



REPORT

Carbon Footprint Report for the Gamsberg Expansion Project

Black Mountain Mining (Pty) Ltd

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Executive Summary

Black Mountain Mining (Pty) Ltd. (BMM), a subsidiary of Vedanta Zinc International (VZI), operates the Black Mountain Complex cluster consisting of the underground Black Mountain Mine operations, Deeps and Swartberg, and the opencast Gamsberg Mine. The Black Mountain Mine complex mines zinc, lead, silver and copper and hoists 1.7 million tonnes (mt) of ore a year with a current production capacity of 90 000 tonnes per annum (tpa) metal-in-concentrate. The Gamsberg Mine came into operation in June 2016 and mines approximately 4 million tonnes per annum (mta) and produces 250-300 tpa of zinc concentrate per annum.

Gamsberg Mine is located over three properties, which are owned by BMM. The mine is situated in the Namakwa District, Northern Cape and is approximately 120 km east of Springbok and approximately 270 km from Upington, between the towns of Aggeneys and Pofadder.

A number of existing environmental related authorisations are in place for the Gamsberg Mine. Furthermore, a permitting process was recently completed for the Gamsberg Smelter. The mine currently requires further environmental related applications to authorise additional infrastructure and activities that are required for ongoing operations and were not included in the previous authorisations.

These proposed activities require regulatory approval prior to commencement. Gamsberg Mine has therefore requested that Golder Associates Africa (Pty) Ltd (Golder), a member of WSP Group Africa (Pty) Ltd (WSP), to undertake the required regulatory approval process. As part of this process, a Carbon Footprint (Greenhouse Gas (GHG)) Assessment Report (this report), for the proposed activity changes, is required.

In line with the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA), Government Notice of 275 of 2017 (Government Gazette 40762), the National Greenhouse Gas Emission Reporting Regulations promulgated on 3 April 2017 requires all qualifying process activities in Annexure 1 to be quantified and submitted. Activities undertaken for Gamsberg Mine fall within the *Energy Sector* under Annexure 1 of the National Greenhouse Gas Reporting Regulations and as such, must quantify such information. Under Section 29 of the NEM:AQA 39 of 2004, Government Notice 710 of 2017 (Government Gazette 40996), the GHGs (carbon dioxide, (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)) have been declared as priority pollutants. The key GHG emissions associated with activities for Gamsberg Mine will only include CO₂ for their operations. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval. It is understood that operations for the Gamsberg Mine operations do not trigger any processes outlined in Annexure A, that will result in an excess of 0.1 Mt GHG annually. As such, a pollution prevention plan will not be required.

The total GHG emissions for Gamsberg Mine was estimated to be 513 961 t CO_{2eq} in 2023 but will decrease to 68 626 t CO_{2eq} by 2030. The decrease in emissions by 2030 is a result of the renewable's energy implementation and displacement of diesel fuel.

The mining surface fleet which currently uses diesel will be replaced with fuel cell technology and have fleet effectively on fuel cells. This technology is based on current development of the technology by Anglo Platinum in conjunction with Engie Africa (which operates in the fields of energy transition, electricity generation and distribution, natural gas, nuclear, renewable energy and petroleum). Additionally, current projections for Gamsberg Mine include replacement of light duty vehicles (LDVs) with battery electric vehicles (BEVs) by 2025. Currently only Ford and Rivian have BEVs on market but Toyota have indicated that they will have BEV Hilux LDVs on market by 2025.

By August 2023, Gamsberg will have 77 MW of renewables in place (currently without storage) and is likely to result in a 40% reduction in emissions. Gamsberg Mine is currently in negotiations with Independent Power

Producers (IPPs) to bring storage into their generation plans which will reduce ESKOM electricity influence to 20% of supply. However, given the ongoing negotiations, the ESKOM transition has not been reflected in the calculations and will need to be updated once this agreement has been finalised.

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1.0 INTRODUCTION

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Gamsberg Mine is located over three properties, which are owned by BMM. The mine is situated in the Namakwa District, Northern Cape and is approximately 120 km east of Springbok and approximately 270 km from Upington, between the towns of Aggeneys and Pofadder.

A number of existing environmental related authorisations are in place for the Gamsberg Mine. Furthermore, a permitting process was recently completed for the Gamsberg Smelter. The mine currently requires further environmental related applications to authorise additional infrastructure and activities that are required for ongoing operations and were not included in the previous authorisations.

These proposed activities require regulatory approval prior to commencement. Gamsberg Mine has therefore requested that Golder Associates Africa (Pty) Ltd (Golder), a member of WSP Group Africa (Pty) Ltd (WSP), to undertake the required regulatory approval process. As part of this process, a Carbon Footprint (Greenhouse Gas (GHG)) Assessment Report (this report), for the proposed activity changes, is required.

2.0 PROCESS DESCRIPTION

2.1 Current operations

BMM plans to mine a total of 150 000 000 tonnes of ore from the Gamsberg Zinc Mine over a 19-year Life of Mine (LoM). Of this expected LoM tonnage, approximately 18 000 000 tonnes of zinc concentrate will be extracted.

Based on the relatively low grade of the zinc deposit, the treatment process will generate approximately 132 000 000 tonnes of tailings and approximately 1.5 billion tonnes of waste rock over the LoM.

The Gamsberg zinc deposit is a tabular relatively thin mineralised lens dipping to the southeast. The South Pit was developed to initially extract the ore reserve found closest to surface. Following this, a process of sequentially excavating push backs were undertaken to gain depth and access to deeper reserves. The final open pit is expected to cover an area of 600 ha, with a final depth of 650 m, and a width and length of 2 220 m and 2 700 m respectively.

Loading and hauling of ore and overburden is performed in the pit using a fleet of large capacity shovels, loaders, excavators, haul trucks and other service equipment. The ore is hauled to the primary crusher and overburden to the waste rock dump using large capacity haul trucks (typically between 220 tonne (t) and 300 t capacity). The primary crusher is located adjacent to the open pit on a flat point of the V-cut access road along the northern slope of the inselberg. The crushed ore is transported from the primary crusher and the Run of Mine (ROM) stockpile to the processing plant via a conveyor system.

An estimated 1.5 billion tonnes of waste rock will be generated during the LoM. The haul trucks transport the waste material to the edge of the inselberg where it is tipped over the edge to form a waste rock dump expected to cover 490 hectares.

The processing plant is currently located between the N14 national road and the Gamsberg inselberg and consists of the following components:

- Milling circuit;
- ROM stockpiles;
- Flotation circuit;
- Dewatering, filtration and zinc concentrate handling circuits;
- Tailings circuit;
- Material lay down and storage areas;
- Equipment wash areas; and
- Bulk fuel storage facilities.

The treatment of ROM ore at a current rate of 4.5 Mt per annum with plans to increase to the planned 10 Mt per annum at the processing plant yields about 9 Mt per annum of tailings material which is disposed at a tailings storage facility (TSF) located north of the N14 national road. The tailings are sent to a thickener to reduce the water content before being pumped to the TSF. The percolated water from the TSF is collected and returned to the return water dam where it is pumped and reused in the concentrating process.

2.2 Future infrastructure requirements

A number of existing environmental related authorisations are in place for the Gamsberg Mine. Furthermore, a permitting process was recently completed for the Gamsberg Smelter in 2020.

The mine currently requires further environmental related applications to authorise additional activities that are required for ongoing operations and which were not included in the previous authorisations, and authorise changes required in infrastructure layout as a result of optimised planning. These activities require an Environmental Authorisation (EA) as contemplated under Section 24 of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) (as amended). Proposed infrastructure developments

2.2.1.1 New potable water pipeline

A new above-ground potable water pipeline is proposed to run from the Horseshoe dam to the processing plant. This pipeline will be developed in an existing servitude already use for pipelines transporting water from Sedibeng Water to the mine. The location where the pipeline is proposed to be developed has already been cleared of vegetation as it is within a road reserve. The proposed pipeline will be installed above-ground and will have an inside diameter of 400 mm, an outside diameter of 460 mm, a throughput of 460 m³/hour and will be approximately 7 km in length. The entire pipeline will belong to Gamsberg Mine.

2.2.1.2 Expansion of dangerous goods storage facilities

To support the ongoing operations at Gamsberg Mine, an increase in storage capacity will be required for the following dangerous goods storage facilities:

- Fuel storage capacity which is proposed to increase from 600 m³ to 1 200 m³; and
- Emulsion storage is proposed to be increased from 2 x 85t silos and 2 x 50t silos to 2 x 100t and 2 x 200t silos respectively.

2.2.1.3 River diversion

To minimise pollution from the waste rock dump, ROM pad and crushers and conveyer infrastructure associated with the phase 1 and 2 plant infrastructure, it is proposed that the ephemeral riverbed that passes between the processing plant and the mining operations, be altered.

The diversion will include the construction of an attenuation weir, diversion berms, two above-ground pipelines for conveying any upstream runoff past the impacted area (processing plant and the mining operations) and an energy dispersion outlet structure. The altered section will be approximately 1.5 km in length.

The alteration will be in place for the duration of the operational phase of the mine and will be rehabilitated during the decommissioning and closure phase.

2.2.1.4 Refined layout for the waste rock dump and quartzite rock dump/berm

A waste rock dump facility, with a capacity to store 1.5 billion tonnes of waste rock on an area of 490 ha, is approved in the *Environmental and Social Impact Assessment Report for the Gamsberg Zinc Mine and Associated Infrastructure in the Northern Cape* (June 2013).

In addition to the main waste rock dump facility and in order to mitigate the impacts on biodiversity as a result of the basin/crater mining activities, it was recommended that a rock dump / berm, comprising only quartzite rock, be designed and constructed to shield the remainder of the basin / crater from mining activities. It is detailed in the *Environmental Management Programme for the Gamsberg Zinc Mine and Associated Infrastructure in the Northern Cape* (May 2013), that the berm should be constructed to the same elevation as the plateau comprising a non-acid leaching rock core and a quartzite rock outer layer. It is further stated that the placement of the barrier must be defined with input from a qualified botanist and the engineering team prior to the placement of the rock.

The Gamsberg Mine engineering team has refined the layout of the current waste rock to optimise the placement of waste rock and to avoid current mine infrastructure and to ensure safe operation of the facility. The updated waste rock dump layout is based on the storage capacity and footprint as approved in the 2013 Environmental Impact Assessment (EIA) and Environmental Management Programme (EMPr).

The 2013 EMPr does not include a final position and layout of the biodiversity protection rock dump / berm. The engineering team, in consultation with the biodiversity specialist has defined the final layout and position.

The updated waste rock dump layout and layout and position of the biodiversity rock dump / berm will be included in the Basic Assessment Report.

2.2.1.5 Defined layout of the crusher and Coarse Ore Stockpile for Plant Phase 2

The 2013 EIA states that the full production capacity of the mine will be 10 Mtpa ore. This capacity will be reached in a modular approach following the mine ramp up plan as described in the report. It is stated that the current concentrator plant will be ramped up in three modules to full capacity. It is indicated that the three phases of the concentrator plant will each consist of a concentrator stream with supporting utility and supporting infrastructure.

An amended concentrator plant boundary and shortened conveyor route was approved in the *Gamsberg Mine Environmental Management Programme Amendment* (December 2016). The information was presented at a high level and did not differentiate between the infrastructure components required for the three plant modules.

The Gamsberg Mine engineering team has defined the phase 2 plant components in preparation for construction. The updated conveyor and phase 2 concentrator plant layout will be included in the Basic Assessment Report.

The layout of the Gamsberg Mine additional infrastructure and activities are illustrated in Figure 1.

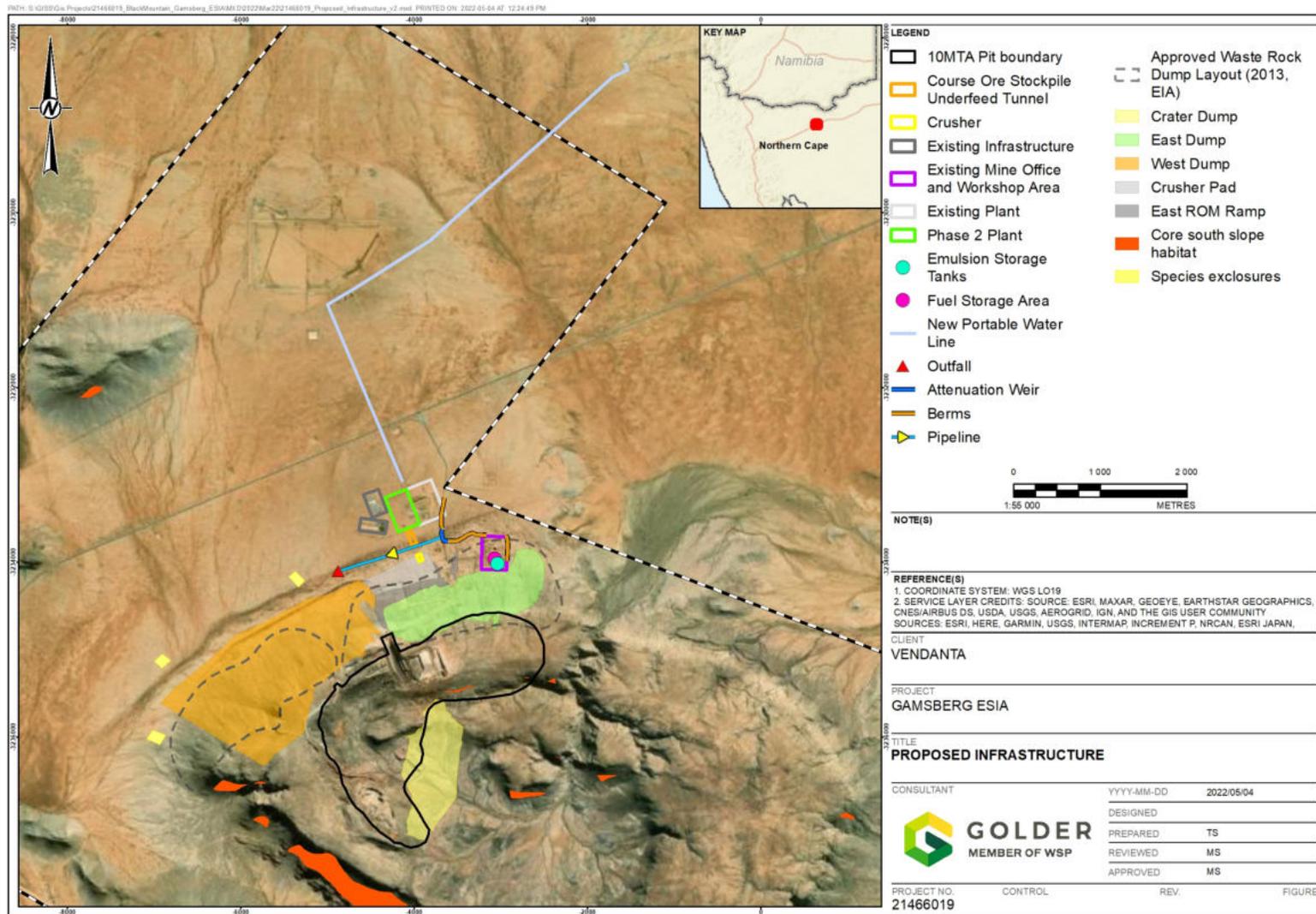


Figure 1: Proposed infrastructure layout of the Gamsberg Mine additional infrastructure and activities

3.0 APPLICABLE LEGISLATION

3.1 National Greenhouse Gas Emission Reporting Regulations

The National Greenhouse Gas Emission Reporting Regulations were published on 3 April 2017 as General Notice 275 of 2017 (Government Gazette 40762). Amendments to these regulations were published on 11 September 2020 as General Notice 994 of 2020 (Government Gazette 43712). These regulations include a list of activities for which GHG emissions must be reported, which include:

- Energy
- Industrial Processes and Product Use.
- Agriculture, Forestry and Other Land Use.
- Waste Sector.

These Regulations apply to the categories of emission sources listed in Annexure 1 to these Regulations and a corresponding data provider as classified in regulation 4 of these Regulations.

The purpose of these Regulations is to introduce a single national reporting system for the transparent reporting of GHG emissions, which will be used:

- To update and maintain a National Greenhouse Gas Inventory.
- For the Republic of South Africa to meet its reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and instrument treaties to which it is signatory.
- To inform the formulation and implementation of legislation and policy.

For purposes of these Regulations, a data provider is classified as follows:

- Category A: any person in control of or conducting an activity marked in the Category A column above the capacity given in the threshold column of the table in Annexure 1 to these Regulations.
- Category B: any organ of state, research institution or academic institution, which holds GHG emission data or activity data relevant for calculating GHG emissions relating to a category identified in table in Annexure 1 to these Regulations.

Notwithstanding Category A, the Minister may identify additional GHGs, sources and associated data providers by following the consultative process set out in sections 56 and 57 of the Act and, in writing, require such data providers to register and to submit data for their emissions within a specified period to the competent authority.

A person classified as a Category A data provider in terms of regulation 4(1)(a) of these Regulations must register all facilities where activities exceed the thresholds listed in Annexure 1 by providing the relevant information as listed in Annexure 2 to these Regulations, within 30 days after the commencement of these Regulations or within 30 days after commencing such an activity after the commencement of these Regulations. A data provider must ensure that the registration details are complete and are an accurate reflection of the Intergovernmental Panel on Climate Change (IPCC) emission sources at each facility. The registration contemplated in sub-regulation (1) must be done as follows:

- On the National Atmospheric Emissions Inventory System (NAEIS); and
- In cases where the NAEIS is unable to meet the registration requirements, the registration must be done by submitting the information specified in Annexure 2 in an electronic format to the competent authority.

A Category A data provider must submit the GHG emissions and activity data as set out in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry for each of the

relevant GHGs and IPCC emission sources specified in Annexure 1 to these Regulations for all of its facilities and in accordance with the data and format requirements specified in Annexure 3 to these Regulations for the preceding calendar year, to the competent authority by 31 March of each year.

3.2 Declaration of Priority Pollutants and Pollution Prevention Plans

Under Section 29 of the National Environmental Management: Air Quality Act (NEM:AQA 39 of 2004), Government Notice 710 of 2017 (Government Gazette 40996), GHGs (carbon dioxide, (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)) have been declared as priority pollutants. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval in line with NEM:AQA, Government Notice 712 of 2017 (Government gazette 40996). On 22 May 2018, in Government Notice 513 in Government Gazette 41642, the Minister of Environmental Affairs amended the National Pollution Prevention Plan Regulations (published in Notice 712 on 21 July 2017). In terms of this amendment, the first pollution prevention plan was due on or before 21 June 2018.

A pollution and prevention plan must include:

- Details of the person submitting the plan, including company name and company registration number in terms of the Companies Act, name and contact details of person responsible for submitting the pollution prevention plan on behalf of the company.
- Description of production processes as listed in Annexure A to these Regulations.
- Greenhouse gases generated from the production processes listed in Annexure A to these Regulations and their activities reported in accordance with the National Greenhouse Gas Emission Reporting Regulations.
- Total GHG emissions from the production process for the calendar preceding the submission of pollution prevention plan.
- Details of the methodology that is to be used by the person to monitor annual GHG emissions and evaluate progress towards meeting GHG emission reductions must be in line with the National Greenhouse Gas Emission Reporting Regulations.
- Description of mitigation measures, based on the best information available at time, that will be implemented and result in deviation from the GHG emissions baseline over the pollution prevention plan's period, and the projected emissions reductions that will be achieved.

A first pollution prevention plan must cover a period from the date of promulgation of these Regulations up to 31 December 2020 and the subsequent pollution prevention plans must cover periods of five calendar years each.

4.0 BASELINE ASSESSMENT

4.1 South Africa's Greenhouse Gas Emissions

South Africa is the world's 14th largest emitter of GHGs. Its CO₂ emissions are principally due to a heavy reliance on coal. Furthermore, South Africa has the world's fifth largest mining sector, which contributed 8% of its gross domestic product (GDP) in 2017.

However, a recently released draft electricity plan proposes a significant shift away from the fuel, towards gas and renewables. While coal would continue to play a role for decades, the plan would see no new plants built after 2030 and four-fifths of capacity closed by 2050.

South Africa has pledged to peak its emissions between 2020 and 2025, allowing them to plateau for roughly a decade before they start to fall (Carbon Brief Profile: South Africa, 2018).

5.0 METHODOLOGY

5.1 Gamsberg's Greenhouse Gas Emissions

This assessment has been undertaken in accordance with the National Greenhouse Gas Emission Reporting Regulations promulgated on 3 April 2017 which requires all qualifying process activities in Annexure 1 to be quantified and submitted. Activities undertaken for Gamsberg fall within the **Energy Sector** under Annexure 1 of the National Greenhouse Gas Reporting Regulations and as such, must quantify such information. Under Section 29 of the NEM:AQA 39 of 2004, Government Notice 710 of 2017 (Government Gazette 40996), the GHGs have been declared as priority pollutants. The key GHG emissions associated with the additional infrastructure and activities proposed for the Gamsberg Mine operations will only include CO₂. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval. It is understood that operations for the Gamsberg operations do not trigger any processes outlined in Annexure A, that will result in an excess of 0.1 Mt GHG annually. As such, a pollution prevention plan will not be required.

5.1.1 Project Boundaries

In determining the GHG emissions inventory for the Gamsberg Mine additional infrastructure and activities, it is necessary to firstly define the organisational and operational boundaries of the assessment.

5.1.1.1 Organisational Boundaries

Organisations vary in their legal and organisational structures and, like financial accounting, reporting on the GHG emissions of operations is dependent on the structure of the organisation, and whether the operations are wholly owned, joint ventures or subsidiaries (WBCSD and WRI, 2004). It is expected that the organisation boundaries will state the makeup of the company, and the operations that the organisation owns or controls.

In defining the organisational boundaries, there are generally two distinct approaches. These are equity share and control. With the equity share approach, the organisation accounts for GHG emissions from operations according to its share of equity in the operation. Typically, the equity share is equivalent to the organisation's percentage ownership. With the control approach, the organisation accounts for 100% of the GHG emissions from operations over which it has control. In terms of this approach, an organisation is not accountable for operations in which it owns a percentage but has no control. Control can be in the form of either financial control, in which the organisation directs the financial and operational policies of the operation, or operational control, where the organisation has the full authority to introduce and implement operational policies.

This assessment reports on the GHG emissions for Gamsberg Mine, in terms of the control approach, where Gamsberg Mine accounts for 100% of the estimated GHG emissions.

5.1.1.2 Operational Boundaries

In defining the operational boundaries, the GHG emissions associated with the organisation's operations are identified and characterised as either direct or indirect emissions.

In order to help with the characterisation of direct and indirect emission sources, three 'scopes' within the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard, are defined. The use of scopes not only improves transparency and consistency in reporting, but also ensures that organisations do not account for different emissions in the same scope (i.e. double counting). A brief description of the three scopes is provided below:

- Scope 1:** Direct emissions arise from activities owned or controlled by an organisation, such as emissions from combustion in boilers, furnaces, and vehicles operating onsite. In the case of Gamsberg Mine, this refers to emissions associated with the usage of diesel and explosives.
- Scope 2:** Indirect emissions released into the atmosphere associated with the consumption of purchased electricity, heat, steam and cooling; these emissions occur at a distance from the site. In the case of Gamsberg, this refers to emissions associated with electricity consumption.
- Scope 3:** Other indirect emissions, other than those associated with energy usage, including business travel by means not owned or controlled by the entity, waste disposal by means not owned or controlled by the entity, and extraction/production and transport of purchased materials or fuels. In the case of Gamsberg, this refers to emissions associated with purchased goods and services and fuel and energy related activities.

Figure 2 presents an overview of Scope 1, Scope 2, and Scope 3 emissions across the value chain of an organisation.

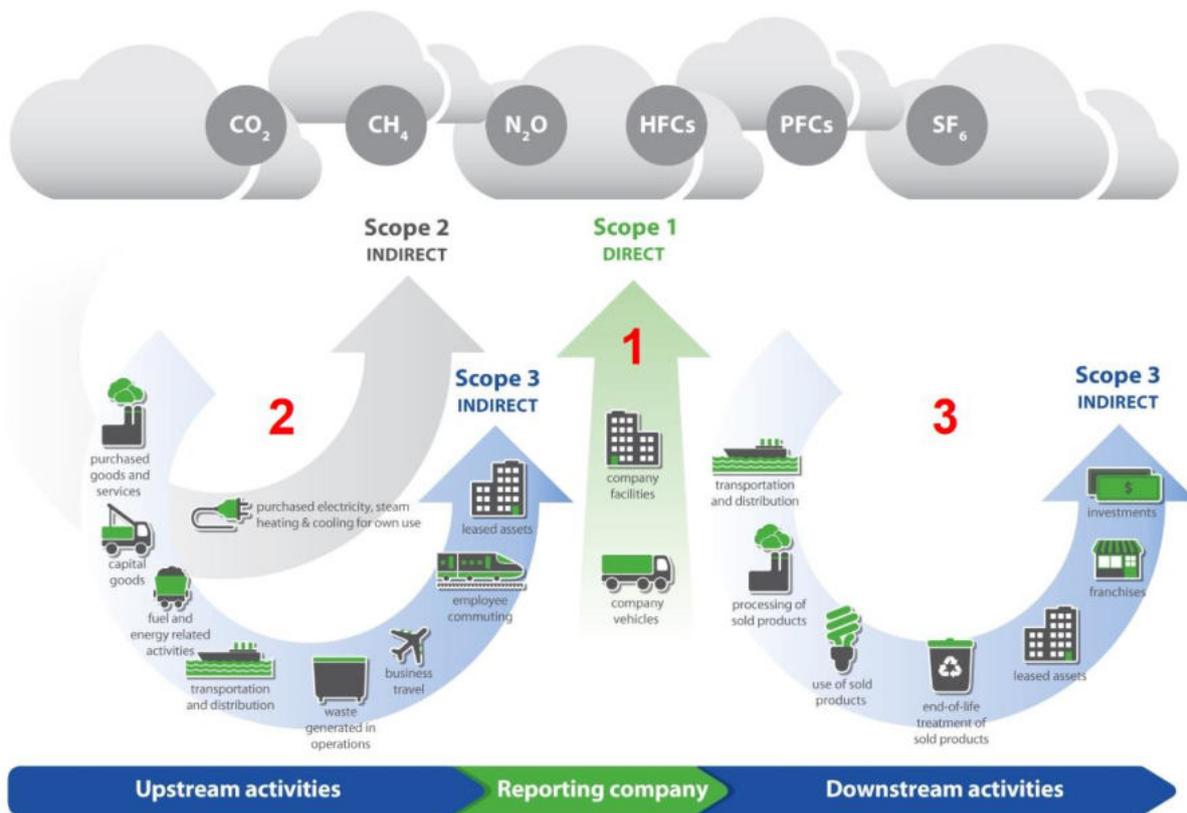


Figure 2: Overview of Scope 1, Scope 2 and Scope 3 emissions across the value chain (WBCSD & WRI, 2004)

5.1.2 Emission Tier Approach

Activities undertaken for Gamsberg Mine fall within the **Energy Sector** under Annexure 1 of the National Greenhouse Gas Reporting Regulations. These regulations include a tiered approach to determining GHG emissions, as follows:

- Tier 1:** Default IPCC emission factors available in the 2006 IPCC Guidelines are used to calculate emissions from activity data.

- **Tier 2:** Country specific emission factors published in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by industry are used to calculate emissions from activity data.
- **Tier 3:** Emission models, material carbon balances and continuous emission measurements in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by industry available on the DEA website (www.environment.gov.za) are utilized.

6.0 GREENHOUSE GAS EMISSION ASSESSMENT

6.1 Gamsberg GHG Emissions

A GHG, as defined by the IPCC, is a compound which has the ability to trap heat over a certain lifetime in the atmosphere. The six priority pollutant GHGs, as listed within the Notice to declare GHG as Priority Air Pollutants (Government Notice 710 of 2017), are CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆. The key GHG emissions associated with activities for Gamsberg will include CO₂ as a result of the diesel combustion, explosives used, electricity consumption, purchased water and fuel and energy related activities on site.

The impact of these GHGs are quantified using their Global Warming Potential (GWP), which is a measure of their heat trapping effect relative to the effects of the same weight of CO₂ released over the same period of time. It is important to consider the GWP of GHG's, given that minor emissions of a high GWP gas could make a significant contribution to a carbon footprint. GHG emissions are therefore usually expressed in CO₂ equivalent terms (CO_{2eq}) to reflect the contribution of the various GHG emissions. The heat trapping ability for CO₂ after 100 years will remain as 1. The emission factors for the project are presented in Table 1, whilst the consumption data is presented in Table 2.

Table 1: Greenhouse gas emission factors

Scope	Source	Activity Use	Emission Factor Unit	CO ₂	Tier Approach
Scope 1	Diesel mobile combustion	Gamsberg openpit, plant vehicles and concentrate plant	Tonne/litre	0.0031	2
	Explosives	Gamsberg	Tonne/tonne	0.17	1
Scope 2	Electricity	Gamsberg openpit and plant	Tonne/MWh	0.932	3
Scope 3	Purchased water	Gasmberg plant	Tonne/million litres	1.4	2
	Diesel production	Gamsberg openpit, plant vehicles and concentrate plant	Tonne/litre	0.00063	2
	Transmission and distribution losses	Gamsberg openpit and plant	Tonne/MWh	0.10523	3
	Explosives	Gamsberg	Tonne/Tonne	2.63	3

Table 2: Consumption data for Gamsberg Mine

Scope	Source	Unit	Quantity/Annum					
			2023	2024	2025	2026	2027	2030 to 2060
Scope 1	Diesel mobile combustion	Kilolitres	93 117	71 513	70 793	69 376	36 544	-
	Explosives	Tonnes	13 924	17 589	17 589	17 589	14 657	17 589
Scope 2	Electricity	MWh	114 020	68 412	45 607	13 680	11 400	13 680
Scope 3	Purchased water	Kilolitres	3 710 160	3 710 160	3 710 160	3 710 160	3 091 800	3710 160
	Diesel production	Kilolitres	93 117	71 513	70 793	69 376	36 544	-
	Transmission and distribution losses	MWh	114 020	68 412	45 607	13 680	11 400	13 680
	Explosives	Tonnes	13 924	17 589	17 589	17 589	14 657	17 589

Using the greenhouse emission factors, consumption data and GWP, the total GHG emissions for Gamsberg Mine was estimated to be 513 961 tCO_{2eq} in 2023 but will decrease to 68 626 tCO_{2eq} by 2030.

The decrease in emissions by 2030 is a result of the renewable's energy implementation and displacement of diesel fuel. The mining surface fleet which currently uses diesel will be replaced with fuel cell technology and have fleet effectively on fuel cells. This technology is based on current development of the technology by Anglo Platinum in conjunction with Engie. Additionally, current projections for Gamsberg Mine include replacement of light duty vehicles (LDVs) with battery electric vehicles (BEVs) by 2025. Currently only Ford and Rivian have BEVs on market but Toyota have indicated that they will have BEV Hilux LDVs on market by 2025.

By August 2023, Gamsberg Mine will have 77 MW of renewables in place (currently without storage) and is likely to result in a 40% reduction in emissions. Gamsberg Mine is currently in negotiations with Independent Power Producers (IPPs) to bring storage into their generation plans which will reduce ESKOM electricity influence to 20% of supply. However, given the ongoing negotiations the ESKOM transition has not been reflected in the calculations and will need to be updated once this agreement has been finalised.

Table 3: Source specific greenhouse gas emissions for Gamsberg Mine

Scope	Source	Total CO ₂ e (tonnes/year)					
		2023	2024	2025	2026	2027	2030 to 2060
Scope 1	Diesel mobile combustion	293 262	225 223	222 955	218 491	115 091	-
	Explosives	2 367	2 990	2 990	2 990	2 492	2 990
Scope 2	Electricity	106 216	63 729	42 485	12 744	10 620	12 744
Scope 3	Purchased water	5 194	5 194	5 194	5 194	4 329	5 194
	Diesel production	58 302	44 775	44 324	43 437	22 881	-
	Transmission and distribution losses	11 999	7 199	4 799	1 440	1 200	1 440
	Explosives	36 621	46 258	46 258	46 258	38 549	46 258
Total Carbon Footprint		513 961	395 368	369 005	330 554	195 162	68 626

6.2 Contribution of Gamsberg Mine to South Africa's GHG Emissions

According to the most recent national GHG inventory, South Africa's total GHG emissions were estimated to be 513 MtCO₂e in 2017 (excluding forestry and other land use). The energy sector was the main contributor (80.1%), followed by agriculture, forestry and land use change (9.5%), industrial processes and product use (6.3%), and waste (4.1%).

The estimated contribution of Gamsberg to the total annual GHG emissions of South Africa is expected to be 0.1% in 2023 and will further decrease to 0.01% by 2030. Such emissions are considered extremely low in relation to the total contribution.

7.0 CONCLUSION AND RECOMMENDATIONS

Gamsberg Mine appointed Golder to undertake a carbon footprint for the additional infrastructure and activities located in the Northern Cape. The total GHG emissions for Gamsberg Mine was estimated to be 513 961 tCO_{2eq} in 2023 but will decrease to 68 626 tCO_{2eq} by 2030.

The strategy for Gamsberg Mine is to attain carbon neutral by 2050 and is focussed on the renewable's energy implementation and displacement of diesel fuel.

The decrease in emissions by 2030 is a result of this approach. The mining surface fleet which currently uses diesel will be replaced with fuel cell technology and have fleet effectively on fuel cells. This technology is based on current development of the technology by Anglo Platinum in conjunction with Engie Africa (which operates in the fields of energy transition, electricity generation and distribution, natural gas, nuclear, renewable energy and petroleum). Additionally, current projections for Gamsberg Mine include replacement of light duty vehicles

(LDVs) with battery electric vehicles (BEVs) by 2025. Currently only Ford and Rivian have BEVs on market but Toyota have indicated that they will have BEV Hilux LDVs on market by 2025.

By August 2023, Gamsberg Mine will have 77 MW of renewables in place (currently without storage) and is likely to result in a 40% reduction in emissions. Gamsberg Mine is currently in negotiations with Independent Power Producers (IPPs) to bring storage into their generation plans which will reduce ESKOM electricity influence to 20% of supply. However, given the ongoing negotiations, the ESKOM transition has not been reflected in the calculations and will need to be updated once this agreement has been finalised.

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APPENDIX A

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