forestry, fisheries & the environment

Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

APPLICATION FORM FOR EXCLUSION OF WASTE STREAM OR PORTION OF WASTE STREAM FROM THE DEFINITION OF WASTE IN TERMS OF GN 715 OF 18 JULY 2018.

	(For official use only)
File Reference Number:	12/9/11
NEAS Reference Number:	
Date Received:	

Application for exclusion of waste stream or portion of waste stream in terms of the National Environmental Management: Waste Act, 2008(Act No.59 of 2008), as amended.

Kindly note that:

1. This application form is current as of 18 July 2018. It is the responsibility of the applicant to ascertain whether subsequent versions of the form have been published or produced by the competent authority.

2. The application must be typed within the spaces provided in the form. The sizes of the spaces provided are not necessarily indicative of the amount of information to be provided. Spaces are provided in tabular format and will extend automatically when each space is filled with typing.

3. Where applicable **black out** the boxes that are not applicable in the form.

4. Incomplete applications may be returned to the applicant for revision.

5. The use of the phrase "not applicable" in the form must be done with circumspection. Should it be done in respect of material information required by the competent authority for assessing the application, it may result in the refusal of the application as provided for in the Regulations.

6. This application must be handed in at the offices of the relevant competent authority as determined by the Act and regulations.

7. Unless protected by law, all information filled in on this application will become public information on receipt by the competent authority. Any interested and affected party should be provided with the information contained in this application on request, during any stage of the application process.

Queries must be addressed to the contact hereunder:

Departmental Details

Postal address:
Department of Environment, Forestry and Fisheries
Attention: Director: Licensing
Private Bag X447
Pretoria
0001

Physical address:
Department of Environment, Forestry and Fisheries
Environment House (473 Steve Biko Rd, corner Steve Biko and Soutpansberg Rds)
Arcadia X6
PRETORIA
0002

Application queries should be directed to the Directorate: Licensing on:

Tel : 012 3999 791 Email: Lmahlangu@environment.gov.za

COMMENCEMENT: Has the activity (ies) commenced: Yes or ~~No~~

If yes, When (provide the Year, Month and Date):

WASTE STREAM/PORTION OF WASTE STREAM

Mine overburden

BENEFICIAL USE

Backfilling into open pit created by opencast mining

SITE GPS CO-ORDINATES

Please provide the geographic co-ordinates of **all corners** of the waste generating site; in degrees, decimal minutes, and seconds for all sites (Indicate the position of the activity using the latitude and longitude of the centre point of the site for each alternative site). Provide geographic coordinates for all corners of the facility (ies) ONLY THE FORMAT PRESCRIBED (e.g. 60° 29' 30" Latitude; 34° 20' 15" Longitude)

1)

CORNER	LATITUDE			LONGITUDE		
1	25°	49'	42.83"	29°	52'	56.82"
2	25°	49'	41.17"	29°	52'	47.95"
3	25°	49'	33.47"	29°	52'	55.42"
4	25°	49'	47.67"	29°	52'	56.35"
5	25°	49'	44.19"	29°	53'	2.30"

2)

CORNER	LATITUDE			LONGITUDE		
1	25°	50'	14.51"	29°	53'	16.63"
2	25°	50'	3.80"	29°	53'	20.06"
3	25°	50'	15.10"	29°	53'	19.27"
4	25°	50'	19.60"	29°	53'	15.52"
5	25°	50'	11.54"	29°	53'	14.95"

3)

CORNER	LATITUDE			LONGITUDE		
1	25°	51'	26.54"	29°	53'	31.27
2	25°	51'	26.47"	29°	53'	28.91"
3	25°	51'	25.84"	29°	53'	33.54"
4	25°	51'	33.17"	29°	53'	29.21"
5	25°	51'	34.78"	29°	53'	38.89"

1. BACKGROUND INFORMATION

Applicant:	UMSIMBITHI MINING (PTY) LTD		
Trading name (if any):	WONDERFONTEIN (OC/UG)		
Contact person:	Thato Gama		
Physical address:	Portion 2 Farm Wonderfontein 428 JS, Carolina		
Postal address:	PO Box 272, Middelburg		
Postal code:	1050		
Telephone:	013 244 8200	Cell:	064 759 3551
E-mail:	Thato.Gama@glencore.co.za	Fax:	086 537 8649
SAWIS registration number:	D06076-01		
Nearest town or districts:	Belfast		

2. DETAILED DESCRIPTION OF WASTE GENERATING PROCESS (Attach supporting illustrations)

Supporting documents attached?	Yes	No
Production Process Flow Chart	✓	
Waste Classification	✓	
Chemical and technical specification[1] (pre-beneficiation)	✓	
Chemical and technical specification (post beneficiation)	Overburden will not be beneficiated. It will be disposed of in-pit as is.	
Risk Assessment Report	✓	
Risk Management Plan	✓	

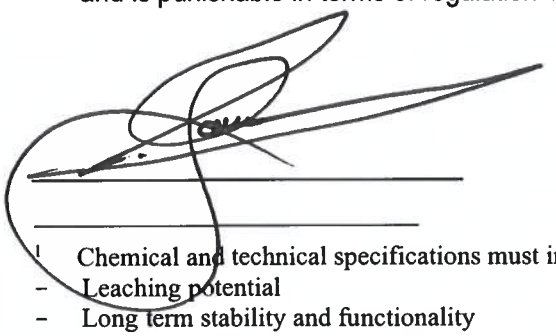
3. DECLARATIONS

3.1 The Applicant

I, Thato Gama declare that

I -

- am, or represent[2], the applicant in this application;
- will provide the Minister with access to all information at my disposal that is relevant to the application;
- will be responsible for the costs incurred, in respect of the undertaking of any process required in terms of the Regulations; and
- hereby indemnify the Government of the Republic, the competent authority and all its officers, agents and employees, from any liability arising out of the content of any report, any procedure or any action which the applicant is responsible for in terms of these Regulations;
- will perform all other obligations as expected from an applicant in terms of the Regulations;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 14(1) of these regulations and is punishable in terms of regulation 14(2) of these Regulations.



[1] Chemical and technical specifications must include the following:
- Leaching potential
- Long term stability and functionality
- Reactivity with environmental factors
- Storage requirements (to be included in the Risk Assessment and Risk Management Plan)

[2] If this is signed on behalf of the applicant, proof of such authority from the applicant must be attached.

Signature of the applicant[3]/ Signature on behalf of the applicant:

Tlato Gama

Name of company (if applicable):

30 September 2021

Date:

[3] If the applicant is a juristic person, a signature on behalf of the applicant is required as well as proof of such authority.

Signature of the Commissioner of Oaths:

LYNDON KELLY

Name of the Commissioner of Oaths:

5/10/2021

Date:

Designation:

Official Stamp:

CERTIFIED TRUE COPY
OF THE ORIGINAL DOCUMENT
GLENCORE COAL S.A.
Private Bag X 7266, Witbank, 1035

2021 -10- 05

Security Manager

COMMISSIONER OF OATHS
EX OFFICIO REP OF SOUTH AFRICA
LYNDON MANFRED KELLY
SECURITY MANAGER
GLENCORE COAL S.A.

Remove maximum topsoil and either place directly on levelled and compacted soft overburden from previous mine cuts (steady-state operation) or place on a topsoil stockpile / topsoil berm (applicable to initial mining cuts).

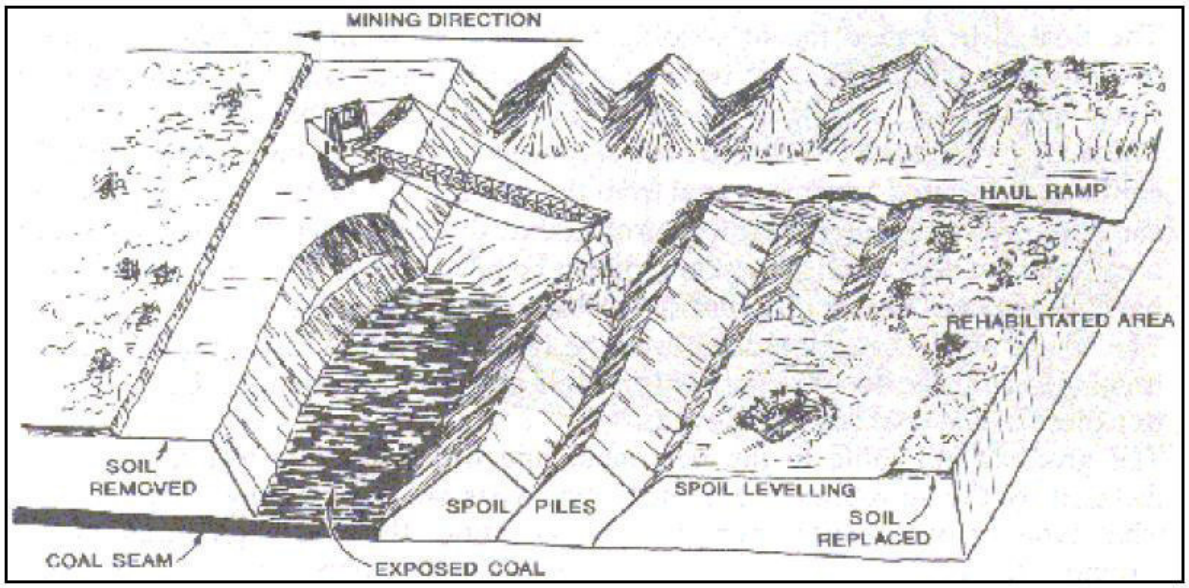
Remove soft overburden with excavator and trucks. Place directly on hard overburden in previous mine cuts (steady-state operation) or place onto soft overburden stockpile, as close to the final void as possible (applicable to initial mining cuts).

Drill and blast the remaining overburden and remove all overburden with an excavator and truck operation to expose the coal. Place directly into previous mine cuts (steady-state operation) or place onto overburden stockpile, as close to the final void as possible (applicable to initial mining cuts).

Remove and stockpile clay where this is present (3 seams are interspersed with the overburden).

Exposed coal is drilled and blasted only when necessary and then temporarily stockpiled within the pit for transport by truck to the processing facilities. Most of the coal is excavated without blasting (free digging) which assists in the reduction of fine coal dust emission and noise and vibration associated with blasting.

The process is repeated to access the next seam down (No. 2L) and then again for the final seam (No.1).



Process Flow illustration of the overburden generation and storage

SAFETY DATA SHEET

Conforms to ISO 11014-1 and the South African Occupational Health and Safety Act (86/1993)

December 2020

MINE OVERBURDEN

1. COMPANY INFORMATION

Name: UMSIMBITHI MINING (PTY) LTD

Address: 428 JS portion 2

Carolina

Trading Name: WONDERFONTEIN (OC/UG)

Tel Number: + 013 244 8200

2. HAZARDS IDENTIFICATION

The overburden is composed of 60% quartz (SiO_2), 25.2% of the clay mineral kaolinite [$Al_2Si_2O_5(OH)_4$], 8.6% the phyllosilicate mineral muscovite [$KAl_2(AlSi_3O_{10})$ $(F,OH)_2$], 4.1% of the aluminosilicate mineral microcline ($KAlSi_3O_8$), 1.7% of the iron carbonate mineral siderite ($FeCO_3$) and 0.4% of the calcium magnesium carbonate mineral dolomite [$CaMg(CO_3)_2$]. The material contains a variety of trace metals, but they are not available to the environment, except in the presence of acids. The Si is expected to be present in a size not to be harmful. Any respirable silica dust generated may cause health effects. Silicosis is normally associated with prolonged inhalation of crystalline silica dust.

The material is not considered hazardous during normal use and if precautionary measures are taken, and when recommended use instructions are followed. The following potential hazards should however be recognised:

Target Organs: May cause respiratory irritation upon exposure to high airborne concentrations. May cause eye irritation if material contacts eye.

Hazard statements:

May be harmful if swallowed (H303).

May be harmful if inhaled (H333).

Precautionary Statement:

Avoid inhaling dust.

Wear protective gloves/protective clothing/eye protection/face.

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses if present. Continue rinsing.

If skin irritation occurs: Get medical advice/attention.

If eye irritation persists: Get medical advice/attention.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

The mine overburden is composed of the following elemental oxides in concentrations greater than 0.01%:

Constituent	*Content (%)*	CAS number
SiO_2	58.5	7631-86-9
Al_2O_3	16.7	1344-28-1
Fe_2O_3	5.57	1309-37-1
K_2O	1.86	1309-48-4
TiO_2	0.96	13463-67-7
MgO	0.517	1309-48-4
CaO	0.246	1305-78-8
P	0.090	7723-14-0
Na_2O	0.078	1313-59-3
MnO	0.065	1344-43-0

4. FIRST AID MEASURES

Eye: Flush eyes with plenty of water for a minimum of 15 minutes. Keep rotating the eyes to ensure complete flushing of all particles. Do not rub eyes. Seek medical attention promptly if irritation persists or any abrasions occur.

Skin: Not severely abrasive on skin but skin should be washed with cool water and mild soap or detergent if rash or irritation occurs.

Inhaled: No specific first aid measures are needed but remove affected person promptly to fresh air. Seek medical attention for discomfort or if coughing or other symptoms do not subside. Always use proper PPE.

5. FIRE FIGHTING MEASURES

Extinguishing Media: Dry powder, carbon dioxide, foam or water spray.

Exposure Hazards: The product will not ignite easily.

6. ACCIDENTAL RELEASE MEASURES

Personal Precaution: Wear personal protective clothing with a respiratory mask, to prevent dust inhalation. Ensure adequate ventilation.

Emergency: Isolate the spill and prevent further leakage or spillage.

Environmental: Prevent entry of the spilled product into waterways, sewers or confined areas.

Clean up methods: Sweep up and shovel it into suitable containers for re-use, recovery or disposal. Avoid creating a dust cloud.

Other Information: See Section 13 for disposal Considerations.

7. HANDLING AND STORAGE

Handling: Handle in a well-ventilated area. Keep dust formation to a minimum. Always wear correct PPE.

Protective clothing: Chemical protective clothing should not be required under normal circumstances when using this material.

Storage: No special storage requirements but store where excessive wind cannot disperse dust particles.

8. ENGINEERING MEASURES

Occupational Exposure Limits (OEL):

There are no exposure limits available for the mine overburden, therefore the ingredients or a substance close to the ingredients will be used. Below is Exposure Limits for dust and silicon. The exposure limits for nuisance dust (particulates not otherwise regulated) are the most important and should be used. Dust to be suppressed while stored above surface.

<u>Particulates not otherwise regulated – Total Dust</u>

TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)

General Industry - TWA 15 mg/m^3

Construction Industry – TWA 15 mg/m^3

TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)

ACGIH Guideline: TWA 10 mg/m^3 (Inhalable Particles)

Silicon [CAS No. 7440-21-3]

TWA 10 mg/m^3 (total) TWA 5 mg/m^3 (resp)

TWA 15 mg/m^3 (total) TWA 5 mg/m^3 (resp)

Personal protection during working application:

Respiratory: Suitable dust masks of same nature as for nuisance dust (NB, recommendations/specifications to be informed by an occupational health practitioner.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Dark Grey
Odour:	None
Odour Threshold:	Not applicable since there is no odour
pH:	7.37
Melting Point:	Not Available
Boiling Point:	Not available
Flash Point:	Not Applicable Inorganic Substance
Evaporation Rate:	Not available
Flammability:	Not Flammable
Explosion limits:	Not Explosive
Vapour Pressure:	Not Available
Vapour Density:	Not Applicable
Relative Density:	Not Available
Water Solubility:	Not available
Partition Coefficient:	Not Applicable, Inorganic Substance

10. STABILITY AND REACTIVITY

Chemical stability:

Stable under normal temperatures and pressures

Possibility of Hazardous Reactions:

Avoid reactions with acids such as hydrofluoric acid and nitric acid and bases.

Conditions to Avoid:

Avoid generating dust.

11. TOXICOLOGICAL INFORMATION

Acute Potential Effects:

Possible silicosis, fibrosis, cancer

May be harmful if swallowed

May be harmful if Inhaled

Chronic Potential Health Effects:

The substance may be toxic to lungs and upper respiratory tract. Repeated or prolonged inhalation or unprotected exposure to the substance can produce target organ damage.

Likely routes of exposure:	Eye contact, skin contact, inhalation
Target Organs:	Skin, Eyes, Respiratory System
Constituent / Ingredient Toxicity (LD50):	Oral > 2000mg/kg, ≤5 000mg/kg; Dermal >5 000 mg/kg
Constituent / Ingredient Toxicity (LC50):	Inhalation >5 mg/l

12. ECOLOGICAL INFORMATION

Persistence and Degradability:

Most ingredients are of inorganic nature and do not biodegrade.

Ecotoxicity:

Daphnia:	Not expected
Fish:	Not expected
Aquatic Plants:	Not expected
Micro-algae	Not expected
Bacteria	Not expected

Mobility in soil:

Constituents relatively insoluble in water.

Expected to be relatively immobile in soil.

Bioaccumulation:

Constituents are insoluble and not expected to bioaccumulate.

13. DISPOSAL CONSIDERATIONS

The preferred methods of disposal are firstly recycling or re-using. Disposal should comply with the waste disposal legislation as well as any other municipal regulations. This product should never be disposed within watercourses.

14. TRANSPORT INFORMATION

Transport Hazard Class: None

Environmental hazard: Hazardous Waste, solid

Special Precaution for User: Not Hazardous for transportation. Avoid dust formation.

15. REGULATORY INFORMATION

No constituents contained in this product has been listed in the Hazardous Chemical Substances Regulations for the Occupational Exposure Limit.

National legislation:

Waste Classification and Management Regulations (GN R.634 of 23 August 2013)

SANS 10228:2010 The identification and classification of dangerous goods for transport (Edition 5)

Regulations Regarding the Planning and Management of Residue Stockpiles And Residue Deposits, NO. R. 632 (as amended 21 September 2018), National Environmental Management: Waste Act, 2008 (act no. 59 of 2008).

SANS 10234- A List of classification and labelling of chemicals in accordance with the Globally Harmonized System (GHS)

16. OTHER INFORMATION

Date of issue: 1st Issue; December 2020

Compiled by: Shangoni Management Services (Pty) Ltd

The data in this SDS relates only to the specific material designated herein and does not relate to use in combination with other materials and in any process. The author assumes no responsibility for any physical or chemical changes, which the Buyer/User may make to the material designated in this SDS.

UMSIMBITHI MINING (PTY) LTD: Wonderfontein

Risk Assessment and Risk Management Plan for the exclusion of mine overburden from the definition of waste for beneficial use

Report date: 15 December 2020

SHANGONI AquiScience

A division of Shangoni Management Services Pty Ltd

www.shangoni.co.za

Executive Summary

Shangoni AquiScience, a division of Shangoni Management Services (Pty) Ltd, was appointed by Umsimbithi Mining (Pty) Ltd for assistance with an application to exclude overburden material, generated on their Wonderfontein Colliery, from the definition of waste. The application was compiled according to the requirements contained in the *Regulations Regarding the Exclusion of a Waste Stream or a Portion of a Waste Stream from the Definition of Waste* (GN 715 in GG 41777 of 18 July 2018).

This report, aimed to support the application, includes a Risk Assessment in terms of Regulation 8 of the Waste Exclusion Regulations, and a Risk Management plan in terms of Regulation 10 of the Waste Exclusion Regulations.

The overall objective is to apply to the minister of The Department of Environment, Forestry and Fisheries ("DEFF") to exclude mine overburden material from the definition of "waste" as per the *Regulations* (GN 715 in GG 41777 of 18 July 2018*).*

The scope of work entailed the following:

1. Risk assessment as per the Legislative Framework, to include:
    a. Waste classification.
2. Risk management plan.
3. Report based on 1 & 2 above.
4. Application to the DEFF for consideration to exclude overburden from the definition of waste.

This report contains the risk assessment and risk management plan as well as the methodology followed to characterise and classify the overburden material. The report will be attached as supporting documentation to the application forms.

Based on the assessment, it is concluded that the overburden material is a low risk waste with low potential for contaminant release but does require some level of control and ongoing management to protect health and the environment. The potential impacts will have little real effect and will not have an influence on or require modification of the activities. Certain mitigation factors are, however, recommended in this report, and the management commitments contained in the mine's EMPr should be adhered to. It is believed that the backfilling and beneficial use will be managed in an environmentally sustainable manner to ensure that little/no cumulative impacts affect the environment.

Table of Contents

List of Figures

List of Tables

1. Introduction

Shangoni AquiScience, a division of Shangoni Management Services (Pty) Ltd, was appointed by Umsimbithi Mining (Pty) Ltd, for assistance with an application for the exclusion of overburden generated at their Wonderfontein Complex from the definition of waste. The application was compiled according to the requirements of the GN 715 in GG 41777 of 18 July 2018 (*Regulations Regarding the Exclusion of a Waste Stream or a Portion of a Waste Stream from the Definition of Waste*). Supporting documentation to the application include a Risk Assessment in terms of Regulation 8 of the Waste Exclusion Regulations and a Risk Management plan in terms of Regulation 10 of the Waste Exclusion Regulations. The risk assessment and management plan to be followed are proposed in this report.

The location of the Wonderfontein Complex is located roughly 40 km east of Middelburg and 24 km south-west of Belfast in the Mpumalanga Province. The site lies within the Emakhazeni Local Municipality (MP314) and the Nkangala DC31 District Municipality. The regional and local setting are depicted in Figure 1.

The region is largely comprised of a mix of cultivated agriculture and grazing land. Adjacent farm portions are currently being utilised for mostly maize and soybean and is historically a strong farming community

The colliery is located in the X11C quaternary catchment of the Nkomati Water Management Area of South Africa. The four closest towns to the mining complex are indicated in Table 1.

Table 1: Closest Towns to the Wonderfontein Mining Complex

Town	Distance	Direction
Belfast	24 km	NE
Middelburg	40 km	W

2. Management of overburden generated

Several topsoil and overburden stockpiles are found next to opencast operations. During rehabilitation, the soft and hard overburden will be used as backfill material in opencast areas. The general procedure is as follows:

1. Remove maximum topsoil and either place directly on levelled and compacted soft overburden from previous mine cuts (steady-state operation) or place on a topsoil stockpile / topsoil berm (applicable to initial mining cuts).
2. Remove soft overburden with excavator and trucks. Place directly on hard overburden in previous mine cuts (steady-state operation) or place onto soft overburden stockpile, as close to the final void as possible (applicable to initial mining cuts).
3. Drill and blast the remaining overburden and remove all overburden with an excavator and truck operation to expose the coal. Place directly into previous mine cuts (steady-state operation) or

place onto overburden stockpile, as close to the final void as possible (applicable to initial mining cuts).

4. Remove and stockpile clay where this is present (3 seams are interspersed with the overburden).
5. Exposed coal is drilled and blasted only when necessary and then temporarily stockpiled within the pit for transport by truck to the processing facilities. Most of the coal is excavated without blasting (free digging) which assists in the reduction of fine coal dust emission and noise and vibration associated with blasting.
6. Bullet 3 to Bullet 5 is repeated to access the next seam down (No. 2L) and then again for the final seam (No.1).

No processing of the overburden will take place. It will be stored on surface away from watercourses and outside of the 1:100 floodline. The overburden is placed directly into previous mine cuts (steady-state operation) or placed onto overburden stockpiles, as close to the final void as possible (applicable to initial mining cuts) to be used later as rehabilitation material ('backfill').

No additional waste will be generated from the proposed activity. Refer to Sections 6 and 7 for the risk assessment and management plan detailing the relevant mitigation and management measures.

Umsimbithi is committed to minimising the impact of overburden deposits on the environment and the community by adopting appropriate waste management principles. Umsimbithi in all practicable cases will endeavour to achieve the best possible environmental outcome by safely handling and disposing of overburden deposits. Leading practice waste management principles are incorporated into Umsimbithi waste management procedures.

Umsimbithi overburden management strategy also reduces the level of risk associated with pollution generation, onsite and off-site. With regards to all overburden facilities, Umsimbithi's waste management objectives are to:

- Comply to the legal and regulatory conditions of South Africa.
- The design, operation and closure will consider the optimisation of water use on and around the facility as well as the minimisation of the potential impacts on water quantity and quality.
- The design, operation and closure of the facility will consider the water management principles through the full life cycle of the facility.
- The precautionary approach is applicable on management of the facilities. Thus, worst-case conservative assumptions will be made in instances where there is lack of information or level of knowledge.
- Technical studies and the design of facilities will be undertaken by suitably qualified personnel.
- Water management will consider the internalisation of overall actual (operating) costs as well as the potential costs of the facility, e.g. the polluter pay principle.

- The design will adopt a holistic approach, including:
  - Sustainability,
  - Full life cycle,
  - Water quantity and quality, and
  - Natural receiving environment.
- Water management principles will play a key and decisive role when evaluating and deciding on rehabilitation and closure strategies.
- Prevent overburden from contaminating the surrounding environment;
- Manage and control disposal of all overburden; and
- Optimise the use of overburden to ensure rehabilitation success.

Table 2 lists the total estimated quantity of overburden to be generated at Umsimbithi Mining (Pty Ltd): Wonderfontein for the life of mine plan (LOMP).

Table 2: Overburden management and estimated quantity of overburden to be generated at Umsimbithi Mining (Pty Ltd): Wonderfontein for the life of mine plan (LOMP)

Type	Waste Description	Source(s)	Estimated quantity of waste (m^3)	Management
Overburden	Rock material overlying coal deposits removed during mining activities and temporarily stored on surface	Wonderfontein	141 351 544	Continuation of regular geochemical assessments. Any overburden material that is found to have elevated elements or acid potential (such as carbonaceous shale) is encapsulated within the overburden dump with the inert and non-acid producing sandstone, non-carbonaceous shale and other rock (dolerite) to reduce any negative impact effects on the environment through leaching.

A production flow chart can be viewed in Figure 1.

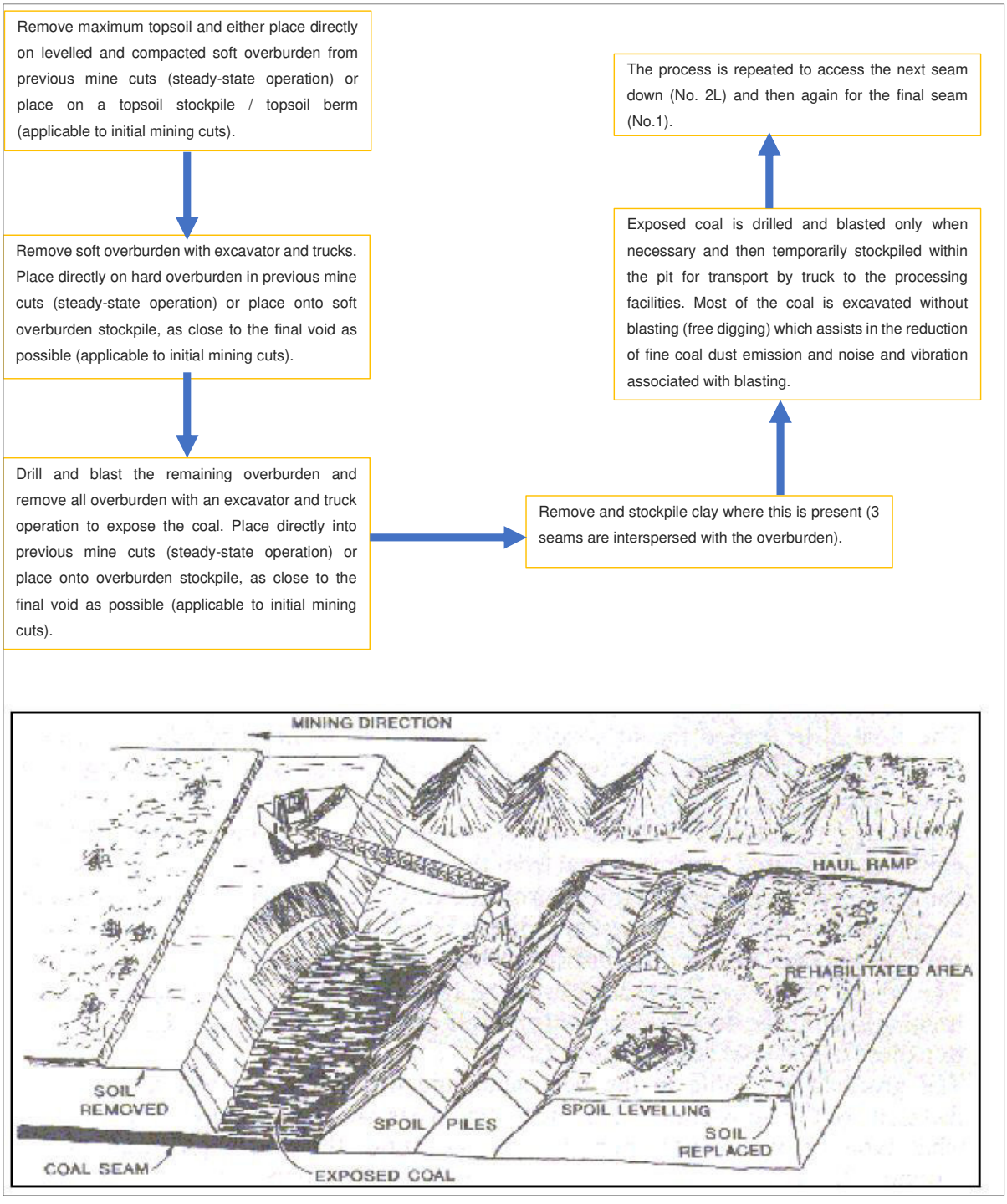


Figure 1: Process Flow illustration

3. Legislative Framework

Criteria for exclusion of a waste stream or portion of a waste stream from the definition of waste:

- The Minister may exclude a waste stream or a portion of a waste stream, from the definition of waste for the purposes of beneficial use, provided that the –
  a) application demonstrates that the waste is being or has been or will be used for a beneficial purpose either locally or internationally;
  b) applicant undertakes a risk assessment and submits a risk management plan demonstrating that the intended beneficial use of the excluded waste can be managed in such a way as to ensure that the intended beneficial use will not result in significant adverse impacts on the environment; and
  c) risk management plan developed and responding to the risks identified in the risk assessment undertaken in terms of paragraph (b) above accompanies any delivery of the excluded waste to the user.

Elements of the Risk Assessment:

- A risk assessment undertaken in terms of regulation 7(b) must include the following elements:
  a) provide information that is facility based;
  b) description and source of the waste;
  c) intended uses of the excluded waste;
  d) description of the methodology used to assess the hazardous characteristics of the waste that is to be excluded;
  e) identification of any potential risks relating to all the activities associated with the intended beneficial use of the excluded waste; and
  f) identification of mitigation measures that can be used to manage the risks identified in paragraph (e) above.

The results of the risk assessment must be used as the basis of a risk management plan.

Contents of the Risk Management Plan:

- The risk management plan contemplated in regulation 7(c) must include the following:
  a) a Safety Data Sheet (“SDS”) which complies with the requirements of SANS 10234, where the waste material is classified as hazardous (refer to Appendix A for SDS);
  b) permitted uses for which the waste material may be used; and
  c) a mechanism to record the amount of waste distributed to specific users for a permitted use; including the number of enterprises established or supported and the extent to which previously disadvantaged individuals have been supported.

4. Objective and Scope of Works

The objective of the project is to submit an application to the minister of DEFF to exclude plant discard from the definition of “waste” as per the requirements of the GN 715 in GG 41777 of 18 July 2018 Regulations.

The scope of work entailed the following:

1. Risk assessment as per the Legislative Framework, to include:
    a. Waste classification.
2. Risk management plan.
3. Report based on 1 & 2 above.
4. Application to the DEFF for consideration to exclude overburden from the definition of waste.

This report contains the risk assessment and risk management plan as well as the methodology followed. The report will be attached as supporting documentation to the application form submitted to the DEFF.

4.1 SANS 10234 Classification

4.1.1 Harmonized criteria for the classification of hazardous substances

Regulations require that waste be classified in terms of SANS 10234, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). The standard covers the harmonized criteria for the classification of hazardous substances and mixtures, including waste, for their safe transport, use at the workplace or in the home according to their intrinsic health and environmental and physical hazards. It gives the harmonized communication of elements for labelling and for generating Safety Data Sheets (SDS).

The standard accordingly provides detail on classification criteria (hazard classes and categories), labelling, hazard identification symbols (pictograms), packaging and the minimum information required for a 16-point safety data sheet (SDS).

Classification in terms of SANS 10234 means establishing whether a waste is hazardous based on the nature of its intrinsic physical, health and environmental hazardous properties (Hazard Classes), as well as Hazard Categories thereunder, which are subdivisions of each hazard group, indicating the degree or severity of the hazard. The system itself does not consider exposure pathways, but only the intrinsic hazard properties of the waste.

The SANS10234 covers the harmonised criteria for classification of potentially hazardous substances and mixtures, including wastes, in terms of its properties/hazards. The classification criteria include:

- Physical hazards (flammability, corrosiveness, etc.);
- Health hazards (toxicity, carcinogenicity, etc.); and

- Environmental hazards (aquatic toxicity, bioaccumulation, etc.).

The main aims of the classification in terms of SANS 10234 were to determine:

(a) Whether the waste is hazardous based on the nature of its physical, health and environmental hazardous properties (hazard classes); and
(b) The degree of severity of hazard posed (hazard categories).

The chemical test results as well as intrinsic properties of the waste streams should be used for the SANS 10234 classification. Constituents present in concentrations exceeding 1% are used for classification in terms of health and ecotoxicological hazards, except when the constituent is known to be toxic at lower concentrations (i.e. carcinogens etc.) (Table 3).

Table 3: Cut-off values/concentration limits for hazard classes

Hazard class	Cut-off value (concentration limit) %
Acute toxicity	>1.0
Skin corrosion	>1.0
Skin irritation	>1.0
Serious damage to eyes	>1.0
Eye irritation	>1.0
Respiratory sensitisation	>1.0
Skin sensitisation	>1.0
Mutagenicity: Category 1 Category 2	 >0.1 >1.0
Carcinogenicity	>0.1
Reproductive toxicity	>0.1
Target organ systemic toxicity	>1.0
Hazardous to the aquatic environment	>1.0

4.1.2 Carcinogenicity

Classification of a substance as carcinogenic[1] is based on the inherent properties of a substance and does not provide information on the level of the human cancer risk. For the purpose of classification for carcinogenicity, a chemical substance is allocated to one of two categories (see table 4) based on strength of evidence and additional considerations (weight of evidence). In certain instances, route specific classification may be warranted.

[1] Chemical substance or a mixture of chemical substances which induce cancer or increase its incidence when inhaled, ingested or absorbed through the skin which the use of the substance may present.

Table 4: Hazard categories for carcinogens

Category	Classification criteria
1A	Known to have carcinogenic potential for humans. Based largely on human evidence.
1B	Presumed to have carcinogenic potential for humans: a) evidence from human studies that establish a causal relationship between human exposure to a chemical and the development of cancer (known human carcinogen); or b) evidence from animal tests for which there is sufficient evidence to demonstrate animal carcinogenicity (presumed human carcinogen); and c) on a case-by-case basis, scientific judgement may warrant a decision of presumed human carcinogenicity derived from studies showing limited evidence of carcinogenicity in humans together with limited evidence of carcinogenicity in animal tests.
2	Suspected human carcinogen: a) evidence obtained from human or animal studies (or both), but which is not sufficiently convincing for classification as a category 1 carcinogen; and b) limited evidence of carcinogenicity in human studies or limited evidence of carcinogenicity in animal tests.

4.2 Phase 2: High-level human health and ecological risk assessment

Phase 2 of the project involved data interpretation and quantification in terms of the potential risks towards:

- human health;
- environmental health (surface and groundwater); and
- aquatic health.

Other impact assessments that were qualified as per the Regulations included visual and socio-economic aspects related to the project.

The risk assessment paradigm essentially consisted of the following logical steps:

- A hazard assessment identified the chemical contaminants suspected to pose hazards and also a description of the types of toxicity that they may evoke;
- An Exposure assessment included a description of the environmental pathways and distribution of hazardous substances and identification of receptors; and
- Risk characterisation, involving the integration of the components described above to determine whether specific exposures to an individual, community or towards the environment might lead to adverse health effects.

5. Results

The main aims of the geochemical investigation were to characterise and classify the waste materials in terms of its i) potential physical, human and environmental hazards (SANS 10234); and ii) providing a high-level human health and ecological risk assessment.

The following tests were performed:

1. Mineralogical composition by X-ray diffraction (XRD).
2. Total minor and major elemental composition test by acid digestion and ICP analysis.
3. Distilled water leach test to determine the leachable fraction of the chemical components or bioavailability.

A total of 11 samples were taken in September 2019 from the 3 overburden facilities at Wonderfontein. The samples were composited into one (1) representative sample for analysis.

A geochemical investigation was performed to identify contaminants of concern ("CoC") and specific elements that will pose an environmental and leachate risk. Crystalline mineralogical abundances including whole rock elemental analyses (aqua regia) and a leachate assessment (1:20 solid:distilled water) were performed. Although not relevant for this study, the results, where applicable, were compared to the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GNR635).

5.1 Mineralogical composition

Table 5 below tabulates the mineralogical abundance ratios of the Wonderfontein overburden.

Table 5: Mineral abundance in the Wonderfontein overburden samples

Description	Quartz	Kaolinite	Dolomite	Microcline	Muscovite	Siderite
	SiO_2	$Al_2Si_2O_5(OH)_4$	$CaMg(CO_3)_2$	$KAlSi_3O_8$	$KAl_2(AlSi_3O_{10})(F,OH)_2$	$FeCO_3$
	%	%	%	%	%	%
Wonderfontein	60	25.2	0.4	4.1	8.6	1.7

Quartz (60%) is the dominant mineral in the overburden followed by the aluminosilicate mineral kaolinite (25%). Muscovite and microcline, both being relatively resistant to weathering and commonly associated with plutonic igneous rocks (e.g. dolerite), are also present in substantial quantities of 8.6% and 4.1%, respectively. The carbonate minerals, dolomite ($CaMgCO_3$) and siderite ($FeCO_3$), both being typically associated with acid neutralisation, are also present in substantial quantities of 0.4% and 1.7%, respectively.

5.2 Acid potential and sulphur speciation

Total sulphur was recorded as relatively low (0.096%), with sulphate-sulphur (0.037%) contributing more to the total sulphur content as opposed to the potentially acid generating sulphide-sulphur (0.015%). Despite the presence of the acid generating sulphide minerals, the quantities are too low to sustain long-term acid generation while sufficient neutralising minerals are present to buffer acidity should it form. In addition, no po pyrite was recorded in any detectable quantities in the mineralogy assessment. Based on the above and other acid potential tests conducted, the overburden material from Wonderfontein possesses no acid potential and can be classified as non-acid forming.

5.3 Whole elemental analysis

Trace and major elemental compositions were determined by digesting a representative sample of Wonderfontein overburden with *aqua reqia* and analysing the supernatant with ICP. The results of the whole elemental analyses, evaluated according to the Total Concentration Thresholds (TCTs) as per the GNR635 National Norms and Standards, are displayed n Figure 2 (major oxides) and Table 3 below.

Multi-element analyses (figure 2 & Table 6) revealed a variety of major elements to be present in concentrations >1% but these elements, including silica (Si), aluminium (Al), iron (Fe) and potassium (K) do not represent major health concerns and are relatively low risk elements. In the leachate assays, concentrations of trace metals recorded in undetectable or parts per billion (“ppb”) ranges and major metals in the ppm ranges.

The significance of these limits is not directly related to the degree of toxicity that may result after exposure long- or short term but merely signifies a “potential risk”. Metal species that are more soluble are considered more bioavailable and toxic. Of all the factors that can influence the speciation of metals in water (or leachate) include: (1) ionic strength of the medium, (2) hardness of the water, (3) presence of organic matter, (4) pH, (5) redox potential and (6) its valence state. In this case, pH is possibly the most important factor that will determine bioavailability and toxicity. Therefore, with reference to the ‘total’ threshold limits of the GNR635, these were established to “classify” waste materials with reference to their potential environmental risk.

It must be stressed that the exceedances of these elements imply that only potential environmental risks or hazards are associated with the materials, since only the bioavailable fractions are potentially hazardous to the environment. Where the whole rock analyses become relevant is with regards to human health evaluations since constituents present in concentrations exceeding 1% are used for classification in terms of health hazards (refer to Table 2).

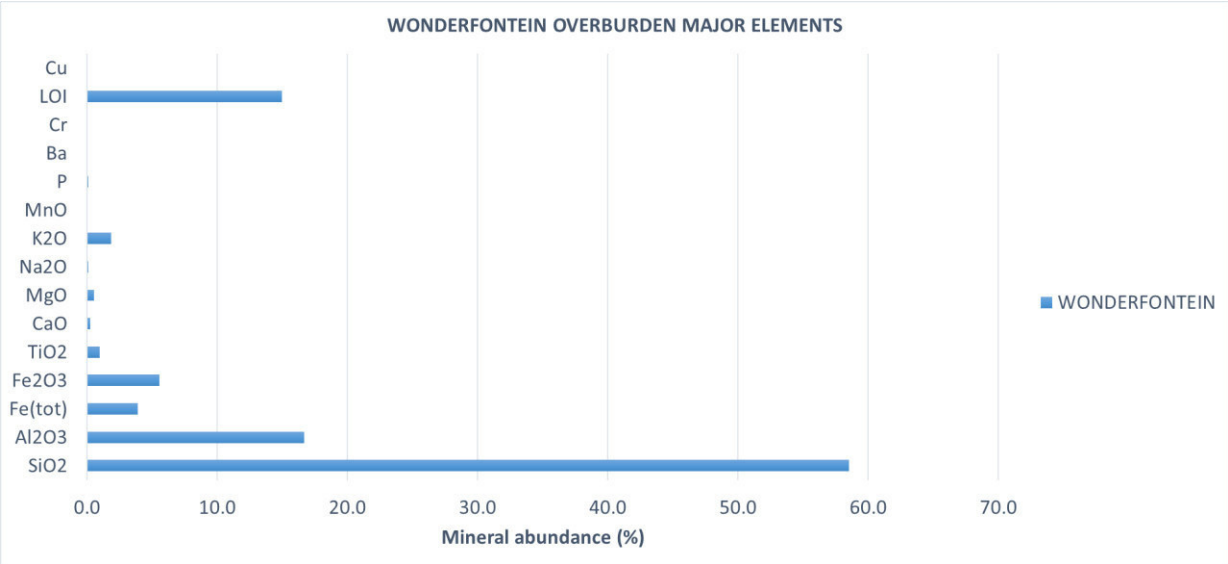


Figure 2: Major elements, loss on material on ignition (LoI) and moisture content (whole rock elemental analysis)

Table 6: Total trace elemental results (in mg/kg) compared against the Total Concentration Threshold (TCT) Limits of GNR635

Elements & Chemical Substances	*Wonderfontein Overburden*	**TCT0**	**TCT1**
Ag, silver (mg/kg)	0.10	n/a	n/a
As, arsenic (mg/kg)	3.72	5.8	500
B, boron (mg/kg)	13.5	150	15000
Ba, barium (mg/kg)	**578**	62.5	6250
Be, beryllium (mg/kg)	2.83	n/a	n/a
Bi, bismuth (mg/kg)	0.38	n/a	n/a
Cd, cadmium (mg/kg)	0.28	7.5	260
Ce, cerium (mg/kg)	3.96	n/a	n/a
Co, cobalt (mg/kg)	14.8	50	5000
Cr, chromium (mg/kg)	147	46000	800000
Cs, caesium (mg/kg)	4.95	n/a	n/a
Cu, copper (mg/kg)	**25.9**	16	19500
Ga, gallium (mg/kg)	19.3	n/a	n/a
Ge, germanium (mg/kg)	1.26	n/a	n/a
Hg, mercury (mg/kg)	0.06	0.93	160
Ho, holmium (mg/kg)	0.07	n/a	n/a
La, lanthanum (mg/kg)	1.05	n/a	n/a
Li, lithium (mg/kg)	31.4	n/a	n/a
Mn, manganese (mg/kg)	479	1000	25000
Mo, molybdenum (mg/kg)	1.57	40	1000

Elements & Chemical Substances	*Wonderfontein Overburden*	**TCT0**	**TCT1**
Nb, niobium (mg/kg)	19.0	n/a	n/a
Nd, neodymium (mg/kg)	1.22	n/a	n/a
Ni, nickel (mg/kg)	30.6	91	10600
Pb, lead (mg/kg)	**29.1**	20	1900
Rb, rubidium (mg/kg)	28.9	n/a	n/a
Sb, antimony (mg/kg)	0.31	10	75
Sc, scandium (mg/kg)	7.64	n/a	n/a
Se, selenium (mg/kg)	0.04	10	50
Sn, tin (mg/kg)	4.08	n/a	n/a
Sr, strontium (mg/kg)	127.3	n/a	n/a
Ta, tantalum (mg/kg)	1.28	n/a	n/a
Te, tellurium (mg/kg)	0.063	n/a	n/a
Th, thorium (mg/kg)	5.19	n/a	n/a
Tl, thallium (mg/kg)	0.93	n/a	n/a
U, uranium (mg/kg)	3.27	n/a	n/a
V, vanadium (mg/kg)	124	150	2680
W, tungsten (mg/kg)	1.35	n/a	n/a
Y, yttrium (mg/kg)	1.45	n/a	n/a
Zn, zinc (mg/kg)	83.4	240	160000
Zr, zirconium (mg/kg)	287	n/a	n/a
F^-, fluoride (mg/kg)	**396**	100	10000
Cr^{6+}, hexavalent chromium (mg/kg)	<5	6.5	500

5.4 Leachable concentrations

The results of the leachate assessment are shown in Table 7. The results, evaluated according to the GNR635 LCT limits, show low mineralisation of trace elements, most being in undetected ranges. All chemical constituents recorded well within NEM:WA LCT0 limits. Based hereupon it can be concluded that the overburden from Wonderfontein poses no risk of poor-quality leachate generation unless it were to come into contact with an acidic solution; according to the acid potentials assays, this is unlikely to occur.

Table 7: Leachable inorganic concentration results evaluated according to the Leachable Concentration Threshold (LCT) Limits

Elements & Chemical Substances	Wonderfontein	**LCT0**	**LCT1**
pH	7.37	n/a	n/a
TDS (mg/l)	46.0	1000	12500
EC (mS/m)	8.78	n/a	n/a
P Alk, carbonate alkalinity (mg/l $CaCO_3$)	<0.6	n/a	n/a
M Alk, total alkalinity (mg/l $CaCO_3$)	20.7	n/a	n/a
F, fluoride (mg/l)	0.17	100	10000
Cl, chloride (mg/l)	0.26	300	15000
NO_3, nitrate (mg/l)	1.17	11	550
SO_4, sulphate (mg/l)	13.8	250	12500
Ag, silver (mg/l)	<0.001	n/a	n/a
Al, aluminium (mg/l)	0.011	n/a	n/a
As, arsenic (mg/l)	<0.001	0.01	0.5
Au, gold (mg/l)	<0.001	n/a	n/a
B, boron (mg/l)	0.003	0.5	25
Ba, barium (mg/l)	0.17	0.7	35
Be, beryllium (mg/l)	<0.001	n/a	n/a
Bi, bismuth (mg/l)	<0.001	n/a	n/a
Ca, calcium (mg/l)	7.73	n/a	n/a
Cd, cadmium (mg/l)	<0.0001	0.003	0.15
Ce, cerium (mg/l)	<0.001	n/a	n/a
Co, cobalt (mg/l)	0.003	0.5	25
Cr, chromium (mg/l)	<0.001	0.1	5
Cs, caesium (mg/l)	<0.001	n/a	n/a
Cu, copper (mg/l)	<0.001	2.0	100
Fe, iron (mg/l)	0.005	n/a	n/a
Ga, gallium (mg/l)	<0.001	n/a	n/a
Ge, germanium (mg/l)	<0.001	n/a	n/a
Hf, hafnium (mg/l)	<0.001	n/a	n/a
Hg, mercury (mg/l)	<0.0001	0.006	0.3
Ho, holmium (mg/l)	<0.001	n/a	n/a
Ir, iridium (mg/l)	<0.001	n/a	n/a
K, potassium (mg/l)	2.59	n/a	n/a
La, lanthanum (mg/l)	<0.001	n/a	n/a
Li, lithium (mg/l)	<0.001	n/a	n/a
Mg, magnesium (mg/l)	4.13	n/a	n/a

Elements & Chemical Substances	Wonderfontein	**LCT0**	**LCT1**
Mn, manganese (mg/l)	0.040	0.5	25
Mo, molybdenum (mg/l)	0.001	0.07	3.5
Na, sodium (mg/l)	0.50	n/a	n/a
Nb, niobium (mg/l)	<0.001	n/a	n/a
Nd, neodymium (mg/l)	<0.001	n/a	n/a
Ni, nickel (mg/l)	0.003	0.07	3.5
Pb, lead (mg/l)	<0.001	0.01	0.5
Pt, platinum (mg/l)	<0.001	n/a	n/a
Rb, rubidium (mg/l)	0.009	n/a	n/a
Sb, antimony (mg/l)	<0.001	0.02	1
Sc, scandium (mg/l)	<0.001	n/a	n/a
Se, selenium (mg/l)	<0.001	0.01	0.5
Si, silicon (mg/l)	1.35	n/a	n/a
Sn, tin (mg/l)	<0.001	n/a	n/a
Sr, strontium (mg/l)	0.068	n/a	n/a
Ta, tantalum (mg/l)	<0.001	n/a	n/a
Te, tellurium (mg/l)	<0.001	n/a	n/a
Th, thorium (mg/l)	<0.0001	n/a	n/a
Ti, titanium (mg/l)	0.004	n/a	n/a
Tl, thallium (mg/l)	<0.001	n/a	n/a
U, uranium (mg/l)	<0.0001	n/a	n/a
V, vanadium (mg/l)	<0.001	0.2	10
W, tungsten (mg/l)	<0.001	n/a	n/a
Y, yttrium (mg/l)	<0.001	n/a	n/a
Zn, zinc (mg/l)	0.001	5	250
Zr, zirconium (mg/l)	<0.001	n/a	n/a
Cr^{6+}, hexavalent chromium (mg/l)	<0.05	6.5	500

6. Discussion of Results

6.1 SANS 10234 Classification

The material analysed during the current assessment are classified as follows in terms of SANS 10234:

- Physical hazards – The overburden is not explosive, flammable or oxidising and does not release toxic gases when in contact with water or acid. Therefore, it is not hazardous in terms of physical characteristics.

- Health hazards – Based on the ATE of the ingredients (Fe and Al), and in terms of its acute toxicity/health hazard, the overburden material is classified as a Category 5 hazard, which is applicable to substances that are of relatively low acute toxicity.
- Environmental hazard – Although total concentrations of Si, Al and Fe exceed the cut-off limit of 1%, the leachable concentrations were low, and therefore, the potential for bioaccumulation is low.
- Based on this assessment, the total and soluble concentrations of CoCs in the Wonderfontein overburden are too low to pose an unacceptable risk to human health or the natural receiving surface- and groundwater environments.
- The overburden material is considered low risk with low potential for contaminant release. It does, however, require some level of control and ongoing management to protect health and the environment.
- Ecotoxicity – although some constituents recorded above the 1% threshold limits, the hazards can be regarded as negligible given nature of application, i.e. temporary disposal on land and absence of significant pathways and linkages to aquatic receptor/s.

Table 8 below highlights the main findings of the geochemical characterisation.

Table 8: Geochemical characterisation and classification summary for overburden at Wonderfontein

Rock unit	Acid potential	Whole rock analyses	Mineralogy	Leachability	Risks or hazards		
					Environmental	Human	Aquatic/biological
Sandstone, shale and possibly dolerite	Non-acid forming - IV	Slight enrichment of Ba, Cu, Pb and F in terms of GNR635 threshold limits (TCT0 only) and crustal abundance.	Predominantly quartz and kaolinite. No detectable pyrite.	Circum-neutral paste pH and of 7.37 and no acid potential indicate low leachability potential. All constituents in leach assessment recorded well within LCT0 and mostly within ppb ranges.	The risk of pollution posed to the natural receiving environment is low.	Category 5 - low acute toxicity.	Low/no risk based on low exposure and absence of defined pathways and receptors.

7. Risk Assessment

7.1 Impact Assessment methodology

An impact assessment is inherently a prediction of eventualities that could possibly/probably occur in future, based on an interpretation/assessment of data/information available at the time of compilation of such an assessment. The methodology that was employed during the impact assessment follows international best practice. The impact assessment considered the potential impacts of the proposed project activities on natural resources such as surface and groundwater resources and air. It is based on defining and understanding the three basic components of the risk, i.e. the source of the risk, the pathway and the target that experiences the risk (receptor).

The assessment focused on the identification of the major impacts that the activities, processes and actions may have on the receiving environment. It indicates the major impacts that these activities may have on the environmental components associated with handling, storing or transporting the material.

The risk assessment and management plan as contained within this report aimed to achieve the following:

- To provide an assessment of the environment that could potentially be affected by the proposed activities.
- To identify and recommend appropriate mitigation measures for potentially significant related impacts.

The environmental risk of each aspect was determined by considering a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk.

The impact assessment was conducted based on a methodology that included the following:

- Clear processes for impact identification, prediction and evaluation.
- Specification of the impact identification techniques.
- Criteria to evaluate the significance of impacts.
- Design of management measures to lessen impacts.
- Definition of the different types of impacts (indirect, direct or cumulative).
- Specification of uncertainties.

After identification of the impacts, the nature and scale of each impact was predicted. The impact prediction provided a basis from which the significance of each impact was determined. Appropriate mitigation measures were subsequently developed with the impact and scale of impact as reference.

7.2 Risk Assessment in terms of Regulation 8 of the Waste Exclusion Regulations

The environmental risk of any aspect is determined by a combination of parameters associated with the impact. Each parameter connects the physical characteristics of an impact to a quantifiable value to rate the environmental risk. The risk assessment methodology is based on the commonly adopted Source-Pathway-Receptor-Consequence model (Figure 3).

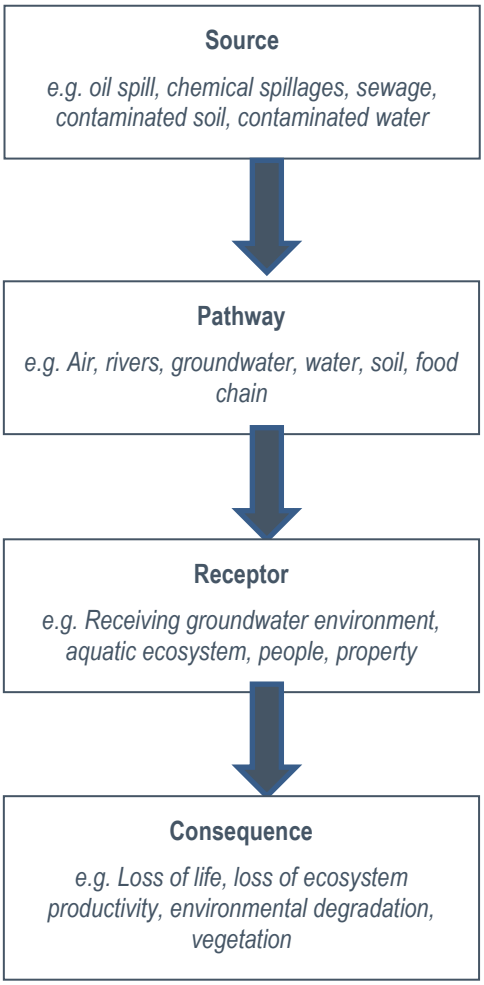


Figure 3: Source – Pathway – Receptor-Consequence Conceptual model

The mobility of contaminants of concern is very low as evaluated with the static leach test. In addition, based on the unlikely acid generating potential of Wonderfontein overburden, mineral dissolution is unlikely to occur long-term. In addition, the sulphide content (0.083%) of the material is insufficient to sustain long-term acid generation.

It is unlikely that the material will leach contaminants into the natural receiving environment if appropriate management and control measures are implemented. A groundwater monitoring protocol

should also be developed and optimised in terms of sampling frequencies and parameters. This should be done by a qualified and professional geohydrologist and updated annually or when required.

Other key potential issues and impact pathways that should be considered for overburden facilities include the following:

- Water balance: Overburden facilities are typically porous with high hydraulic conductivities and as a result a significant portion of rainfall reports as seepage.
- While overburden facilities do sometimes include toe paddocks, older facilities often do not, giving rise to direct pathways of contaminated runoff and sediment load to surface water systems.
- The geochemical nature of residues and presence of reactive minerals or minerals and salts that can be mobilized by dissolution, results in water quality deterioration and potential impacts on ground and surface water.
- While coarse-grained mine deposits, such as overburden facilities, do have lower reactive surface areas per unit mass due to higher particle sizes, they do contain a wide range of particle sizes ranging from very fine to very coarse and should be considered as geochemically very reactive facilities.
- Fugitive dust from these surfaces can deposit geochemical reactive dust particles outside of the direct management area of the facility, giving rise to potential contaminated runoff to surface water systems.
- The phreatic surface is typically depressed but may still be in contact with the underlying aquifer. Due to the low phreatic surface, practically the complete residue is exposed to oxidizing (geochemically reactive) conditions.
- The underlying aquifer may be hydraulically connected to adjacent surface water systems and contaminated seepage may reach surface water systems through that route.

An impact assessment considering the physical, biological, social, economic and cultural aspects of the environment was compiled based on the Source – Pathway – Receptor-Consequence Conceptual model as in Figure 4 above.

A prescribed set of factors and criteria were used to assess the impacts of the activities. These factors and criteria as proposed by the DEFF are shown in Table 9.

Table 9: Factors and criteria used for the risk assessment

Criteria	
MAGNITUDE (Severity)	**DURATION**
10 – Very high	5 – Permanent (longer than 10 years)
8 - High	4 – Long-term (5 to 10 years)

6 – Moderate	3 – Medium-term (12 months to 5 years)
4 – Low	2 – Short-term (0 to 12 months)
2 - Minor	1 - Immediate
SCALE	**PROBABILITY (Likelihood)**
5 - International	5 – Definite
4 – National	4 – Highly probable
3 – Regional	3 – Medium probability
2 – Local	2 – Low probability
1 – Site only	1 – Improbable
0 - None	0 - None

Magnitude

Magnitude measures the size of the impact.

Duration

Duration refers to the lifetime of the impact i.e. how long it will last.

Scale

The scale refers to the extent of the impact.

Probability

The probability refers to the chance of impact to occur. The potential impact could be most likely to occur, unlikely, etc.

Assessment of Significance of impact

Significance rating of the potential impacts illustrates the importance of the impact itself. The size of area affected by pollution may be extremely high, but the significance of this effect is dependent on the concentration or level of pollution in that area. In order to determine the significance of impact, the following method was used:

Significance Points (SP) = (Magnitude + Duration + Scale) x Probability

The values of Significance Points (“SP”) are then ranged as in Table 10:

Table 10: Ratings and descriptions of the SP values

Rating		Description
SP>60	Indicates high environmental significance	An impact which could influence the decision about whether to proceed with the activities regardless of any possible mitigation.

SP 30 – 60	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management, and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which will not have an influence on or require modification of the activities.
+	Positive impact	An impact that is likely to result in positive consequences/effects.

The risk is assessed without mitigation is shown in Table 11.

Table 11: Risk Assessment without Mitigation for the beneficial use of the overburden material (backfilling into open pits)

Activity	Risk description	Environmental Receptors	Assessment of Risk					Significance
			Impact	Probability	Magnitude	Duration	Scale	
Loading	Loading of material onto trucks resulting in pollution	Air	Windblown particles - Localised dust generation and air pollution	3	2	2	1	15
Storage	Accidental spillage onto the environment resulting in pollution	Soil	Soil contamination	2	2	2	1	10
		Surface water	Contamination of surface water	2	2	2	1	10
		Groundwater	Contamination of groundwater	2	2	2	1	10
		Aquatic ecosystem	Reduced aquatic ecosystem productivity	2	2	2	1	10
	Leachate from stockpiled material resulting in pollution	Soil	Soil contamination	4	4	2	1	28
		Surface water	Material carried by run-off deposited in storm water channels and	2	4	3	1	16

Activity	Risk description	Environmental Receptors	Assessment of Risk					Significance
			Impact	Probability	Magnitude	Duration	Scale	
			water body in the vicinity of the storage area					
		Groundwater	Seepage into groundwater and contamination	3	4	3	1	24
		Aquatic ecosystem	Reduced aquatic ecosystem productivity	2	4	3	1	16
Backfilling	Development of poor leachate quality during the operational phases of mining resulting in pollution	Soil	Soil contamination	1	2	2	1	10
		Surface water	Contamination of surface water	1	2	2	1	10
		Groundwater	Contamination of groundwater	1	2	2	1	10
		Aquatic ecosystem	Reduced aquatic ecosystem productivity	1	2	2	1	10
Backfilling	Development of poor leachate quality during the	Soil	Soil contamination	3	4	3	1	24

Activity	Risk description	Environmental Receptors	Assessment of Risk					Significance
			Impact	Probability	Magnitude	Duration	Scale	
	closure phases resulting in pollution	Surface water	Contamination of surface water	3	4	3	1	24
		Groundwater	Contamination of groundwater	3	4	3	1	24
		Aquatic ecosystem	Reduced aquatic ecosystem productivity	3	4	3	1	24

8. Risk Management Plan

The risk management plan as proposed for the storage and backfilling (beneficial use) of the overburden material is tabulated in Table 12.

Table 12: Risk management plan for the beneficial use of the discard material (backfilling)

Activity	Risk Description	Action(s) to minimise/ manage the risk	Responsibility
1. Loading of material onto trucks (on the mine)	Uncontrolled dispersion of dust	**Preventative mitigation measure** • Dust management during loading of material through wetting (depending on particle size analysis). • Dependant on particle size, stop loading during extreme wind conditions.	Wonderfontein
		Corrective mitigation measure • Wearing of relevant PPE (dust mask and eye protection) during loading where required.	Wonderfontein
2. Transportation of material (on the mine)	Uncontrolled dispersion of dust	**Preventative mitigation measure** • Dust management during transportation will include ensuring vehicles follow an approved route that will limit the exposure of dust in nearby communities. • Side tippers with tarpaulin devices will be recommended for the transportation of the material locally on the mine, where the community can be exposed but dependant on the particle size. **Corrective mitigation measure** • None	Wonderfontein
3. Off-loading of material (on and off the mine)	Uncontrolled dispersion of dust	**Preventative mitigation measure** • Dust management during off-loading of material through wetting (depending on particle size analysis). • Stop off-loading of material during extreme wind conditions. **Corrective mitigation measure** • Wearing of relevant PPE (dust mask and eye protection) during off-loading where required.	Wonderfontein
4. Storage of material (on the mine)	Uncontrolled dispersion of dust Seepage into water resource/s	**Preventative mitigation measure** • Confirmatory monitoring of AMD potential from overburden disposed. •	Wonderfontein

Activity	Risk Description	Action(s) to minimise/ manage the risk	Responsibility
		• Incorporate the geochemistry results into a geochemical model to evaluate long-term geochemical behaviour. • Allow for effective clean and affected water separation. • Material will be placed by means of soft placement and not tipped from a height. • Where possible, use existing infrastructure to backfill overburden material into the open pits. • All activities and supporting infrastructure / equipment in or adjacent to watercourses shall be minimised where appropriate. • Maintenance of equipment should be undertaken regularly, and adherence to operational procedures. • Ensure water management facilities are operating adequately until such time that these get rehabilitated to prevent silt loading of surrounding areas or water courses. • All activities and supporting infrastructure / equipment in or adjacent to watercourses shall be minimised where appropriate. • Capture seepage from the dump and reticulate to a closed affected water circuit or treat and dispose. • Do not discharge water that does not comply with regulatory release standards. • Vegetate long-term stockpiles. • Seed all long-term stockpiles. Seeding must be completed as soon as practically possible in the wet season. **Corrective mitigation measure** • The use of Safety Data Sheet (SDS) with hazard classification which is provided to all users. • Clean-up plan to be implemented where material is carried away from storage area. • Berms to be constructed to contain silt transported downslope during runoff events.	
6. Rehabilitation (backfilling)	Decant into water resource/s	**Preventative mitigation measure** • Confirmatory monitoring of AMD potential from overburden disposed.	Wonderfontein

Activity	Risk Description	Action(s) to minimise/ manage the risk	Responsibility
		• Place carbonaceous material in the bottom of the pit to enable fast saturation. • Compact soils to limit are and water infiltration and contour efficiently to reduce ponding. • Incorporate the geochemistry results into a geochemical model to evaluate long-term geochemical behaviour. • Maintain water levels in backfilled pit to levels below decant level. • Monitor water levels and quality in backfilled pits. • Monitor area for erosion and pooling and rehabilitate if necessary. • Replace soils to adequate depths over contoured areas and ameliorate as necessary and vegetate as soon as possible to limit long-term water and oxygen ingress. • Ensure soils are replaced to an adequate depth and ensure soil quality is adequate. **Corrective mitigation measure** • Digging of a cut-off trench up to the hard/fresh rock that drains to the PCD. • Water treatment of decant if quality is substandard. • Pump dirty water to a water treatment plant. • Implement acid management plan as needed or when required.	

9. Benefits of backfilling with mine residue

Mined voids are increasingly viewed by industry as a resource for the storage of wastes such as tailings, heap leach residues, acid/solute generating waste rock and salts derived from mine water treatment and as a means to reduce post-closure risks to receiving environments. Mine closure guidelines and regulator feedback of mine closure plans are also showing a greater recognition of backfilling in the context of achieving agreed post-closure land use.

A key driver for mines, where multiple voids are developed, is that existing voids provide a cost-effective opportunity to store residue in an existing ‘engineered structure’ rather than build and operate a new facility. In some instances, backfilling is used as an approach to avoid pit lakes altogether, in circumstances where the results of assessments indicate that pit lake water quality may deteriorate in the long-term and affect downstream water quality and ecosystems.

Backfilling can significantly reduce the areas of land left in a disturbed state (post-closure), related closure rehabilitation costs, e.g. ongoing water management, and the safety issues associated with leaving an open pit. In addition, backfilling makes efficient use of the excavated storage space with improved containment or encapsulation by geological materials adjacent to the void rather than constructing above ground facilities such as tailings dams with specifically engineered liners and waste rock dumps with covers. In addition, regulatory agencies are increasingly seeing backfilling as a way of returning land to a form that supports pre-mining land use.

Comparison needs to be made of the relative operational risks to the environment between managing wastes using pit backfilling and an above-ground facility. An above-ground facility will often comprise complex liner and monitoring systems, ensuring that downstream surface water resources and near surface groundwater resources remain protected. Depending on the hydrogeological context, and the connectivity between in-pit wastes and downstream receptors of importance, and their beneficial use attributes, backfilled pits may in themselves provide significant encapsulation of wastes. This might reduce water management effort and costs and preclude the need for the installation of extensive lining and monitoring systems.

Partial or full backfilling of mine voids provides the opportunity to remove the connections between problematic mine wastes and the hydrosphere by placing materials in contact with deeper geological environments that are naturally stable, comprise low permeability and are less connected to the hydrosphere and local ecosystems.

Backfilling will typically see leachable wastes, such as waste rock, tailings or salts (derived from water treatment), deposited from the base of the pit and covered with waste rock to the natural surface or covered with water, i.e. pit lake. Wastes will usually be placed below the lowest, seasonal water table to ensure that oxygen ingress to the wastes, and generation of acid and/or solutes, is minimised. A key objective of this strategy is to limit solute mobilisation/acid generation, place wastes in contact with low permeability geological materials (in the pit), increase the pathway distance between the wastes and downstream receptors and reduce overall solute migration from the wastes to downstream environments.

An important consideration is the change in the hydrological status of the pit as it evolves from a groundwater ‘sink’ to groundwater ‘source’. Hydrological equilibrium between the pit and downstream groundwater systems may take decades and so groundwater monitoring programmes need to be established in a way that will provide useful information to support the results of predictive modelling.

In open pit operations, such as at Wonderfontein, backfilling is often only cost-effective and feasible where it is considered during the operational (or earlier) phase of the mine and is driven by cost-savings (e.g. removing the requirement to construct a new tailings storage facility), regulatory requirements, managing long-term environmental risks, e.g. predicted potential poor quality water within a pit lake, and/or closure objectives which aim to achieve an agreed post-mining land use.

Backfilling is increasingly seen as 'best practise' for mine closure rehabilitation and an important aspect to whole-of-mine planning. This is because long-term management of environmental risks and return of land to an acceptable post-mining land use can in some circumstances only be achieved by pit backfilling.

Other benefits of the proposed beneficial use include the following:

- The overburden is temporarily stored on surface but will be completely removed from surface during rehabilitation for use as backfill material to fill the open voids created by mining. Not only will this activity eliminate dust generation but will also further ensure that this area is rehabilitated to meet the mine's closure objectives for final land use.
- Better use of the available storage on the mine site can be achieved. This allows for the improvement/elimination of water seepage from waste impounds and facilitate in the final rehabilitation to meet closure objectives.
- No treatment of the material will be undertaken and will be temporarily stored and backfilled untreated.
- No additional / secondary waste will be generated, since no treatment or processing of the material will take place.
- There will be no need for the waste material to be taken to a landfill disposal facility. This will minimise impacts associated with the transportation of the material and potential unnecessary depletion of landfill space.

10. Conclusion

The main objective of this project is to submit an application to the minister of The Department of Environment, Forestry and Fisheries ("DEFF") to exclude overburden generated at Umsimbithi Mining (Pty Ltd): Wonderfontein from the definition of "waste" as per the requirements of the GN 715 in GG 41777 of 18 July 2018 (*Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste*).

The investigation assessed the risk related to the beneficial use of the material (backfilling into open pits) and proposed a risk management plan to manage the material in an environmentally sustainable manner. This report will be submitted with the application forms for the exclusion application.

Based on the data generated and the assessment the following are concluded:

- The overburden is a low risk waste with low potential for contaminant release but does require some level of control and ongoing management.
- The material does not pose any health hazards should safety and management measures be implemented.
- Risks towards the receiving environment are low even unmitigated.

- The potential impacts will have little real effect and will not have an influence on or require modification of the activities.
- Certain mitigation factors are recommended to manage the material in an environmentally sustainable manner to ensure that little/no cumulative impacts affect the environment.
- Based on the leachate assessment, the overburden has a low potential for contaminant release and the beneficial use thereof should not pose any environmental risks, although some level of control and ongoing management would be necessary.