.8 metres.	Unlikely	Medium	Medium	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
19			Physical contamination as a result of increased silt load due to dust deposition	N	Y	Construction and Operational Phase	Regional	Definite	Medium	High	Control / Remedy		Possible	Medium	Medium	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
20			Physical contamination as a result of overflow of the return water dam	N	Y	Operational and Decommissioning Phase	Regional	Probable	Medium	Medium	Control		Unlikely	Low	Low	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

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21			Chemical contamination as a result of nitrification due to explosives.	Y	Y	Operational and Decommissioning Phase	Regional	Definite	Medium	High	Control	Stormwater management on site will be managed in accordance with the Storm Water Management Plan. Mining footprint areas will be adequately rehabilitated as per the standard defined in the closure plan. Rehabilitation will be undertaken in accordance with the rehabilitation plan, and dumps will be sloped, grasses and seeded in order to reduce erosion and infiltration. A bio-monitoring programme will be instituted. Should the bio-monitoring indicate a further deterioration in the ecological integrity of the stream, the necessary actions will be taken to address this (for issues that the mine has control over). Where applicable, the mine to investigate methods of removing excess nitrogen from the water system. The mine will have a back-up system in order to ensure that adequate pollution control can be implemented during load shedding. The removal of sewage tanks post-closure will reduce the pollution potential from the septic tanks. The cessation of mining will result in the cessation of dewatering. This will impact on the water balance. An oil absorbent fibre emergency kit will be issued to the site supervisor to clean accidental oil pollution. Oil spills will be removed and handled according to waste management procedure. Vehicles will only be permitted to be serviced on concrete floors, and drip trays used during repairs. Refuelling will be done in allocated areas (bunded with a concrete floor). Oils and hydrocarbons will be kept in bunded areas. Equipment containing oil and diesel must be stored on a concrete floor, and drain to an oil trap. Water monitoring and management reports are to be submitted to the DWS, in accordance to the approved WUL.	Possible	Medium	Medium	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
22			Flow alteration as a result of the of waste rock dumps in non-perennial tributary's floodline.	N	Y	Operational and Decommissioning Phase	Regional	Definite	High	High	Control / Remedy		Definite	High	High	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
23			Physical contamination due to uncontained run-off from waste rock dump and tailings dams	N	Y	Operational and Decommissioning Phase	Regional	Possible	Medium	Medium	Control / Remedy		Possible	Medium	Medium	To conserve the surface water resource and prevent impact on downstream water users.	Surface water quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

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24	Groundwater	Mining	Chemical contamination due to seepage of AMD from stockpiles and tailings dams	N	Y	Operational and Decommissioning Phase	Regional	Unlikely	High	Medium	Control / Remedy		Unlikely	High	Medium	To prevent groundwater pollution	Groundwater monitoring Water management measures in compliance with NWA, 1998 and GN 704, 1999.	Operational and Decommissioning Phase
25			Change in water balance, loss of yield as a result of groundwater abstraction and dewatering	Y	Y	Operational and Decommissioning Phase	Regional	Probable	Medium	Medium	Control / Remedy		Possible	Medium	Medium	To prevent groundwater pollution	Groundwater monitoring Water management measures in compliance with NWA, 1998 and GN 704, 1999.	Operational and Decommissioning Phase
26			Chemical contamination as a result of nitrification from blasting activities	N	Y	Operational and Decommissioning Phase	Regional	Definite	Medium	High	Control		Probable	Medium	Medium	To prevent groundwater pollution	Groundwater monitoring Water management measures in compliance with NWA, 1998 and GN 704, 1999.	Operational and Decommissioning Phase
27			Chemical contamination as a result of seepage from contaminated soils & dumps	N	Y	Operational and Decommissioning Phase	Regional	Probable	Medium	High	Control		Possible	Medium	Medium	To prevent groundwater pollution	Groundwater monitoring Water management measures in compliance with NWA, 1998 and GN 704, 1999.	Operational and Decommissioning Phase
28	Air Quality	Mining	Air pollution from vehicular emissions	N	Y	Construction, Operational and Decommissioning Phase	Regional	Definite	Low	Medium	Control	The mine will ensure legislative compliance, in particular with the Air Quality Act and Mine Health and Safety Act. Vehicle exhaust gases will be minimized by the maintenance of effective exhaust systems on mine vehicles. Equipment will be maintained, and employees versed in the operation thereof.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA.	Operational and Decommissioning Phase

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29			Dust pollution from haul roads	N	Y	Construction, Operational and Decommissioning Phase	Local	Definite	Low	Medium	Control	The mine will continue to monitor the dust fallout levels emanating from the mining activities, and will institute mitigatory measures should the dust fallout levels be too high. The mine will continue to apply dust suppression measures where, and when, necessary. These measures will be revised if the dust fallout levels become too high. Where dust assessment indicates high dust fallouts within operational areas, the mine will ensure that all employees are adequately trained in the use of personal protective equipment. Dust suppression measures that include the watering of/use of chemical palliatives on the haul roads and water sprays in the beneficiation process. The topsoil stockpiles will be seeded.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA.	Operational and Decommissioning Phase
30			Dust pollution from ore transfer points, stockpiles, crushing & screening	N	Y	Operational Phase	Local	Definite	Low	Medium	Control	Ore will be kept wet where possible to prevent dust generation. The mine will continue to monitor the dust fallout levels emanating from the mining activities, and will institute mitigatory measures should the dust fallout levels be too high. The mine will continue to apply dust suppression measures where, and when, necessary. These measures will be revised if the dust fallout levels become too high. Where dust assessment indicates high dust fallouts within operational areas, the mine will ensure that all employees are adequately trained in the use of personal protective equipment.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA and Dust fallout regulations	Operational Phase
31			Dust pollution from topsoil stockpile, ore stockpiles, waste rock dump	N	Y	Operational and Decommissioning Phase	Local	Definite	Low	Medium	Control	Dust suppression measures that include the watering of/use of chemical palliatives on the haul roads, dust suppression (wetting) on the waste rock dumps and tailings dams, water sprays in the beneficiation process. The topsoil stockpiles will be seeded.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA.	Operational Phase
32			Dust pollution from tailings dam	N	Y	Operational and Decommissioning Phase	Local	Probable	Low	Medium	Control	Dust suppression measures that include the watering of/use of chemical palliatives on the haul roads, dust suppression (wetting) on the waste rock dumps and tailings dams, water sprays in the beneficiation process. The topsoil stockpiles will be seeded. Footprint areas will be adequately rehabilitated. The waste rock dumps and the tailings dams will be rehabilitated according to the specifications of the rehabilitation plan, and concurrent rehabilitation will take place as far as is possible.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA.	Operational Phase

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33			Dust pollution from transport of ore	N	Y	Operational Phase	Local	Probable	Low	Medium	Control	For transport on public roads truck tyres carrying ore will be make use of a tarpaulin in order to reduce dust from the use of these vehicles. The cessation of mining activities will result in diminished vehicular traffic, and the transport of ore will cease, thus reducing the dust generation potential.	Probable	Low	Medium	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring Air quality management measures in compliance with NEM: AQA.	Operational Phase
34	Noise and vibration	Mining	Noise generation from machinery, screens & crushers, pumps, pipeline operation	Y	N	Operational Phase	Local	Definite	Low	Medium	Control	The mine will ensure legislative compliance, in particular with the Mine Health and Safety Act. The mine currently has a noise monitoring programme (as part of the Occupational Hygiene programme) and mitigatory measures will be implemented should the noise levels be too high. Vehicles and machinery will be well maintained and serviced on a regular basis in order to minimize noise generation. Employees will be trained in the correct use of machinery in order to minimize the generation of noise. A complaints register will be maintained. The mine will ensure legislative compliance, in particular with the Mine Health and Safety Act. Where required, vehicles will be fitted with vibration control devices on machines that are found to affect the health of the operator/driver	Possible	Low	Medium	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase
35			Noise generation from conveyor belt siren	Y	N	Operational Phase	Local	Definite	Low	Medium	Control	The mine currently has a noise monitoring programme (as part of the Occupational Hygiene programme) and mitigatory measures will be implemented should the noise levels be too high. A complaints register will be maintained.	Possible	Low	Medium	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase
36			Vibration from blasting activities.	Y	N	Operational Phase	Local	Definite	Low	Medium	Control	A blasting procedure shall be drafted to include blasting times and techniques shall be employed to minimize noise will be applied at all times. Blasting techniques to minimize vibration will be applied at all times. Blasting times will be limited to the start of each shift, and only take place during daylight hours. Blasting activities will be closely monitored, and corrective and mitigatory measures implemented as necessary.	Probable	Low	Medium	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase

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37			Noise generation from vehicular traffic	Y	N	Operational Phase	Local	Definite	Low	Medium	Control	Vehicles and machinery will be well maintained and serviced on a regular basis in order to minimize noise generation.	Probable	Low	Medium	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase
38			Noise generation from rehabilitation activities	Y	N	Decommissioning and closure phase	Local	Definite	Low	Medium	Control	The mine currently has a noise monitoring programme (as part of the Occupational Hygiene programme) and mitigatory measures will be implemented should the noise levels be too high. Vehicles and machinery will be well maintained and serviced on a regular basis in order to minimize noise generation. Employees will be trained in the correct use of machinery in order to minimize the generation of noise. A complaints register will be maintained.	Probable	Low	Medium	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase
39	Traffic	Mining	The impacts that may arise from vehicular traffic are detailed in the 'air pollution' and 'noise, vibration and shock' sections.															
40	Heritage resources	Mining	No heritage resources have been identified.									No heritage resources are expected to be found during future operation, however, should artefacts or remains be discovered on the mine, this must be immediately reported the South African Heritage Resources Council prior to further damage or removal.						
41	Sensitive landscapes	Mining	The Hex River (and its associated riparian zone and habitats) has been classified as a sensitive area. Refer to surface water.															

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42	Visual aspects	Construction and operation	Aesthetics altered due to the construction of mine infrastructure.	Y	N	Operational and Decommissioning Phase	Local	Definite	Medium	Medium	Control	Refer to mitigation measures for topography and air pollution as they have implicit relevance to managing the atheistic impacts. The rehabilitation, and the associated demolishing and grassing of structures, will improve the aesthetics of the area as the land is returned to the pre-mining land use. The tailings dams and waste rock dumps will be rehabilitated in a manner as to decrease the final aesthetic impact resulting from the permanent presence of these structures.	Definite	Low	Medium	To control visual impacts associated with the mine	Rehabilitation in terms of MPRDA and NEMA principles. General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational and Decommissioning Phase
43			Aesthetics altered due to the construction of tailings dams, stockpiles, waste rock dumps & topsoil stockpile.	Y	N	Operational and Decommissioning Phase	Local	Definite	Low	Medium	Control		Definite	Low	Medium	To control visual impacts associated with the mine	Rehabilitation in terms of MPRDA and NEMA principles. General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational and Decommissioning Phase
44	Socio-economic	Mining	Conflict may result from the creation of varying wealth classes	Y	N	Operational and Decommissioning Phase	Regional	Probable	Low	Medium	Control	The mine will undertake an annual audit of its Social and Labour Plan in order to determine the effectiveness, and progress, of the programmes being implemented. The mine has appointed a Skills Development Facilitator to allow for the effective implementation of the skills training programmes. Waterval has registered with the Mine Qualification Authority (MQA), and pays the relevant skills levies. The mine's HR Training and Development Centre has been registered as a fully accredited Training and Development Centre with the MQA. The mine will recruit local labour as far as is possible. Discussions will be held with community leaders when recruitment takes place, and it is anticipated that these discussions will sensitize the local community to the presence of migrant workers in the area. Migrant workers will be encouraged to stay in formal housing, and settlement into informal settlements will be discouraged. Mine workers will receive education as to the prevention of the spread of communicable diseases. The local recruitment strategy, as well as the implementation of the procurement programme, will encourage economic diversification of the area. SMMEs that are established as part of the Local Economic Development Programme will need to be sustainable.	Possible	Low	Medium	Prevent socio economic impacts by employment opportunities.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

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			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
												The mine will have exit strategies in order to encourage this sustainability post-closure. Employees who are retrenched will be redeployed within the group. Should this not prove to be feasible, the mine will attempt to find employment in the mining industry on their behalf. Employees will be re-skilled in order to encourage job seeking outside of the mining industry. The Health, Safety, Environmental, and Community Standards identify key community risks and opportunities and manage those effectively to prevent adverse impacts, and deliver sustained benefits to the communities in which the Company operates.						
45			Increased unemployment as a result of influx of job seekers into the local area.	Y	N	Operational and Decommissioning Phase	Regional	Probable	Low	Medium	Control	The mine will undertake an annual audit of its Social and Labour Plan in order to determine the effectiveness, and progress, of the programmes being implemented. The mine's HR Training and Development Centre has been registered as a fully accredited Training and Development Centre with the MQA. The mine will recruit local labour as far as is possible. Discussions will be held with community leaders when recruitment takes place, and it is anticipated that these discussions will sensitize the local community to the presence of migrant workers in the area.	Possible	Low	Medium	Prevent socio economic impacts by employment opportunities.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
46			Conflict may arise due to an influx of job seekers into the local area.	N	Y	Operational and Decommissioning Phase	Regional	Probable	Low	Medium	Control		Possible	Low	Medium	Prevent socio economic impacts by employment opportunities.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
47			Increased spread of communicable diseases due to an influx of job seekers into the local area and disruption of family units.	N	Y	Operational and Decommissioning Phase	Regional	Definite	High	High	Control	Mine workers will receive education as to the prevention of the spread of communicable diseases.	Possible	Medium	Medium	Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
48			Loss of agricultural and grazing land	Y	N	Operational and Decommissioning Phase	Regional	Definite	High	High	Control / Remedy	The adequate rehabilitation of the mining footprint will return the land to its former agricultural and grazing potential.	Possible	Medium	Medium	Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
49			Skills transfer to employees	Y	N	Operational and Decommissioning Phase	Regional		Positive		Enhancement	The mine will undertake an annual audit of its Social and Labour Plan in order to determine the effectiveness, and progress, of the programmes being implemented. The mine has appointed a Skills Development Facilitator to allow for the effective implementation of the skills training programmes. Waterval has registered with the Mine Qualification Authority (MQA), and pays the relevant skills levies. The mine's HR Training and Development Centre has been registered as a fully accredited Training and Development Centre with the MQA.		Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
50			Job creation	Y	N	Operational Phase	Regional		Positive		Enhancement	The mine will undertake an annual audit of its Social and Labour Plan in order to determine the effectiveness, and progress, of the programmes being implemented. The mine has appointed a Skills Development Facilitator to allow for the effective implementation of the skills training programmes. Waterval has registered with the Mine Qualification Authority (MQA), and pays the relevant skills levies. The mine's HR Training and Development Centre has been registered as a fully accredited Training and Development Centre with the MQA. The mine will recruit local labour as far as is possible. Discussions will be held with community leaders when recruitment takes place, and it is anticipated that these discussions will sensitize the local community to the presence of migrant workers in the area. Migrant workers will be encouraged to stay in formal housing, and settlement into informal settlements will be discouraged. Mine workers will receive education as to the prevention of the spread of communicable diseases. The local recruitment strategy, as well as the implementation of the procurement programme, will encourage economic diversification of the area. SMMEs that are established as part of the Local Economic Development Programme will need to be sustainable. The mine will have exit strategies in order to encourage this sustainability post-closure. Employees who are retrenched will be redeployed within the group. Should this not prove to be feasible, the mine will attempt to find employment in the mining industry on their behalf.		Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
51			Increase in local employment	Y	N	Operational Phase	Regional		Positive		Enhancement			Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
52			Income generation	Y	N	Operational Phase	Regional		Positive		Enhancement			Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
53			Increase in economic diversification	Y	N	Operational Phase	Regional		Positive		Enhancement			Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
54			Community upliftment	Y	N	Operational Phase	Regional	Positive			Enhancement	Employees will be re-skilled in order to encourage job seeking outside of the mining industry. The Health, Safety, Environmental, and Community Standards identify key community risks and opportunities and manage those effectively to prevent adverse impacts, and deliver sustained benefits to the communities in which the Company operates.	Positive			Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
55	Energy consumption	Construction, operation & decommissioning	Loss of renewable resources due to energy uses for construction, mining & decommissioning activities.	N	Y	Operational and Decommissioning phase	National	Definite	Low	High	Control	Energy consumption will be monitored and tracked. Energy saving equipment (i.e. lights, geysers etc.) will be investigated over the Life of Mine.	Definite	Very low	High	Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

15.2 Impacts and risks associated with the PGM EMPR, 2011[5]

The following information was obtained from the approved *Environmental Impact Assessment and Environmental Management Programme, Waterval PGM plant EMPr*, dated 2011 and compiled by Environmental and Energy Services (Shangoni, 2021).

Table 89: Impacts and Risks identified including mitigation/management measures included in the PGM EMPR, 2011 (Shangoni, 2021)

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance					
1	Geology	Construction and operation of the tailings dam	The tailings dam will be used to store potentially chemically dangerous substances (chrome). The probability exists that the chrome may seep into the underlying rock if the necessary preventative measures are not implemented	N	Y	Construction, Operational and Decommissioning Phase	District			Very Low	Control	Ensure the tailings dam is constructed as per design.	To minimise the destruction of the geological strata and to prevent the unnecessary loss of geology	In compliance with the Mining Rights issued in terms of the MPRDA (2002) and the EMPr.	Operational Phase
2	Topography	Construction and operation of the waste rock dump and tailings dam	The infrastructure related to the tailings dam will have a definitive impact on the topography. Change in landform: Topographical changes can be expected from the waste rock dump and tailings dam.	N	Y	Construction, Operational, Decommissioning and Closure Phase	District			Medium	Control	Remove structures which are not needed for the efficient operation of the mine. Ensure the tailings dam is constructed as per design.	To minimise impacts on topography	General implementation of activities taking Mining and Biodiversity Guidelines into account. Rehabilitation in terms of MPRDA and NEMA principles.	Decommissioning phase
3	Soil	Soil disturbance on the different disturbed areas. Lack of proper water management structures. Un-rehabilitated areas and lack of vegetation.	Soil Erosion: Although the soils are not highly erodible (there is no significant increase in clay from subsoil to topsoil, while there are large areas with rock outcrops acting as stabilisers), this impact is potentially significant due to the topography of the area (increased speed of water from slopes) and the nature of rainfall in the area (mostly thundershowers).	N	Y	Construction, Operational, Decommissioning and Closure Phase	Site			Low	Control / Remedy	Visually inspect the terrain for signs of erosion and stability of surface run-off control structures. Usable soil for the purposes of rehabilitation will be stripped from areas to be cleared for construction and operation and stored in designated soil stockpiles. Stripped soil will be stockpiled and stored using the following conservation principles: Soil will be stockpiled by means of end-tipping to avoid compaction; Stockpile areas will have their soils stripped to conserve the seed bank; Single handling will be practiced; Stockpiles that are likely to remain unused for more than 12 months will be revegetated to manage dust and erosion and to maintain the soil's viability	To minimise and prevent degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational Phase

[5] The impacts, risks and mitigations provided in this section were extracted from the original approved EMPr (dated 2011). The approved EMPr provided for the rating of each respective risk and impact, however, there is no rating of the risks and impacts for post-mitigation.

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance					
4		Site preparation, the construction of access roads and other infrastructure. Vehicles travelling on undisturbed land compacts the soil	Soil Compaction: Structures such as the establishment of roads and the hauling of material to the plant cause compaction of soil. The process during which the integrity of the soil structure is altered from its natural state is called compaction. This change may result in reduced water holding capacity and ability of the soil to release this water to plants. It could therefore further lead to the loss of a growth medium and the plant alienation of a particular surface area	Y	N	Construction, Operational and Decommissioning Phase	Site		Low		Control / Remedy	(further principles regarding rehabilitation will be contained in the soil utilisation plan. Usable soils will be re-spread with a minimum of compaction; Land to which soil has been reapplied will be revegetated. Stockpiles and newly spread soil will be kept clear of invasive vegetation. Minimise the area to be cleared that is safe for construction and operation activities, thereby minimising the disturbed footprint and its vulnerability to erosion, pollution of storm water and dust generation. Areas to be disturbed will be cleared as close to the start of construction as possible so that bare areas are not left exposed for long periods of time. Rehabilitation will be progressive throughout the life of mine and will commence as soon as the disturbing activity has ceased. Roads to be constructed as part of the mine will be designed and built to minimise erosion. Prevent contamination of soils due to leaching of contaminants from the mine residue deposits and plant area during operation and decommissioning	To minimise and prevent degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational Phase
5		Seepage from the return water dam, the tailings dam, and waste rock dump; Earth moving equipment breakages and oil / lubricant / diesel spills may contaminate soil. Poor housekeeping at the workshops	Soil Contamination: Possible contaminants and their impacts will depend on the nature of the seepage or loss, as well as the buffering capacity of the soil. However, in severe cases there can be a sterilisation effect on the soil and a subsequent loss of land capability.	N	Y	Construction, Operational, Decommissioning and Closure Phase	Site		High		Control / Remedy		To minimise and prevent degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational Phase
6		Topsoil stripping	In the process of removing topsoil the soil layers are mixed and the structure may be disturbed.	N	Y	Construction, Operational and Decommissioning Phase	Site		Low		Control		To minimise and prevent degradation of soil	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
7	Land capability	The construction of roads and buildings. Removal of soil covering the tailings dam changes the land capability of the mining area.	Temporary loss of land capability to support grazing: The land capability on the new tailings dam will be lost. The land capability on the haul roads and plant area is also alienated until the area is rehabilitated. Prior to mining the land was used mostly as a wilderness area. After rehabilitation the land will still be able to be used as a wilderness area.	N	Y	Construction, Operational and Decommissioning Phase	Site			Moderate	Control / Remedy	Disturbed areas will be rehabilitated as soon as possible in accordance with the rehabilitation principles of the mine. Ensure the natural vegetation cover between the sections receives the highest level of protection to ensure proper plant material remains. An invasive and alien control programme must be drafted and implemented by the operation. All illegal exotic or invader plants and weeds shall be eradicated as legislatively required. Awareness program to all staff must include alien and exotic species identification (species expected on this site only) and eradication measures. Unpaved roads will be constructed and maintained using a dust suppressant. Regularly grading will take place and, if necessary, the roads will be watered to suppress dust. Establish a temporary network of dust fallout monitoring points along boundary around the tailings dam and plant areas (including waste rock dumps) to identify hotspot areas for dust impacts and use the results to establish permanent continuous monitoring stations. Monitoring of air quality. Records of dust suppression interventions.	To prevent the loss of valuable land	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
8	Land use	The current mining activities already affected the previous land use and the construction of the new shaft and waste rock dump will have an additional impact on the land use potential.	Change in land use: Land use impacts are integrally linked with soils and land capability, along with the visual and socio-economic aspects. The demarcated mining areas lost their original land use (wilderness). This plus the proposed new shaft and waste rock dump area will be alienated for agricultural purposes. The rest of the area will keep its original capability.	N	Y	Construction, Operational Phase	Local			Low	Control / Remedy		To prevent the loss of valuable land	Rehabilitation monitoring to be undertaken by suitably qualified rehabilitation specialist (in consultation with ecologist). General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational, Decommissioning and Closure Phase
9	Vegetation	The clearance of the footprint for the new waste rock dump. The footprint of the new incline shaft. All existing mine infrastructure	Vegetation clearance, disturbance and trampling: Species diversity can be negatively influenced by the fragmentation of vegetation communities. Denuded areas and invasion of invaders and exotic species may follow due to the disturbed soil. Large areas of undisturbed vegetation will remain and they should serve as reference for vegetation success and source of natural plant material and seed.	Y	Y	Construction, Operational Phase	Local			High	Control / Remedy		To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
10		Earthmoving equipment, light vehicles, loading and hauling operations are responsible for dust generation inside the boundaries of the mine. It is also generated and spread by wind.	Dust coverage of plants Most plants are known to be resistant to dust pollution, which normally washes away after a small downpour. This may become a problem during extended dry periods or when excessive dust is present.	Y	Y	Construction, Operational Phase	Local			Low	Control / Remedy		To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase
11		The removal of natural vegetation and soil disturbance due to mining activities and improper rehabilitation	Habitat change, loss of sensitive species, spread of alien and invasive species	N	Y	Construction, Operational Phase	Local			Moderate	Control / Remedy		To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase
12	Wildlife	The flora, which normally serves as habitat for animals, birds and insects will be destroyed during mining. The increase in activity will temporarily scare other animals. The area will recover after rehabilitation	Wildlife habitat destruction / change / disturbance	N	Y	Construction, Operational Phase	Local			Moderate	Control / Remedy	Re-establish trees and grass cover as soon as possible during and after mining. Where breeding nests are found and where required, the necessary demarcations must be erected. Killings etc. must be reported in the incident register. Game catching, hunting, traps, snares, poaching and any other unnecessary disturbance of animals inside the boundaries of the operation must be a disciplinary offence. Machine operators and drivers to undergo appropriate level of environmental impact training to ensure they understand their impact on the environment. Implement Environmental Awareness program	To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase
13		The movement of vehicles Snares and traps	Injury and killing of fauna	N	Y	Construction, Operational and decommissioning Phase	Site			Low	Control / Remedy		To prevent the loss of biodiversity	General implementation of activities taking Mining and Biodiversity Guidelines into account. Biodiversity and alien invasive management in accordance with NEMBA, 2004	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
14	Air quality	Any unmitigated construction or loading and hauling activity or vehicles travelling on dirt roads will generate an impact. These impacts will be aggravated by high winds.	PM 10 dust pollution: The IAP's raised this aspect and the dust outfall needs to be monitored.	N	Y	Construction, Operational and decommissioning Phase	Local		Low		Control / Remedy	Regularly grading will take place and, if necessary, the roads will be watered to suppress dust. The mine will plant trees, in consultation with a vegetation specialist, to act as windbreakers. Establish a temporary network of dust fallout monitoring points along boundary around the tailings dam and plant areas (including waste rock dumps) to identify hotspot areas for dust impacts and use the results to establish permanent continuous monitoring stations. Daily inspections of plant and equipment. Monitoring of air quality. Records of dust suppression interventions.	To reduce air quality impacts from mining and related activities.	Dust fallout monitoring (monthly) Air quality management measures in compliance with NEM: AQA.	Operational and Decommissioning Phase
15	Noise	Heavy vehicles traversing the area, compressors, ventilation fans, the crusher and the plant equipment will be the main sources of noise.	Excessive noise pollution: The mine is located in a rural environment with the nearest residences many kilometres away. Excessive noise may have an impact on the mine residences. The impact will also be of importance regarding the direct worker environment that should adhere to the requirements in terms of the Mine Health and Safety Act.	Y	N	Construction, Operational and decommissioning Phase	Local		High		Control / Remedy	The majority of construction with high noise potential will take place during daylight hours when the ambient noise level is higher, for example braking of concrete, compaction, steel works and heavy vehicle transport along the access road. Construction equipment will be maintained in good working order. Non-compliance machinery will be removed from service until repaired. All vehicle exhaust units will be maintained in good working order. Non-compliant vehicles will be removed from service until repaired.	To reduce noise impacts from mining and related activities	Noise control measures in compliance with Code SABS 0328 of 2008	Operational Phase
16	Archaeological and cultural	The mine is already developed. The new infrastructure will not affect any of the identified sensitive areas.	N/A	N/A	N/A	N/A	N/A		N/A		N/A	Although no known site will be affected by the development, the following aspects must however be considered during the life of mine: Fence off archaeological sites within the mine Notify SAHRA timeously in the event that additional sites are located during construction and operation. Allow extended archaeological investigations to be conducted if sites deemed unique are identified within the mine area and are likely to be disturbed by mining activities. Apply for necessary permits from SAHRA and implement the requirements of the National Heritage Act should any of the sites need to be destroyed or if graves need to be exhumed. Where it is necessary to exhume and re-bury bodies the mine will apply for the necessary permissions. (This will include acquisition of permits from SAHRA, national and provincial health departments, community (and next of kin) consultation, and collaboration with a forensic archaeologist if new graves are located during construction or operation). The mine will implement an education programme for construction and operational staff to ensure that they are aware of and respect the cultural significance of known sites. This requirement will be included in contractor tender documentation. If it becomes known that a site of archaeological or cultural significance within the mine area is likely to be visited, then provision for access will be made to ensure the safety of visitors and the security of the mine.	To reduce impacts from mining and related activities on cultural and archaeological artefacts	Compliance to the National Heritage Resources Act.	Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
17	Sensitive landscapes	No sensitive landscapes are present	N/A	N/A	N/A	N/A	N/A		N/A		N/A	N/A	N/A	N/A	N/A
18	Visual Impacts	The plant is pre-existing and only the tailings-dam will add to the visual impact that already exists at the site. The in-mine roads, shaft infrastructure, waste rock dump, power lines and other infrastructure in and around the operation will create a visual impact.	The visibility of the waste rock dump and plant were identified as specific problem areas by IAP's. Lights from the mine are also very visible at night time.	Y	Y	Construction, Operational and decommissioning Phase	Local		High		Control / Remedy	Consideration will be given to appropriate planting trees, in consultation with a vegetation specialist, at sensitive areas. Focused lighting will be implemented to direct light towards the mine, to reduce the impact of light pollution at night.	To control visual impacts associated with the mine	Rehabilitation in terms of MPRDA and NEMA principles. General implementation of activities taking Mining and Biodiversity Guidelines into account.	Operational and Decommissioning Phase
19	Socio Economic	Additional employees are sourced from the surrounding communities in line with objectives of the social and labour plan.	Increase in Socio – economic activity at local level. Unemployment is present within the communities. The mining and agricultural sectors employ most of the employed population. The company's Social investment programme as listed in the Social and Labour plan should assist the communities.	Y	N	Construction, Operational and decommissioning Phase	Local		Positive		Enhance	Ensure the SLP is developed and implemented. See that all contracts with employees, contractor, SMME's, farmers etc. take all these commitments into consideration. Ensure compliance with all Health and Safety requirements.	Prevent socio economic impacts by employment opportunities.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase
20	Interested and Affected Parties	Employment, procurement, services etc, impacts on the community individually and as a whole. Visual impacts, dust and noise could become a nuisance factor.	Impact of activities on I& AP's A portion of the expected expenditure for the project will go to the community. This will also bring long-term employment and financial spin-offs. Noise, traffic and dust could become a nuisance factor.	Y	N	Construction, Operational and decommissioning Phase	Local		Moderate		Control	Ensure the complaints registration process is implemented and treated at the highest level. Ensure the SLP is implemented. Make sure the community forums are implemented and functional. Ensure all the commitment made during the consultation process are implemented or adhered to. The mine will have a dedicated community liaison officer to co-ordinate communications with the surrounding interested and affected parties. The community liaison officer will: a) be sensitive to socio-economic issues; b) be experienced in community liaison; c) have good communication skills; d)	Prevent socio economic impacts by employment opportunities.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
												have conflict management and facilitation skills, e) is fluent in the local languages. The mine will participate in relevant local forums and bodies which may be established from time to time. The mine will operate in accordance with the agreed commitments in its SLP.			
21	Water resources	Pollution of surface waters from the Tailings Dam Complex	Potential contaminants are most likely to arise from the transport of tailings slurry or return water. The dirty water will be reused in the process to minimise the need for additional make-up water requirements. An additional risk is the failure of the tailings dam or return water dam, where quality is likely to be poor. Design of the tailings dam can ensure that these impacts are adequately managed.	N	Y	Construction, Operational, decommissioning and Post-closure Phase	Local to Regional		Low		Control	Storm water control measures must be implemented to divert clean water away from the site and contain contaminated water. Water control structures must be well designed and constructed to ensure a minimum down wash of topsoil. Stilling ponds, silt traps and energy dissipating structures must be used where and when necessary. The mine will maximise on opportunities to recycle water. It is intended that all process water will be recycled with no direct release to the environment. Storm water will be contained and reused up to the 1:50 year 24 hour storm event in accordance with Regulation 704. Visual inspection to identify any risk. Provision of spill cleaning kits. Training to ensure awareness of this risk and action plans for emergencies. The disturbed surface area must be rehabilitated in accordance with the rehabilitation plan to ensure normal drainage. Minimal clean water run-off should end-up in silt traps and return water dam but will become part of the ground water regime due to seepage.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
22		Ground water contamination from Tailings Dam Complex	The Bushveld Complex Aquifer is considered a non-aquifer with low transmissivities and yields. The Dam will not be placed in close proximity to any faults. Monitoring will be essential to establish whether or not significant contamination is occurring.	N	Y	Construction, Operational, decommissioning and Post-closure Phase	Local to Regional		High		Control	Ensure water management structures are designed and constructed in such a way as to allow the maximum amount of "clean" water to be diverted away from the operations and into natural drainage channels. Regular water sampling and monitoring to be done. Mine vehicles to be inspected to ensure no oil and hydraulic fluid leaks occur. All oil spills must be cleaned up immediately. All process water and return water from tailings dams should be contained and reused. All other 'dirty' water generated on site should be used preferentially to 'clean' make up water. Linear infrastructure (roads and pipelines) will be inspected on a regular basis. All surface water management infrastructure constructed from soil (berms, canals and bunds) will be inspected on a regular basis, with more frequent inspections during periods of high rainfall and after major rainfall events. All drainage facilities will be checked regularly during the rainy season and any undue erosion or siltation, especially at discharge points, will be noted	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT: Impact description	POTENTIAL IMPACT: Reversible	POTENTIAL IMPACT: Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated: Probability	SIGNIFICANCE if not mitigated: Magnitude	SIGNIFICANCE if not mitigated: Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
23		Loss of catchment, reducing availability downstream from Tailings Dam Complex	Due to the ephemeral nature of the stream, downstream water users are not solely reliant on the surface water. The impact cannot be mitigated, except by minimising the infrastructure footprints. In a stressed catchment all contributions are important.	Y	N	Construction, Operational, decommissioning and Post-closure Phase	Local to Regional			High	Control	and repaired. The mine will identify the cause of such undue erosion or siltation and suitable remedial measures will be implemented. Stormwater berms will be provided downslope of areas recently stripped of vegetation to ensure that silt-laden stormwater does not flow directly into the watercourses. Energy dissipaters, such as rock packs and logs, will be placed in footpaths where there are signs of erosion. The footpaths will be inspected on a regular basis, with more frequent inspections during periods of high rainfall and after major rainfall events. Clean water diversions and dirty water collection facilities will be established before land clearing and construction commences, to prevent clean rainfall runoff becoming contaminated by construction activities. The measures envisioned are simple soil berms to prevent clean runoff entering dirty areas and others to divert dirty water to settlement paddocks. Dirty water drains will be sized to manage the 'dirty' water generated by a 1:50 year storm arising on contaminated areas (plant, shaft, pits, tailings dam, waste rock dumps, stockpiles, stores, workshops etc). Dirty water will be directed into sumps or retention ponds, from where it can be returned to the process water circuit.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
24		Alteration to hydraulic head affecting aquifer system from Tailings Dam Complex	Water infiltration will generate a hydraulic head under the dam which will cause water to move away from the dam. The tailings dam is located some distance from any such feature and thus no such impact is foreseen here.	N	Y	Construction, Operational, decommissioning and Post-closure Phase	Regional			Low	Control	The storage facilities will have a minimum freeboard of 0.8m above full supply level. Dirty water systems will prevent water containing waste from entering water resources. The dirty water drains will be constructed of concrete or have an impermeable liner to ensure impermeability. Clean water diversion canals will be sized to divert runoff from upstream catchments around all contaminated areas. The clean runoff will be released into the natural watercourses downstream or the dirty area. Ideally, the release will be into the same catchment from which the water was diverted. Clean water diversion canals will be sized to safely divert the 1:50 year flood event. Construction material for clean water diversions will be at least compacted earth for areas with level gradients. These will be grassed to limit erosion. In steeper areas, the canals will be constructed from concrete, inert rock or other suitable material to act as erosion control and energy dissipaters. The width and height of the drains will be determined to ensure compatibility with identified hydraulic requirements of the drain. The mine will keep water systems clear of obstructions, so drains will be inspected regularly. Unless problems are encountered during these inspections, the drains will be cleaned and maintained annually, as necessary.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
25		Erosion and/or scouring from Tailings Dam Complex	If storm water runoff is not managed then erosion can occur along clean and dirty water drainage systems. Eroded material can contribute to the pollution of surface waters. Clean water diversion release points are particularly vulnerable.	Y	Y	Construction, Operational, decommissioning and Post-closure Phase	Local to Regional			High	Control	The water levels in the dirty water storage facilities will be kept low by recycling into process water circuit. This ensures the facility has enough capacity in the event of another severe rainfall event. Unused roads will be rehabilitated after construction while high traffic roads (access road) will be surfaced. Other roads still used by the mine will be maintained and any new roads will have proper engineered designs to prevent erosion. This may include contour banks, erosion control measures such as stone walls across gullies and dongas and proper stormwater diversion measures. As access roads will stretch along steep topography, road surfaces need to be properly maintained, and any runoff channelled	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring.	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
												from the surfaces via properly sized and designed culverts, to minimise erosion. Road crossings will be sized to meet the National Drainage Manual requirements. Embankments at watercourse crossings, within the flooding zone, will be protected against erosion. Where culverts are used at crossings, the culverts will have downstream erosion protection and energy dissipaters to reduce flow rates to their original velocities.		Water management measures in compliance with NWA, 1998 and GN 704, 1999	
26		Changes to watercourses due to Tailings Dam Complex	Drainage lines in the area of the tailings dam will be affected and thus constitutes a Section 21 water use. Only real significance relates to loss of catchment, as discussed earlier.	Y	Y	Construction, Operational, decommissioning and Post-closure Phase	Local to Regional		High		Control	Mine residue deposits, water storage facilities and plant infrastructure will be located above the 1:100 year floodline or at least 100 m from a watercourse, whichever is the greater. The mine will not conduct any mining within the 1:50 year flood line or 100m of a watercourse, whichever is the greater. All mine residue deposits will be designed and operated in accordance with the requirements of SABS 0286:1998 and the Mandatory Code of Practice for the Operation of Mine Residue Deposits. The tailings pipeline will be designed to minimise the risk to soils and watercourses along the pipeline route Existing and proposed mine residue deposits and water storage facilities will be designed and constructed under the supervision of appropriately qualified professional engineers. All mine deposits and water storage facilities will be maintained in a stable state and comply with relevant legislation. The return water dams will be sized to accept seepage from the under drainage systems and decant systems for up to the 1:50 year rainfall event, over and above normal operating conditions.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
27		Pollution of surface waters from the tailings pipelines	Potential contaminants Pollution only likely to arise from spills/leaks associated with poor housekeeping and incorrect management of pipeline bursts.	N	Y	Construction, Operational and decommissioning Phase	Local to regional		Low		Control	Spillways will be constructed in all mine residue return water dams and mine water storage facilities to ensure safe overflow of runoff arising from storm with a recurrence interval greater than 1:50. The mine will not locate any sanitary convenience (sewage works), fuel depot or storage facility for anything which may cause pollution within the 1:50 year flood line of a watercourse. All spillages within the reagent storage and makeup areas will be retained by the construction of bund walls. The bund will be capable of containing the bulk reagents independently and the bund wall will be lined/treated to ensure that the reagents do not affect the integrity of the bund wall (e.g. acid proofing). Spillages within the bund can then be cleaned up and disposed of appropriately. Spillages within the make-up areas will be pumped to the process water system. The ore stockpiles will be kept on concrete or other impermeable hard-standing, to prevent entry of pollutants into soils and groundwater and, through recharge, into surface water.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance					
28		Ground water contamination from the tailings pipelines	Potential contaminants Pollution only likely to arise from spills/leaks associated with poor housekeeping and incorrect management of pipeline bursts.	N	Y	Construction, Operational and decommissioning Phase	Regional		Low		Control	Oil/fuel storage facilities will be adequately bunded (110%), with no outlets to external drainage systems. Oil/fuel filling points will be located within the bund wall. Spilt or leaked oil will be contained and either reused or disposed of by a suitably qualified waste oil contractor. Workshop areas where oil/fuel spills can occur, will be located within a fully contained catchment area. All drainage from the area will report to an oil/silt separator. 'Treated' drainage will then report to the 'dirty' water system for reuse/recycling. Waste oil collected in the separator must be disposed of by a suitably qualified waste oil contractor. The mine will develop a monitoring programme that defines: a) the objectives of the monitoring exercise; b) the water quality compliance criteria, guidelines or targets to be used as a basis for assessing quality and fitness for use; c) the sampling points to be used; d) the collection method for samples; e) sample storage/preservation procedures; f) constituents to be analysed for; g) quality control procedures for analyses; h) reporting and data storage format. Surface and ground water monitoring sampling points will be sited to ensure that adequate baseline information can be collected, both upstream/ upgradient of the mine. During operation, the monitoring points will ensure information is collected to enable the mine to determine its potential impacts to surround water users and to identify problems before they occur, if possible. To ensure consistency in monitoring, a sampling protocol will be prepared and adhered to. This will detail: a) where samples will be taken; b) the frequency of sampling; c) how samples will be taken; d) how flows will be measured at the time of sampling; e) the preparation of samples for analysis; f) the range of analysis required; g) the method of analysis; h) quality control on all aspects of the monitoring programme; i) how results will be interpreted, stored and reported. The people taking the samples, the laboratory carrying out the analysis and the people assessing the results will be kept informed of changes to the sampling protocol. An accredited laboratory, with the necessary quality assurance, will carry out analysis of key samples and will have quality control measures in place (blanks, standards, duplicates, cation-anion balances etc). This will ensure consistency in monitoring and the verification and validation of water quality data. Should contamination (concentrations exceeding guideline values) be detected, the mine will immediately notify the Regional Director of DWS. The mine will then: a) identify the source of the contamination; b) identify, and if necessary implement, measures for the prevention of this contamination (short and long term); c) determine, and if necessary implement, any remediation measures. Data from water quality monitoring and flow monitoring will be stored together electronically to enable trend analysis and waste load calculations to be carried out. Monitoring of the water quality in the mine workings will take place until it can be demonstrated that the potential for contamination of the regional aquifer by poor quality leachate is low.	To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
29		Erosion and/or scouring at the tailings pipelines	If storm water runoff is not managed then erosion can occur along linear infrastructure. Eroded material can contribute to pollution of surface waters.	Y	Y	Construction, Operational and decommissioning Phase	Local to regional		Low		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
30		Changes to watercourses from the tailings pipelines	Pipeline crossing constitutes a Section 21 water use. Inadequate design can lead to flooding of mine or other infrastructure.	N	Y	Construction, Operational and decommissioning Phase	Local		Low		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring.	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
														Water management measures in compliance with NWA, 1998 and GN 704, 1999	
31		Pollution of surface waters from the Waste Rock Dump	Potential contaminants Acid Rock Drainage (ARD) tests indicate non-acid generating, low heavy metal mobilisation potential and low salt concentrations. Rehabilitation of the dump will help minimise rainfall infiltration and assist in getting water off the dump as quickly as possible, with less chance of picking up contaminants.	N	Y	Construction, Operational and decommissioning Phase	Local to regional		Low		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
32		Ground water contamination from the Waste Rock Dump	Underlying aquifer is considered a non-aquifer, with low transmissivites and yields. Rehabilitation of the dump will help minimise rainfall infiltration and assist in getting water of the dump as quickly as possible, with less chance of picking up contaminants.	N	Y	Construction, Operational, decommissioning and Post-closure Phase	Local to regional		High		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
33		Loss of catchment reducing availability downstream	Leads to a loss in MAR. Rehabilitation of the dump post-closure could enable some runoff to be considered "clean" hence reducing the loss of catchment postclosure. This would need to be confirmed by adequate surface water monitoring.	N	Y	Construction, Operational, decommissioning and Post-closure Phase	Regional		High		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase
34		Erosion and/or scouring at the Waste Rock Dump	If the storm water runoff is not managed then erosion can occur along clean and dirty water drainage systems. Eroded material can contribute to pollution of surface waters. Post closure maintenance will be required until the dump and associated storm water drains are considered stable and safe.	Y	Y	Construction, Operational, decommissioning and Post-closure Phase	Regional		High		Control		To conserve the surface water and groundwater resource and prevent impact on downstream water users.	Surface water and groundwater monitoring quality monitoring. Compliance with DWS's Best Practice Guideline Series in terms of integrated water and waste management and monitoring. Water management measures in compliance with NWA, 1998 and GN 704, 1999	Construction, Operational and Decommissioning Phase

15.3 Impacts and risks associated with the Millsell - Waterkloof EMPR, 2010

The following information was obtained from the approved *Environmental Management Programme Report for Samancor Chrome Limited (Western Chrome Mines): Millsell - Waterkloof Section on various portions of the farm Waterkloof 305 JQ, North West Province,* dated 2010 and compiled by M2 Environmental Connections cc (Shangoni, 2021).

Table 90: Impacts and Risks identified including mitigation/management measures included in the Millsell - Waterkloof EMPR, 2010 (Shangoni, 2021)

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT			PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated			MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated			STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
			Impact description	Reversible	Irreplaceable loss			Probability	Magnitude	Significance			Probability	Magnitude	Significance			
1	Geology	Underground mining	<u>Altering of geology</u> By the nature of mining projects the geology is exploited for the target minerals therefore the impact on the geology as a whole is high and this cannot be mitigated. In this project the chrome ore in the middle group series is the target mineral. Any other minerals that occur in the exploited middle group series could be negatively affected.	N	Y	Operational	Site		High		Control	Care will be taken that no unnecessary ore is mined. Ensure that mining is limited to the target mineral only. Ensure that mining is conducted within the approved Mining Right boundary area only		High		To minimise the destruction of the geological strata and to prevent the unnecessary loss of geology	In compliance with the Mining Rights issued in terms of the MPRDA (2002) and the EMPr.	Operational Phase
2	Topography	Underground mining	<u>Surface subsidence</u> There will be no surface subsidence above the underground workings. Support will be provided in the underground workings to ensure this.	Y	N	Operational and Decommissioning Phase	Site		High		Control	Adequate support will be provided in the underground workings to ensure that there is no subsidence above these workings. A professional rock engineer will design pillar dimensions for underground support to ensure no subsidence above the workings occurs. The mine will monitor subsidence. If subsidence is detected, the mine will immediately identify the cause and then implement appropriate measures to prevent further subsidence.		Low		To minimise impacts on topography	In compliance with the Mining Rights issued in terms of the MPRDA (2002) and the EMPr.	Decommissioning phase
3	Groundwater	Underground mining	<u>Progressive development of underground mine and extraction of ore</u> During the operational phase and for a long time after closure the mine acts as a groundwater sink. Groundwater will thus flow radially inwards towards the mine and the natural groundwater flow direction will be increased, decreased, altered or reversed, depending on the position in the depression cone.	N	Y	Operational phase	Local		Medium		Control	Drilling and monitoring of boreholes for groundwater level and quality aspects will be undertaken to quantify impacts from all potential sources and to verify the predicted impacts on the groundwater.		Medium		To prevent groundwater pollution	Groundwater monitoring (quarterly) Water management measures in compliance with NWA, 1998 and GN 704, 1999.	Operational and Decommissioning Phase
4	Socio-economic	Continuation of mining	Job creation plays a major role in increasing the economic well being of employees and their dependants. The mining of the additional mining area will result in increased job security.	N	N	Operational Phase	Region		Positive		Enhance	Enhancement of positive impact.		Positive		Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

NO.	ASPECTS AFFECTED	ACTIVITY whether listed or not listed	POTENTIAL IMPACT Impact description	Reversible	Irreplaceable loss	PHASE in which impact is anticipated	SIZE AND SCALE of disturbance	SIGNIFICANCE if not mitigated Probability	Magnitude	Significance	MITIGATION TYPE (modify, remedy, control, or stop) through e.g. noise control measures)	MITIGATION MEASURES	SIGNIFICANCE If mitigated Probability	Magnitude	Significance	STANDARD TO BE ACHIEVED	COMPLIANCE WITH STANDARDS	TIME PERIOD FOR IMPLEMENTATION
5		Planned and premature closure	Both premature and planned closure of the project could have serious impacts on local communities reliant on the project however; there are a number of other mines in the area that provide a source of income to the communities in the vicinity of the project.	N	Y	Closure phase	Region	High			Control	Promotion of diversification in the local communities by investment in small and medium enterprises, through advice and encouragement for employees on how to take responsibility of their futures in their own hands, and appropriate rehabilitation of the project site to enable the grazing potential of the land to be exploited post closure of the project. Where feasible, relocate employees.	Low - medium			Prevent socio economic impacts.	Implementation of approved Social and Labour Plan.	Operational and Decommissioning Phase

15.4 Impacts and risks associated with the UG1 opencast project

Impacts and risks identified and the during the impact assessment phase significance thereof are shown in tables Table 101 and Table 103. The sections below provide modelling results and a summary of the impacts to be expected.

15.4.1 Soils

The proposed development will result in the stripping of topsoil for the opencast mining and where access routes to the existing project area need expanding and alterations to the existing land uses. The changes in the land use will be from agricultural to mining activities development (or transformed). The proposed activities will impact on areas expected to be of high agricultural production (in some areas), with some aspects affecting “High” sensitivity areas. It is possible that suitable agricultural land could become fragmented, resulting in these portions no longer being deemed feasible to farm in the future (TBC1, 2022).

During the construction phase, topsoil often will be cleared, stripped and stockpiled. Access roads will be created with trenches being dug for the installation of relevant cables. The erection of transmission lines where relevant to the current existing lines will occur. Contractor and laydown yards will also be cleared with construction material being transported to laydown yards. Potential erosion is expected during the construction phase due to some erodible soils within the footprint assessment area, such as the hydromorphic soil forms. The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. Erosion of the area could result in further loss of topsoil, and soil forms suitable for agriculture and these soils with deposit in downslope areas such as the local watercourses, negatively affecting these ecologically sensitive ecosystems. Soil compaction can also result due to increased traffic on site along the proposed project area (TBC1,2022).

During the operational phase, limited impacts are foreseen. Only the footprint area will be disturbed, this will minimise soil and vegetation disturbance of the surrounding area. Revegetation will be carried out on exposed surrounding areas to avoid surface erosion. Maintenance of vegetation, infrastructure maintenance will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour. (TBC1, 2022).

The operational phase of the UG1 Opencast mining project (Constructed Infrastructure) includes anthropogenic movement and activities. The relevant infrastructure will be maintained by professionals throughout the lifetime of the operation. Besides compaction and erosion caused by increased traffic and surface water run-off for the area, few aspects are expected to be associated with this phase. The spread of alien invasive species will be a risk, predominantly adjacent to developed aeras (edge effect (TBC1, 2022).

15.4.2 Biodiversity

Although the project area still contains natural vegetation, it has been either transformed or degraded from its historical natural state. A look at the surrounding vegetation that is in close proximity to the proposed opencast mining development indicates that the project area and its surroundings have been severely degraded in their entirety. The area therefore has no particularly high botanical/conservation value (TBC2, 2022).

Although not completely transformed, ecological processes on the project areas have been significantly impacted by livestock trampling, rock dumping, pollution, invasion of alien invasive plants and weeds and habitat fragmentation. Many of these impacts are associated with the establishment of mining activities (TBC2, 2022).

15.4.3 Surface Water

Impacts associated with surface water include siltation of surface water resource – transportation of disturbed soils and contamination of surface water resources.

It is recommended that formal storm water structures are constructed. The containment of the run-off from the stockpiles and the diversion of clean run-off away from the operations and dirty run-off from the haul roads and RoM are proposed (HEES1, 2023).

It is proposed that toe paddocks be constructed at the topsoil and overburden stockpiles. These paddocks will contain all run-off (water and sediment) from the stockpile and evaporation will ensure that the sediment is contained in the paddocks. The sediment accumulation must be monitored and removed as required (HEES1, 2023).

Dirty run-off from the haul roads and ROM stockpile needs to be diverted by dirty-water trenches towards the PCD (HEES1, 2023).

The proposed project area and storm water layout is shown in Figure 69. This layout will allow for the diversion of clean water away from the project area and the protection of the resource and environment. Details of the paddocks, dirty water diversion channels and clean water diversion channels are shown in Figure 70, Figure 71 and Figure 72 respectively (HEES1, 2023).

Figure 69: Proposed stormwater infrastructure layout (HEES3, 2022)

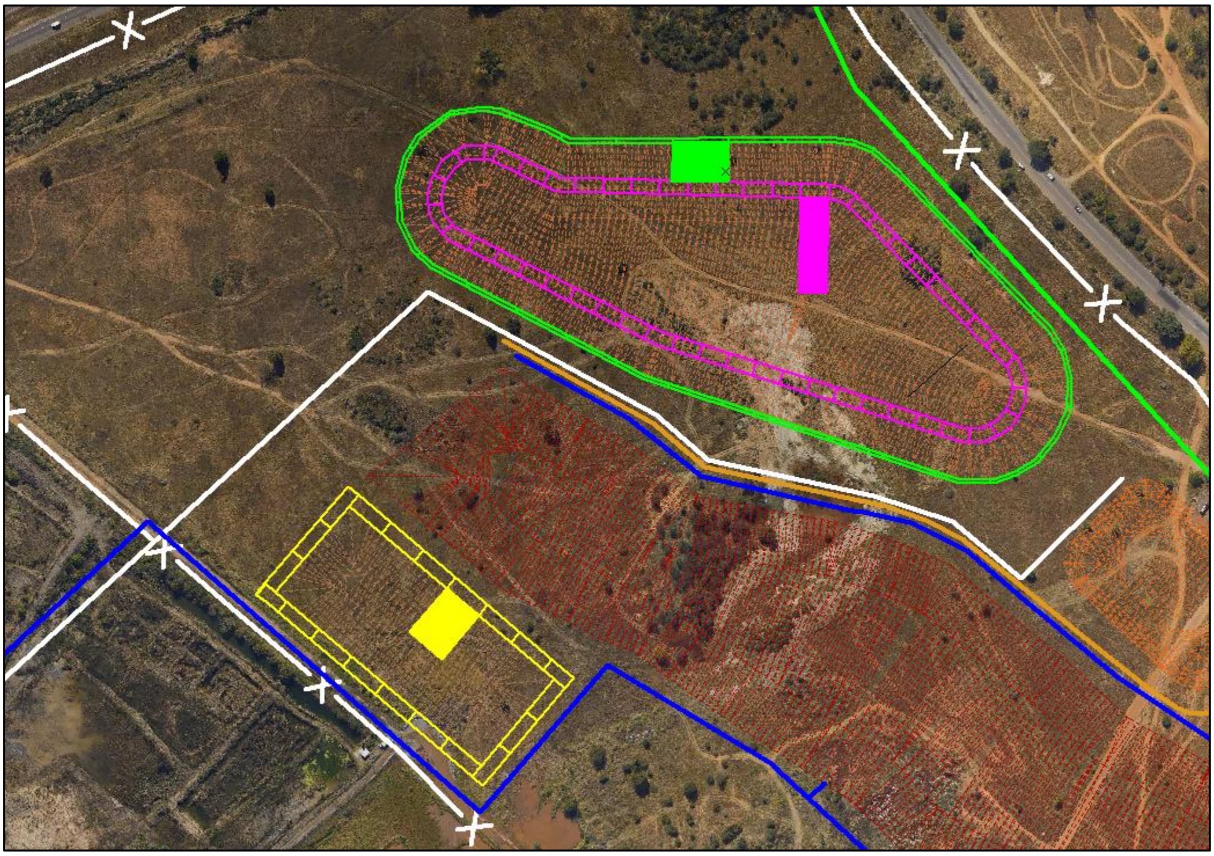

Figure 70: Paddocks catchment areas and locations (HEES3, 2022)

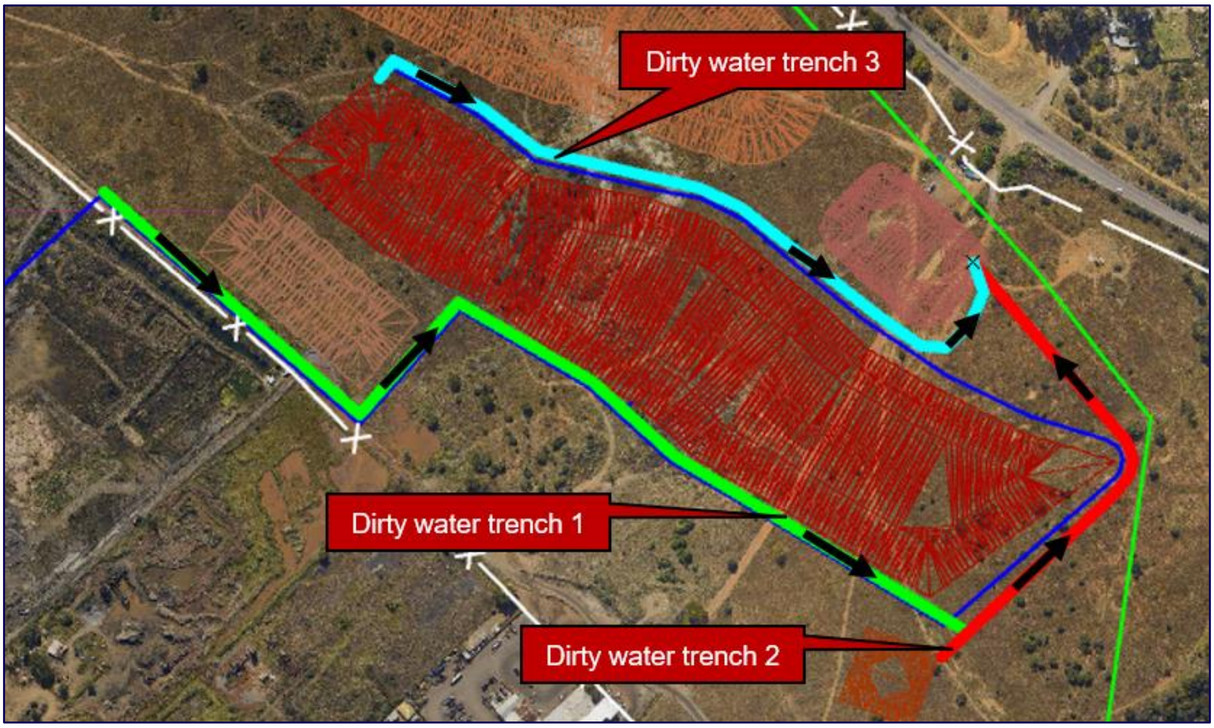

Figure 71: Locality for the dirty water diversion trenches (HEES3, 2022)

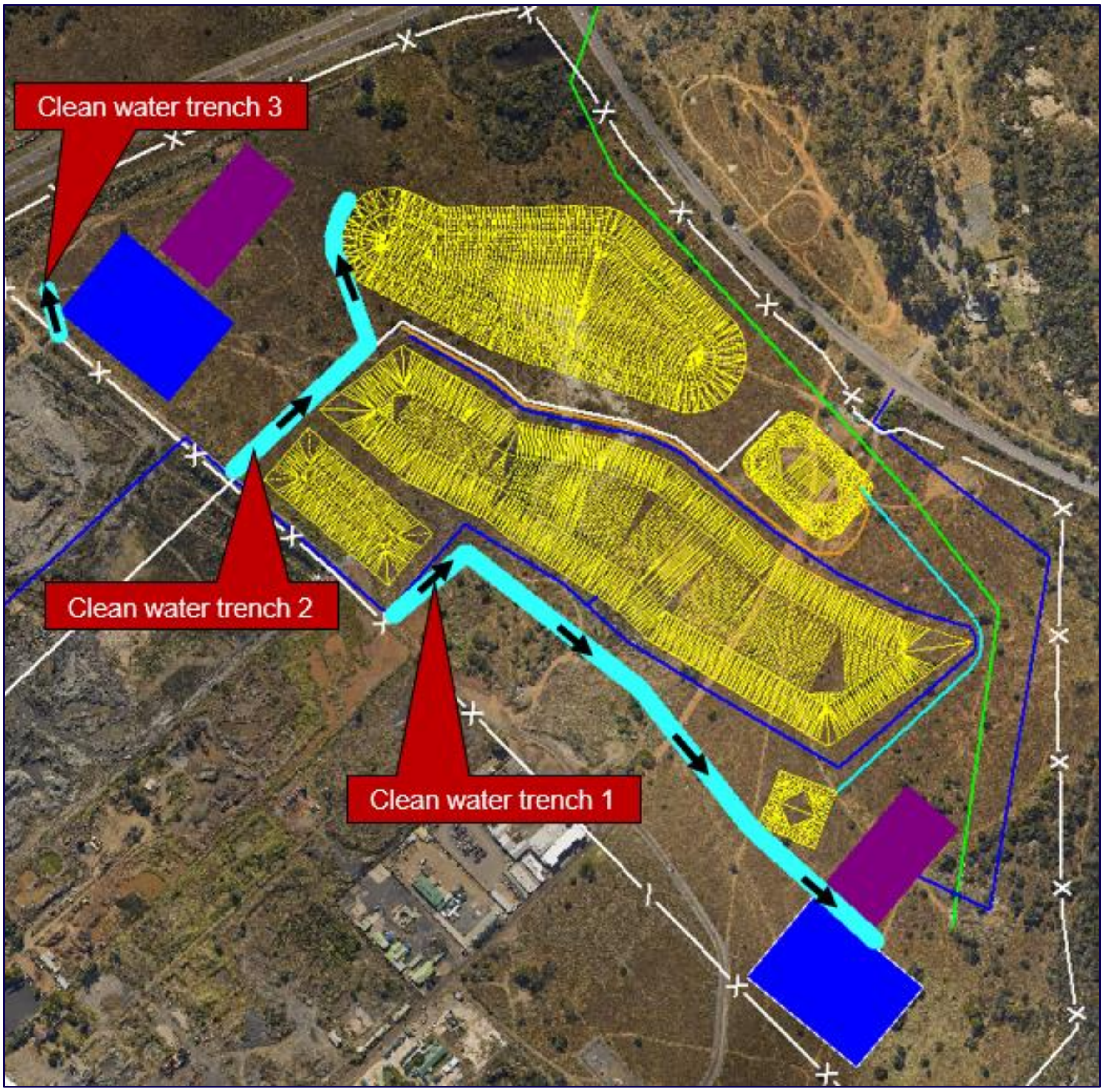

Figure 72: Locality for the clean water diversion trenches (HEES3, 2022)

15.4.4 Wetlands

The proposed project is associated with mining activities, namely the opencast mining of the areas identified in this report. Although much of the proposed PAOI has been disturbed by local mining and other accompanying anthropogenic activities, the proposed activities will nonetheless pose some level of impact to the local water resources. It is apparent from the proposed layout that no direct impacts to natural resources are expected, with indirect impacts being considered for the impact assessment. The impact assessment for the respective phases determined the highest risk to the delineated resources is associated with the potential environmental pollution due to contamination, increased sedimentation and erosion of watercourses. The pre-mitigation impact significance was determined to be medium, but the residual impact significance is expected to be low. The impact significance of the remaining aspects was determined to be low, with the significance being further reduced with the prescribed mitigation measures. The overall low residual impact significance may be attributed to the already disturbed state of the area, and the potential to contain and isolate surface disturbances (TBC3, 2022).

15.4.5 Groundwater

Construction phase

During construction an initial cut or boxcut will be opened between the western and eastern open pit mine sections. The construction phase will be 2 months in duration. Groundwater inflow into the boxcut will initially be low, however, this could increase over the construction period to a peak volume of 480 to 750 m^3/d (Geostratum, 2023).

A groundwater dewatering cone will develop around the boxcut due to mine dewatering during construction activities. Figure 73 shows the simulated extent of the drawdown cone at the end of the construction phase. The extent of the drawdown cone in the construction phase is small and site specific, with no impact expected on surrounding groundwater users or environmental receptors (Geostratum , 2023).

A groundwater dewatering cone will develop around the boxcut due to mine dewatering during construction activities. The extent of the drawdown cone in the construction phase is small and site specific, with no impact expected on surrounding groundwater users or environmental receptors (Geostratum , 2023).

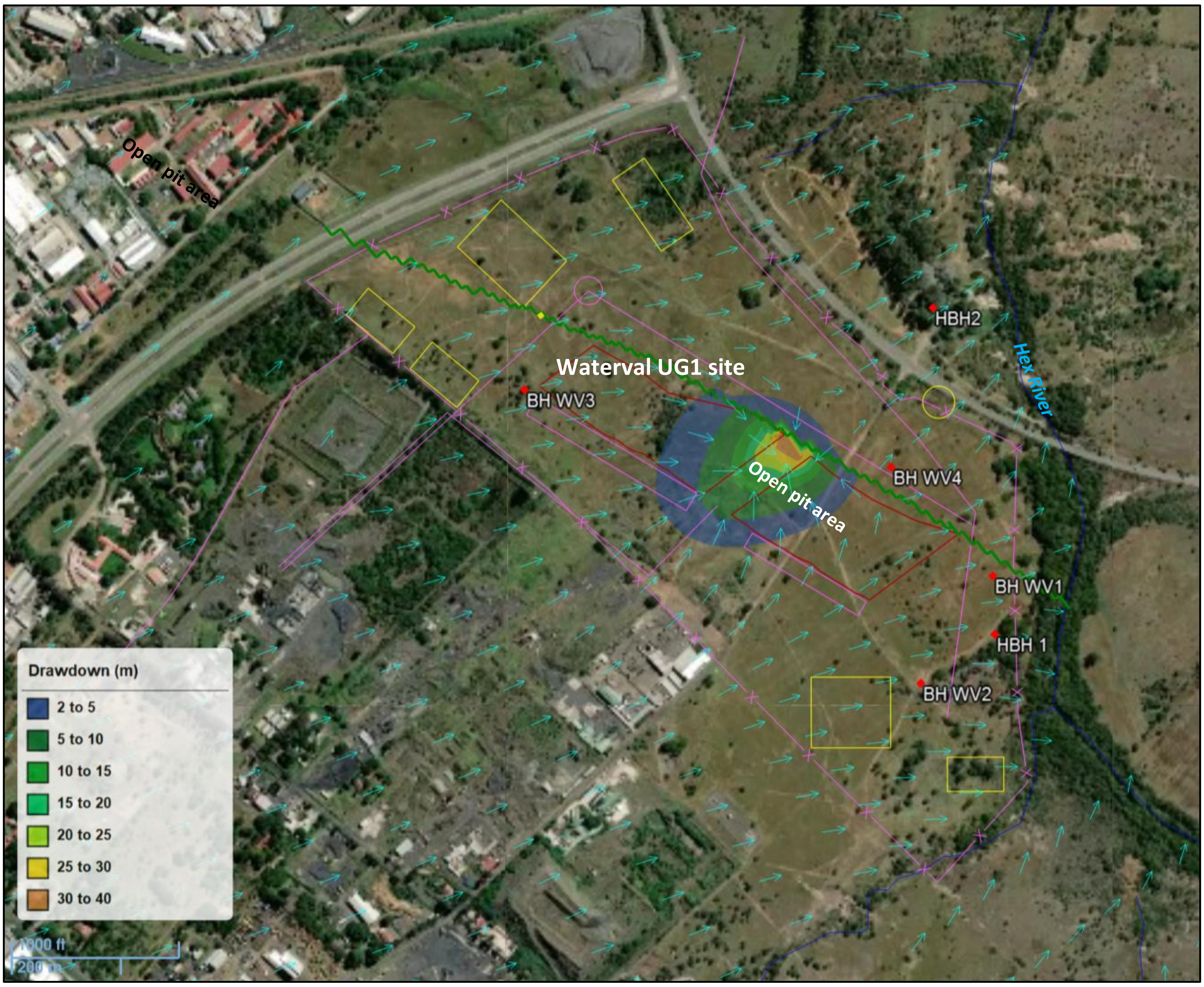

Figure 73: Simulated groundwater drawdown cone at the end of construction activities (Geostratum, 2023)

Operational phase

Groundwater abstraction associated with mine dewatering was simulated over the life-of-mine. The groundwater abstraction and inflow were simulated using drain cells, representing the open pit seepage face. The seepage face inside the open pit correlates with the UG1 footwall elevations (Geostratum , 2023).

Initial groundwater high inflows could occur due the initial drainage of aquifer storage in the construction phase. Groundwater inflows are likely to be around 550 m^3/d (≈500 to 700 m^3/d) during early operational stages. The inflow rate would increase, peaking around month 28 at 850 m^3/d (≈700 to 1000 m^3/d). A slight decrease in groundwater inflow could be expected towards the end of mine operations as the aquifer storage is depleted (Geostratum, 2023).

Basic model sensitivity calculations indicates that the open pit groundwater inflow is most sensitive to the hydraulic conductivity of model layers 1 and 2 (weathered aquifer unit). The simulated open pit inflow volumes are generally much more sensitive to hydraulic conductivity compared to equivalent changes in aquifer recharge and specific yield (Geostratum, 2023).

A groundwater dewatering cone or a zone of groundwater drawdown will develop around the open pit due to mine dewatering. The drawdown cone will enlarge as mining proceeds and will extend up to 400m from the pit perimeter at the end of mining. The simulated groundwater drawdown cone at the end of the life-of-mine is shown in Figure 74 (Geostratum, 2023).

The likely drawdown zone will include borehole HBH2 from month 16 onwards with the maximum simulated groundwater level not exceeding 2.5m. It was estimated from the hydrocensus that the borehole, used at the Shingwezi Club and Carwash, is abstracted at about 5 m^3/d. This abstraction rate is very low, and it is unlikely that this borehole would be impacted in terms the current usage. The borehole should be monitored as part of the proposed monitoring programme for the Waterval UG1 project (Geostratum, 2023).

Mine dewatering could also reduce the groundwater baseflow availability for river flow. The simulated reduction in groundwater flow into the river cells (Hex River) towards the end of the operational period is 100 to 120 m^3/d (≈1.2 to 1.4 l/s). The potential impact is likely to be insignificant during the rainy season but notable during the dry season (Geostratum, 2023).

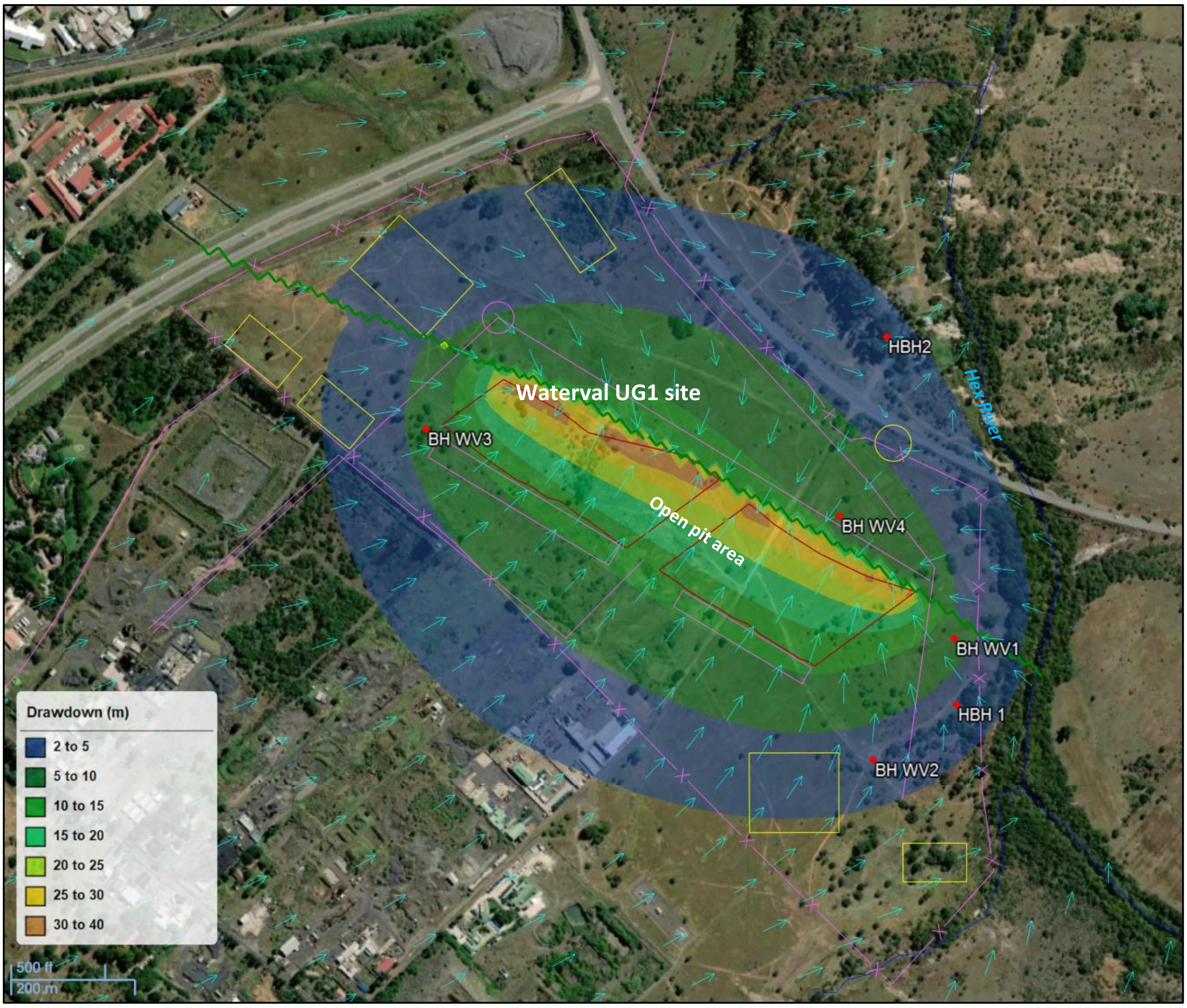

Figure 74: Simulated groundwater drawdown cone at the end of mining operations (Geostratum, 2023)

The monitored groundwater nitrate concentration (as N) is ranging between 0.5 and 15.5 mg/l. Most boreholes have nitrate concentration around 2 to 5 mg/l, with BH WV1 and BH WV2 having concentrations of 15.5 and 9.23 mg/l, respectively. The higher nitrate concentrations near the Hex River could be due to existing and historical anthropic activities (Geostratum, 2023).

Mine waste (overburden) and ore are not likely to produce acid drainage or significant leachable constituents of concern. Nitrate (NO_3) concentrations for similar mining environments are, however, often elevated above background water concentrations due to ammonium nitrate (or other nitrogen compound) explosives used in the mining process. The nitrate concentration in mine water is often impacted by dilution from groundwater and surface water inflow, frequency of blasts and type of explosives used. Underground mine water for this reason often has a higher nitrate concentration compared to shallow open pits such as Waterval UG1 (Geostratum, 2023).

The nitrate leachate concentration from unaltered overburden material and ore are low (<10 mg/l), however, the use of explosives during mining will likely increase the leachate concentration values. Monitoring data from similar mines suggest anything from 5 to 40 mg/l (NO_3 as N). The most likely concentration would be below 25 mg/l. (Geostratum, 2023).

Potential groundwater plumes for nitrate (or any other contaminant) were simulated for the overburden and ore stockpile areas for the operational phase. The simulated groundwater plumes at the end of the life of mine is shown in Figure 75 for different infiltration rates and depths (layer 1 and layer 2). The plume concentrations contours are presented as a percentage (%) of the source concentration due to the unknown concentration of the source leachate (Geostratum, 2023).

The potential impact is site specific and of low magnitude. The impact on groundwater quality is less than 10 % of the source concentration. Leachate from the overburden stockpiles will seep into the open pit and would therefore not migrate further than the proposed open pit. The likely increase in groundwater nitrate concentration would be less than 2 mg/l or 1 mg/l (as N) assuming 25 and 10 mg/l sources, respectively. The overall impact is seen as insignificant to small (Geostratum, 2023).

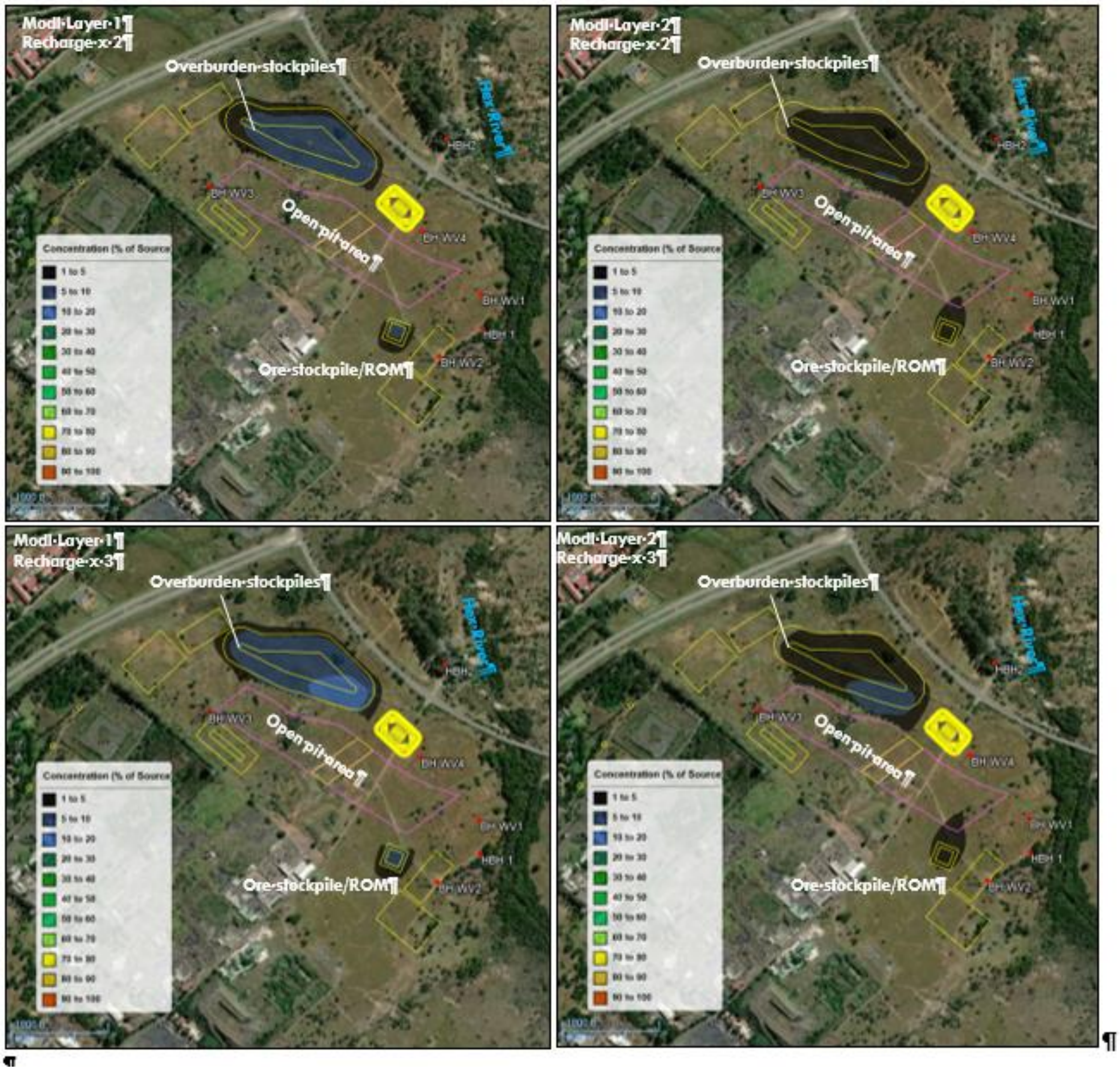

Figure 75 Potential groundwater contamination from overburden and ore stockpile areas (as a % of the source concentration) (Geostratum, 2023)

Post closure

The Waterval UG1 project allows for backfilling of overburden and topsoil as part of the rehabilitation process. It was estimated from the numerical model simulations that post-mining groundwater inflow will saturate the backfilled overburden, reaching a steady state pit water level in less than 10 years (post-mining) at about 1127.5 mamsl (Geostratum, 2023).

There exists a risk that surface decant may occur from the backfilled pit at the north-eastern corner of the pit (Figure 76), depending on the final rehabilitation plan. The calculated decant rate is in the order of 60 m^3/d or about 0.7 l/s (Geostratum, 2023).

It is advisable to re-assess the decant potential before mine closure. Decant water could be channelled to the Hex River, depending on the quality (Geostratum, 2023).

The nitrate concentration in the saturated backfilled overburden could potentially pose a water quality risk to the surrounding aquifer, assuming that the overburden material still contains nitrate salt residue from the operational blasting. The long-term groundwater contaminant plume was simulated from the saturated open pit, based on a constant contaminant source, with contours indicating the relative quality as a percentage (%) of the source quality (Figure 76) (Geostratum, 2023).

The contaminant simulations suggests that the potential contaminant plume could impact borehole HBH2 and even reach the Hex River. Borehole HBH2 is about 340 m downgradient of the proposed open pit high wall. The groundwater plume could reach the borehole from year 10 onwards (post-mining) (Geostratum, 2023).

The long-term prediction suggests that the borehole could be impacted by up to 60 % of the source concentration in year 50 (post-mining). For example, the groundwater plume concentration at the borehole could reach about 32 mg/l (as N) (plume plus current background concentration) if the nitrate source concentration from the open pit is 25 mg/l (as N). The SANS 241 Drinking Water Standard suggests a nitrate concentration ≤ 11 mg/l (NO_3 as N) to avoid potential health risks, while the SAWQG Domestic Water Use ideal values are ≤ 6 mg/l (NO_3 as N). Although the current nitrate concentration at HBH2 (17 mg/l) already exceeds the drinking quality standards, the risk of further elevating the nitrate concentration exists in the long-term (Geostratum, 2023).

The contaminant plume may also impact on the Hex River water quality from year 10 onwards (post-mining) with a simulated long-term groundwater quality of about 10 to 55 % of the source quality next to the Hex River (Figure 76) (Geostratum, 2023).

Water quality data presented for the Hex River in the vicinity of the project site suggests that river water is impacted by mining and other human activities. Data from 2006 indicated an average nitrate concentration (as N) of 23 mg/l (June 2005 to June 2006). Information of the Department of Water Affairs gave a water concentration of 13.6 mg/l next to the site (WMS A22_189436) for nitrate and nitrite (as N) during September 2006. Time series nitrate and nitrite (as N) concentrations for the Hex River at the monitoring point WMS A22_184805, downstream at Tekwane. The mean concentration over the monitoring period was 10.1 mg/l and the maximum 41.8 mg/l. The nitrate and nitrite concentration in general was higher during the dry season compared to the wet season (Geostratum, 2023).

If the long-term source concentration from the open pit is 25 mg/l (NO_3 as N), then the nitrate salt load (as N) would be 0.7 to 0.9 kg/d. The quality of groundwater entering the river could be about 10 to 15 mg/l, which is in the same order as the current river water quality. It is advisable to undertake an integrated salt balance over the area to further investigate the nitrate contamination risk to the Hex River. Monitoring of the river water should furthermore take place to obtain up to date and accurate water quality data of the Hex River next to the proposed mining site (Geostratum, 2023).

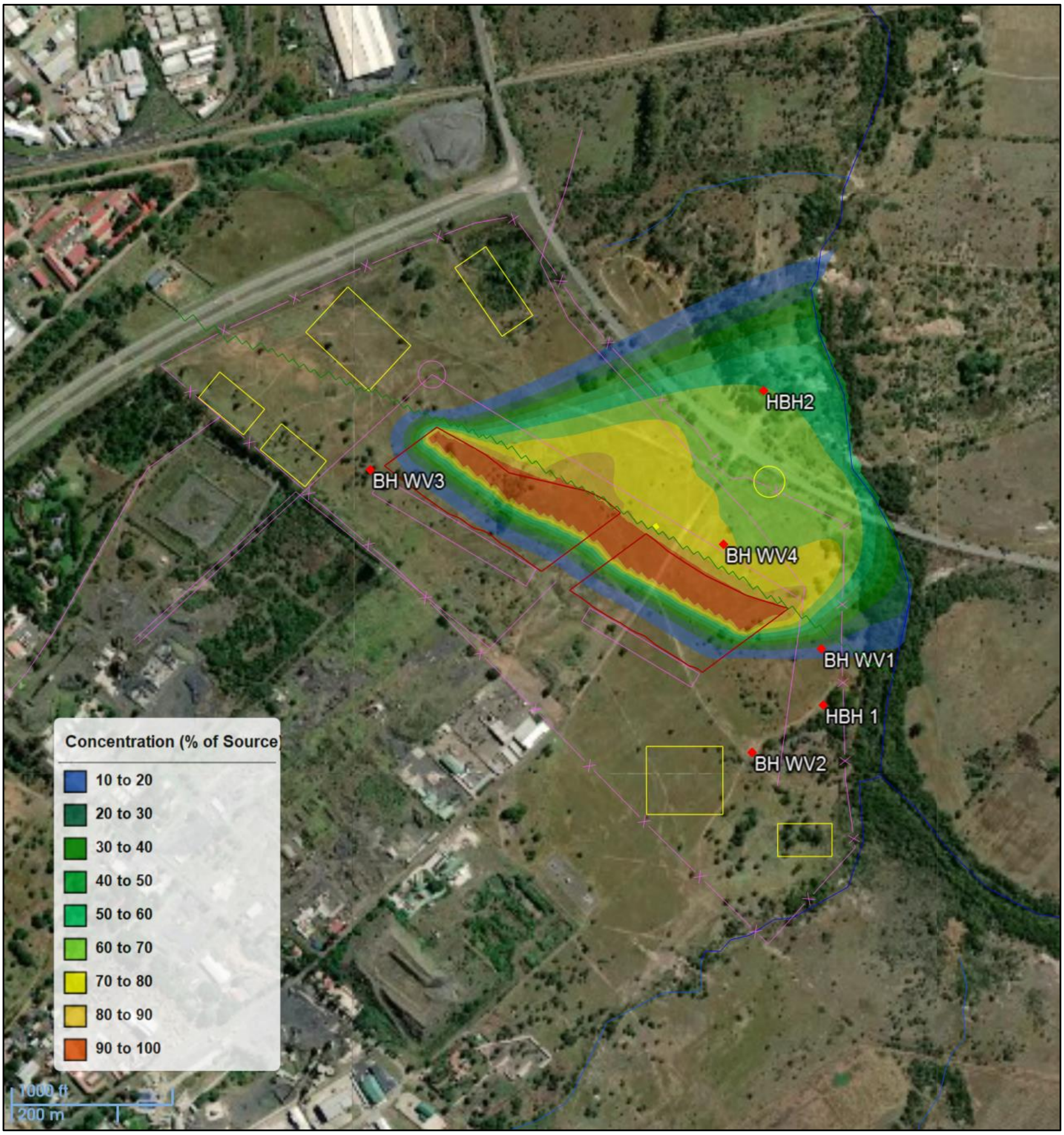

Figure 76: Simulated long-term contaminant plume (as a % of the source quality), with a contaminant source as part of the overburden backfill material (weathered aquifer unit) (Geostratum, 2023)

15.4.6 Air Quality

The total emission of TSP from the proposed activities is estimated to be 137.7 tonnes per annum (Table 91). The total PM_{10} and $PM_{2.5}$ emission is 42.2 and 8.2 tonnes per annum respectively (uMoya, 2022).

Unpaved haul roads are expected to be the largest source of TSP, PM_{10} and $PM_{2.5}$ at the Waterval UG1 Opencast Area, followed by the opencast pit and then the stockpiles (Table 91). With respect to the stockpiles, emissions are directly proportional to their size, with the highest emissions generated at the overburden stockpile, followed by the topsoil stockpile and then the RoM stockpile (uMoya, 2022).

Table 91: Particulate emissions in tonnes per annum for the proposed UG1 opencast project (uMoya, 2022)

Operation	TSP	PM_{10}	$PM_{2.5}$
	tpa	tpa	tpa
Opencast Pit			
Overburden Removal	17.12	3.30	1.80
Boring/Blast Hole Drilling	1.13	0.60	0.60
Blasting	1.89	0.98	0.06
Subtotal	**20.14**	**4.88**	**2.45**
ROM Stockpile			
Material Handling	0.01	0.003	0.0004
Wind Erosion	0.74	0.37	0.15
Subtotal	**0.74**	**0.37**	**0.15**
Topsoil Stockpile			
Material Handling	0.03	0.01	0.002
Wind Erosion	2.21	1.10	0.44
Subtotal	**2.24**	**1.12**	**0.44**
Overburden Stockpile			
Material Handling	0.22	0.11	0.02
Wind Erosion	10.90	5.45	2.18
Subtotal	**11.12**	**5.55**	**2.20**
Unpaved Haul Roads			
Opencast Pit to Process Plant	76.06	21.68	2.17
Opencast Pit to ROM	1.81	0.52	0.05
Opencast Pit to Topsoil Stockpile	5.57	1.59	0.16
Opencast Pit to Overburden Stockpile	16.17	4.61	0.46
Grading	3.81	1.88	0.12
Subtotal	**103.42**	**30.28**	**2.96**
TOTAL EMISSIONS	**137.66**	**42.20**	**8.19**

The maximum predicted PM_{10} and $PM_{2.5}$ concentrations and the maximum predicted TSP deposition resulting from emissions from mining and haul roads at the proposed UG1 Opencast Area is presented in Table 92. The PM_{10} and $PM_{2.5}$ predicted annual average and the 99th percentile of the predicted 24-hour concentrations as well as the TSP deposition are also presented as isopleth maps. Isopleth maps show lines of equal concentration of the pollutant of concern (uMoya, 2022).

Table 92: Maximum predicted PM_{10} and $PM_{2.5}$ concentrations in µg/m^3 and maximum dustfallout in mg/m^2/day (uMoya, 2022)

	Operational Phase		
Parameter	**Exposure period**	**Concentration**	**Limit Value**
PM_{10}	Annual	73.9	40
	24-hour	167	75
$PM_{2.5}$	Annual	15.2	20
	24-hour	35.3	40
	Exposure period	**Dust Fallout**	**Limit Value**
Dust fallout	30-day	185	Residential D < 600 Non-residential 600 < D < 1 200

Predicted PM_{10} concentrations

The predicted annual PM_{10} concentrations resulting from emissions from mining and haul roads at the proposed Waterval UG1 Opencast Area are shown in Figure 77 The emissions from haul roads strongly influence the dispersion pattern with the highest concentrations in the vicinity of the roads (uMoya, 2022).

The highest predicted concentration of 73.9 µg/m^3, which exceeds the NAAQS of 40 µg/m3, occurs over the opencast pit (close to the haul road between the overburden stockpile and opencast pit). Exceedances of the NAAQS are predicted to occur across the central parts of the UG1 Opencast Area (uMoya, 2022).

Predicted ambient concentrations are below the NAAQS throughout the rest of the UG1 Opencast Area and well below the NAAQS in the surrounding environment. No exceedances are predicted in the nearby residential areas (uMoya, 2022).

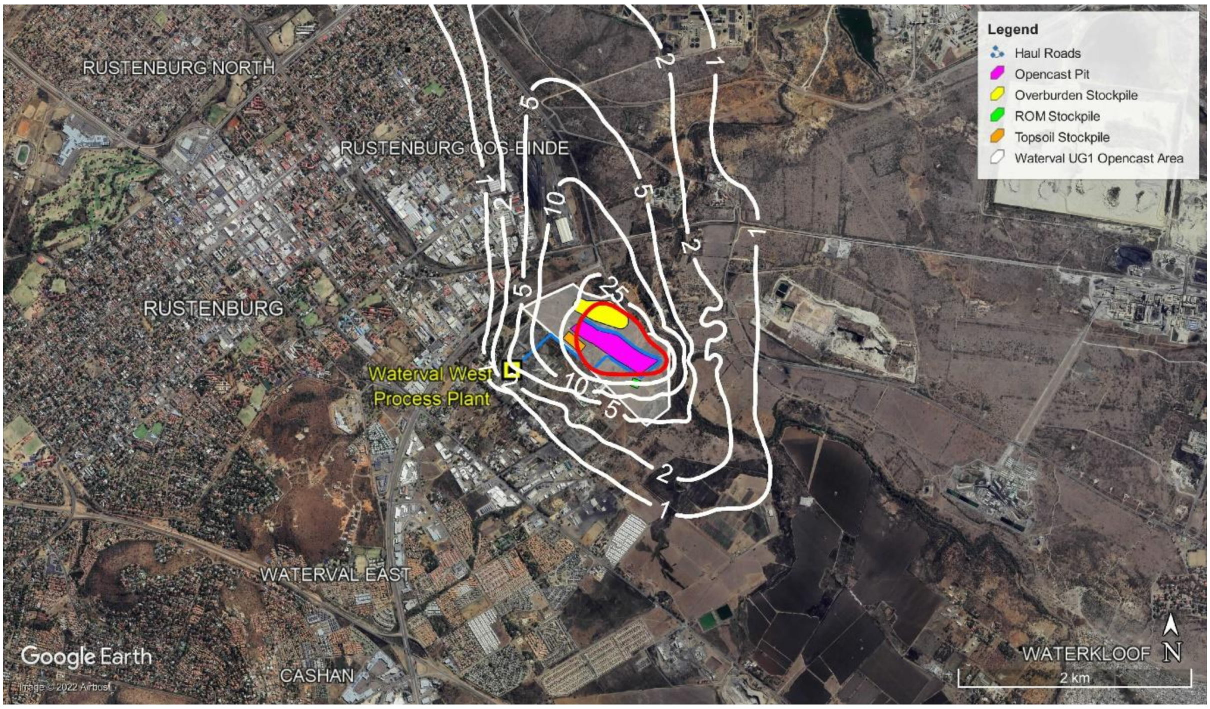

Figure 77: Predicted ambient annual average PM_{10} concentrations in µg/m³ resulting from the Waterval UG1 Opencast Project (the NAAQS is shown in red) (uMoya, 2022)

The 99th percentile of the maximum predicted 24-hour PM_{10} concentrations resulting from emissions from mining and haul roads at the proposed Waterval UG1 Opencast Area are shown in Figure 78 . The emissions from haul roads strongly influence the dispersion pattern with the highest concentrations in the vicinity of the roads (uMoya, 2022).

The highest predicted concentration of 167 µg/m³, which exceeds the NAAQS of 75 µg/m³, occurs over the opencast pit (close to the haul road between the overburden stockpile and opencast pit). Exceedances of the NAAQS are predicted to occur across the central parts of the Waterval UG1 Opencast Area. Here the limit value of the NAAQS is predicted to be exceeded 423 times in the 3-year modelling period, or approximately 141 times per year. The NAAQS allows for 4 exceedances annually. It must however be borne in mind that the NAAQS do not apply on the mining site, i.e. the occupational environment. Therefore, the predicted 99th percentile of the ambient 24-hour PM_{10} concentrations comply with the NAAQS (uMoya, 2022).

Predicted ambient concentrations are below the NAAQS throughout the rest of the Waterval UG1 Opencast Area and well below the NAAQS in the surrounding environment. No exceedances are predicted in the nearby residential areas (uMoya, 2022).

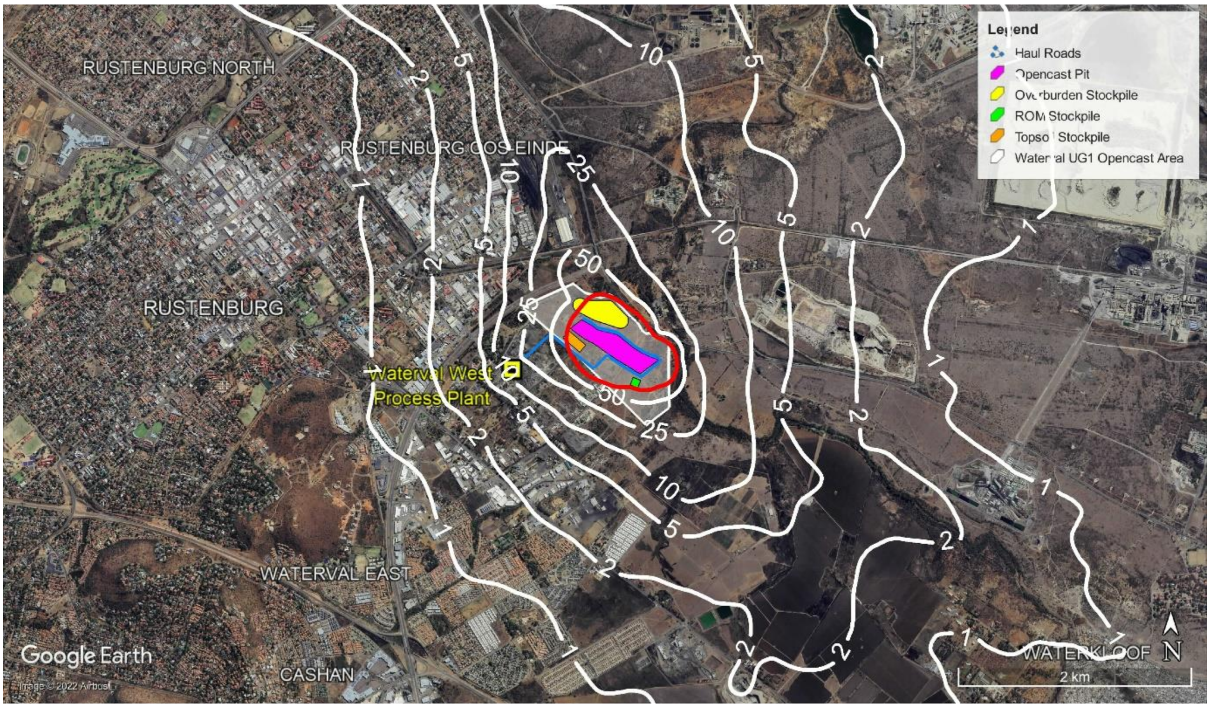

Figure 78: Predicted ambient 24-hour PM_{10} concentrations in µg/m³ resulting from the Waterval UG1 Opencast Project (the NAAQS is shown in red) (uMoya, 2022)

Predicted $PM_{2.5}$ concentrations

The predicted annual $PM_{2.5}$ concentrations resulting from emissions from mining and haul roads at the proposed Waterval UG1 Opencast Area are shown in Figure 79. The emissions from haul roads strongly influence the dispersion pattern with the highest concentrations in the vicinity of the roads (uMoya, 2022).

The highest predicted concentration of 15.2 µg/m³ is below the NAAQS of 20 µg/m³, and occurs directly over the haul road between the ROM stockpile and topsoil stockpile (uMoya, 2022).

Predicted ambient concentrations are well below the NAAQS throughout the rest of the Waterval UG1 Opencast Area and surrounding environment, and no exceedances are predicted in the nearby residential areas (uMoya, 2022).

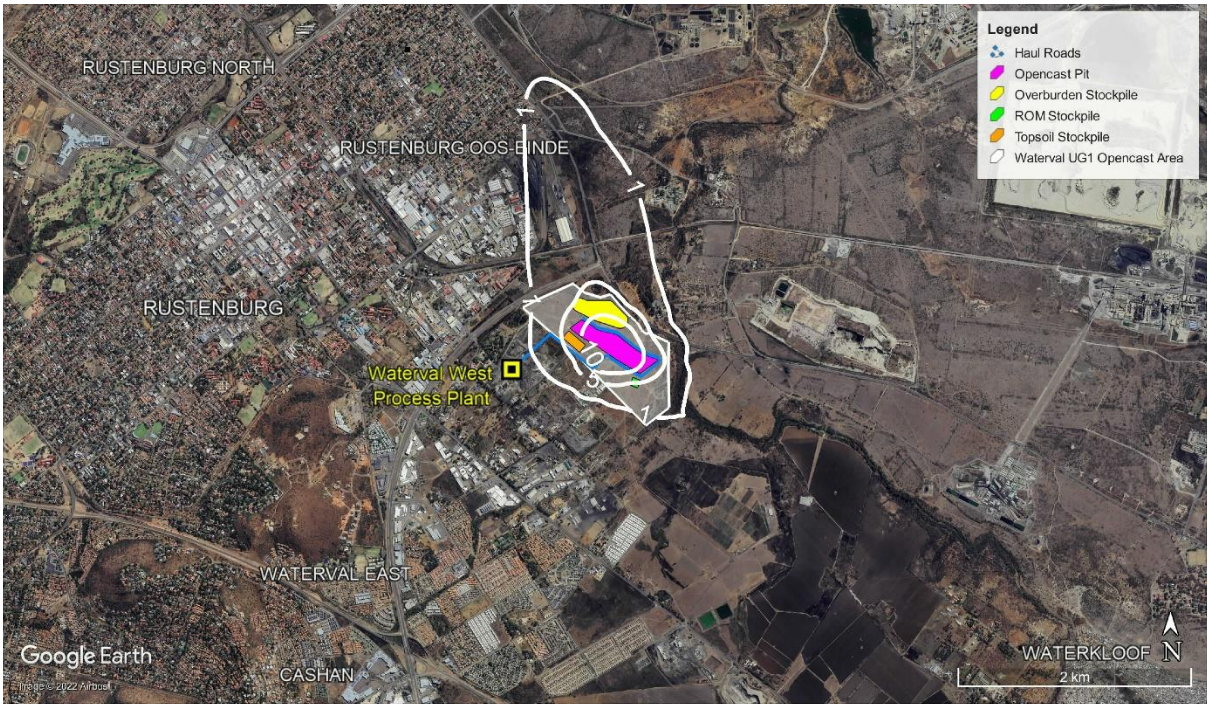

Figure 79: Predicted ambient annual average PM2.5 concentrations in µg/m³ resulting from the Waterval UG1 Opencast Project (uMoya, 2022)

The 99th percentile of the maximum predicted 24-hour $PM_{2.5}$ concentrations resulting from emissions from mining and haul roads at the proposed Waterval UG1 Opencast Area are shown in Figure 80. The emissions from haul roads strongly influence the dispersion pattern with the highest concentrations in the vicinity of the roads (uMoya, 2022).

The highest predicted concentration of 35.3 µg/m³ is below the NAAQS of 40 µg/m³, and occurs over the opencast pit (close to the haul road between the ROM stockpile and opencast pit) (uMoya, 2022).

Predicted ambient concentrations are well below the NAAQS throughout the rest of the Waterval UG1 Opencast Area and surrounding environment, and no exceedances are predicted in the nearby residential areas (uMoya, 2022).

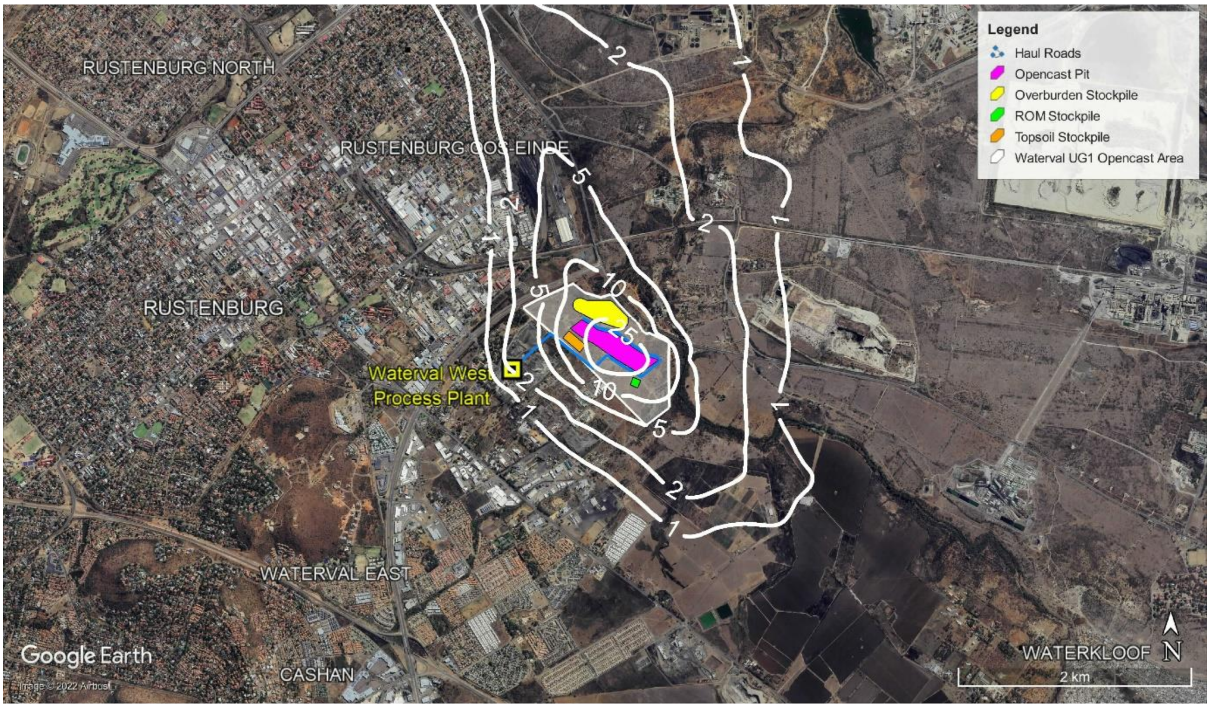

Figure 80: Predicted ambient 24-hour $PM_{2.5}$ concentrations in µg/m^3 resulting from the Waterval UG1 Opencast Project (uMoya, 2022)

Predicted TSP deposition

The predicted dust fallout resulting from emissions from mining and haul roads at the proposed Waterval UG1 Opencast Area are shown in Figure 81. The emissions from haul roads strongly influence the dispersion pattern with the highest dust fallout in the vicinity of the roads (uMoya, 2022).

The highest predicted dust fallout of 185 mg/m^2/day occurs over the eastern corner of the opencast pit (close to the haul road) and is well below the dust fallout standard of 600 mg/m^2/day for residential areas and 1 200 mg/m^2/day for non-residential areas (uMoya, 2022).

The predicted dust fallout is well below the standard throughout the rest of the Waterval UG1 Opencast Area and surrounding environment, and no exceedances are predicted in the nearby residential areas (uMoya, 2022).

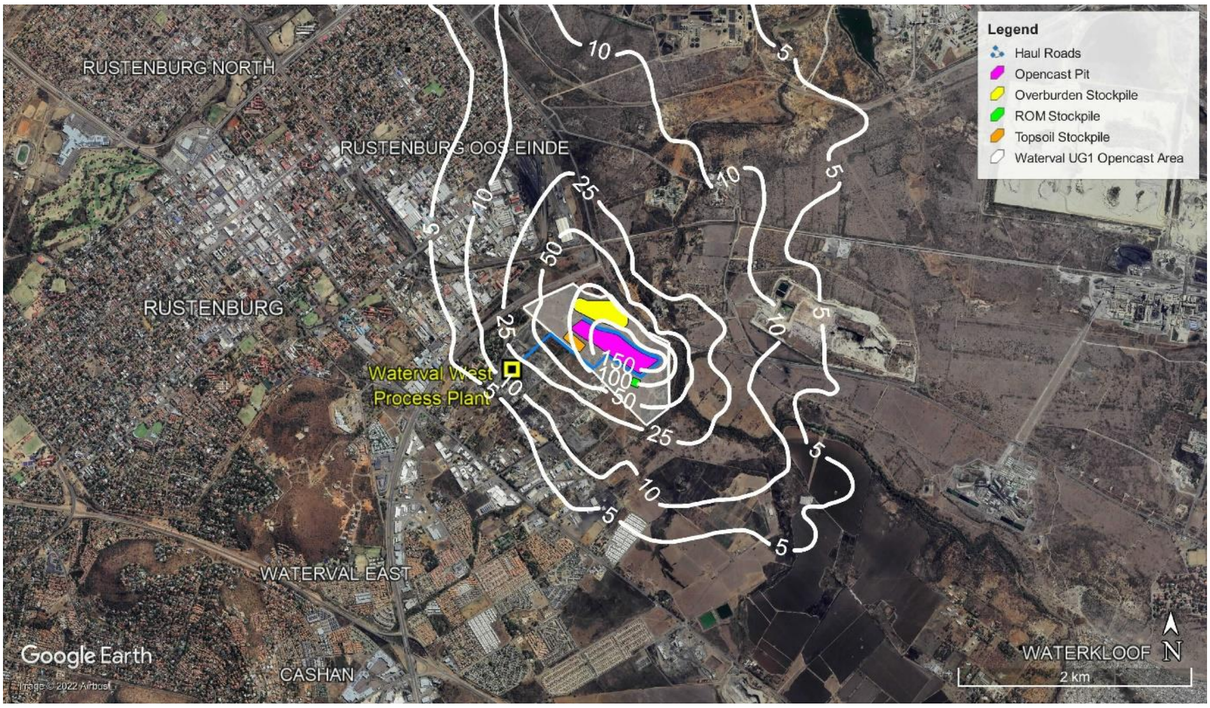

Figure 81: Predicted TSP Deposition in mg/m²/day resulting from the Waterval UG1 Opencast Project (uMoya, 2022)

15.4.7 Noise

The noise levels at the noise sensitive areas was added in a logarithmic manner to determine the overall sound exposure at the receptor. The increase in the prevailing ambient noise level was then calculated (dBAcoustic, 2022).

The criterion for assessing the magnitude of a noise impact is illustrated in Table 93.

Table 93: Noise intrusion level criteria (dBAcoustics, 2022)

Increase Δ-dBA	Assessment of impact magnitude	Color code
0 <Δ≤ 1	Not audible	
1 <Δ≤ 3	Very Low	
3 <Δ≤ 5	Low	
5 <Δ≤ 10	Medium	
10 <Δ≤ 15	High	
15 <Δ	Very High	

Construction phase

The following sound levels were used in determining the noise intrusion level during the construction phase during mining establishment (dBAcoustic, 2022).:

- Clearing and stripping of topsoil and vegetation at the Opencast west – 85.0dBA;
- Construction activities at the Change rooms – 86.0dBA;
- Construction activities at the Overburden west stockpile – 85.0dBA;
- Construction activities at the Ore stockpile – 85.0dBA;
- Construction activities at the Opencast west pit – 86.5dBA;

- Construction activities at the PCD
- Construction activities at the access road to the mining area – 84.0dBA; and
- Construction activities at the Haul roads – 88.0dBA.

The noise intrusion levels during the construction phase are given in Table 94 and the threshold value of 7.0dBA will not be exceeded (dBAcoustic, 2022).

Table 94: Noise intrusion levels (in dBA) during construction phase (dBAcoustics, 2022)

Position	Clearing and stripping of Topsoil and vegetation at the Opencast pits	Construction of the changerooms	Construction at overburden stockpile	Construction at the Ore stockpile	Construction activities at the access road to the mining areas	Construction activities at the pollution control trenches, and	Construction activities at the PCD	Construction activities of the Haul roads	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – Night-time	Intrusion noise level - daytime	Intrusion noise level – night-time
A	25.6	24.3	24.2	22.7	21.3	23.8	23.8	26.3	33.0	44.3	46.5	0.3	0.2
B	25.2	22.1	23.5	27.6	19.1	21.6	21.6	24.1	32.7	44.3	46.5	0.3	0.2
C	20.6	18.7	18.9	19.5	15.7	18.2	18.2	20.7	27.9	44.1	46.4	0.1	0.1
D	20.0	18.2	18.3	18.9	15.2	17.7	17.7	20.2	27.3	44.1	46.4	0.1	0.1
E	21.2	19.0	19.5	20.9	16.0	18.5	18.5	21.0	28.4	44.1	46.4	0.1	0.1
F	21.6	18.8	19.9	23.3	15.8	18.3	18.3	20.8	29.0	44.1	46.4	0.1	0.1
G	30.9	25.1	26.5	24.7	22.1	24.6	24.6	27.1	35.3	53.1	56.8	0.1	0.0
H	28.3	29.7	25.5	19.6	26.7	29.2	29.2	31.7	37.1	45.1	47.4	0.8	0.4

Operational phase

The following sound levels were used in determining the noise intrusion level during the operational phase of the mining activities (dBAcoustic, 2022).:

- Earth drilling – 90.0dBA;
- Removal of overburden rock – 95.0dBA;
- Removal of Ore from the pit – 89.0dBA;
- Ore Stockpile activities – 84.0dBA; and
- ROM activities – 75.0dBA;
- Pump at the PCD – 87.0dBA.

The calculated noise levels and subsequent noise intrusion levels at the abutting noise receptors during the operational phase of the project at the different areas within the mining boundaries are illustrated in Table 95 and Table 96. The threshold value of 7.0dBA will not be exceeded (dBAcoustic, 2022).

Table 95: Noise intrusion levels (in dBA) during the operational phase – Opencast west (dBAcoustics, 2022)

Position	Earth drilling at the opencast pit	Earthworks within the pit	Removal of overburden from the pits	Hauling of ore from the pit	ROM stockpile	PCD pump	Hauling within the footprint	Ore Stockpile	Access road to the mining area	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – night- time	Intrusion noise level - daytime	Intrusion noise level – night-time
A	36.8	31.8	31.1	22.3	26.2	23.1	22.3	31.1	16.9	40.0	45.4	47.2	1.4	0.9
B	35.8	30.8	30.1	20.1	29.0	22.1	21.3	31.8	14.5	39.4	45.3	47.1	1.3	0.8
C	31.6	26.6	26.4	16.7	22.6	18.4	17.1	26.8	11.4	35.0	44.5	46.6	0.5	0.3
D	31.1	26.1	25.9	16.2	22.1	17.9	16.6	26.3	11.0	34.5	44.5	46.6	0.5	0.3
E	32.1	27.1	26.9	17.0	23.8	18.9	17.6	27.6	11.6	35.6	44.6	46.7	0.6	0.4
F	32.4	27.4	27.1	16.8	25.6	19.1	17.9	28.6	11.4	36.1	44.7	46.7	0.7	0.4
G	40.3	35.3	36.4	23.1	31.2	28.4	25.8	39.0	17.4	44.6	53.6	57.1	0.6	0.3
H	40.1	35.1	36.2	30.3	24.2	28.2	25.6	31.3	25.3	43.3	46.8	48.5	2.5	1.5

Table 96: Noise intrusion levels (in dBA) during the operational phase – Opencast east (dBAcoustics, 2022)

Position	Earth drilling at the opencast pit	Earthworks within the pit	Removal of overburden from the pits	Hauling of ore from the pit	ROM stockpile	PCD pump	Hauling within the footprint	Ore Stockpile	Access road to the mining area	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – night- time	Intrusion noise level - daytime	Intrusion noise level – night-time
A	35.1	30.1	30.6	20.1	26.2	23.1	21.1	31.1	16.9	38.8	45.1	47.0	1.1	0.7
B	37.5	32.5	33.0	22.5	29.0	22.1	20.1	31.8	14.5	40.8	45.7	47.4	1.7	1.1
C	31.8	26.8	27.3	16.8	22.6	18.4	16.4	26.8	11.4	35.3	44.5	46.6	0.5	0.3
D	31.3	26.3	26.8	16.3	22.1	17.9	15.9	26.3	11.0	34.8	44.5	46.6	0.5	0.3
E	32.9	27.9	28.4	17.9	23.8	18.9	16.9	27.6	11.6	36.3	44.7	46.7	0.7	0.4
F	34.7	29.7	30.2	19.7	25.6	19.1	17.1	28.6	11.4	38.0	45.0	46.9	1.0	0.6
G	43.6	38.6	39.1	28.6	31.2	28.4	26.4	39.0	17.4	46.9	54.0	57.2	1.0	0.4
H	34.2	29.2	29.7	19.2	24.2	28.2	26.2	31.3	25.3	38.6	45.3	47.6	1.0	0.6

Closure and rehabilitation phase

The following sound levels were used in determining the noise intrusion level during the rehabilitation phase of the mining activities (dBAcoustic, 2022).:

- Removal of all Infrastructure – 85.0dBA; and
- Earthworks and planting of vegetation – 85.0dBA.

The calculated noise levels and subsequent noise intrusion levels at the abutting noise receptors during the rehabilitation phase of the project at the different areas within the mining boundaries are illustrated in Table 97 (Rehabilitation of Opencast West) and Table 98 (Rehabilitation of Opencast East). The threshold value of 7.0dBA will not be exceeded during the rehabilitation phase (dBAcoustic, 2022)..

Table 97: Rehabilitation of Opencast West (dBAcoustics, 2022)

Position	Removal of all infra-structure	Earthworks and planting of vegetation	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – Night-time	Intrusion noise level - Daytime	Intrusion noise level – Night-time
A	23.8	22.8	26.5	44.1	46.3	0.1	0.0
B	22.8	21.8	25.4	44.1	46.3	0.1	0.0
C	18.6	17.6	21.4	44.0	46.3	0.0	0.0
D	18.1	17.1	20.9	44.0	46.3	0.0	0.0
E	19.1	18.1	21.9	44.0	46.3	0.0	0.0
F	19.4	18.4	22.1	44.0	46.3	0.0	0.0
G	27.3	26.3	29.8	53.0	56.8	0.0	0.0
H	27.1	26.1	29.7	44.4	47.1	0.1	0.1

Table 98: Rehabilitation of Opencast East (dBAcoustics, 2022)

Position	Removal of all infra-structure	Earthworks and planting of vegetation	Cumulative Levels	Cumulative noise level - Daytime	Cumulative noise level – Night-time	Intrusion noise level - Daytime	Intrusion noise level – Night-time
A	23.8	22.8	24.8	44.1	46.3	0.1	0.0
B	22.8	21.8	27.1	44.1	46.4	0.1	0.1
C	18.6	17.6	21.6	44.0	46.3	0.0	0.0
D	18.1	17.1	21.1	44.0	46.3	0.0	0.0
E	19.1	18.1	22.6	44.0	46.3	0.0	0.0
F	19.4	18.4	24.4	44.0	46.3	0.0	0.0
G	27.3	26.3	33.2	53.0	56.8	0.0	0.0
H	27.1	26.1	23.9	44.3	47.0	0.0	0.0

15.4.8 Visual

Taking the Visual Absorption Capacity (VAC) (vegetation and topography) of the surrounding environment into consideration, the proposed mining activities will not be highly visible to sensitive receptors situated further than 2km. The proposed project is therefore considered to be in the moderately low visibility zone to any receptors situated further than 2km, predominantly due to the mountainous backdrop as well as the existing mining infrastructure (SAS, 2022).

From the viewshed analysis, it was found that the proposed topsoil stockpile will be visible to receptors or vantage points situated in all directions and within 1 km of the study area. The viewshed becomes scattered and limited after km and it is noted that receptors located to the north north-west does not fall within the viewshed, therefore these receptors will not observe the proposed topsoil stockpile. As such it is evident that the majority of the town of Rustenburg will not observe the proposed mining activities. This was verified during the field assessment (SAS, 2022)..

The viewshed analysis undertaken for the RoM stockpile indicates that a limited range of vantage points within a 5km radius will observe the proposed RoM stockpile, due to the low height of the stockpile and the surrounding undulating topography. The viewshed analysis further indicates that very little receptors located to the north of the study area will have a clear line of sight toward the proposed RoM stockpile (SAS, 2022)..

The viewshed of the overburden stockpile is denser than the previous stockpiles, which is mostly attributed to the height of the overburden stockpile, indicating that more receptors are likely to observe the overburden stockpile than the other stockpiles (SAS, 2022).

It should however be noted that the viewshed analysis does not take into account existing vegetation or existing infrastructure, as such the field assessment provides a more accurate result of the visibility of the proposed mining activities. Figure 82 to Figure 84 below indicate the visual simulations rendered from the Key Observation Points (KOPs) (Table 99) (SAS, 2022).

Table 99: Key observation points for the UG1 opencast project

Key Observation Points (KOPs)				
	Location	**Visibility**	**Receptor Sensitivity**	**Motivation**
KOP1	Within the town of Rustenburg located at the Selly Park Convent Primary School located approximately 2,7 km west of the study area.	None	Moderate – scholars	The proposed mining activities will not be visible from the school due to the urbanisation of the area and associated vegetation as well as the undulating topography of the town.
KOP2	At the Shingwedzi Lifestyle Restaurant located approximately 200m east of the study area.	Moderate to high	High – people visiting the restaurant	The proposed overburden stockpile will be clearly visible from roadside at the restaurant, however the restaurant is associated with tall and dense vegetation, thus when the people are at the restaurant it will not be as exposed and the mining activity will not be as significantly visually intrusive as when the people are at the parking or on the road.
KOP3	Within the town of Rustenburg at the Greystone Crossing Shopping Centre, approximately 2 km west of the study area.	None	Moderate – people visiting the shopping centre and people at their place of work	The proposed mining activities will not be visible due to the distance, undulating topography, urban build up and associated vegetation.
KOP4	Within the Rustenburg town, located approximately 2,4 km west of the study area. It is a few houses on a hill overlooking the town in the direction of the proposed mining activities.	Moderate	Moderate – permanent residents	The proposed mining activities will be visible from this vantage point in the distance, however it is likely to blend in with the mountainous terrain and existing mining infrastructure. On a sunny day with clear skies the visibility is likely to be higher.

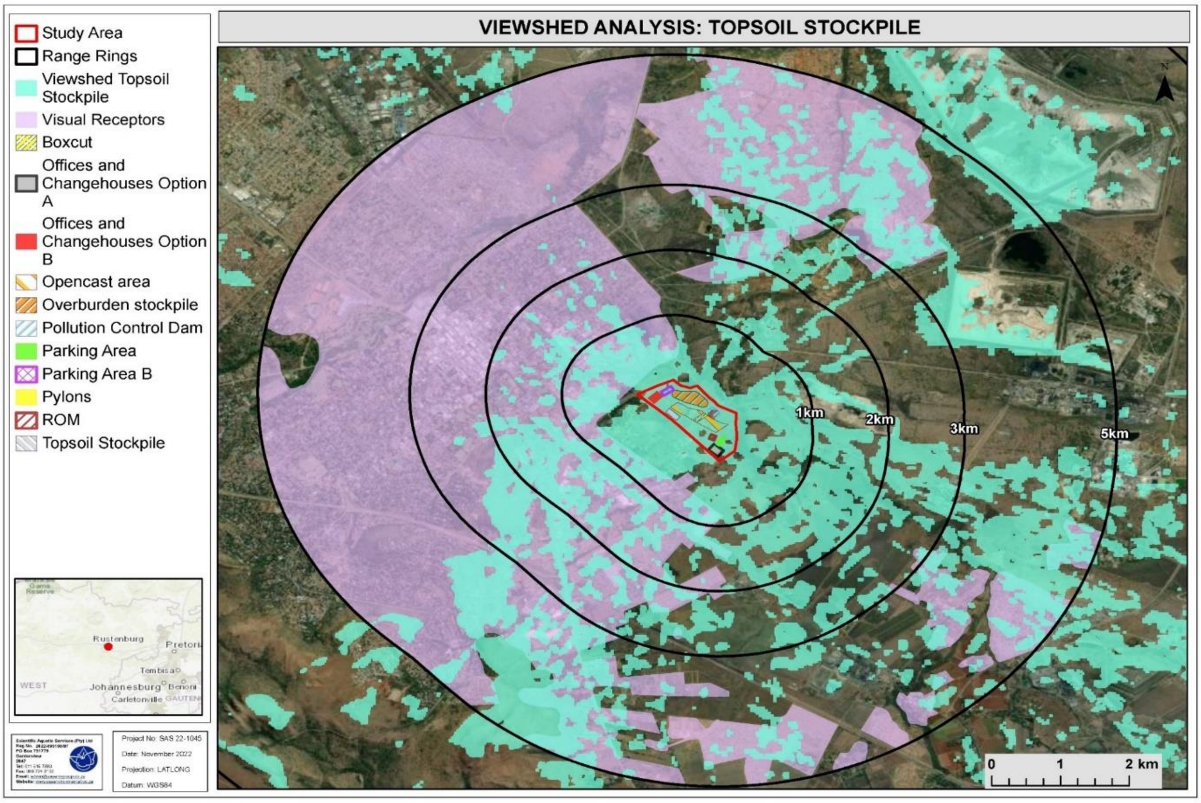

Figure 82: Viewshed (indicated as shaded areas) of the proposed topsoil stockpile (10m) overlaid onto digital satellite imagery (SAS, 2022)

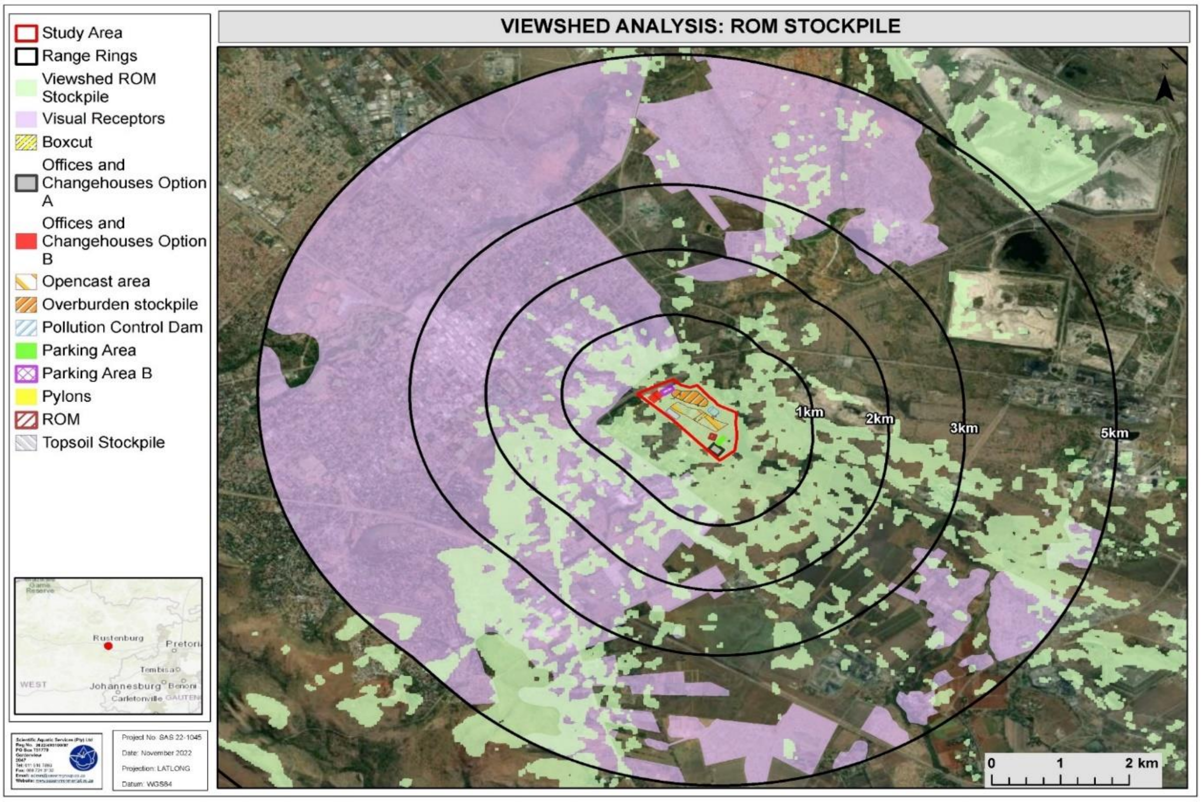

Figure 83: Viewshed (indicated as shaded areas) of the proposed Run of Mine (ROM) stockpile (4m) overlaid onto digital satellite imagery (SAS, 2022)

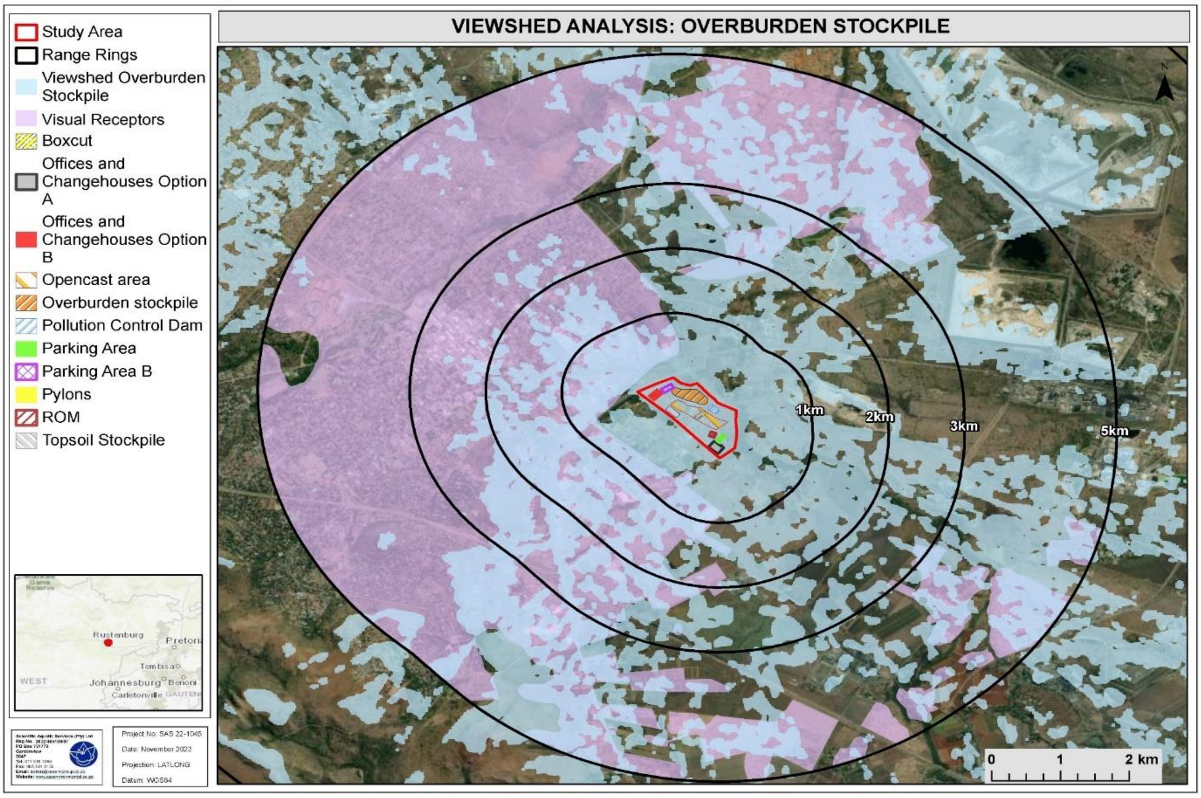

Figure 84: Viewshed (indicated as shaded areas) of the proposed Overburden stockpile (20m) overlaid onto digital satellite imagery (SAS, 2022)

15.4.9 Heritage

The proposed UG1 opencast project area is a disturbed piece of land that has been fallow for several years. Historical cultivation of the site, illegal dumping of building rubble and refuse material and earthmoving activities altered the site and no standing structures older than 60 years or heritage resources were noted during the site visit. According to the SAHRA Paleontological sensitivity map, the study area is of insignificant/zero paleontological significance and no further studies are required for this aspect (Beyond Heritage, 2022).

The impact on heritage resources is considered to be low and the project can be authorised provided that the recommendations in this report are adhered to and based on SAHRA's approval.

15.4.10 Blasting

Information for this section was obtained from Blast Management and Consulting's (BMC) Blast Impact Assessment Waterval UG 1 Opencast Project (Ref No. 151-002. April 2022). Refer to Appendix C11 for the full report.

Ground vibration levels

Ground vibration is measured in velocity with units of millimetres per second (mm/s). Ground vibration can also be reported in units of acceleration or displacement if required. Different types of structures have different tolerances to ground vibration. A steel structure or a concrete structure will have a higher resistance to vibrations than a well-built brick and mortar house.

The opencast operations were evaluated for expected levels of ground vibration from future blasting operations. Review of the site and the surrounding installations / houses / buildings showed that structures vary in distances from the pit area. The influences will also vary with distance from the pit area. The model used for evaluation does indicate minor levels. It will be imperative to ensure that a monitoring program is done to confirm levels of ground vibration to ensure that ground vibration levels are not exceeded.

The evaluation mainly considered a distance up to 3500m from the pit area. The closest structures observed are the Mine Buildings/Structurers, Hex River, Explosive Magazine, Road, Communication Tower, and Mine Activity. The ground vibration levels predicted for these points of interests (POI) ranged between 0.1 mm/s and 11 mm/s for structures surrounding the open pit area.

The distances between structures and the pit area are a contributing factor to the levels of ground vibration expected and the subsequent possible influences. It is observed that for the different charge masses evaluated those levels of ground vibration will change as well.

The nearest public structures (Shingwedzi Country Pub & Restaurant) are located 353m from the pit boundary. Ground vibration level predicted at this building where people may be present is 5.7mm/s for the maximum charge.

Structure conditions ranged from industrial construction to poor condition structures.

On a human perception scale sixteen POI's were identified where vibration levels may be perceptible and lower for the minimum charge and twenty-five POI's for the maximum charge. One POI (Shingwedzi Country Pub& Restaurant) was identified where vibration levels may be unpleasant for the minimum charge and two POI's (Shingwedzi Country Pub& Restaurant and Sitona) for the maximum charge. Perceptible levels of vibration may be experienced up to 1159m and unpleasant up to 353m. Problematic levels of ground vibration – levels greater than the proposed limit – are expected up to 75m from the pit edge for the maximum charge. Any blast operations further away from the boundary will have lesser influence on these points.

Based on the expected outcomes for the maximum charge considered and location of the structures / infrastructure surrounding the planned pit areas there are no specific mitigations required. Apply the maximum charge and the distance to structures the expected levels of ground vibration are within the accepted for all structures.

The N4 road is 3044 m from the pit area and no influence is expected. The R24 Road on the northern side of the pit area, is at an approximate distance of 381 m and the R104 Road at 1368 m. No specific consideration regarding effects from blasting operations will be required for these roads. There are other dirt roads in the area. No specific consideration regarding effects from blasting operations will be required for these roads. There may however be people and animals on these routes and will require careful planning to maintain safe blasting radius. It will be required that clearance distances be set, and road travel managed during blasting operations.

Air blast

Air blast or air-overpressure is a pressure wave generated from the blasting process. Air blast is measured as pressure in pascal (Pa) and reported as a decibel value (dBL). Air blast is normally associated with frequency levels less than 20 Hz, which is at the threshold for hearing. Air blast can be influenced by meteorological conditions such as, the final blast layout, timing, stemming, accessories used, blast covered by a layer of soil or not, etc. Air blast should not be confused with sound that is within the audible range (detected by the human ear). A blast does generate sound as well but for the purpose of possible damage capability we are only concerned with air blast.

Review of the air blast levels indicate greater concerns. Air blast predicted for the maximum charge ranges between 117.2 and 134.2 dBL for all the POI's considered. This includes the nearest points such as the Buildings/Structures, Farm Buildings/Structures, Informal Housing, Industrial Buildings/Structures and Houses.

These levels may contribute to effects such as rattling of roofs or door or windows with limited points that are expected to be damaging and that could lead to complaints.

Minimum charge predictions identified that sixty POI's at the pit area could experience levels of air blast that could lead to complaints. Maximum charge predictions indicate that seventy-three POI's at the pit area could experience air blast that could lead to complaints. Only one POI were identified where the expected air blast is on the accepted limit. Damage is not expected but certainly it will cause effects that could lead to complaints.

The current accepted limit on air blast is 134 dBL. Damages are only expected to occur at levels significantly greater than 134 dBL. Prediction shows that air blast will be greater than 134 dBL at distance of 246 m and closer to the pit boundary. Infrastructure within this distance from the pit areas such as the Hex River and roads are present, but air blast does not have any influence on these installations.

The possible negative effects from air blast are expected to be the same than that of ground vibration. It is maintained that if stemming control is not exercised this effect could be greater with greater range of complaints or damage. The pit is located such that "free blasting" – meaning no controls on blast preparation – will not be possible. The effect of stemming control will need to be considered. In many cases, the lack of proper control on stemming material and length contributes mostly to complaints from neighbours.

Flyrock

The occurrence of fly rock in any form will have a negative impact if found to travel outside the unsafe zone. This unsafe zone may be anything between 10m or 1000m. A general unsafe zone applied by most mines is normally considered to be within a radius of 500 m from the blast; but needs to be qualified and determined as best possible.

Calculations are also used to help and assist in determining safe distances. A safe distance from blasting is calculated following rules and guidelines from the International Society of Explosives Engineers (ISEE) Blasters Handbook. Using this calculation, the minimum safe distances should be cleared of people, animals and equipment can be determined. Figure 85 shows the results from the ISEE calculations for fly rock range based on a 127mm diameter blast hole and 3.0 m stemming length. Based on these values, a possible fly rock range with a safety factor of 2 was calculated to be 273 m.

The absolute minimum unsafe zone is then the 273m. This calculation is a guideline and any distance cleared should not be less. The occurrence of fly rock can however never be 100% excluded. Best practices should be implemented at all times. The occurrence of fly rock can be mitigated but the possibility of the occurrence thereof can never be eliminated. Figure 86 shows the area around the Pit areas that incorporates the 273m unsafe zone.

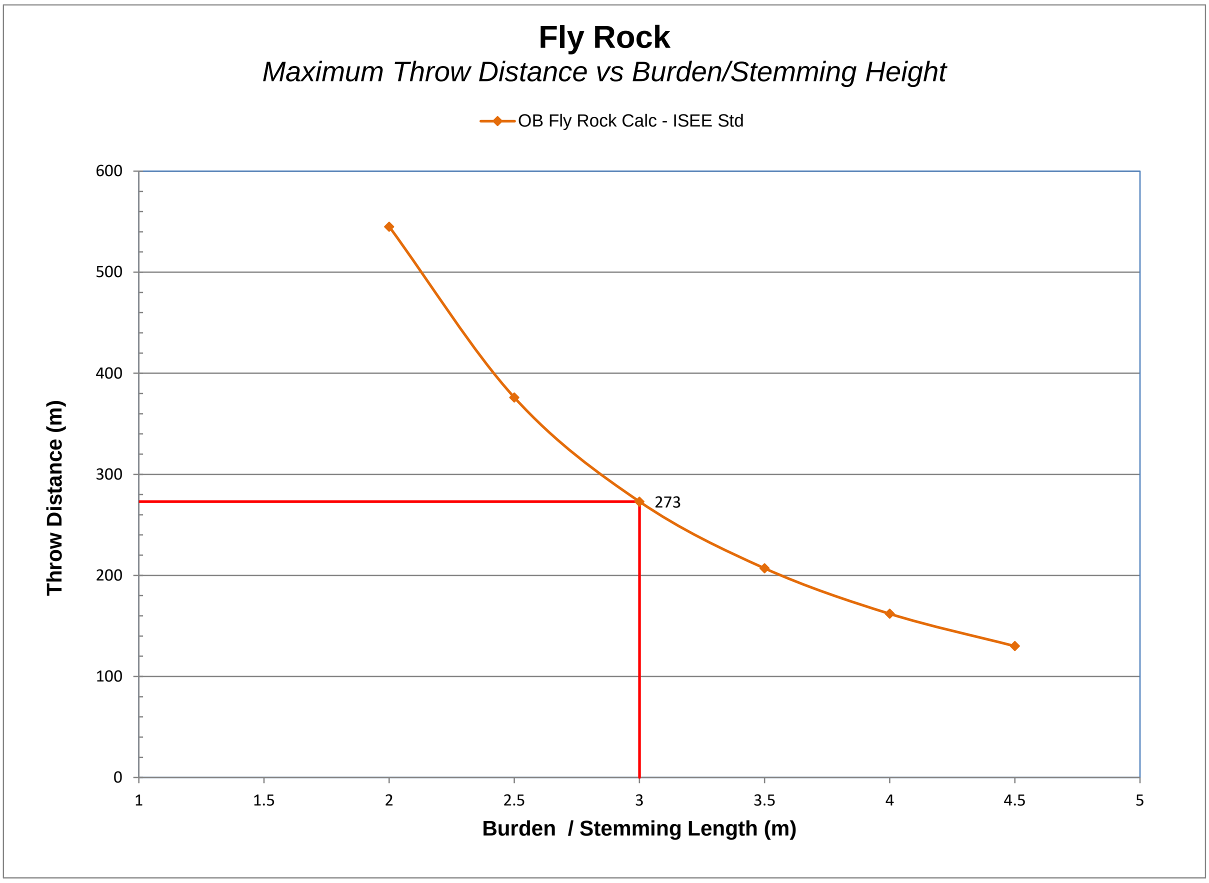

Figure 85: Fly rock prediction calculation (BMC, 2022)

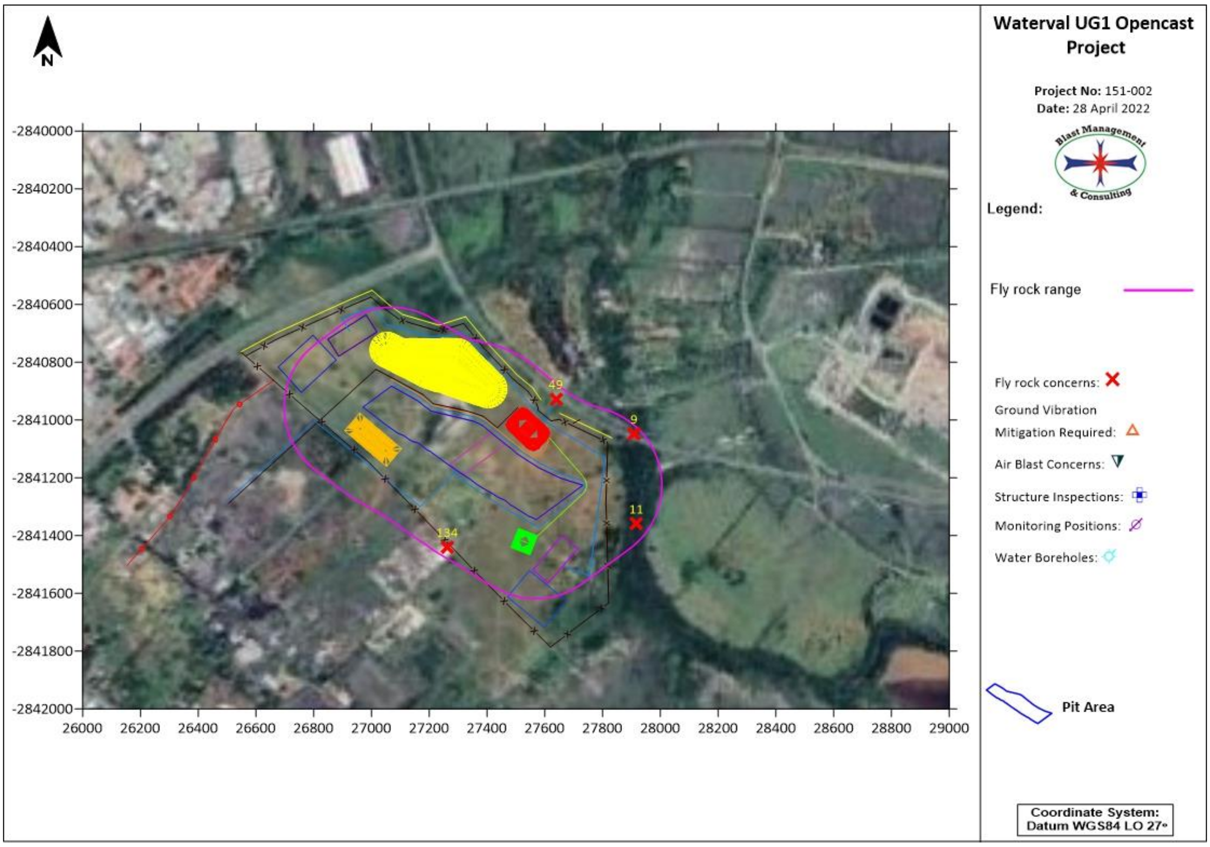

Figure 86: Predicted Fly Rock Exclusion Zone for the UG1 Pit area (BMC, 2022)

Review of the calculated unsafe zone showed four POIs for the pit area are within the unsafe zone. Table 100 below shows the POIs of concern and coordinates.

Table 100: Fly rock concern POIs (BMC, 2022)

Tag	Description	Y	X
9	Hex River	-27909.57	2841049.15
11	Hex River	-27917.85	2841359.73
49	Road and Unpaved Road	-27639.62	2840928.01
134	Sitona Structures	-27263.51	2841440.93

Table 101: Assessment of identified impacts of the proposed UG1 opencast project during the construction phase

UG1 Opencast Project: Impact Assessment – Construction Phase																					
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	
Soils																					
Clearing of vegetation, removal of topsoil and stockpiling of topsoil	**The loss of utilisable resource (sterilisation and erosion), compaction and contamination or salinisation** During the construction phase, the loss of the utilisation of the soil resource will impact the land use, reducing the land capability from arable and grazing to mining. The construction for the mining and its support activities will, if un-managed and without mitigation:	6	4	1	3	3	5	85	M	Low	Negative	• Demarcate the footprint area. • Vegetation clearing and removal of topsoil to be limited to the demarcated area. • Restrict all activities to the designated areas, no activities permitted beyond the project boundary. • Make use of existing routes / roads as much is feasible. • Topsoil removed from the development footprint area must be stockpiled for use toward the mine's rehabilitation strategy. • Erosion mitigation strategies and proper stormwater management must be considered to limit erosion within the development footprint area. • Only proposed access roads and existing access roads to be used to reduce any unnecessary compaction. Compacted areas are to be ripped to loosen the soil structure where necessary. • A rehabilitation strategy focused on revegetation must be initiated after the construction phase.	4	2	1	2	1	2	20	L	
Construction of surface infrastructure	**Contamination of soil** Soil can become contaminated due to spillage of hydrocarbons or other hazardous material	4	4	1	3	3	5	75	M	Low	Negative	• Prevent any spills from occurring as far as possible. • Machines must be parked within hard park areas or dedicated storage areas and must be checked regularly for fluid leaks. • All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • Contractors must have spill kits available to address any unlikely spillages. • Hydrocarbons (such as diesel) and other hazardous material must be stored within a bunded area. • Contaminated soils, if any, must be discarded of in the hazardous waste bins/skips and disposed of at a licenced waste disposal facility. • Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems.	2	2	1	2	1	2	16	L	
Clearing of vegetation, removal of topsoil and stockpiling of topsoil	**Soil erosion** Increased bare surfaces, surface water runoff and potential for erosion and resulting in increased sedimentation loads	6	4	1	3	3	5	85	M	Low	Negative	• Demarcate the footprint area and limit vegetation clearing limited to the demarcated area. • Signs of erosion must be addressed immediately to prevent further erosion. • Implement a Stormwater Management Plan at the UG1 opencast project area.	2	2	1	2	1	2	16	L	
Terrestrial biodiversity																					

UG1 Opencast Project: Impact Assessment – Construction Phase																					
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	
Clearing of vegetation, removal of topsoil and stockpiling of topsoil	**Loss of indigenous vegetation** No significant patches of intact natural vegetation remain within the project area or immediate surroundings which is evident by the disturbed and transformed habitats within and outside of the proposed development area. The project area is of Low botanical sensitivity and presents no botanical constraints to the proposed development. Impacts on vegetation is expected to be low.	4	4	1	2	2	2	26	L	Low	Negative	• Demarcate the footprint area. • Restrict the potential removal of vegetation to the footprint area only. • Cleared vegetation (if any) and debris that has not been utilised must be collected and disposed through an appropriate manner. • Collection of branches, wood (dead or alive), shrubs or any vegetation for fire making purposes is strictly prohibited. • Open fires at site is prohibited, including the burning of waste material. The irresponsible use of welding equipment, oxy-acetylene torches, and other naked flames, which could result in veld fires, or constitute a hazard should be guided by safe practice guidelines.	2	2	1	2	1	2	16	L	
Clearing of vegetation, removal of topsoil and stockpiling of topsoil	**Spread and/or establishment of alien and/or invasive species** Several invasive species have been identified at the UG1 opencast project area, which, if left unchecked, will continue to grow and spread prolifically leading to further and more significant deterioration to the health of the natural environment within the project area.	4	4	1	3	3	5	75	M	Low	Negative	• Compile and implement the Alien Invasive Plant Management Plan, which identifies species that pose the greatest threats, in terms of habitat transformation, within the development areas, and considers all appropriate chemical, mechanical, biological and cultural control methods to effectively control the species. Use of locally indigenous plant species for landscaping purposes is strongly recommended. • Under no circumstances shall exotic and invasive plants be used for landscaping purposes.	2	2	1	2	1	2	16	L	
Surface water																					
Clearing of vegetation, removal of topsoil and stockpiling of topsoil Construction of surface infrastructure	**Siltation of watercourses** Impacts may arise from erosion during rainfall events, resulting in increased suspended solids in run-off water, reporting to the local watercourses.	4	4	1	3	3	5	75	M	Low	Negative	• Construct paddocks around stockpiles • Construct diversion berms to divert clean water away from mining area. • Construct PCD to contain contaminated water. • Construct dirty water trenches to convey contaminated water to the PCD.	2	2	1	1	1	2	14	L	

UG1 Opencast Project: Impact Assessment – Construction Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Construction of surface infrastructure	**Contamination of surface water resources** Surface run-off may be contaminated by activities on site due to spillage of hydrocarbons or other hazardous material	4	4	1	3	3	5	75	M	Low	Negative	• Storage of chemical and other hazardous substances in bunded areas. • All contractors must have spill kits available and be trained in the correct use thereof. • No cleaning or servicing of vehicles, machines and equipment in unauthorized areas such as delineated wetlands. • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. • All waste generated on-site must be adequately managed and separated and recycled of different waste materials should be supported. • All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site. • Implementation of a stormwater management plan around the UG1 opencast project area.	2	2	1	1	1	2	14	L
Clearing of vegetation, removal of topsoil and stockpiling of topsoil Construction of surface infrastructure	**Environmental pollution due to contamination, increased sedimentation and erosion of watercourses, impaired water quality**	6	2	3	3	3	3	51	M	Low	Negative	• Implement stormwater management plan • Only clear (vegetation) in demarcated areas • Implement concurrent rehabilitation • Implement dust suppression	4	2	2	3	3	2	28	L
Wetlands																				
Vegetation clearance, construction of surface infrastructure	**Degradation of wetlands** Pollution into wetlands due to contamination, increased sedimentation and erosion of watercourses	4	2	2	3	3	2	28	L	Medium	Negative	• Restrict all activities to the designated areas, no activities permitted beyond the project boundary. • Make use of existing routes / roads as much as is feasible. • Implement a stormwater management plan. • Implement dust suppression. • Demarcate footprint areas, ensure visible demarcation.	2	2	1	3	3	1	11	L
Vegetation clearance, construction of surface infrastructure	Spread and/or establishment of alien and/or invasive species	4	2	2	2	2	2	24	L	Medium	Negative	• Implement an alien vegetation eradication and control plan. • Do not import soil materials from outside the working area. Implement onsite cleaning of haulage vehicles access the area from offsite. Cleaning must be as often is feasible.	2	2	1	2	2	1	9	L
Vegetation clearance, construction of surface infrastructure	Alterations in hydrological regime (flow of surface and sub-surface water)	4	2	2	3	2	2	26	L	Medium	Negative	• Implement the stormwater management plan. • Implement concurrent rehabilitation. Rehabilitate to the agreed land use, and ensure slope represents the natural (original) topography. • Implement landscape management plan.	2	2	1	3	2	1	10	L

ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
UG1 Opencast Project: Impact Assessment – Construction Phase																				
		ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION											**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**							
Groundwater																				
Vegetation clearance, construction of surface infrastructure	Increased vulnerability of the aquifer to contamination due to an increase in the surface infiltration rate.	1	2	1	1	1	2	12	L	Low	Negative	• Mitigation is not possible. • Groundwater monitoring should be used to manage the potential impact.	1	2	1	1	1	2	12	L
Vegetation clearance, construction of surface infrastructure	**Impact on groundwater quality** Spillage of hydrocarbons which can infiltrate into the subsurface and contaminate the aquifer.	6	2	1	3	3	4	60	M	Low	Negative	• Machinery should be inspected regularly for leakages. Maintenance on machinery should be carried out in a dedicated repair area only. • Drip trays should at all times be placed under machinery that require on-site maintenance. • Drip trays should be emptied into designated containers only and the contents disposed of at a licenced hazardous material disposal facility. • Any spills need to be reported immediately so that effective remediation and clean-up strategies and procedures can be implemented. • Soil that has been contaminated by spills should be collected to be treated at pre-determined and dedicated location, or should be treated on-site using sand or an absorption medium.	4	2	1	2	2	3	33	L
Dewatering of the boxcut	**Lowering of groundwater levels** A groundwater dewatering cone will develop around the boxcut due to mine dewatering during construction activities. The extent of the drawdown cone in the construction phase is small and site specific, with no impact expected on surrounding groundwater users or environmental receptors.	2	2	1	1	1	3	21	L	Low	Negative	• The water levels of the newly drilled monitoring boreholes should be monitored and can function as an early warning detection measure to prevent possible unexpected excessive drawdown.	2	2	1	1	1	1	7	L
Air Quality																				

UG1 Opencast Project: Impact Assessment – Construction Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Vegetation clearance, construction of surface infrastructure	**Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations** Construction dust is generally coarse and manifests as a nuisance rather than a health issue. The magnitude of the impact associated with the construction activity is therefore considered to be very low. The construction activities are likely to endure for a maximum of two months and impacts may only occur during this period. The duration is therefore short-term. The pollutants are released close to ground level with little or no buoyancy. This implies that their dispersion is limited and the extent of potential impacts will be limited to the construction site. With no irreplaceable resources in the zone of impact there is deemed to be a very low or no potential for the loss of irreplaceable resources. If the impacts described occur, they will be reversible if exposure ceases. Furthermore, there is a low probability of the potential impacts occurring as a result of the construction activities.	2	2	1	1	1	2	14	L	Low	Negative	• Continue with current dust control measures, i.e. spraying of mine roads and haul roads. • Continue with current monthly dust fallout monitoring program.	2	2	1	1	1	2	14	L

UG1 Opencast Project: Impact Assessment – Construction Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Noise																				
Vegetation clearance, construction of surface infrastructure	**Increase in ambient noise levels** Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas.	4	2	2	3	3	3	42	M	Low	Negative	• Construction activities to take place during day/night-time provided that the prevailing ambient noise level along the mine boundaries will not be exceeded Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and any noise sources above 85.0dBA to be acoustically screened off. • Environmental noise monitoring must be undertaken on a bi-annual basis during the construction phase.	2	2	2	3	3	3	36	L
Visual																				
Vegetation clearance, construction of surface infrastructure.	Impact on Landscape Character and Sense of Place	6	3	3	3	3	4	72	M	High	Negative	• The development footprint areas and related disturbed areas should be kept as small as possible and the areas cleared of natural vegetation must be kept to a minimum. • Where possible, the proposed infrastructure should be placed in areas that have already been disturbed. • Existing roads are to be utilised, also for construction purposes, to prevent additional site clearance. • Existing vegetation, particularly taller shrubs and trees, in the vicinity and on the periphery of the study area, should be retained to screen the proposed mining activities as far as possible from surrounding receptor sites. • Appropriate rehabilitation action must be taken where damage to natural visual resources such as the Hex River and any other freshwater ecosystems in the vicinity of the study area has taken place.	4	2	2	2	2	3	36	L
Vegetation clearance, construction of surface infrastructure.	Visual Intrusion and VAC impacts	6	3	3	3	3	3	54	M	Medium	Negative	• Erosion must be prevented by limiting loss of natural vegetation cover, limiting the duration of exposed soils and where erosion or excessive soil loss noted soil stabilisation measures and revegetation must be put in place immediately. • It must be ensured that the stockpiles are not steeply sloped so as to blend in with the surrounding mountainous terrain any longer term stockpiles should be battered down from the angle of repose to blend better in to the landscape. • Placement of infrastructure should be positioned in order to avoid areas where significant excavations would be required. • The stockpile heights should not exceed the maximum proposed heights of 10 m for topsoil stockpile, 20 m for overburden stockpiles, and 4 m for the ROM stockpile. • The study area must be fenced off with a clear VU fence, or similar, which will result in a more unified and tidy appearance	4	2	2	3	3	3	42	M

UG1 Opencast Project: Impact Assessment – Construction Phase																					
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**	
Vegetation clearance, construction of surface infrastructure	Visual Exposure and Visibility Impacts	4	2	2	3	3	3	42	M	Medium	Negative	• Construction timeframes should be kept as short as possible. • During the construction phase all dirt and temporary access roads will require dust suppression such as regular watering. • Access roads must be suitably maintained to limit erosion and dust pollution. • Vehicle speed on unpaved roads must be reduced to limit dust generation. • It must be ensured, where possible, that existing natural vegetation is to be retained and incorporated into the design, especially within the line of sight from visual receptors such as the R24 roadways. • The height of structures should be a low as possible, where this can be achieved without increasing the infrastructure footprint. • The use of permanent signs and project construction signs should be in line with minimum legal requirements and visually unobtrusive. • Housekeeping of the site during construction and operational activities must be maintained at a high standard. • Once construction activities have been completed, it must be ensured that all temporary and construction-related infrastructure be removed and that efficient rehabilitation to take place within these areas, with specific mention of the revegetation of disturbed areas. • All lights used for illumination (except for lighting associated with security) should be faced inwards and shielded to avoid light escaping above the horizon; and Making use of motion detectors on security lighting, at office areas and the maintenance area, ensures that the site will remain in relative darkness, until lighting is required for security and maintenance purposes.	4	2	2	2	2	2	24	L	
Heritage																					
Vegetation clearance, construction of surface infrastructure	**Impact on Archaeological Resources** Due to the lack of any heritage finds at the UG1 opencast project area, the impact to the heritage record of the area is low. Any additional effects to subsurface heritage resources can be successfully mitigated by implementing a chance find procedure.	6	4	1	3	3	3	51	M	Low	Negative	• Implementation of a chance find procedure.	2	5	3	1	1	2	24	L	
Blasting																					

UG1 Opencast Project: Impact Assessment – Construction Phase																						
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**									
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**		
No blasting will be undertaken during the construction phase, therefore no impacts are expected.																						
Waste management																						
Vegetation clearance and construction of surface infrastructure	Increase waste generation due to construction activities	5	5	5	5	5	5	125	L	Low	Negative	• Rubble and other construction waste produced should be re-used if possible, otherwise be disposed of in line with the mine's Waste Management Procedure (Appendix E) and associated procedures. • Adequate bins must be provided on site and cleared regularly. Bins must not overflow. • The construction area must remain litter free and regular inspections for litter must be conducted. The activity should not contribute to any surrounding windblown litter. • Waste skips must be covered and emptied regularly. No overflowing of the skips is allowed. • Waste must not to be buried or burned.	2	5	3	1	1	2	24	L		
Social																						
Construction of surface infrastructure	Benefits resulting from employment and income opportunities created by the construction of the UG1 opencast project.	4	2	2	2	1	3	33	L	Low	Positive	• Implement management and enhancement measures as per the SLP.	6	2	2	2	1	4	52	M		

Table 102: Assessment of identified potential impacts of the proposed UG1 opencast project during the operational phase

UG1 Opencast Project: Impact Assessment – Operational Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Soils																				
Opencast mining activities, hauling of ore to the Waterval West Plant	**Contamination of soil** Soil can become contaminated due to spillage of hydrocarbons or other hazardous material during the operational phase	4	4	1	4	3	4	64	M	Low	Negative	• Prevent any spills from occurring. Machines must be parked within hard park areas or dedicated storage areas and must be checked regularly or fluid leaks. • Contractors must have spill kits available to address any unlikely spillages. • Hydrocarbons (such as diesel) and other hazardous material must be stored within a bunded area. • Contaminated soils, if any, must be discarded in the hazardous waste bins/skips and disposed of at a licenced waste disposal facility.	2	5	1	1	3	2	24	L
Opencast mining activities, hauling of ore to the Waterval West Plant	**Soil erosion** Increased bare surfaces, surface water runoff and potential for erosion and resulting in increased sedimentation loads	6	4	1	3	3	5	85	M	Low	Negative	• Demarcate the footprint area and limit vegetation clearing limited to the demarcated area. • Signs of erosion must be addressed immediately to prevent further erosion. • Implementation of a Stormwater Management Plan at the UG1 opencast project area.	2	2	1	2	1	2	16	L
Terrestrial biodiversity																				
Opencast mining activities, hauling of ore to the Waterval West Plant	**Spread and/or establishment of alien and/or invasive species** Several invasive species have been identified at the UG1 opencast project area, which, if left unchecked, will continue to grow and spread prolifically leading to further and more significant deterioration to the health of the natural environment within the project area	4	4	1	4	3	4	64	M	Low	Negative	• Maintain the Alien Invasive Plant Management Plan, which identify species that pose the greatest threats, in terms of habitat transformation, within the development areas, and considers all appropriate chemical, mechanical, biological and cultural control methods to effectively control the species.	2	5	1	1	3	2	24	L
Opencast mining activities, hauling of ore to the Waterval West Plant	Introduction of nuisance vectors (pests) such as flies, rodents and monkeys	6	2	1	2	1	3	36	L	Low	Negative	• Ensure the correct handling, storage and operation of general waste generated at the UG1 opencast project site. Remove general waste generated frequently as to prevent the development of a breeding habitat for nuisance pests such as flies, and attracting rodents and baboons.	2	2	1	2	1	2	16	L
Surface Water																				

UG1 Opencast Project: Impact Assessment – Operational Phase																					
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**	
Opencast mining activities, hauling of ore to the Waterval West Plant	**Siltation of watercourses** Impacts may arise from erosion during rainfall events, resulting in increased suspended solids in run-off water, reporting to the local watercourses	4	4	1	3	3	5	75	M	Low	Negative	• Construct paddocks around stockpiles Construct diversion berms to divert clean water away from mining area. • Construct PCD to contain contaminated water. • Construct dirty water trenches to convey contaminated water to the PCD.	2	2	1	1	1	2	14	L	
Opencast mining activities, hauling of ore to the Waterval West Plant	**Contamination of surface water resources** Surface run-off may be contaminated by activities on site due to spillage of hydrocarbons or other hazardous material	4	4	1	3	3	5	75	M	Low	Negative	• Storage of chemical and other hazardous substances in bunded areas. • All contractors must have spill kits available and be trained in the correct use thereof. • No cleaning or servicing of vehicles, machines and equipment in unauthorized areas such as delineated wetlands. • Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. • All waste generated on-site must be adequately managed and separated and recycled of different waste materials should be supported. • All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site. • Implementation of a stormwater management plan around the UG1 opencast project area.	2	2	1	1	1	2	14	L	
Opencast mining activities	**Reduced catchment yield** The loss in yield associated with mining at the UG1 opencast project site will be primarily due to the mine infrastructure and opencast mining activities	4	4	1	3	3	5	75	M	Low	Negative	• Implement effective clean and dirty water separation systems as part of the stormwater management plan. Ensure through effective implementation that clean water is allowed to leave the site and that clean water is not allowed to spill into the dirty water system and vice versa. • Confine any unpolluted water to a clean water system, away from any dirty areas. • Implement a suitable surface water monitoring programme as per the requirements of the Water Use Licence. • Inspect diversion trenches and berms after a heavy storm event as to ensure the integrity and stability and to address any erosion problems. • Implementation of energy dissipaters at the appropriate places to reduce the velocity and speed of surface water run-off.	4	3	2	3	3	2	30	L	
Wetlands																					

UG1 Opencast Project: Impact Assessment – Operational Phase																				
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**							
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**
Opencast mining activities	Degradation of wetlands	2	3	2	3	3	2	26	L	Medium	Negative	• Restrict all activities to the designated areas, no activities permitted beyond the project boundary. • Make use of existing routes / roads as much is feasible. • Implement a stormwater management plan. • Implement dust suppression. • Demarcate footprint areas, ensure visible demarcation • Undertake maintenance activities immediately should there be signs of any damage or areas where erosion of soils is occurring.	2	3	1	3	3	1	12	L
Opencast mining activities	Environmental pollution due to contamination, increased sedimentation and erosion of watercourses	6	3	3	3	3	3	54	M	Medium	Negative	• Implement stormwater management plan. • Only clear (vegetation) in demarcated areas. Implement concurrent rehabilitation. • Implement dust suppression.	4	3	2	3	3	2	30	L
Opencast mining activities, hauling of ore to the Waterval West Plant	Alterations in hydrological regime (flow of surface and sub-surface water)	4	5	1	4	4	4	72	M	Low	Negative	• Maintain an effective Storm Water Management Plan. • Undertake maintenance activities immediately should there be signs of any damage or areas where erosion of soils is occurring.	4	3	2	3	3	2	30	L
Groundwater																				
Dewatering of the pit areas	**Lowering of groundwater levels** A groundwater dewatering cone or a zone of groundwater drawdown will develop around the open pit due to mine dewatering. The drawdown cone will enlarge as mining proceeds and will extend up to 400 m from the pit perimeter at the end of mining. (impact on the neighbouring groundwater user (HBH2).	2	3	2	3	3	3	39	L	Low	Negative	• Boreholes BH WV1-4 as well as HBH2 should be included in the mine's water level monitoring network/program. Application hereof can function as a type of early warning detection measure to prevent possible unexpected excessive drawdown and subsequent degradation of the aquifer.	2	3	2	2	2	3	33	L

UG1 Opencast Project: Impact Assessment – Operational Phase																					
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	
Dewatering of the pit areas	**Reduction of baseflow to the Hex River** Mine dewatering could also reduce the groundwater baseflow availability for river flow. The simulated reduction in groundwater flow into the river cells (Hex River) towards the end of the operational period is 100 to 120 m³/d (≈1.2 to 1.4 l/s). The potential impact is likely to be insignificant during the rainy season but notable during the dry season.	4	3	2	3	3	3	45	M	Medium	Negative	• Boreholes BH WV1-4 as well as HBH2 should be included in the mine's water level monitoring network/program. Application hereof can function as a type of early warning detection measure to prevent possible unexpected excessive drawdown.	4	3	2	2	2	3	39	L	
Infiltration of contaminants from the PCD	Deterioration in water quality due to leakages from the Pollution control dam	4	3	1	3	4	4	60	M	Medium	Negative	• The proposed pollution control dam is at the location of the NW-SE striking dolerite dyke with potential enhanced aquifer conditions. The dam should be lined with an impermeable liner. Borehole BH WV4 will serve as an early warning detection in the event of leakage of the liner.	4	3	2	2	2	3	39	L	
Infiltration of contaminants leached from overburden and ore stockpiles	Deterioration of groundwater quality	4	3	1	3	4	4	60	M	Medium	Negative	• A barrier system should be installed for the stockpile areas to reduce the infiltration of potential contaminants. A stormwater management system should be implemented to prevent additional recharge to the aquifer.	2	3	1	1	3	3	30	L	
Air Quality																					
Opencast mining activities	**Increase in ambient TSP concentrations** The predicted dust deposition is low and well below the limit value for acceptable dust fallout in non-residential areas. The magnitude of the current impact is therefore very low. The duration of the impact will be for the life of the operations and is therefore long term. The extent of the impact is small and is limited to within 5 km of the site and mainly along the haul road and is therefore classified as local. The impact of exposure of dust on vegetation is through deposition on leaf surfaces	2	4	2	1	1	2	20	L	Low	Negative	• Continue with current dust control measures, i.e. spraying of mine roads and haul road. • Continue with current monthly dust fallout monitoring program.	4	4	2	1	1	3	36	L	

UG1 Opencast Project: Impact Assessment – Operational Phase																				
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		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
	and inhibiting transpiration. The predicted dust fallout is low and localised. With no irreplaceable resources in the zone of impact, there is deemed to be a very low or no potential for the loss of irreplaceable resources. If the impacts described occur, they will be reversible if exposure ceases. There is a low probability of the potential impacts occurring as a result of the proposed project considering the low predicted dust fallout and generally low measured dust fallout. The significance of the impact of the proposed operations on air quality is low																			
Hauling of ore from the opencast area to the Waterval West Plant Mine related traffic on opencast project area	**Increase in ambient, PM_{10} and $PM_{2.5}$ concentrations** Although predicted ambient PM_{10} and $PM_{2.5}$ concentrations are relatively low and well below the respective NAAQS throughout the surrounding environment and nearby residential areas, the high emissions from haul roads results in predicted ambient concentrations that exceed the annual average and 24-hour NAAQS for PM_{10} and are relatively high for $PM_{2.5}$ over the central parts of the Waterval UG1 Opencast Area. The magnitude of the impact is therefore very high. The duration of the impact will be for the life of the operations and is therefore long term. The extent of the impact is limited to within 1 km of the haul roads and is therefore classified as local. The human health impact of	10	4	2	3	1	3	60	M	Low	Negative		4	4	2	1	1	3	36	L

UG1 Opencast Project: Impact Assessment – Operational Phase																				
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		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
	exposure to PM_{10} and $PM_{2.5}$ is primarily through inhalation. Although the predicted exceedances do not extend into the commercial and residential areas around the Waterval UG1 Opencast Project site, there is a moderate potential for the loss of irreplaceable resources. If the impacts described occur, they will be reversible if exposure ceases. There is a medium probability of the potential impacts occurring considering the predicted extent and magnitude of the high concentrations.																			
Noise																				
Earth drilling at the opencast pit, earthworks within the pit, removal of overburden from pit	Noise increase in excess of the permissible threshold value of 7.0dBA before a noise disturbance is created at the footprint of the shaft complex, other mining activities and/or the mining right boundary of the mine.	6	4	2	4	3	4	76	MH	Low	Negative	• Equipment and/or machinery which radiate noise levels above 85.0dBA to be acoustically screened off. • Noise monitoring at the residential areas and the mine boundaries to be done annually; • Actively manage the process and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The levels to be evaluated in terms of the baseline noise levels. • Road surface along the access road to be maintained in a good order and free from potholes. • Motor vehicles to keep within the speed limit of the road.	4	4	2	3	3	4	64	M
Hauling of ore within UG1 opencast project area	Noise increase in excess of the permissible threshold value of 7.0dBA before a noise disturbance is created at the footprint of the mine footprint, other mining activities and/or the mining right boundary of the mine.	6	4	2	4	3	4	76	MH	Low	Negative		4	4	2	3	3	4	64	M
Access road to the mining area from the main road	Noise increase in excess of the permissible threshold value of 7.0dBA before a noise disturbance is created at the footprint, other mining activities and/or the mining right boundary of the mine.	4	3	2	3	3	3	45	M	Low	Negative	• Vehicles to maintain the speed limit along the access road. • The access road to be free of potholes, speed humps and to be maintained in a good order at all times.	4	3	2	3	3	2	30	L
Visual																				
Opencast mining activities		6	5	3	4	4	4	88	MH	High	Negative	• Concurrent/ progressive rehabilitation must be implemented where possible and disturbed areas must be rehabilitated as soon as areas	6	4	2	3	3	3	54	M

UG1 Opencast Project: Impact Assessment – Operational Phase																				
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		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
												become available by replacing topsoil and revegetating disturbed areas. • No further clearing of vegetation may take place during the operational phase of the project. • No alien vegetation or vegetation not naturally occurring within the area which may stand out against the natural vegetation may be used as part of any ongoing landscaping activities. • An alien vegetation control plan must be implemented. • The appearance and general upkeep of the infrastructure must be maintained to a high standard and be kept neat and orderly at all times. • Long term stockpiles should be, as far as possible, sloped in such a manner so as to resemble the topography and existing mining dumps of the surrounding area, or as close as possible to it.								
Opencast mining activities	Visual Intrusion and VAC impacts	6	5	3	3	3	4	80	MH	Medium	Negative	• Concurrent/ progressive rehabilitation must be implemented where possible and disturbed areas must be rehabilitated as soon as areas become available by replacing topsoil and revegetating disturbed areas. • The design and height increase of the stockpiles must be monitored to ensure that these components relate to acceptable environmental standards in terms of slope and elevation. • The stockpiles should ideally be shaped at an adequate slope from the commencement of the project to ensure that it integrates more successfully into the natural topography of the visual landscape. • As far as possible, existing roads are to be utilised to prevent cumulative impacts from roads and traffic. • Transport of routes, vehicles and road usage should be optimised as far as possible to limit the number of additional vehicles on local and district roads.	6	4	2	3	3	3	54	M
Opencast mining activities	Visual Exposure and Visibility Impacts	6	5	3	3	3	4	80	MH	Medium	Negative	• As far as possible, existing roads are to be utilised to prevent cumulative impacts from roads and traffic. • Transport of routes, vehicles and road usage should be optimised as far as possible to limit the number of additional vehicles on local and district roads. • The appearance and general upkeep of the infrastructure must be maintained to a high	6	4	2	3	3	3	54	M

UG1 Opencast Project: Impact Assessment – Operational Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
												standard and be kept neat and orderly at all times.								
Opencast mining activities	Impacts due to Night Time Lighting	6	5	3	3	3	4	80	MH	Low	Negative	• The use of bright floodlighting at the opencast pits should be to avoided as the use of additional night-time lighting which may lead to skyglow A lighting engineer may be consulted to assist in the planning and placement of light fixtures in order to reduce visual impacts associated with glare and light trespass. • Outdoor lighting must be strictly controlled. • No unnecessary lighting may be introduced. The use of high light masts and high pole top security lighting should be avoided along the periphery of the buildings. Any high lighting masts should be covered to reduce sky glow. • Up-lighting of structures must be avoided, with lighting installed at downward angles that provide precisely directed illumination beyond the immediate surroundings of the infrastructure, thereby minimising the light spill and trespass. • Care should be taken when selecting luminaries to ensure that appropriate units are chosen and that their location will reduce spill light and glare to a minimum. Only "full cut-off" light fixtures that direct light only below the horizontal must be used on the buildings. • Censored and motion lighting may be installed to prevent use of lights when not needed. • Minimum wattage light fixtures should be used, with the minimum intensity necessary to accomplish the light's purpose. • The use of low-pressure sodium lamps, yellow LED lighting, or an equivalent reduces skyglow and wildlife impacts. • Vehicle-mounted lights or portable light towers are preferred over permanently mounted lighting for night-time maintenance activities. If possible, such lighting should be equipped with hoods or louvers and be aimed toward the ground to avoid causing glare and skyglow (BLM, 2013). • The use of permanent signs should be in accordance with the requirements of the project and mining regulations, be minimised and visually unobtrusive.	6	4	3	3	3	3	57	M
Heritage																				
Impact on Archaeological Resource - Iron Age sites	**Impact on Archaeological Resources** Due to the lack of any heritage finds at the UG1 opencast project area, no impacts are expected during the operation phase.																			

UG1 Opencast Project: Impact Assessment – Operational Phase																					
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	
Blasting																					
Blasting activities	Increased ground vibration	4	2	2	2	4	2	28	L	Medium	Negative	• Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. Various points of interests are observed within the pit that needs consideration as well within 500 m from the mining area. The mine will have to apply for the necessary authorisations as prescribed in the various acts, and specifically Mine Health and Safety Act Reg 4.16 as well as recommendations regarding infrastructure within the pit areas. • Blast designs as presented should be applied. Review of blast design with increased stemming lengths should be considered. A monitoring programme for recording blasting operations is recommended. The following elements should be part of such a monitoring program: ○ Ground vibration and air blast results. ○ Blast Information summary. ○ Video Recording of the blast. ○ Fly rock observations. • Calculated minimum safe distance is 273 m. The final blast designs that may be used will determine the final decision on safe distance to evacuate people and animals. This distance may be greater pending the final code of	3	2	2	2	4	2	26	L	
Blasting activities	Fly rock	6	2	2	3	4	3	51	M	Medium	Negative		4	2	2	3	4	2	30	L	

UG1 Opencast Project: Impact Assessment – Operational Phase																						
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		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Blasting activities	Increased ground vibration	8	2	2	4	4	4	80	MH	Medium	Negative	practice of the mine and responsible blaster's decision on safe distance. The blaster has a legal obligation concerning the safe distance and he needs to determine this distance. The R24 Road on the northern side of the pit area, is at an approximate distance of 381 m from the pit area. It will be required that clearance distances be set, and road travel managed during blasting operations when blasting is done closer to the mine's set unsafe boundary. • The option of photographic survey of all structures up to 1500 m from the pit area is recommended. • It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These 'do nots' stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate. • It is recommended that a standard blasting time is fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times. • Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work • Video of each blast will help to define if fly rock occurred and origin of fly rock. Immediate mitigation measure can then be applied if necessary. The video will also be a record of blast conditions.	4	2	2	4	4	2	32	L
Waste Management																				
Vegetation clearance and construction of surface infrastructure	Increase waste generation due to operational activities	5	5	5	5	5	5	125	L	Low	Negative	• Rubble and other construction waste produced should be re-used if possible, otherwise be disposed of in line with the mine's Waste Management Procedure (Appendix E) and associated procedures. • Adequate bins must be provided on site and cleared regularly. Bins must not overflow. • The construction area must remain litter free and regular inspections for litter must be conducted. The activity should not contribute to any surrounding windblown litter.	2	5	3	1	1	2	24	L

UG1 Opencast Project: Impact Assessment – Operational Phase																				
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**							
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**
												• Waste skips must be covered and emptied regularly. No overflowing of the skips is allowed. • Waste must not to be buried or burned.								
Social																				
Opencast mining activities	**Improved infrastructure in the study area due to social investment activities** Glencore Waterval Mine has developed an SLP which has the potential to promote and support community development, capacity building and empowerment, which includes job creation, skills and SMME development and infrastructure development. The impact will be most significant during the operations phase of the mine. While benefits will cease with mine closure, sustainable projects and infrastructure will endure post closure.	2	4	2	1	1	2	20	L	Low	Positive	• Implement management and enhancement measures as per the SLP.	4	4	2	1	1	3	36	L
Opencast mining activities	**Benefits resulting from employment and income opportunities created by the UG1 opencast project** Employment and a secure income provide many socio-economic benefits to employees and their dependents, including: Improved material wealth and standard of living; Enhanced potential to invest in and improve access to social services such as education, health services, etc. (which may be provided directly by the company to employees and/or employees may now have the funds to pay for these services); and, Employment and training of unskilled workers facilitates skills development and improves the future	2	4	2	1	1	2	20	L	Low	Positive	• Implement management and enhancement measures as per the SLP.	4	4	2	1	1	3	36	L

UG1 Opencast Project: Impact Assessment – Operational Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
	employment prospects of such workers.																			
Opencast mining activities	Dissatisfaction over employment opportunities and conditions of procurement which could potentially lead to community protests and unrests, as well as conflicts within communities	8	3	2	2	2	3	51	M	Low	Negative	• Implement management and enhancement measures as per the SLP.	4	4	2	1	1	3	36	L

Table 103: Assessment of identified impacts of the proposed UG1 opencast project during decommissioning and closure phase

UG1 Opencast Project: Impact Assessment – Closure Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Soils																				
Demolishment of surface infrastructure, rehabilitation of disturbed areas	**Potential for compaction and contamination of soils** The impact will remain the net loss of the soil resource if no intervention or mitigating strategy is implemented. The magnitude of impact will remain moderate and negative for all of the activities if there is no active management (rehabilitation and intervention) in the decommissioning phase, and closure will not be possible.	6	4	1	3	3	5	85	M	Low	Negative	• Re-instatement of the stored soils onto areas of disturbance where infrastructure has been demolished and removed. • Contour and stabilise slopes to be free draining and limit/control vehicle movement and dirty water outflows, vehicle maintenance and assessment of risk of contamination from infrastructure prior to demolition.	4	2	1	2	1	2	20	L
Biodiversity																				
Demolishment of surface infrastructure, rehabilitation of disturbed areas	**Re-vegetation of rehabilitated areas** Re-vegetation of areas where demolition and clearing of surface infrastructure has taken place will positively impact on the biodiversity of the area. Strict rehabilitation management measures should be implemented to ensure establishment of indigenous vegetation of rehabilitated areas.	6	4	1	3	3	5	85	M	Low	Positive	• Only regionally, biome specific indigenous species should be used in the landscaping and rehabilitation. • Vegetation establishment must be inspected. • Ensure the removal of the alien and weed species encountered on the rehabilitated area.	4	2	1	2	1	2	20	L
Surface water																				

UG1 Opencast Project: Impact Assessment – Closure Phase																				
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**							
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**
Demolishment of surface infrastructure, rehabilitation of disturbed areas	**Siltation of watercourses** Impacts may arise from erosion during rainfall events, resulting in increased suspended solids in run-off water, reporting to the local watercourses	4	4	1	3	3	5	75	M	Low	Negative	The storm water management infrastructure, including the PCD will be decommissioned last, to ensure adequate storm water management during the rehabilitation phase. Servicing of heavy vehicles will take place only in dedicated areas that are equipped with drip trays. Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil. Spill-sorb or a similar type product will be kept on site and used to clean up hydrocarbon spills in the event that they should occur.	2	2	1	1	1	2	14	L
Groundwater																				
Migration of contaminants from the backfilled pit material	Deterioration of groundwater quality (impact on the neighbouring groundwater user (HBH2))	6	4	2	3	4	4	76	MH	Medium	Negative	• The final layer of the backfilled pit (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the area. • Borehole HBH2 and BH WV1-4 should be included in the mine's water quality monitoring network/program in order to monitor plume migration and to ensure the user of HBH2 is notified of unacceptable levels of contamination. • Consideration should be given to the possibility of needing supply the user of HBH2 with water if the groundwater quality deteriorates to such a degree that it can no longer be used for the intended purposes. • A borehole could be drilled into the pit area to be used for monitoring the recovery of the groundwater level and for establishing the contaminant source concentration. • At least one dedicated monitoring borehole should be drilled between the proposed overburden stockpile and the road to the northeast.	6	4	2	2	4	3	54	M
Migration of contaminants from the backfilled pit material	Deterioration of groundwater quality (impact on the Hex River water quality.	4	4	1	2	3	4	56	M	Low	Negative	• The final layer of the backfilled pit (just below the topsoil cover) should be as clayey as possible and compacted if feasible, to reduce recharge to the area. • Borehole HBH2 and BH WV1-4 should be included in the mine's water quality monitoring network/program in order to monitor plume migration. • The water quality of the Hex River should be monitored. • A borehole could be drilled into the pit area to be used for monitoring the recovery of the groundwater level and for establishing the contaminant source concentration. • At least one dedicated monitoring borehole should be drilled between the proposed overburden stockpile and the road to the northeast.	4	4	1	1	3	3	39	L

UG1 Opencast Project: Impact Assessment – Closure Phase																				
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION							
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance
Surface decant from the backfilled pit area	Contamination of surface water bodies by decanting water	4	4	1	4	3	3	48	M	Low	Negative	• A dirty water management system should be implemented to intercept decant water. Any decant water should be diverted away from vulnerable areas. The decant potential should be reassessed before closure.	2	4	1	2	2	2	22	L
Air Quality																				
Earthworks and revegetation, rehabilitation activities.	**Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations** Dust generated through the closure activities will be generally coarse and impacts will manifest as a nuisance rather than a health issue. The magnitude of the impact is likely to be very low. The decommissioning and closure activities are likely to endure for 6 to 12 months and impacts might only occur during this period. The duration is therefore short-term. The pollutants are released close to ground level with little or no buoyancy. This implies that their dispersion is limited and the extent of potential impacts will be limited to the site. Ambient concentrations of particulates is expected to be very low from decommissioning and closure, and potential air quality impacts are expected to be limited to the site. With no irreplaceable	2	2	1	1	1	2	14	L	Low	Negative	• Continue with current dust control measures, i.e. spraying of mine roads and haul road. • Continue with current monthly dust fallout monitoring program.	2	2	1	1	1	2	14	L

UG1 Opencast Project: Impact Assessment – Closure Phase																					
ACTIVITY	POTENTIAL ENVIRONMENTAL IMPACT	ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION								Cumulative	Status	RECOMMENDED MITIGATION MEASURES/ REMARKS	ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION								
		Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance				Magnitude	Duration	Extent	Irreplaceability	Reversibility	Probability	TOTAL	Significance	
	resources in the zone of impact, there is deemed to be a very low or no potential for the loss of irreplaceable resources. If the impacts described occur, they will be reversible if exposure ceases. Furthermore, there is a low probability of the potential impacts occurring.																				
Noise																					
Removal of infrastructure	Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas	4	3	2	3	3	3	45	M	Low	Negative	• Demolition activities at the mining area to be done during daytime provided that the prevailing ambient noise level at the mine boundaries will not be exceeded.	4	3	2	3	3	2	30	L	
Earthworks and revegetation, rehabilitation activities	Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas	4	3	2	3	3	3	45	M	Low	Negative	• Earthworks and planting of vegetation to be done during daytime provided that the prevailing ambient noise level at the mine boundaries will not be exceeded.	2	2	2	3	3	3	36	L	
Visual																					
Demolishment of surface infrastructure, rehabilitation of disturbed areas	Impact on Landscape Character and Sense of Place	6	2	3	3	3	3	51	M	Low	Negative	• Decommissioning and demolition footprints and adjacent disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose. • All areas where infrastructure is removed must be re-sloped to resemble the pre-development landscape and revegetated as soon as possible, as far as is practical and feasible. • The stockpile areas should be rehabilitated and sloped in such a manner that it blends in with the surrounding mountainous terrain.	4	2	2	2	2	2	24	L	

UG1 Opencast Project: Impact Assessment – Closure Phase																					
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**	
												• Ongoing alien invasive species management should take during and after the decommissioning phase of the project.									
Demolishment of surface infrastructure, rehabilitation of disturbed areas	Visual Intrusion and VAC impacts	4	2	2	3	3	3	42	M	Low	Negative	• Additional rehabilitation must be implemented where possible to enhance the rehabilitation requirements throughout the life of mine. • Indigenous and locally occurring plant species for use in re-vegetation should be selected taken quick growth rates into consideration in order to cover bare areas and prevent soil erosion. • Upon final rehabilitation, it must be aimed to remove all surface infrastructure and to reshape the landscape to pre-development conditions. • During rehabilitation, the removal of infrastructure, ripping of roads and reshaping of impacted areas should take place.	2	2	1	2	2	2	18	L	
Demolishment of surface infrastructure, rehabilitation of disturbed areas	Visual Exposure and Visibility Impacts	6	2	3	3	2	3	48	M	Low	Negative	• Decommissioning and demolition footprints and adjacent disturbed areas should be kept as small as possible and no further indigenous vegetation should be cleared or soils exposed for this purpose. • Additional rehabilitation must be implemented where possible to enhance the rehabilitation requirements throughout the life of mine. Appropriate rehabilitation must take place to ensure that the post development of the land use is supported in a manner that is not visually intrusive in the landscape.	4	2	2	2	2	2	24	L	
Heritage																					
Impact on Archaeological Resource - Iron Age sites	**Impact on Archaeological Resources** Due to the lack of any heritage finds at the UG1 opencast project area, no impacts are expected during the decommissioning and closure phase.																				
Blasting																					
No blasting will be undertaken during the closure phase, therefore no impacts are expected.																					
Social																					

UG1 Opencast Project: Impact Assessment – Closure Phase																					
ACTIVITY	**POTENTIAL ENVIRONMENTAL IMPACT**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**								**Cumulative**	**Status**	**RECOMMENDED MITIGATION MEASURES/ REMARKS**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		Magnitude	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**				**Magnitude**	**Duration**	**Extent**	**Irreplaceability**	**Reversibility**	**Probability**	**TOTAL**	**Significance**	
Demolishment of surface infrastructure, rehabilitation of disturbed areas	**Loss of employment and enterprise development opportunities due to closure of mine** During decommissioning and closure, all mining activities will cease and therefore employment opportunities will be limited. It is anticipated that there will be a negative effect on employees as a result of job losses.	6	3	3	3	3	3	54	M	Low	Positive	Develop a closure plan which will aim to reinforce the objectives of the SLP by reducing the reliance on Glencore for employment by promoting skills transfer to enable alternative livelihoods.	4	3	2	2	2	2	26	L	

16 Methodology used in determining the significance of the environmental impacts

16.1 Methodology applied in the existing approved Updated EMPR, 2009

The impacts have been assessed according to the following:

- Nature of the impact,
- Extent of the impact,
- Duration of the impact, and
- Probability of the impact.

Each of the above parameters have been rated, and the impacts classified as follows:

- Low – no/negligible need for mitigatory measures. Rating between 0-6.
- Medium – mitigation measures necessary, will not prevent the project from going forward. Rating between 7-12.
- High – mitigatory measures necessary, and may prevent the project from going forward. Rating between 13-16.

Table 104: Impact and risk rating methodology (Shangoni 2021)

Parameter	**Rating**				
	0	1	2	3	4
Extent	None	Site specific	Adjacent area/local	Regional	National
Duration	None	Short-term	Medium-term	Long-term	Permanent
Severity	None	Negligible (Environment not altered)	Low (Environment altered but systems continue to function)	Medium (Environment altered and systems temporarily cease to function)	High (Environment altered and systems irrevocably damaged)
Probability	None	Unlikely (0-10%)	Possible (10-50%)	Probable (50-90%)	Definite (>90%)

16.2 Methodology applied in the existing approved PGM EMPR, 2011

Table 105: Impact and risk rating methodology (Shangoni, 2021)

Methodology	
PROBABILITY / LIKELIHOOD of occurrence of impact	
Very low: <20% sure of particular fact or likelihood of impact occurring. **Low:** 20 to 39% sure of particular fact or likelihood of impact occurring. **Moderate:** 40 to 59% sure of particular fact or likelihood of impact occurring. **High:** 60 to 79% sure of particular fact or likelihood of impact occurring **Very high:** 80 to 99% sure of particular fact or likelihood of impact occurring.	
DURATION of impact	**EXTENT of impact (spatial scope)**

Very short: < 1 year **Short term:** 1 – 5 years **Medium term:** 6– 12 years **Long term:** 13 – 50 years **Irreversible**	**On site** **Local:** Neighbouring properties **District:** 0 – 5 km from the site **Regional:** Rustenburg Local Municipality **National**

SIGNIFICANCE of impact
No impact: There would be no impact at all - not even a very low impact on the system or any of its parts. **Very low:** Impact would be negligible. In the case of negative impacts, almost no mitigation and/or remedial activity would be needed, and any minor steps, which might be needed, will be easy, cheap and simple. In the case of positive impacts, alternative means would almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. **Low:** Impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and/or remedial activity would be either easily achieved or little would be required, or both. In case of positive impacts, alternative means for achieving this benefit would likely be easier, cheaper, more effective, less time-consuming, or some combination of these. **Moderate:** Impact would be real but not substantial within the bounds of those, which could occur. In the case of negative impacts, mitigation and/or remedial activity would be both feasible and fairly easily possible. In the case of positive impacts, other means of achieving these benefits would be about equal in time, cost and effort. **High:** Impacts of a substantial order. In the case of negative impacts, mitigation and/or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these. In the case of positive impacts, other means of achieving this benefit would be feasible, but these would be more difficult, expensive, time-consuming or some combination of these. **Very high:** Of the highest order possible within the bounds of impacts which could occur. In the case of negative impacts, there would be no possible mitigation and/or remedial activity to offset the impact at the spatial or time scale for which it was predicted. In the case of positive impacts, there is no real alternative to achieving the benefit.

16.3 Methodology applied in the exiting approved Millsell - Waterkloof EMPR, 2010

Table 106: Impact and risk rating criteria (Shangoni, 2021)

Criteria	
Extent	
Classification of the physical and spatial scale of the impact	
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Site	The impact could affect the whole, or a significant portion of the site.
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
National	The impact could have an effect that expands throughout the country (South Africa).
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.
Duration	
The lifetime of the impact that is measured in relation to the lifetime of the proposed development.	
Short	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.
Short to Medium	The impact will be relevant through to the end of a construction phase (1.5 years)
Medium	The impact will last up to the end of the development phases, where after it will be entirely negated.
Long	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	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 can be considered transient.
Intensity	
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as	
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
Probability	

Criteria	
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25 %.
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.
Highly 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 %.
Definite	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 %.

The status of the impacts and degree of confidence with respect to the assessment of the significance must be stated as follows:

- Status of the impact - A description as to whether the impact would be positive (a benefit), negative (a cost), or neutral.
- Degree of confidence in predictions - The degree of confidence in the predictions, based on the availability of information and specialist knowledge.

Other aspects to take into consideration in the specialist studies are:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the full-lifecycle of the proposed development, including construction, operation and decommissioning.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region.
- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

16.3.1 Determination of Significance – Without Mitigation

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact “without mitigation” is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as “positive”. Significance is rated on the following scale:

Table 107: Determination of Significance – Without Mitigation (Shangoni, 2021)

Determination of Significance – Without Mitigation	
No significance	The impact is not substantial and does not require any mitigation action.

Determination of Significance – Without Mitigation	
Low	The impact is of little importance, but may require limited mitigation.
Medium	The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
High	The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

16.3.2 Determination of Significance – With Mitigation

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation is rated on the following scale:

Table 108: Determination of Significance – With Mitigation (Shangoni, 2021)

Determination of Significance – With Mitigation	
No significance	The impact will be mitigated to the point where it is regarded as insubstantial.
Low	The impact will be mitigated to the point where it is of limited importance.
Low to Medium	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.
Medium	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.
Medium to 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.
High	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.

For each impact under scrutiny, a scaled weighting factor is attached to each respective impact. The purposes of assigning such weights serve to highlight those aspects considered the most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Table 109: Rating criteria (Shangoni, 2021)

Extent		Duration		Intensity		Probability		Weighting Factor (WF)		Significance Rating (SR)	
Footprint	1	Short	1	Low	1	Probable	1	Low	1	Low	0-19
Site	2	Short to medium	2		2	Possible	2	Low to medium	2	Low to medium	20-39
Regional	3	Medium	3	Medium	3	Likely	3	Medium	3	Medium	40-59

Extent		**Duration**		**Intensity**		**Probability**		**Weighting Factor (WF)**		**Significance Rating (SR)**	
National	4	Long	4		4	Highly likely	4	Medium to High	4	Medium to High	60-79
International	5	Permanent	5	High	5	Definite	5	High	5	High	80-100

Mitigation Efficiency (ME)		Significance Following Mitigation (SFM)	
High	0,2	Low	0-19
Medium to High	0,4	Low to medium	20-39
Medium	0,6	Medium	40-59
Low to Medium	0,8	Medium to High	60-79
Low	1,0	High	80-100

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.

16.3.3 Identifying the 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).

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

16.3.4 Identifying the 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 was necessary to re-evaluate the impact.

Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a Mitigation Effectiveness (ME) rating. The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact.

Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency

Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

16.4 Impact assessment methodology used for the UG1 opencast project

The significance of the identified impacts will be determined using an accepted methodology from the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, April 1998. As with all impact methodologies, the impact is defined in a semi-quantitative way and will be assessed according to methodology prescribed in the following section.

Table 110: Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating Scale and Description/criteria
MAGNITUDE of negative impact (at the indicated spatial scale)	**10 - Very high**: Bio-physical and/or social functions and/or processes might be *severely* altered. **8 - High**: Bio-physical and/or social functions and/or processes might be *considerably* altered. **6 - Medium**: Bio-physical and/or social functions and/or processes might be *notably* altered. **4 - Low** : Bio-physical and/or social functions and/or processes might be *slightly* altered. **2 - Very Low**: Bio-physical and/or social functions and/or processes might be *negligibly* altered. **0 - Zero**: Bio-physical and/or social functions and/or processes will remain *unaltered*
MAGNITUDE of POSITIVE IMPACT (at the indicated spatial scale)	**10 - Very high (positive)**: Bio-physical and/or social functions and/or processes might be *substantially* enhanced. **8 - High (positive)**: Bio-physical and/or social functions and/or processes might be *considerably* enhanced. **6 - Medium (positive)**: Bio-physical and/or social functions and/or processes might be *notably* enhanced. **4 - Low (positive)**: Bio-physical and/or social functions and/or processes might be *slightly* enhanced. **2 - Very Low (positive)**: Bio-physical and/or social functions and/or processes might be *negligibly* enhanced. **0 - Zero (positive)**: Bio-physical and/or social functions and/or processes will remain *unaltered.*
DURATION	**5 - Permanent** **4 - Long term**: Impact ceases after operational phase/life of the activity > 20 years. **3 - Medium term**: Impact might occur during the operational phase/life of the activity – 20 years. **2 - Short term**: Impact might occur during the construction phase - < 3 years. **1 - Immediate**
EXTENT (or spatial scale/influence of impact)	**5 - International**: Beyond National boundaries. **4 - National**: Beyond Provincial boundaries and within National boundaries. **3 - Regional**: Beyond 5 km of the proposed development and within Provincial boundaries. **2 - Local**: Within 5 km of the proposed development. **1 - Site-specific**: On site or within 100 m of the site boundary. **0** - None
IRREPLACEABLE loss of resources	**5 – Definite** loss of irreplaceable resources. **4 – High** potential for loss of irreplaceable resources. **3 – Moderate** potential for loss of irreplaceable resources. **2 – Low** potential for loss of irreplaceable resources. **1 – Very low** potential for loss of irreplaceable resources. **0 - None**
REVERSIBILITY of impact	**5 –** Impact **cannot** be reversed. **4 – Low** potential that impact might be reversed. **3 – Moderate** potential that impact might be reversed. **2 – High** potential that impact might be reversed. **1 –** Impact **will be** reversible. **0 –** No impact.
PROBABILITY (of occurrence)	**5 - Definite:** >95% chance of the potential impact occurring. **4 - High probability:** 75% - 95% chance of the potential impact occurring. **3 - Medium probability:** 25% - 75% chance of the potential impact occurring

Evaluation Component	Rating Scale and Description/criteria
	2 - Low probability: 5% - 25% chance of the potential impact occurring. **1 - Improbable:** <5% chance of the potential impact occurring.
Evaluation Component	**Rating Scale and Description/criteria**
CUMULATIVE impacts	**High**: The activity is one of several similar past, present or future activities in the same geographical area, and might contribute to a very significant combined impact on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Medium***: The activity is one of a few similar past, present or future activities in the same geographical area, and might have a combined impact of moderate significance on the natural, cultural, and/or socio-economic resources of local, regional or national concern. ***Low***: The activity is localised and might have a negligible cumulative impact. ***None***: No cumulative impact on the environment.

Once the Environmental Risk Ratings have been evaluated for each potential environmental impact, the Significance Score of each potential environmental impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Environmental Significance of each potential environmental impact as per Table 111. The Environmental Significance rating process is completed for all identified potential environmental impacts both before and after implementation of the recommended mitigation measures.

Table 111: Scale used for the evaluation of the Environmental Significance Ratings

Significance Score	Environmental Significance	Description/criteria
125 – 150	**Very high (VH)**	An impact of very high significance will mean that the project cannot proceed, and that impacts are irreversible, regardless of available mitigation options.
100 – 124	**High (H)**	An impact of high significance which could influence a decision about whether or not to proceed with the proposed project, regardless of available mitigation options.
75 – 99	**Medium-high (MH)**	If left unmanaged, an impact of medium-high significance could influence a decision about whether or not to proceed with a proposed project. Mitigation options should be relooked
40 – 74	**Medium (M)**	If left unmanaged, an impact of moderate significance could influence a decision about whether or not to proceed with a proposed project.
<40	**Low (L)**	An impact of low is likely to contribute to positive decisions about whether or not to proceed with the project. It will have little real effect and is unlikely to have an influence on project design or alternative motivation.
+	**Positive impact (+)**	A positive impact is likely to result in a positive consequence/effect, and is likely to contribute to positive decisions about whether or not to proceed with the project

16.5 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

The following provides a summary of the advantages and disadvantages of the proposed UG1 opencast project site/layout.

Advantages

- The proposed UG1 opencast project falls within Glencore Waterval Mine's approved Mining Right Area;

- The chrome resource has already been quantified;
- The project will ensure on-going mining and safeguard that Waterval Mine remains operational;
- Limited environmental impacts as the area have already been disturbed by historic farming practices;
- Low faunal and floral diversity as the area is within the mining right area and has already been historically impacted;
- Waterval Mine will retain current direct employment;
- With the implementation of the roll-over method of mining, concurrent rehabilitation will be implemented allowing the area to be returned to its natural pre-mining state as far as possible.

Disadvantages

- Potentially pit dewatering will be required;
- LoM is planned to be in the order of only +/-3 years;
- Increased noise and dust impact that will require management such as dust suppression;
- Potential long term impacts on groundwater quality i.e., post closure;
- Visual impacts i.e., height of overburden stockpiles, night lighting etc);
- Impacts of blasting on neighbouring properties and businesses.

16.6 The possible mitigation measures that could be applied and the level of risk

The mitigation measures to be implemented and the level of risk of potential impacts have been addressed in Part A Section 15.4. Comments and concerns raised by stakeholders are included and addressed in Table 30.

16.7 Motivation where no alternative sites were considered

Alternatives were considered and are discussed in Part A Section 8 of this Draft EIA/EMPr.

16.8 The Final Site Layout Plan

The final site layout plan for the proposed UG1 opencast project is presented in Figure 18.

The property for the preferred location has been selected as it is located within Glencore's existing Mining Right Area on property owned by Glencore (remaining extent of Portion 82 of the farm Waterval 306 JQ).

The preferred location has also been constrained due to the location of the mineral resource and proven reserve, the shallowness of the reserve as well as the location of the site in relation to the Waterval West processing plant. The proposed location of the UG1 opencast project will allow Waterval Mine to continue with processing of ore at its existing Waterval West plant

17 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 plant) through the life of the activity

All impacts and risks as identified are contained within Section 15.4 (impacts and risks identified). 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 methodology applied in assessing and ranking the impacts and risks is described in Section 16.4. The potential impacts and risks of the activities were identified through consultation with the applicant regarding the activities undertaken, as well as by means of GIS data and spatial tools and specialist studies.

A number of specialist studies have been to establish the baseline status quo of the UG1 opencast project area as well as to identify potential impacts and provide mitigation measures. The following specialist studies were undertaken:

- Agricultural compliance statement - *The Biodiversity Company*
- Vegetation compliance statement- *The Biodiversity Company*
- Freshwater assessment - *The Biodiversity Company*
- Surface water study - *Hydrological Environmental Engineering Solutions (HEES)*
- Groundwater assessment - *Geostratum Water Management Consultants*
- Air quality - *uMoya-NILU Consulting*
- Noise assessment- *dBAcoustics*
- Heritage impact assessment- *Beyond Heritage*
- Visual impact assessment - *Scientific Aquatic Services*
- Closure Plan and financial provision - *Hydrological Environmental Engineering Solutions (HEES)*

18 Assessment of each identified potentially significant impact and risk

Refer to the full risk assessment and mitigation measures tables provided in Part A Section 15.4.

19 Summary of specialist reports

Refer to Table 112 for recommendations made by specialists relating to the proposed UG1 opencast project.

Table 112: Recommendations made by specialists – UG1 Opencast project

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
Hydrological Environmental Engineering Solutions, December 2022 *Surface Water Management Plan*	• Paddocks are required at the toe of the overburden stockpiles and topsoil stockpiles will contain erosion and sedimentation into the environment. • Diversion trenches are required to divert clean water at the West of the mine boundaries away from the mining area. • Diversion channels and berms are required next to the haul road to divert the dirty run-off from the haul roads towards the PCD. • A dirty-water trench is required to allow the dirty run-off from the ROM stockpile to flow into the PCD. • Gutters and trenches are required in the office and change house area as well as the parking area to ensure that these areas are free draining, and that clean water is diverted back into the environment.	x	Refer to the Table 101 to Table 103
Geostratum, January 2023 *Hydrogeological Investigation*	• A groundwater monitoring programme to measure or estimate mine dewatering abstraction rates should be implemented. • The model should be updated once operational borehole water level monitoring data and mine dewatering volumes become available. • The potential long-term nitrate source concentration of the backfilled should be determined. The data should be used to update the long-term quality risks. • Class C barrier systems should be installed for the stockpile areas. • The existing groundwater monitoring program should be expanded in order to include the 4 (four) newly drilled monitoring boreholes and the neighbouring borehole HBH2.	x	Refer to the Table 101 to Table 103

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
	• The water levels of the newly drilled monitoring boreholes should be monitored during the construction phase. • The new monitoring boreholes as well as HBH2 should be included in the mine's water level monitoring network during the operational phase. • A stormwater management system should be implemented. • The final layer of the backfilled pit should be as clayey as possible and compacted. • A borehole should be drilled into the pit area for monitoring groundwater level recovery and establishing the contaminant source concentration of the backfilled pit. • At least one dedicated monitoring borehole should be drilled between the proposed overburden stockpile and the road to the northeast. • The decant potential should be reassessed before closure.		
Geostratum, January 2023 *Hydrogeological Investigation – Groundwater model*	• The model should be updated once operational borehole water level monitoring data and mine dewatering volumes become available. It is therefore important to implement a groundwater monitoring programme and to measure or estimate mine dewatering abstraction rates. • The potential long-term nitrate source concentration of the backfilled material (after being affected by blasting) should be determined from monitoring data. The data should be used to update the long-term quality risks.	x	Refer to the Table 101 to Table 103
uMoya-NILU Consulting, October 2022 *Air Quality Assessment*	• Development of a fugitive dust management plan for the Waterval UG1 Opencast Project, including: • Routine water spraying of the haul road in the Waterval UG1 Opencast pit and the haul road to Waterval West.	x	Refer to the Table 101 to Table 103

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
	• Establishment of DFO monitoring and monthly reporting at Waterval UG1 Opencast Project. • Revegetating rehabilitated areas. • Use dust fallout data to manage the dust control program by identifying areas or sources of concern and implement stricter control measures such as more frequent spraying, spraying with surfactant or paving the haul road.		
dBAcoustics, October 2022 *Noise Impact Assessment*	• Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and any noise sources above 85.0dBA to be acoustically screened off. • Construction activities to take place during day/night-time provided that the prevailing ambient noise level along the mine boundaries will not be exceeded. • Environmental noise monitoring on a bi-annual basis during construction phase, and annually during the operational phase. • Actively manage the process and the noise management plan must be used to ensure compliance to the noise regulations and/or standards. The levels to be evaluated in terms of the baseline noise levels. • Reverse signal on the vehicles to be replaced with a vibration type signal. • Road surface along the access road to be maintained in a good order and free from potholes. • Motor vehicles to keep within the speed limit of the road • Machinery with low noise levels which complies with the manufacturer's specifications to be used; and • Activities to take place during daytime period only.	x	Refer to the Table 101 to Table 103

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
Scientific Aquatic Services, November 2022 Visual Impact Assessment	• Recommendations were developed to address and mitigate the impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.	x	Refer to the Table 101 to Table 103
Beyond Heritage, October 2022 *Heritage Impact Assessment*	• The study area should be monitored by the Environmental Control Officer (ECO) during construction to facilitate the implementation of the Chance Find Procedure for the project.	x	Refer to the Table 101 to Table 103
Blast Management & Consulting, April 2022 *Blast Impact Assessment*	• Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. Various points of interests are observed within the pit that needs consideration as well within 500 m from the mining area. The mine will have to apply for the necessary authorisations as prescribed in the various acts, and specifically Mine Health and Safety Act Reg 4.16 as well as recommendations regarding infrastructure within the pit areas. • Blast designs can be reviewed prior to first blast planned and done. Specific attention can be given to the possible use of electronic initiation rather than conventional timing systems. This will allow for single blast hole firing instead of multiple blast holes. Single blast hole firing will provide single hole firing – thus less charge mass per delay and less influence. • The current proposed stemming lengths used provides for some control on fly rock. Consideration can be given to increase this length for better control. Specific designs where distances between blast and point of concern are known should be considered. Recommended stemming length should range between 20 and 30 times the blast hole diameter. In cases for	x	Refer to the Table 101 to Table 103

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
	better fly control this should range between 30 and 34 times the blast holes diameter. Increased stemming lengths will also contribute to more acceptable air blast levels. • Calculated minimum safe distance is 273 m. The final blast designs that may be used will determine the final decision on safe distance to evacuate people and animals. This distance may be greater pending the final code of practice of the mine and responsible blaster's decision on safe distance. The blaster has a legal obligation concerning the safe distance and he needs to determine this distance. • The R24 Road on the northern side of the pit area, is at an approximate distance of 381m from the pit area. It will be required that clearance distances be set, and road travel managed during blasting operations when blasting is done closer to the mine's set unsafe boundary. • The option of photographic survey of all structures up to 1 500 m from the pit area is recommended. The mine will be operating for a significant number of years. This will give advantage on any negotiations with regards to complaints from neighbours on structural issues due to blasting. This process can however only succeed if done in conjunction with a proper monitoring program. It is expected that ground vibration levels will be significantly less than proposed limits at 1 500m, but this process will ensure record of the pre-blasting status of the nearest structures to the pit area. At 1 500m the expected level of ground vibration will be perceptible. • Comply to the ground vibration and air blast levels limits recommended for blasting operations in this area. • It is always good to conduct a first test blast to confirm levels and ground vibration and air blast. It is recommended that such a		

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
	blast be done, and detail monitoring done and used to help define blasting operations going forward. This test blast can be based on the existing design and only after this blast it may be necessary to define if changes are required or not. • A further consideration of blasting times is when weather conditions could influence the effects yielded by blasting operations. It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. These ‘do nots’ stem from the influence that weather has on air blast. The energy of air blast cannot be increased but it is distributed differently and therefore is difficult to mitigate. • It is recommended that a standard blasting time is fixed and blasting notice boards setup at various routes around the project area that will inform the community of blasting dates and times. • Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work. This will bring about unbiased evaluation of levels and influence from an independent group. Monitoring could be done using permanent installed stations. Audit functions may also be conducted to assist the mine in maintaining a high level of performance with regards to blast results and the effects related to blasting operations. • Video of each blast will help to define if fly rock occurred and origin of fly rock. Immediate mitigation measure can then be applied if necessary. The video will also be a record of blast conditions.		

List of specialist studies	Recommendations of specialist reports	Specialist recommendations that have been included in the EIA report	Reference to applicable section where recommendations have been included
	• A monitoring programme for recording blasting operations is recommended. The following elements should be part of such a monitoring program: ○ Ground vibration and air blast results. ○ Blast Information summary. ○ Meteorological information at time of the blast. ○ Video Recording of the blast. ○ Fly rock observations.		

20 Environmental Impact Statement

20.1 Summary of the key findings of the environmental impact assessment

A summary of the assessment of the potential environmental impacts associated with the proposed UG1 opencast project is provided in Table 113. The mitigated assessment assumes that technical design controls, as included in the project description, together with mitigation measures included would be implemented when the proposed project is constructed and operated.

Table 113: Summary of significance of the potential impacts of the proposed UG1 opencast project

Aspect	**Impact**	**Significance before mitigation**	**Significance after mitigation**
Construction phase			
Soils	The loss of utilisable resource (sterilisation and erosion), compaction and contamination or salinisation	Medium (-)	Low (-)
	Contamination of soil	Medium (-)	Low (-)
	Soil erosion	Medium (-)	Low (-)
Terrestrial Biodiversity	Loss of indigenous vegetation	Low (-)	Low (-)
	Spread and/or establishment of alien and/or invasive species	Medium (-)	Low (-)
Surface water	Siltation of watercourses	Medium (-)	Low (-)
	Contamination of surface water resources	Medium (-)	Low (-)
Wetlands	Degradation of wetlands	Low (-)	Low (-)
	Spread and/or establishment of alien and/or invasive species	Low (-)	Low (-)
	Alterations in hydrological regime (flow of surface and sub-surface water)	Low (-)	Low (-)
Groundwater	Increased vulnerability of the aquifer to contamination due to an increase in the surface infiltration rate	Low (-)	Low (-)
	Impact on groundwater quality	Medium (-)	Low (-)
	Lowering of groundwater levels	Low (-)	Low (-)
Air quality	Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations	Low (-)	Low (-)
	Increase in dust deposition	Low (-)	Low (-)
Noise	Increase in ambient noise levels	Medium (-)	Low (-)
Visual	Impact on Landscape Character and Sense of Place	Medium (-)	Low (-)
	Visual Intrusion and VAC impacts	Medium (-)	Medium (-)
	Visual Exposure and Visibility Impacts	Medium (-)	Low (-)
Heritage	Impact on Archaeological Resources	Medium (-)	Low (-)
Waste management	Increase waste generation due to construction activities	Low (-)	Low (-)

Aspect	Impact	Significance before mitigation	Significance after mitigation
Social	Benefits resulting from employment and income opportunities created by the construction of the UG1 opencast project	Low (+)	Medium (+)
Operational Phase			
Soils	Contamination of soil	Medium (-)	Low (-)
	Soil erosion	Medium (-)	Low (-)
Terrestrial biodiversity	Spread and/or establishment of alien and/or invasive species	Medium (-)	Low (-)
	Introduction of nuisance vectors (pests) such as flies, rodents and monkeys	Low (-)	Low (-)
Surface water	Siltation of watercourses	Medium (-)	Low (-)
	Contamination of surface water resources	Medium (-)	Low (-)
	Reduced catchment yield	Medium (-)	Low (-)
Wetlands	Degradation of wetlands	Low (-)	Low (-)
	Environmental pollution due to contamination, increased sedimentation and erosion of watercourses	Medium (-)	Low (-)
	Alterations in hydrological regime (flow of surface and sub-surface water)	Medium (-)	Low (-)
Groundwater	Lowering of groundwater levels	Low (-)	Low (-)
	Reduction of baseflow to the Hex River	Medium (-)	Low (-)
	Deterioration in water quality due to leakages from the Pollution control dam	Medium (-)	Low (-)
	Deterioration of groundwater quality	Medium (-)	Low (-)
Air Quality	Increase in ambient TSP concentrations	Low (-)	Low (-)
	Increase in ambient, PM_{10} and $PM_{2.5}$ concentrations	Medium (-)	Low (-)
Noise	Noise increase in excess of the permissible threshold value of 7.0dBA	Medium-high (-)	Medium (-)
Visual	Impact on Landscape Character and Sense of Place	Medium-high (-)	Medium (-)
	Visual Intrusion and VAC impacts	Medium-high (-)	Medium (-)
	Visual Exposure and Visibility Impacts	Medium-high (-)	Medium (-)
	Impacts due to Night Time Lighting	Medium-high (-)	Medium (-)
Blasting	Increased ground vibration	Medium-high (-)	Low (-)
	Fly rock	Medium-high (-)	Low (-)
	Increased ground vibration	Medium-high (-)	Low (-)
Waste management	Increase waste generation due to operational activities	Low (-)	Low (-)
Social	Improved infrastructure in the study area due to social investment activities	Low (+)	Low (+)

Aspect	Impact	Significance before mitigation	Significance after mitigation
	Benefits resulting from employment and income opportunities created by the UG1 opencast project	Low (+)	Low (+)
	Dissatisfaction over employment opportunities and conditions of procurement which could potentially lead to community protests and unrests, as well as conflicts within communities	Medium (-)	Low (-)
Closure			
Soils	Potential for compaction and contamination of soils	Medium (-)	Low (-)
Terrestrial biodiversity	Re-vegetation of rehabilitated areas	Medium (-)	Low (-)
Surface water	Siltation of watercourses	Medium (-)	Low (-)
Groundwater	Deterioration of groundwater quality (impact on the neighbouring groundwater user (HBH2))	Medium-high (-)	Medium (-)
	Deterioration of groundwater quality (impact on the Hex River water quality	Medium (-)	Low (-)
	Contamination of surface water bodies by decanting water	Medium (-)	Low (-)
Air quality	Increase in ambient TSP, PM_{10} and $PM_{2.5}$ concentrations	Low (-)	Low (-)
Noise	Noise increase in excess of the threshold value for a noise disturbance of 7.0dBA above the ambient noise level at the boundary of the mine footprint and at the abutting residential areas	Medium (-)	Low (-)
Visual	Impact on Landscape Character and Sense of Place	Medium (-)	Low (-)
	Visual Intrusion and VAC impacts	Medium (-)	Low (-)
	Visual Exposure and Visibility Impacts	Medium (-)	Low (-)
Social	Loss of employment and enterprise development opportunities due to closure of mine	Medium (-)	Low (-)

20.2 Final site map

The final site map for the existing Waterval Mine is presented in Figure 7.

The final site map for the proposed UG1 opencast project is presented in Figure 18.

20.3 Summary of the positive and negative implication and risks of the proposed activity and identifies alternatives

Alternatives have been assessed along with the advantages and disadvantages of the various alternative options and preferred site layout options. These are described in Part A Section 8.

21 Proposed impact management outcomes for inclusion into the EMPr

Table 114 summarises the impact management outcomes for inclusion in the EMPr and consideration in the Environmental Authorisation.

Table 114: Impact management objectives and the impact management outcomes (Shangoni, 2021)

Environmental aspect	Objective	Summary of impact management outcome
Geology	To minimise the destruction of the geological strata and to prevent the unnecessary loss of geology.	Monitoring of mineral resources and reserves.
Topography	To minimise the extent of alteration of localised topography.	Monitor the mining and related activities in relation to the footprint area of the mine.
Soil	To prevent the loss of soil and soil fertility during the mining and mining activities.	Site inspection and monitoring programmes
Soil erosion	To prevent the loss of soil and soil fertility during decommissioning and rehabilitation activities.	Rehabilitation monitoring programme.
Land use and capability	To restore the land use and land capability to the agreed upon end land use.	Returning the land use of the area to the specifics as agreed upon during the discussions with the DMRE and the municipalities.
Flora	Prevent the destruction of vegetation and subsequent impacts on species of conservation concern and protected species.	Implementation of a declared weed and invader plant species management programme. Site inspection and monitoring programme
Flora	Prevent the destruction of vegetation and subsequent impacts on plant biodiversity.	Implementation of a declared weed and invader plant species management programme. Site inspection and monitoring programme Implement rehabilitation plan
Fauna	To minimise the destruction of faunal habitat and prevent fragmentation as far as possible.	Implementation of access control measures and training programmes
Surface water	To prevent quality deterioration of surface water quality and prevent impact on catchment yield.	Implementation and upgrading of storm water management programme and infrastructure. Surface water monitoring programme.
Groundwater	To prevent quality deterioration of groundwater resource.	Groundwater monitoring programme.
	To prevent quantity and quality deterioration of groundwater resource.	

Environmental aspect	Objective	Summary of impact management outcome
	To minimise the extent of disturbance of the aquifer	
Sensitive Landscapes	Control and mitigation measures will be implemented to minimise the impact on the Hex River.	Surface water monitoring programme.
Air quality	Prevent the deterioration of air quality and indirect effects on floral, faunal and human health	Air quality monitoring programme.
Noise	Prevent and mitigate against the effects of noise on sensitive receptors (including employees and surrounding communities and towns).	Noise monitoring programme.
Visual aspects	Prevent visual intrusions on sensitive receptors	Implementation of control measures to mitigate against visual intrusions.
Sites of archaeological and cultural importance	Prevent the destruction of National Heritage Resources	If any findings of archaeological importance are made, activities will be stopped immediately with such findings reported to the South African Heritage Resources Agency (SAHRA)
Socio-economic aspects	Enhance the positive impact on the socio-economic aspects.	Sourcing of employees from the local community and surrounding areas.
	To mitigate the effects of the influx of job seekers to the area.	Sourcing of employees from the local community and surrounding areas. Implementation of measures indicated in the SLP.
	To prevent and / or limit public exposure to unacceptable health risks.	Implement control measures both on-site and off-site.

22 Final proposed alternatives

Proposed alternatives are detailed in Part A Section 8. The preferred infrastructure option is shown in Figure 18.

23 Aspects for inclusion as conditions of the authorisation

The following should form part of the conditions of the Environmental Authorisation to ensure compliance with the EMPr (Shangoni, 2021):

- The mine should remain in full compliance with the requirements of the EMPr and with all regulatory requirements.
- The EMPr should be implemented by qualified environmental personnel who have the competency and credibility to interpret the requirements of the EIA and the EMPr. Such persons must be issued with a written mandate by Glencore Alloys management to provide guidance and instructions to employees and contractors.
- Stakeholder engagement must be maintained during the phases of the mining operation.

24 Description of any assumptions, uncertainties and gaps in knowledge

In terms of Section 3(p) of Appendix 3 to the EIA Regulations GN 982 (as amended), the EAP must provide a description of any assumptions, uncertainties and gaps in knowledge upon which the impact assessment has been based. Table 115 provides the assumptions and limitations applicable to the various specialist assessments.

Table 115: Assumptions and limitations relating to the proposed UG1 opencast project

Specialist	Assumptions and limitations
General	• It is assumed that Alta van Dyk Environmental Consultants cc has been provided with all relevant project information and that it was correct and valid at the time it was provided. • There will be no significant changes to the project description or surrounding environment between the completion of the S&EIR process and implementation of the proposed project that could substantially influence findings and recommendations with respect to mitigation and management. • The assessment of the mitigated scenario assumes that the design controls and recommended mitigation would be implemented adequately.
Soils	• The GPS used for delineations is accurate to within five meters. Therefore, the soil delineation plotted digitally may be offset by at least five meters to either side. • The information contained in the soils report is based on auger points taken and observations on site. There may be variations in terms of the delineation of the soil forms across the area. • Soil fertility analysis was not conducted on-site for the soils report.
Vegetation	• Only a single-season one day survey was conducted for the respective studies, this would constitute a wet season survey; • The assessment for a vegetation compliance statement does not include recorded descriptions of fauna species; and • This assessment has not assessed any temporal trends for the project.
Surface Water	The following assumptions were made: • Although every effort was made to simulate and model the volume of the open pit (overburden stockpile) before roll-over commence the type of equipment, mine plan and pit bench design can have an influence on this volume. A pit bench with a slope of 1(V): 1(H), a box cut with one section excavated each side before backfill commence and a backfill slope of 1(v): 2(H) was assumed. • It was assumed and is accepted that the Pollution Control Dam will be operated empty with all run-off and seep utilised in the Waterval West Plant. • The strength of material for the overburden was assumed from the material investigations with a conservative (to the safe side) slope deposition of the overburden stockpile of 1(V): 3(H).
Groundwater	The following limitations and assumptions are applicable for the groundwater study • The study is limited to the scope of work provided by the client. • The top of the weathered aquifer is represented by the surface topography and available surface elevations are used to construct a representative spatial extent in the groundwater Model. • Recharge rates were assumed as constant throughout the simulated period, therefore no wet-dry cycles are simulated. • The hydraulic properties of aquifer units were calculated from aquifer test data and assumed to be uniform and isotropic across the unit. This may not reflect the true complexity of the geology. • The model simulates the fractured rock environment as an equivalent porous medium, which is an overall simplification of the flow process.

Specialist	Assumptions and limitations
	• No intermine flow or impacts of other mining related activities were included. • The model was constructed and calibrated based on data available. • Contaminant movement will mostly take place as a result of advection. This assumption was based on the calculation of the Peclet number (Pe) for the aquifer which indicated that advection is the main flow mechanism. • Chemical reaction between rock and dissolved species were not taken into consideration during the simulations.
Wetlands	• Significant artificial water inputs are distributed throughout a large portion of the project area, which limits the verification of natural wetland areas; • A large portion of the project area has previously been disturbed, which limits the accuracy of wetland delineations due to the fact that natural hydromorphic soils are limited; and • The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.
Air Quality	• Meteorological data from South African Weather Service (SAWS) Rustenburg station is representative of the area. • Available data from monitoring station near to the site has been used. The data sets are limited and monitoring is not done on-site. It is assumed that the available monitoring data adequately describe the baseline condition of the general area. • Information provide on the proposed mine and mining activities are used to estimate emissions used in the dispersion modelling. It is assumed that the project information is representative resulting estimated emissions that too are representative. • Primary inputs to the dispersion model are meteorological and emission data, and model parameterisation. The Air Pollution Model (TAPM) diagnostic model is used to generate a 3-dimensional hourly-resolved meteorological input file for the modelling domain. It is assumed that estimated emissions are representative of the mining and the mining activities.
Noise Impact Assessment	• The prevailing ambient noise levels for the study area was created by far and near noise sources associated with traffic, mining activities and seasonal agricultural activities with the result that the prevailing ambient noise level may change at times; • Noise measurements in the presence of winds in excess of 3.0m/s may impact the outcome of the environmental noise results; • The identification of noise measuring points may create a problem in terms of the prevailing noise levels should it not be done with outmost care and in a scientific manner; • The influx of traffic into an area will have an influence on the prevailing ambient noise levels and should be considered during the noise impact assessment process; and • Insect noise may inflate the prevailing ambient noise level during summertime whereas the prevailing ambient noise during wintertime may be lower.
Visual Impact Assessment	• No specific national legal requirements for VIAs currently exist in South Africa. However, the assessment of visual impacts is required by implication when the provisions of relevant acts governing environmental management are considered and when certain characteristics of either the receiving environment or the proposed project indicate that visibility and aesthetics are likely to be significant issues and that visual input is required (Oberholzer, 2005); • Due to a lack of visual specialist guidelines within the North West Province, the “Guidelines for Involving Visual and Aesthetic Specialists in the EIA Process” (Oberholzer, 2005), prepared for the Western Cape Department of Environmental Affairs & Development Planning, was used;

Specialist	Assumptions and limitations
	• Distance and terrain plays a critical role when assessing visual impacts of an area. Due to the mountainous terrain of the area surrounding the study area, the presence of the existing mines located in the immediate vicinity and the height of the proposed structures, it was deemed necessary to identify all potential sensitive receptors within a 5 km radius, on a desktop-level, which would then be verified during the field assessment. The 5 km radius can be considered the "visual assessment zone". It should be noted that the visibility of an object decreases exponentially the further away the observer is from the source of impact. Sensitive receptors located north and east of the study area was not visited during the field assessment due to the presence of the existing Waterval Smelter, Sibanye Thembelani Mine, Platinum Mile Resources, and Khomanani 2 Mine and its associated infrastructure such as the WRD, which completely screens the view towards the study area; • All information relating to the proposed project as referred to in this report is assumed to be the latest available information. Additionally, best practice guidelines were taken into consideration and the maximum expected heights of the infrastructure and the placement thereof utilised in the viewshed calculations as a precautionary approach; and • Abstract or qualitative aspects of the environment and the intangible value of elements of visual and aesthetic significance are difficult to measure or quantify and as such depend to some degree on subjective judgments. It therefore is necessary to differentiate between aspects that involve a degree of subjective opinion and those that are more objective and quantifiable.
Heritage Impact Assessment	The authors acknowledge that the brief literature review is not exhaustive on the literature of the area. Due to the nature of heritage resources and pedestrian surveys, the possibility exists that some features or artefacts may not have been discovered/recorded and the possible occurrence of graves and other cultural material cannot be excluded. This limitation is successfully mitigated with the implementation of a Chance Find Procedure and monitoring of the study area by the ECO. This report only deals with the footprint area of the proposed development and consisted of non-intrusive surface surveys. This study did not assess the impact on medicinal plants and intangible heritage as it is assumed that these components will be highlighted through the public consultation process if relevant. It is possible that new information could come to light in future, which might change the results of this Impact Assessment.
Blasting Impact Assessment	The following assumptions have been made: • The anticipated levels of influence estimated in the report are calculated using standard accepted methodology according to international and local regulations. • The assumption is made that the predictions are a good estimate with significant safety factors, to ensure that expected levels of ground vibration, air blast or occurrence of fly rock are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active. • The limitation is that this is a new project with no blasting done. No confirmation of the predicted values could be made. • The blast designs that were provided by the project applicant were applied. • The work done is based on the author's knowledge and information provided by the project applicant.

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

25.1 Reasons why the activity should be authorised or not

No fatal flaws in the project have been identified thus far through the impact assessment process. However, several environmental and social impacts are envisaged from construction phase through to post-closure, which require careful mitigation and monitoring. It is the opinion of the EAP that all major impacts have been identified and have been assigned appropriate management measures. Most Medium-high negative impacts with mitigation, are reduced to a MEDIUM or LOW significance, and can be managed accordingly.

It is recommended by the EAP that the proposed UG1 opencast project is allowed to proceed, on the assumption that the environmental and social management commitments included in this EIA/EMPr are adhered to, the project description remains as per the description provided in this document.

25.2 Specific conditions to be included into the compilation and approval of the EMPr

Should the DMRE grant authorisation for the proposed UG1 opencast project, it should be subject to the following conditions (Shangoni, 2021):

- The project should remain in full compliance with the requirements of the EMPr and with all regulatory requirements;
- The EMPr should be implemented by qualified environmental personnel who have the competence and credibility to interpret the requirements of the EIAR and the EMPr. Such persons must be issued with a written mandate by mine management to provide guidance and instructions to employees and contractors; and
- Stakeholder engagement must be maintained during the operational and closure/rehabilitation phases of the project.

25.3 Rehabilitation requirements

Refer to the Closure and Rehabilitation Plan (Appendix C12).

26 Period for which the authorisation is required

The total period for which authorisation has been granted in the 2021 Consolidated EMPr, is equal to the remaining Life of Mine (LoM) for Waterval Mine, which is in excess of 30 years. Refer to Table 116. The proposed UG1 opencast project timeframes are as follows:

The project will take place in three phases: The proposed schedule for the phases is as follows:

- Construction Phase ≈ Two months
- Operation Phase ≈ 3 years
- Decommissioning and Closure Phase ≈ 6 – 12 months

Therefore, no additional period of environmental authorisation is required, and the 30 year period for which environmental authorisation is required remains unchanged.

Table 116: Period for which authorisation is required (Shangoni, 2021) (approved)

Stages of operation	**Timeframe (Years)**
Planning	N/A
Construction (proposed infrastructure as described in this EIAR / EMPr)	1 year
Commissioning (proposed infrastructure as described in this EIAR / EMPr)	1 year
Operation (ongoing)	> 30 years
Decommissioning and Closure	± 8 years
Total Period	**> 30 years**

27 Undertaking

The undertaking by the EAP is provided in Part B Section 12 (Environmental Management Programme). This undertaking confirms: the correctness of the information provided in the reports, the inclusion of comments and inputs from stakeholders and I&APs, the inclusion of inputs and recommendations from the specialist reports where relevant and the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

28 Financial provision

28.1 Financial provision for Waterval Mine

Information for this section was obtained from Environmental and Energy Services' Glencore Waterval Chrome Mine Closure Cost Report (Reference Number GLE 01/03/2022/6. March 2022). Refer to Appendix C13 for the full report.

The closure cost calculation was done in line with the prescribed format presented by the DMR and the 2021 official master rates were increased by CPI of 5% and used to calculate the closure quantum.

The total closure cost at year end 2022 was estimated to be **R 56 676 138.35** (inclusive of VAT).

28.2 Financial provision for the UG1 opencast operation

Information for this section was obtained from Hydrological Environmental Engineering Solutions' Financial Provisioning and Closure Design Report (HEES2), available in Appendix C12.

The required and estimated yearly financial provisioning for annual and final rehabilitation until LoM is shown in Table 117 (including VAT):

Table 117: Financial Provision for UG1 opencast project

	Annual rehabilitation	Final rehabilitation
2024	R 718 819.00	R 73 808 181.00
2025	R 718 819.00	R 91 949 213.00
2026	R 718 819.00	R 110 208 207.00

28.3 Confirm that this amount can be provided for from operating expenditure

This financial provision will be provided for in terms of a bank guarantee.

29 Deviations from the approved scoping report and plan of study

29.1 Deviations from the Methodology used in determining the significance of potential environmental impacts and risks

The methodology to rate the impacts and risks associated with the proposed UG1 opencast project detailed in this EIA/EMPr have not deviated from those described in the Final Scoping Report (approved by the DMRE on 13 January 2023).

29.2 Motivation for the deviation

Not applicable.

30 Other information required by the competent authority

30.1 Compliance with the provisions of section 24(4)(a) and (b) read with section 24(3)(a) and (7) of the National Environmental Management Act 107 of 1998

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

Socio-economic impacts are addressed in Part A Section 15.4.

30.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act 25 of 1999

The proposed UG1 opencast project area is a disturbed piece of land that has been fallow for several years. Historical cultivation of the site, illegal dumping of building rubble and refuse material and earthmoving activities altered the site and no standing structures older than 60 years or heritage resources were noted during the site visit. According to the SAHRA Paleontological sensitivity map the study area is of insignificant/zero paleontological significance and no further studies are required for this aspect

The impact on heritage resources is considered to be low and the project can be authorised provided that the recommendations in this report are adhered to and based on SAHRA's approval.

31 Other matters required in terms of Sections 24(4)(a) and (b) of the Act

Not applicable.

PART B: ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

1 Details of the EAP

The details and expertise of the EAP are detailed in Part A Section 1.3.

2 Description of the aspects of the activity

The details of the aspects of the activity are described in Part A Section 4.3.

3 Composite map

Refer to Figure 18.

4 Description of impact management objectives including management statements

4.1 Determination of closure objectives

Refer to the Part B Section 6.1.1 for a description of the closure objectives for Waterval Mine.

The vision and closure objectives aim to reflect the local environmental and socio-economic context of the project and to represent both the requirements and expectations of the stakeholders. The determination of a realistic post-closure vision for the mining site is based on a good understanding of the ecological, physical, socio-economic and operational characteristics of the area within which the mine is located. Site specific closure objectives are then developed taking into consideration these characteristics inclusive of legal compliance, financial and end-land use goals. Each of these closure objectives as set forth are defined and discussed in further detail below (HEES2, 2023).

Refer to Part B Section 6.1.2 for a description of the closure objectives for the UG1 opencast project.

4.2 The process for managing any environmental damage, pollution, pumping and treatment of extraneous water or ecological degradation as a result of undertaking a listed activity

Refer to the Storm Water Management Plan (Appendix C5).

4.3 Potential risk of Acid Mine Drainage

4.3.1 Potential risk of Acid Mine Drainage: Waterval Mine

The information contained below has been extracted from the report titled *Waterval Chrome Mine: Mine Residue and Soil Classification*, dated 19 May 2017, and compiled by Exigo (Shangoni, 2021).

As part of the hydrogeochemical leach tests, 3 samples (5kg each) were taken from the tailings facilities and composited into one representative sample after which the following analyses were undertaken:

- XRD analysis for mineralogical composition;

- Aqua-regia whole rock digest and ICP-MS analysis of the leachate to determine the metal and macro-chemical composition; and
- A distilled water leach was done to simulate leaching potential from rainfall.

4.3.1.1 XRD analysis

The XRD analysis indicated that the mineralogical chemical composition consists mainly of chromite, enstatite, plagioclase feldspar and smectite clay.

Table 118: Waterval Chrome mine residue XRD analysis results (Shangoni, 2021)

Composition (%)	
GH 1053 (WTVL West Tailings)	
14996	
Mineral	**Amount (weight %)**
Chromite	35.93
Enstatite	2.46
Plagioclase	19.32
Talc	2.51
Diopside	6.65
Smectite	20.15
Actinolite	7.08
Kaolinite	5.56
Muscovite	0.34
Total	**100**

The mineral chemistry is dominated by Cr, Fe, Ca, Mg, SiO_2, Na and Al. In the tailings and waste rock material, the whole rock total concentration (TCT) analyses indicated none of the samples exceeded the threshold values for TCT0. The leachable component (LCT) analyses indicated that none of the constituents exceeded the threshold values for LCT0.

Table 119: Waterval tailings and waste rock facilities mineral composition (Shangoni, 2021)

Mineral	**Composition'**
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)$
Chromite	$FeCr_2O_4$
Diopside	$CaMgSi_2O_6$
Enstatite	$MgSiO_3$
Kaolinite	$Al_4(OH)_8(Si_4O10)$
Muscovite	K Al2 ((OH)2 Al Si_3O_{10})
Plagioclase	$(Na,Ca)(Si,Al)_4O_8$
Smectite	$(Na,Ca)_{0,3}(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet n(H_2O)$

4.3.1.2 Macro-chemical leachate and distilled water leach

The macro-chemical leachate (LCT) analysis indicated that the leachate is close to neutral with a pH of 6.9. Leachate of $CaCO_3$ (560 ppm), is the only notable constituent. It is expected that the calcium originates from the plagioclase feldspar and the actinolite minerals, which occur naturally in the area.

No leaching of metals is expected due to the combination of neutral pH values and high smectite mineral content. Smectite minerals have high adsorption potential for metals and metalloids. The pH is almost neutral and hence no significant leaching of metals is expected. ***There is no risk for acid rock drainage (ARD) as the sulphide mineral content is insignificantly low.***

Table 120: Waterval mine residue facilities - chemical and distilled water leach test results – macro-parameters (Shangoni, 2021)

Analysis	
Sample Number	**14991**
TCLP / Acid Rain / Distilled Water / H_2O_2	**Distilled Water**
Dry Mass Used (g)	50
Volume Used (mℓ)	1000
pH Value at 25˚C	6,9
Electrical Conductivity in mS/m at 25˚C	2,3
Inorganic Anions	mg/ℓ
Total Dissolved Solids at 180 ˚C	188
Total Alkalinity as $CaCO_3$	28
Bicarbonate Alkalinity as $CaCO_3$ (calc)	28
Phenolphthalein Alkalinity as $CaCO_3$	<5
Chloride as Cl	<2
Sulphate as SO_4	<2
Nitrate as N	<0.1
Nitrite as N	<0.05
Fluoride as F	<0.2
Free & Saline Ammonia as N	<0.1
Ortho-Phosphate as P	<0.1
Hexavalent Chromium as Cr^{6+}	<0.010
Total Cyanide as CN	<0.01

Table 121:Waterval chemical and distilled water leach test results – metals and micro-parameters (Shangoni, 2021)

Parameter	R635 Total Concentration Threshold Values			R635 Leach Concentration Threshold Values				Glencore Waterval West Tailings	
								GH 1053	
	TCT0	TCT1	TCT2	LCT0	LCT1	LCT2	LCT3	TCT	LCT
Sample no								14996	14996
Unit	mg/kg	mg/kg	mg/kg	mg/ℓ	mg/ℓ	mg/ℓ	mg/ℓ	mg/kg	mg/ℓ
Al								11600.000	0.943
As	5.8	500	2,000	0.01	0.5	1	4	<0.400	<0.001
B	150	15,000	60,000	0.5	25	50	200	0.401	0.001
Ba	62.5	6,250	25,000	0.7	35	70	280	6.380	0.016
Ca								5200.00	1.00
Cd	7.5	260	1,040	0.003	0.15	0.3	1.2	<0.400	<0.001
Co	50	5,000	20,000	0.5	25	50	200	1.110	0.003
Cr	46,000	800,000	n.a	0.1	5	10	40	35.000	0.087
Cr(VI)	6.5	500	2,000	0.05	2.5	5	20		
Cu	16.0	19,500	78,000	2.0	100	200	800	1.410	0.004
Fe								33200	3.150
Hg	0.93	160	640	0.006	0.3	0.6	2.4	<0.400	<0.001
K								454	0.5
Mg								33600	5
Mn	1,000	25,000	100,000	0.5	25	50	200	868	0.137
Mo	40	1,000	4,000	0.07	3.5	7	28	<0.400	<0.001
Na								1200	1
Ni	91	10,600	42,400	0.07	3.5	7	28	13	0.032
Pb	20	1,900	7,600	0.01	0.5	1	4	<0.400	<0.001
Sb	10	75	300	0.02	1.0	2	8	<0.400	<0.001
Se	10	50	200	0.01	0.5	1	4	<0.400	<0.001
Si	-	-	-	-	-	-	-	108800	9.3
Te		-	-	-	-	-	-	<0.400	<0.001
Th		-	-	-	-	-	-	<0.400	<0.001
U		-	-	-	-	-	-	<0.400	<0.001
V	150	2,680	10,720	0.2	10	20	80	2.48	0.006
Zn	240.0	160,000	640,000	5.0	250	500	2,000	2.45	0.006

The following conclusions can be drawn:

- The tailings material consists mainly of chromite, enstatite, plagioclase feldspar, actinolite and smectite.
- The macro-chemical leachate (LCT) analysis indicated that the leachate is close to neutral with a pH of 6.9. Leachate of $CaCO_3$ (28 mg/L), is the only potential parameter that could leach from the tailings material. It is expected that the calcium originates from the plagioclase feldspar and the actinolite minerals, which would occur naturally in the area.
- No leaching of metals is expected due to the combination of neutral pH values and high smectite mineral content. Smectite minerals have high adsorption potential for metals and metalloids. The pH is almost neutral and hence no significant leaching of metals is expected.
- There is no risk for acid rock drainage (ARD) as the sulphide mineral content is insignificantly low.
- The whole rock analysis indicated that none of the constituents exceeds the regulatory value of Regulation 635 for TCT0.
- The leachable concentration threshold (LCT) analyses indicated that none of the constituents exceeded the threshold values for LCT0.
- The analysis indicated that the tailings material would classify as a Type 4 "waste" and is therefore inert according to R635.

4.3.2 Potential risk of Acid Mine Drainage: UG1 Opencast Project

The material produced by the UG1 opencast project area are not likely to produce acid drainage or significant leachable constituents of concern and are therefore considered to be non-acid generating. The potentially leached metal concentrations are likely to represent a LOW ENVIRONMENTAL RISK (Geostratum, 2023).

4.4 Steps taken to investigate, assess and evaluate the impact of acid mine drainage

4.4.1 Waterval Mine

Quarterly groundwater monitoring is undertaken at Waterval Mine and resultant reports generated and provided to the mine for implementation purposes. Results are interpreted by Aquatico Scientific on a quarterly basis and provided (against the relevant target water quality guidelines) in the mentioned reports. As mentioned above, there is currently no sign of impacts associated with acid mine drainage at Waterval Mine, when reviewing the results as contained in the quarterly groundwater monitoring reports (Shangoni, 2021).

Furthermore, as per Groundwater Complete's annual groundwater monitoring report for 2014, the water quality parameter (analyte) range depends mainly on the characteristics of the contamination source that is monitored and to a lesser extent on the natural hydrogeochemistry of the aquifers in the area. The sources are mostly inorganic and include ions like sulphate and nitrate. The focus with the monitoring program should thus be to determine the inorganic content of the water by firstly measuring analytes like macro element cations (Ca, Mg, Na, K) and anions (Cl, SO_4, NO_3, F) as well as pH, EC and alkalinity. Scans for metals (like iron, manganese and aluminum) are also important to show where mobilisation of metals occur due to acid mine drainage or related reactions. These parameters are analysed for at Glencore Rustenburg and this aspect is therefore considered to be adequate (Shangoni, 2021).

4.4.2 UG1 Opencast Project

Information on the steps taken to investigate, assess and evaluate the impact of acid mine drainage was obtained from Geostratum's hydrogeological report. Refer to Appendix C6 for the full report.

The geochemical assessment for the UG1 Opencast Mining Operation for the Waterval Chrome Mine, comprised of five different geological horizons that were sampled from four exploration boreholes across the proposed pit areas. The exploration boreholes sampled include WW135, WW139, WW140 and WW137.

Waste quality assessment was completed for five waste streams representing different geological horizons at the Glencore Waterval site. The aim of the assessments was to establish the risk associated with leaching from these waste streams, according to national regulations. A description of the samples analysed are presented in Table 122.

Table 122: Waste rock samples analysed (Geostratum, 2023)

Sample ID	Description	Group
S1	Weathered Norite	Overburden
S2	Slightly Weathered Norite	
S3	Pyroxenite	Roof
S4	Chromite	Ore
S5	Footwall	Footwall

The solid and leachable concentrations were analysed against GNR 635 guideline limits. A few parameters exceed the TCT0 and LCT0 limits, however, none exceed the TCT1 or LCT limits. Thus, according to national regulations, all of the rock materials (S1 to S5) are classified as Type 3 wastes and are therefore considered as low risk. Based on the results obtained, the following de-classification is motivated.

Declassification of material

The Department of Human Settlement, Water and Sanitation (DHSWS) has adopted the Gazetted National Environmental Management: Waste Act (Act No. 59 of 2008): Waste Classification Regulations as the methodology for the classification of waste. These regulations include:

- Regulation 634: NEM:WA: Waste Classification and Management Regulations;
- Regulation 635: National Norms and Standards for the assessment of waste for landfill disposal; and
- Regulation 636: National norms and Standards for disposal of waste to landfill.

Where the classification is based on the Total Concentration Threshold (TCT) as well as the Leachable Concentration Threshold (LCT) limits of elements and chemical substances found within waste, these corresponding limits determine the type of waste classification that is then awarded as shown below.

The waste classification as defined in GN635 (Section 7) are summarized below:

- Wastes with any element or chemical substance concentration above LCT3 or TCT2 limits (LC>LCT3 or TC>TCT2) are Type 0 Wastes.
- Wastes with any element or chemical substance concentration above the LCT2 but below or equal to the LCT3 limits, or above the TCT1 but below or equal to the TCT2 limits (LCT2<LC<LCT3 or TCT1<TC<TCT2), are Type 1 Wastes.

- Wastes with any element or chemical substance concentration above the LCT1 but below or equal to the LCT2 limits, and all concentrations below or equal to the TCT1 limits (LCT1<LC<LCT2 or TC<TCT1), are Type 2 Wastes.
- Wastes with any element or chemical substance concentration above the LCT0 but below or equal to the LCT1 limits, and all concentrations below or equal to the TCT1 limits (LCT0<LC<LCT1 or TC<TCT1), are Type 3 Wastes; or
- Wastes with all elements and chemical substance concentration levels for metal ions and inorganic anions below or equal to the LCT0 and TCT0 limits (LC≤LCT0 and TC≤TCT0), and with all chemical substance concentration levels also below the relevant concentration limits for organics and pesticides, are Type 4 Wastes.

The Norms and Standards have three different leaching procedures based on the conditions of the waste and disposal. These conditions are explicit to the definitions below and indicate that for the conditions of disposal and use on the Distilled Water Leaching Procedure would be valid.

- TCLP Leach (Acidic leach – pH of 5) – Typical condition of a general landfill site where putrescible / biodegradable waste is disposed of;
- Borax Leach (Alkaline leach – pH of 9.3) – Typical of a site where alkaline wastes and no putrescible wastes are disposed of (resting pH of many metallurgical wastes);
- Distilled water leach (neutral leach reagent water – pH of 7) – typically a mono-disposal site, where no putrescible waste is disposed of. Rainwater would be the only liquid coming into contact with this waste.

As this is the condition that would prevail on site, the distilled leach values form the basis for the declassification consideration.

In accordance with the waste classification methodology, the specific type of waste is determined by comparing the TC and LC of the elements and chemical substances in the waste material with TCT and LCT limits as specified in the Norms and Standards. It should be noted that based on the origin of the material, no organics have been analysed for as it does not form part of the waste stream. The results of the geochemical test work, specifically the total and leachable concentrations of overburden, were used to classify the waste material in accordance to the NEM:WA – Norms and Standards as specified in the Government Notices R. 634, 635 and 636 (Government Gazette No. 41920, 21/09/2018), allows for the pollution control measure, to be determined on a case by case basis, based on a risk analysis conducted by a “Competent person”. This motivation / application supports this risk analysis.

The classification of the following material at the UG1 opencast project area was undertaken by an external accredited laboratory and conforms to this prescribed methodology:

- Overburden material (S1, S2, S3 and S5)
- RoM Material (S4)

The analytical results of the Total Concentration Threshold show that Barium (S1, S3), Copper (S1, S2, S3, S4, S5), Molybdenum (S1) are the only elements to be slightly higher than that of the TCT0 limit but orders of magnitude lower than that of the TCT1 limit.

The analytical results of the Leachable Concentration Threshold show that TDS (S1, S2, S3, S4, S5) and Manganese (S2,S3), Chromium (S4, S5) is the only elements to be slightly higher than that of the LCT0 limit but orders of magnitude lower than that of the LCT1 limit.

The distilled leach test results are an indication of the prevailing condition to which the material would be exposed to on site – normal rainwater.

Due to the fact that the material produced by UG1 opencast project area are not likely to produce acid drainage or significant leachable constituents of concern, and are therefore considered to be non-acid generating. The potentially leached metal concentrations are likely to represent a LOW ENVIRONMENTAL RISK.

The following should also be taken into consideration with regards to the above-mentioned risk profile:

The following should also be taken into consideration with regards to the above-mentioned risk profile:

- In the laboratory with controlled conditions, two litres of leach solution are used to extract material that has been graded to <10 mm over a period of 18hrs. In practice, not much of the overburden material will be crushed into such small particles. Therefore, these elements coming into solution, will if any, occur in much lower concentrations than indicated in the analysis;
- The open pit areas where the overburden will be disposed of would be considered as mono-disposal site, where the neutral to slightly alkaline conditions would prevail, with the likelihood of no leaching of any element above LCT0 to take place
- Based on the assessment of the material, the material is not considered a risk in terms of leachability of the listed metals and the conditions that would prevail when the material is backfilled to the open pit.
- This therefore motivates the material (S1, S2, S3, S4, S5) to be defined as per Section 7(2)(e) of the Norms and Standards as Type 4 waste based on the scenarios provided and actual conditions found on site and would therefor allow for the backfilling of the overburden into the UG1 open cast area without a risk of causing pollution to the groundwater resource.

Declassification of the overburden material from a Type 3 to a Type 4 waste - Based on the geochemical test work that was undertaken in June 2022, the overburden material that will be generated, stockpiled and used for backfilling can be declassified from a Type 3 material to a Type 4 material in terms of the National Environmental Management: Waste Act (Act No. 59 of 2008) – Norms and Standards as specified in the Government Notices R. 634, 635 and 636 (Government Gazette No. 36784, 23/08/2013).

4.5 Engineering or mine design solutions to be implemented to avoid or remedy acid mine drainage

Due to the fact that the material produced by the UG1 opencast project area are not likely to produce acid drainage or significant leachable constituents of concern, this section is not appliable.

4.6 Measures that will be put in place to remedy any residual or cumulative impacts that may result from acid mine drainage

The mitigation measures to be put in place to remedy and or minimize the effects of Acid Mine Drainage (AMD) should it occur are as follows (Shangoni, 2021:

- A long-term goal may entail the establishment of a joint water management strategy with mines in the region and possible treatment capacity;
- Reduce water inflow into shaft areas through efficient storm water management;
- Water levels within the basins should be held at or below the relevant environmental critical levels (ECLs) through pumping of water; and
- Improved monitoring of mine water, groundwater, surface water.

4.7 Volumes and rate of water required for the mining, trenching or bulk sampling operation

The water balance for Waterval Mine is presented in Figure 13: Waterval water flow diagram (WSP Golder, 2022)Figure 13 and shows the volumes of water sourced for operations at the mine and used within the mining process.

The water balance (average rainfall period) for the UG1 opencast project is shown in Figure 87.

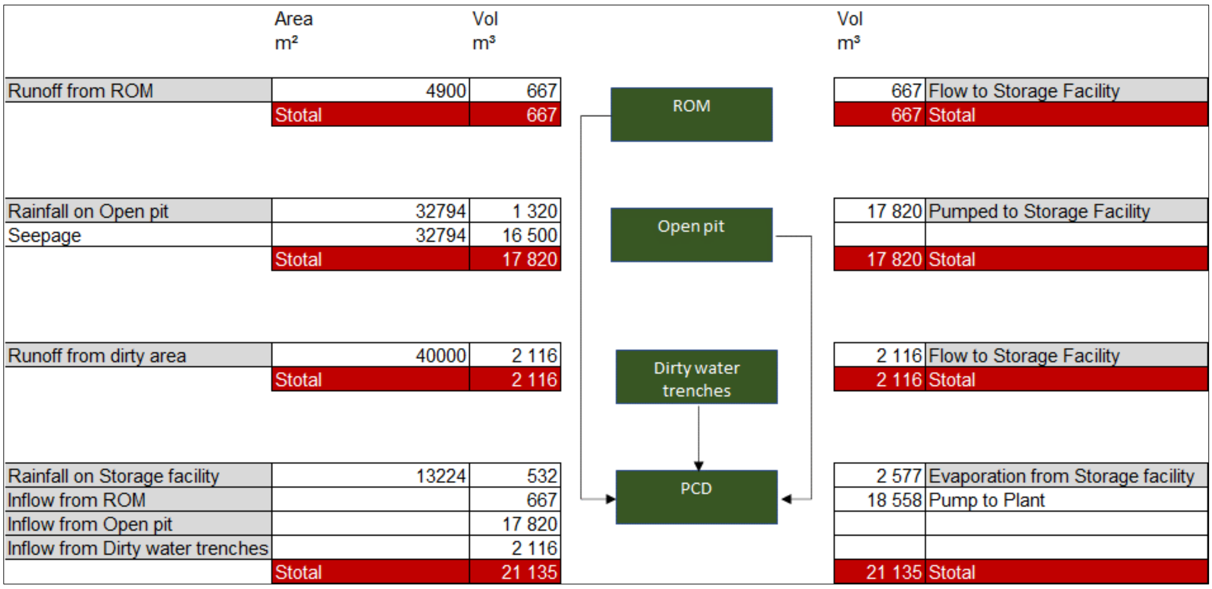

Figure 87: UG1 opencast project water balance for average rainfall period (HEES1, 2023)

4.8 Water Use Licence

4.8.1 Waterval Mine

Glencore Waterval Mine has an Integrated Water Use Licence (IWUL), dated January 2015 (Licence no 03/A22H/ABFGJ/2749). Refer to Table 13 to Table 16 for current authorised water uses at Waterval Mine.

4.8.2 UG1 Opencast Project

The proposed UG1 opencast activities will require a WULA to authorise water uses in terms of Section 21 of the NWA.

The following water uses are required for authorisation:

- Section 21 (a) – taking water from a resource;
- Section 21 (c) – impeding or diverting flow of water in a watercourse;
- Section 21 (g) – disposing of waste or water containing waste in a manner which may detrimentally impact on a water resource;
- Section 21 (i) – altering the bed, banks course or characteristics of a watercourse; and
- Section 21 (j) – removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

Waterval Mine is in the process of submitting a WULA for the proposed UG1 opencast project to the DWS.

4.9 Impacts to be mitigated in their respective phases

Refer to the full risk assessment and mitigation measures table provided in Part Section 15.3.

5 Impact Management Actions

Included in Table 101 to Table 103.

6 Financial Provision

6.1 Describe the closure objectives and the extent to which they have been aligned with the baseline environment

6.1.1 Closure objectives for the existing Waterval Mine

The following closure objectives have been developed for the existing Waterval Mine (Shangoni, 2021):

Surface infrastructure

Pre-closure engagement to determine buildings/infrastructure that can be utilised post closure. The plant area and associated workshops, conveyors and buildings will either be leased or sold. Should this not occur they will be broken down and their footprints will be returned to grazing potential land use. The following decommissioning and closure standards have been identified:

- All infrastructure and concrete buildings to be dismantled and broken down to natural ground level;
- All remaining building rubble must be taken to an approved municipal waste disposal site or be backfilled into the shaft;
- Any hazardous substances removed from the building, must be disposed of at an appropriate hazardous waste site;
- Septic tank areas to be rehabilitated to accepted standard;
- Grading and final shaping of the disturbed footprint areas will be in line with final designs;
- Storm water control measures, such as berms and trenches, must be installed where required to prevent erosion.

Underground shafts and ventilation shafts

All shafts are to be sealed as per DMRE requirements. All structures will be demolished and removed; shafts will be rehabilitated to an agreed upon end land use. Topsoil will be placed in line with final designs.

- All infrastructure, headgear and concrete buildings to be dismantled and broken down to natural ground level.
- Ventilation shafts to be sealed as per DMRE requirements i.e. concrete plug 1m below ground level with a metal beacon attached.
- Access shaft must also be sealed as per DMRE requirements; this includes backfilling the shaft, placing a concrete plug over the entrance and then placing material over the plug to conceal it.
- Grading and final shaping of the disturbed footprint areas will be in line with final designs.
- Stormwater control measures, such as berms and trenches, must be installed where required to prevent erosion.

Roads

All roads not required for long term pollution monitoring must be rehabilitated to the agreed upon end land use. Engagement to identify roads to remain post closure. Topsoil will be placed as per final design, with a sustainable indigenous grassland vegetation cover. The following standards for decommissioning and closure will be applied:

- All signage along the roads must be removed, unless the roads will be utilised post closure.

- Roads surfaces will be rehabilitated as per designs if not used post closure.
- Grading and final shaping of the disturbed footprint areas will be completed in line with the final designs.
- Storm water management measures, such as berms and trenches, must be installed where required to prevent erosion.
- The areas shall be rehabilitated with natural and indigenous vegetation where applicable.

Slimes Dams

Slimes dumps will be rehabilitated to a landform that does not pose danger to public, or animal, health and safety. The slimes dams have a potential to be re-mined in future, as such rehabilitation must cater for future re-mining, unless otherwise agreed upon.

- Footprints must be topsoiled as per design.
- Area to be re-vegetated with indigenous vegetation.
- Water management structures such as cut off trenches and surface run –off berms must be designed and implemented to control erosion.
- Reshape the dumps as per design.
- Shaping to ensure free draining landform.

Clean and dirty water dams

Long-term strategic uses for the dams should be determined, as they can act as flood mitigating structures and water storage points for future farming activities. Should the dams not be required for storage, they must be broken down and the footprint returned to the agreed upon end land use.

- Strategically assess each dam to determine viability of post-closure land use.

6.1.2 Closure objectives for the UG1 opencast project

The following closure objectives have been developed for the UG1 opencast project (HEES2, 2023):

Safety:

To ensure physical safety of the closed mining site over time, any void or pit left after mining activities have ceased will be filled accordingly or fenced as to ensure the safety of human and/or animal and prevent falls from height. A security fence to be constructed around the perimeter of the open pit over the rehabilitated stockpiles. Where no stockpiles protect the pit a safety berm of 3m high, 1m crest and side slopes of 1(V):2(H) will be constructed inside the security fence. The construction of the berm is considered part of the mining operations and will not be included in the financial provisioning plan.

Physical and ecological stability

To ensure the physical stability and therefore the physical sustainability of the closed mining site over time, physically stable landscapes that are compatible with the intended post-mining land use will be worked towards. This will limit the latent occurrence of environmental degradation by limiting water and wind erosion.

- By ensuring the following, a physically stable and sustainable landscape post-mining is achievable:
- Ensure slopes of stockpiles to have a 1 (V):3(H) ratio, with a length of 30-40m.
- Slope run-off will be intercepted by benches of vertical spacings between 10-15m of which any water contained will be contained on the benches for evaporation and infiltration.
- Maintain and restore biodiversity levels as to provide appropriate habitats.
- Shape all channels, drains and dams to smooth slopes and integrate into natural drainage patterns.
- Remove alien and/or invasive vegetation.

- A 3m high security berm, with a crest of 1m and a slope of 1(V):2(H) will be constructed with waste rock around the open pit during mining operations. A security fence will be kept in place to ensure no trespassing or dangerous access to the open pit and the steep pit section of the stockpiles.

Chemical stability

To ensure the prevention of negative effects on the local and adjacent environment, chemical contamination arising from mining and mining related activities should be managed by ensuring the prevention of soil, surface and groundwater contamination by managing water on the site.

Socio-economic transition

To ensure as far as practically possible a smooth transition in the socio-economic conditions that exist pre-mine closure to that will exist post-mine closure. The socio-economic transition will comprise of a net beneficial socio-economic impact to the affected communities in the region.

Risk Limitation

To ensure a restraint in the number and acceptable level of numerous risks such as safety, environmental, financial, legal and social aspects as to safeguard the execution of closure activities in such a way that it is the most cost-effective and efficient approach for the mine.

Long-Term Care

To ensure the design and implementation of a closure plan that will guarantee the minimization or elimination of the need for long-term post-closure care and maintenance. This is achievable by ensuring physical, ecological, chemical and socio-economic stability that will allow for the relinquishment of the closed site to the appropriate third parties.

6.2 Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and Interested and Affected Parties

As part of the stakeholder engagement process, this Draft EIA/EMPr is currently available for public comment for a period of 30 days (10 March to 12 April 2023). Stakeholders are encouraged to comment on this report, including the closure objectives as presented in Part B Section 6.1. Any comments received will be addressed and responded to for inclusion in the Final EIA/EMPr to be submitted to the competent authority, the DMRE.

6.3 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

6.3.1 Waterval Mine

A rehabilitation plan has been compiled and contained in Appendix C14.

6.3.2 UG1 Opencast Project

The closure and rehabilitation plan for the UG1 opencast project was compiled by Hydrological Engineering Solution (HEES2, 2023) and is available in Appendix C12.

Two options were considered:

Option 1 included the total backfill of the open no voids left. At LoM, the remaining open voids will be backfilled with the overburden stockpile and imported waste material/dump rock. No security fence or berm will be required as there will be no voids left and the area will be shaped to be free draining.

Option 2 included the partial backfill of the open pit and safeguarding of the voids. The roll-over method will be used to place material inside the open pit in such a way that the ground level is the same as pre-mining conditions. The overburden stockpile will however not be backfilled into the remaining voids when life of mine is reached. The remaining void will be safeguarded by the construction of a 3m high rockfill berm with a security fence. Access for the community stock could be allowed at a safe entrance to the void through the access ramp. The construction of the security berm is considered as being part of the mining operations and are not part of the financial provisioning plan.

Option 1 is the preferred option for closure.

Rehabilitation plan

The rehabilitation plan provide the required actions necessary if the mine should cease operations at any time while this also provide a framework to adjust the mine plan towards final rehabilitation.

The basis of the recommended annual rehabilitation for the UG1 opencast project is:

- The backfilled surface section of the UG1 opencast pit must be vegetated.

The basis of the recommended final rehabilitation for the UG1 opencast project is:

- Inactive haul roads must be ripped and vegetated. At LoM all haul roads must be ripped and vegetated.
- All trenches must be demolished, ripped, filled and vegetated.
- The perimeter fence must be demolished and transported to scrap metal.
- The opencast pit must be completely backfilled with the local overburden stockpile and material from inert waste rock and overburden stockpiles from other existing stockpiles at Waterval mine
- The topsoil stockpile will be used to re-vegetate all rehabilitated areas,
- The ROM material will be removed and the impermeable concrete foundation demolished and haul to backfill the open pit as it is inert material.
- All offices and building and parking areas will be donated to the community for use as deemed fit.
- The perimeter berm will be demolished and hauled to the open fill as backfill.
- The Pollution Control Dam will be decommissioned, the liner removed to a approved land fill site and the reservoir backfilled with the overburden stockpile material and covered with a topsoil layer and the footprint re-vegetated.
- Allowance is made for the removal of electricity. However, with the building structures issued to the community this item can be negotiated.

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

The rehabilitation actions that Waterval Mine intends on undertaking at the end of the life of project are designed to comply with the requirements of the closure objectives.

Using available baseline and operational information, as well as identifying the opportunities and constraints imposed by the colliery on the environment and vice versa, the following post closure land use vision has been developed for the colliery. To progressively reinstate a post-mining landscape that improves local spatial development patterns and maximises socio-economic opportunities, by supporting sustainable agricultural production, while maintaining essential ecosystem services.

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

6.5.1 Waterval Mine

Information for this section was obtained from Environmental and Energy Services' Glencore Waterval Chrome Mine Closure Cost Report (Reference Number GLE 01/03/2022/6. March 2022). Refer to Appendix C13 for the full report.

The closure cost calculation was done in line with the prescribed format presented by the DMR and the 2021 official master rates were increased by CPI of 5% and used to calculate the closure quantum.

The total closure cost at year end 2022 was estimated to be **R 56 676 138.35** (inclusive of VAT).

6.5.2 UG1 Opencast project

As part of the closure and rehabilitation plan for the UG1 opencast project compiled by Hydrological Engineering Solution (HEES2), financially provisioning was determined. The financial provisioning for mine closure during any stage during life of mine is determined through the costing of the rehabilitation actions in line with the mine implementation plan and closure. The LoM is planned for 2023 to 2025.

The required and estimated yearly financial provisioning for annual and final rehabilitation until life of mine for Option 1 is shown Table 123.

Table 123: Financial provisioning for Option 1 (excluding VAT) (HEES2, 2023)

Year	Annual rehabilitation	Final rehabilitation
2023	R 718 819.00	R73 808 18.00
2024	R 718 819.00	R 91 949 213.00
2025	R 718 819.00	R 110 208 207.00

6.6 Confirm that the financial provision will be provided as determined

The financial provision as determined is provided for in the form of a bank guarantee.

7 Mechanisms for monitoring compliance with and performance assessment against the environmental management programme

Mechanisms for monitoring compliance with and performance assessment against the environmental management programme and reporting thereon, including:

- Monitoring of Impact Management Actions;
- Monitoring and reporting frequency;
- Responsible persons;
- Time period for implementing impact management actions; and
- Mechanism for monitoring compliance.

Table 124: Current monitoring programmes and compliance thereto at Waterval Mine (Shangoni, 2021)

Waterval Mine				
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**
Pumping of water, found underground, to the surface.	The pumping of groundwater may result in the development of a cone of depression.	Implementing the groundwater monitoring programme in line with the WUL to determine if there are any impacts on groundwater quantity and quality.	The Glencore Environmental Department is to ensure that groundwater monitoring is taking place in line with the WUL. The resultant groundwater monitoring reports need to be submitted to the DWS and kept on record as per WUL requirements.	Groundwater quality and level monitoring to be conducted in line with the WUL. The reports will be submitted to the DWS as per WUL requirements.
Underground mining activities at Waterval Mine	Groundwater quality may be impacted upon as a result of spillages, unauthorised disposal of contaminated substances as well as seepage from mine residue deposits (TSFs, Waste Rock Dumps and Product Stockpiles).			
Mining and mining related activities at Waterval East and Waterval West Shaft and Plant areas.	Surface water runoff may become contaminated should it come into contact with pollutants (chemicals, hydrocarbons, general waste, and coal mining waste / product).	Implement the surface water monitoring programme in line with the WUL to determine the quality of the water within the dirty water containment facilities (sumps, cooling ponds) as well the quality of the water within the adjacent surface water bodies, both upstream and downstream.	The Glencore Environmental Department is to ensure that the surface water monitoring is taking place in line with the WUL. The resultant surface water monitoring reports need to be submitted to the DWS and kept on record as per WUL requirements.	Surface water monitoring to be conducted in line with the WUL and the reports submitted to the DWS as per WUL requirements.
Activities at the TSFs and waste rock dumps.	Surface water runoff from the TSFs and waste rock dumps may result in pollution of downstream water resources.			
Mining and mining related activities at Waterval Mine	Mining activities at Waterval Mine may impact on the natural ecosystem of the Hex River.	Continue to implement the biomonitoring programme for Waterval Mine to assess the impact on the Hex River ecosystem.	The Environmental Department is to ensure that the biomonitoring is taking place as per WUL requirements. The resultant biomonitoring reports need to be submitted to the DWS and kept on record.	Biomonitoring to be conducted on a biannual basis (once in the summer and once in the winter) and the reports submitted to the DWS as per WUL requirements.
Activities that may result in the generation of waste.	Waste will be generated at the various areas on the mine (offices, ablutions, workshops,	A waste monitoring programme has been developed and implemented as per Regulation GNR 634 of 23 August 2013 under the NEM:WA (2008).	The Glencore Environmental Department is to ensure that all departments at the Mine are keeping accurate and up to date records of the waste generated. The Environmental	Annual internal and external audits will be conducted on the commitments as stipulated in the IWWMP and the Water Use Licence

Waterval Mine				
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**
	stores) which may result in the contamination of surface water runoff, groundwater resources, and soil and may impact on fauna, flora and visual aspects.	Sub-regulation 10 of GNR 634 requires the following: • Waste generators must keep accurate and up to date records of the management of the waste they generate, which records must reflect- the classification of the wastes. • The quantity of each waste generated, expressed in tons or cubic metres per month. • The quantities of each waste that has either been re-used, recycled, recovered, treated or disposed of. • by whom the waste was managed. • The records contemplated above must be retained for a period of at least five (5) years. • made available to the Department upon request.	Department will ensure that all waste reports are combined and kept on record.	and will be submitted to the DWS as per WUL requirements.
Mining and Mining related activities at Waterval Mine.	Potential environmental impacts resulting from the non-compliance with legislation.	Environmental legal compliance audits, including GN704 audits, are to be conducted to ensure compliance against all applicable environmental legislation and policies.	The Environmental Department is to ensure that the Environmental Legal Compliance audit is to be conducted by an independent and suitably qualified individual.	The Environmental Legal Compliance audits must be undertaken every 5 years .
		Environmental Audits on the EMPr compliance (as per the EIA Regulations, 2014 (or amendments thereto) are to be conducted, in line with NEMA Regulation 34.	The Environmental Department is to ensure that the Environmental audits are conducted by an independent and suitably qualified individual , in line with NEMA Regulation 34.	The Environmental audit is to be conducted, in line with NEMA Regulation 34. (unless otherwise instructed by the DMRE), kept on record and submitted to the DMRE.
		Internal and external WUL audits are to be undertaken as required by the Waterval Mine WUL.	The Glencore Environmental Department is to ensure that the Environmental audits are conducted by an independent and suitably qualified individual.	The internal and external WUL audits are to be conducted on an annual basis and submitted to the DWS as per WUL requirements.
Mining-related activities including the	Dust may be generated as a result of mining-related	The dust fallout and air quality monitoring plan will be continued throughout the Life	The Glencore Environmental Department is to ensure that the dust fallout and air quality	The dust fallout and air quality monitoring reports are to be

Waterval Mine				
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**
conveyance of ore and the disposal of mining waste on the TSF's and waste rock dumps.	activities conducted on the surface.	of Mine in order to determine potential impacts and sources of dust.	monitoring is conducted by a suitably qualified individual. The dust fallout monitoring programme must establish a network of monitoring points using method AST D1739 (1970) .	submitted to the DMRE and the North West Department of Economic Development, Environment, Conservation and Tourism upon request.
Mining and related activities	Mining and related activities such as the use of vehicles on roads, crushing etc. generate noise.	The mine will continue to implement environmental noise monitoring.	The Glencore Environmental Department is to ensure that noise monitoring is conducted by a suitably qualified individual.	The noise monitoring reports are to be submitted to the DMRE and the North West Department of Economic Development, Environment, Conservation and Tourism upon request.
Decommissioning and rehabilitation activities.	Impacts such as soil erosion, deterioration of vegetation and dust may result in the event that the rehabilitation techniques were incorrectly implemented	The rehabilitation monitoring programme will be implemented to ensure that the rehabilitation techniques that were implemented are sufficient for the rehabilitation of Waterval Mine and that no significant impact (soil erosion, dust, weed and invasive plant species establishment) are occurring on the rehabilitated areas.	The Glencore Environmental Department will ensure that the rehabilitation monitoring programme is being implemented, the monitoring techniques were implemented correctly and that no impacts occurring on the rehabilitated areas.	Monitoring of the rehabilitation success will take place for approximately 3 years and will include corrective follow-up action. The rehabilitation monitoring reports will be submitted to the DMRE on an annual basis during the Decommissioning / Closure Phase.

8 Indicate the frequency of the submission of the performance assessment report

Unless otherwise instructed by the DMRE or as a condition to the authorisation, the Environmental Management Programme performance assessments (environmental audits) will be undertaken in line with NEMA Regulation 34. The subsequent environmental audit reports will be submitted to the DMRE.

9 Environmental Awareness Plan

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

Formal training (induction) will be provided to all employees regarding the hazards of the duties to be performed to both their health as well as the surrounding environment. It is the responsibility of the Mine Manager and the Health and safety officers to ensure that adequate training is provided to all employees. It is also the responsibility of the relevant Heads of Department to identify the need for further training. As part of the mandatory training provided to all employees and contractors, environmental awareness training will be provided, as described in Part B Section 10.2 (Shangoni, 2021).

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

The following Environmental Awareness Training will be implemented by Waterval Mine in order to inform employees and contractors of the environmental risk that may result from their work, or the risk of their interaction with the sensitive environment. The training will be conducted as part of the induction process for all new employees (including contractors) that will perform work in terms of the proposed activities. Proof of all training provided must be kept on-site (Shangoni, 2021).

The Environmental Awareness Training will, as a minimum cover the following topics (Shangoni, 2021):

- Air Quality
  - Activities that may result or mitigate impact on air quality; speeding on roads, covering of haul trucks etc; and
  - Negative impacts on the receiving environment if mitigation measures are not implemented.
- Surface and groundwater
  - Risks to surface and groundwater, e.g. fuel and chemical handling and further risks of erosion or damage to riparian vegetation;
  - How incidents should be reported, and emergency requirements;
  - The importance of storm water control, maintenance of pollution control infrastructure; and
  - The importance to reuse water and to prevent spillages.
- Cultural Heritage
  - To respect all cultures and believes;
  - To remain within working areas and not to enter or interfere with any cultural heritage; and
  - How to report any sightings as identified during operation activities (e.g. fossils).
- Fauna
  - Overview of the fauna found on site and the uniqueness thereof;
  - Mitigation measures that all contractors and employees need to abide by; and

- No contractor or personnel allowed to catch or kill any species, and how any sightings should be reported if further actions are required (e.g. to catch and release).
- Flora
  - Overview of the flora diversity on site, and the rare and endangered nature thereof;
  - Measures taken by the mine to protect species; and
  - No contractor or personnel allowed to remove, harvest or destroy any flora species unless clearly instructed based on the construction and operational plans.
- Waste management
  - The correct segregation of general and hazardous waste;
  - Waste Management Practices; and
  - Measures to avoid waste generation and to participate in waste minimisation/reduction strategies.
- Traffic
  - Abide by traffic rules, no speeding allowed;
  - To stay on designated roads (and not to drive on areas that are not fit and designed for this purpose); and
  - To be aware of the fauna species and to be on the lookout and avoid collisions.
- Natural Resource Consumption
  - Minimise unnecessary use of energy by making use of energy saving devices, switching off non-essential appliances etc.; and
  - Optimise utilisation of mining and plant equipment, travelling routes etc.
- Emergency Preparedness and Response
  - Designated smoking areas;
  - How to report any emergency or incident; and
  - How to respond when emergency alarm goes off.
- General rules and conduct
  - Respect for the sensitive environment;
  - Do not litter;
  - HIV/AIDS awareness;
  - Respect for each other and for different cultures; and
  - Safety and health requirements.

10 Specific information required by the Competent Authority

The information, as presented in Table 125, will be required by the competent authority.

Table 125: Monitoring information required by the competent authority (Shangoni, 2021)

Information	Frequency of submission
Quantum of Financial Provision	Annually
Annual rehabilitation plan	Annually
Environmental Audit Report on approved EIA/EMPr and other environmental authorisations	In line with NEMA Regulation 34.
Legal compliance audit report	Every 5 years
GN704	In line with external and internal WUL audit requirements
Surface water monitoring	Submission as per WUL requirements.
Biomonitoring	Submission as per WUL requirements.
Groundwater quality monitoring	Submission as per WUL requirements.

Information	Frequency of submission
Groundwater level monitoring	Submission as per WUL requirements.
Fall-out Dust Monitoring and Noise Monitoring	Upon request by the competent authority
Rehabilitation Monitoring Report	Annually (during Decommissioning / Closure Phase)

11 Undertaking regarding correctness of information

I, Suzanne van Rooy, herewith undertake that the information provided in the foregoing report is correct, and that the comments and inputs from stakeholders and Interested and Affected parties has been correctly recorded in the report.

____

Signature of the EAP

____

Date

12 Undertaking regarding level of agreement

I, Suzanne van Rooy, herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

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Signature of the EAP

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Date

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Appendices

Appendix A: Curriculum Vitae of EAP

Appendix B: Stakeholder Engagement Documentation

Appendix B1: List of stakeholders

Appendix B2: Minutes of pre-application meetings

Appendix B3: Proof of site notices

Appendix B4: Background Information Document

Appendix B5: Proof of distribution of BIDs

Appendix B6: Advertisements: Scoping Phase

Appendix B7: Notification letter: Availability of Draft Scoping Report

Appendix B8: Proof of distribution of Scoping Phase Notification Letter

Appendix B9: Attendance Registers: Scoping Phase Open Day

Appendix B10: Advertisements: Impact Assessment Phase

Appendix B11: Notification letter: Availability of Draft EIA/EMPr

Appendix B12: Proof of distribution of Impact Assessment Phase Notification Letter

Appendix B13: Communication with Stakeholders

Appendix C: Specialist Studies

Appendix C1: Soil Pedology

Appendix C2: Vegetation Compliance Statement

Appendix C3: Wetland Study

Appendix C4:Surface Water Assessment

Appendix C5: Stormwater Management Plan

Appendix C6: Groundwater

Appendix C7: Air Quality

Appendix C8: Noise

Appendix C9: Visual

Appendix C10: Heritage

Appendix C11: Blasting

Appendix C12: UG1 Opencast Closure Plan and Financial Provision

Appendix C13: Waterval Mine Closure Cost Assessment

Appendix C14: Waterval Mine Rehabilitation Plan

Appendix D: Proof of Water Use Licence Application

Appendix E: Waste Management Procedure