ENVIRONMENTAL IMPACT REPORT

INTEGRATED ENVIRONMENTAL IMPACT ASSESSMENT

FOR

ESTABLISHMENT OF A SUPER FINES STORAGE FACILITY AT GLORIA MINE

ASSMANG (PTY) LTD BLACK ROCK MINE OPERATIONS, SANTOY, NORTHERN CAPE

ASSMANG MANGANESE

BLACK ROCK MINE OPERATIONS

DEPARTMENT OF MINERAL RESOURCES REFERENCE NO: NC-00164-MR/102

05 May 2020

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PROJECT INFORMATION SHEET

PROJECT:
ESTABLISHMENT OF A SUPER FINES STORAGE FACILITY AT GLORIA MINE, BLACK ROCK MINE OPERATIONS, HOTAZEL, NORTHERN CAPE

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DMR REFERENCE NUMBER: NC-00164-MR/102

REPORT STATUS:
Environmental Impact Report for review and comment by interested and affected parties

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ABBREVIATIONS

Assmang	Assmang (Pty) Ltd
BRMO	Black Rock Mine Operations
DEFF	Department of Environmental Forestry and Fisheries (Formerly Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA	Department of Water Affairs (now DWS)
DWS	Department of Water and Sanitation (now DHWS)
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EO	Environmental Officer
EScience	EScience Associates (Pty) Ltd
IAPs	Interested and Affected Parties
Mn	Manganese
MPRDA	Minerals and Petroleum Resources Development Act
Mtpa	Million tonnes per annum
NCDENC	Northern Cape Department of Environment and Nature Conservation
NEMA	National Environmental Management Act, No. 107 of 1998 NEMA EIA
NEMAQA	National Environment Management: Air Quality Act, No. 39 of 2004
NEMBA	National Environmental Management: Biodiversity Act (Act10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
NHRA	National Heritage Resources Act (Act 25 of 1999)
NWA	National Water Act (Act 36 of 1998)
PM	Particulate matter
Ptn	Portion
RDL	Red Data Listed
RWD	Return Water Dam
SCC	Species of Conservation Concern
SFSF	Super Fines Storage Facility
TSF	Tailings Storage Facility

1 INTRODUCTION

Assmang (Pty) Ltd mines manganese ore in the Black Rock area of the Kalahari, in the Northern Cape Province. The ore is mined from the Kalahari Manganese field. The Black Rock Mine Operations (BRMO) are approximately 80 kilometres (km) north-west of the town of Kuruman, in close proximity to the town of Hotazel.

In 1940, Assmang acquired a manganese ore outcrop on a small hillock known as Black Rock. Several large properties underlain by ore were subsequently found and acquired. Manganese ore mining operations were extended and today include 3 underground mining complexes:

- Gloria (commissioned in 1975), producing medium grade carbonated ore;
- Nchwaning II and Nchwaning III (commissioned in 1981 and 2004 respectively), producing high grade oxide ore.

The manganese ores of the Kalahari Manganese field are contained within sediments of the Hotazel Formation of the Griqualand West Sequence, a subdivision of the Proterozoic Transvaal Supergroup. The manganese ore bodies exhibit a complex mineralogy and more than 200 mineral species have been identified to date. The hydrothermal upgrading has resulted in a zoning of the orebody with regard to fault positions.

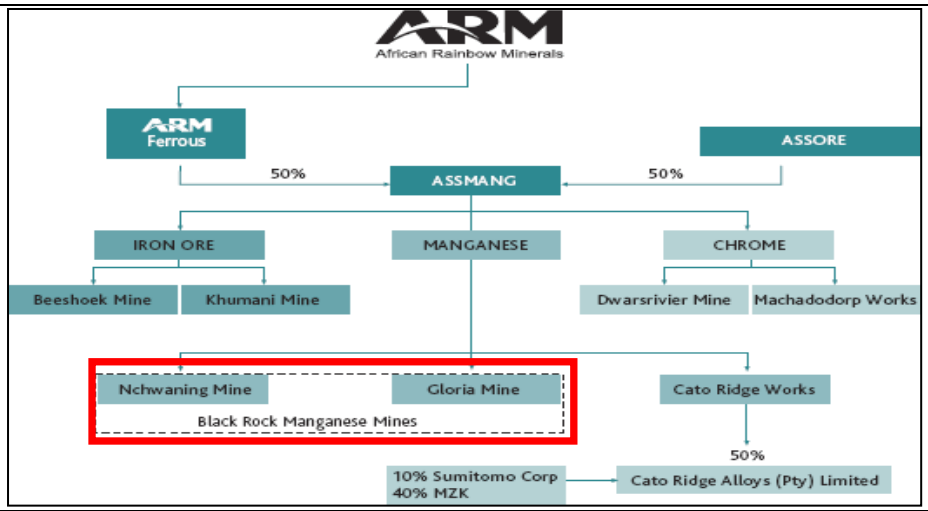
Distal areas exhibit more original and low-grade kutnohorite and braunite assemblages, while areas immediately adjacent to faults exhibit a very high-grade hausmannite ore. The intermediate areas exhibit a very complex mineralogy, which includes bixbyite, braunite, and jacobsite, amongst a host of other manganese-bearing minerals.

A similar type of zoning also exists in the vertical sense. At the top and bottom contacts it is common to have high iron (Fe) and low manganese (Mn) contents while the reverse is true towards the centre of the seam. This vertical zoning has given rise to a mining practice where only the centre portion of the seam is being mined. At the Gloria Mine, the intensity of faulting is much less, which also explains the lower grade.

Two manganese seams are presently mined. The No. 1 seam is up to 6 metres (m) in thickness and approximately 400 m underground at Nchwaning II and 200 m underground at Gloria. No. 2 seam is situated above No. 1 seam and is accessed via the Nchwaning II mining infrastructure.

1.1 ASSMANG (PTY) LIMITED

Assmang (Pty) Ltd is jointly owned by African Rainbow Minerals Limited (ARM) and Assore Limited, and currently has three independently operating divisions based on three respective commodities – chrome, manganese, and iron ore (Figure 1-1). Assmang's Manganese Division consists of the Nchwaning II, Nchwaning III, and Gloria manganese mines in the Northern Cape, as well as the ferromanganese works at Cato Ridge in Kwazulu-Natal.



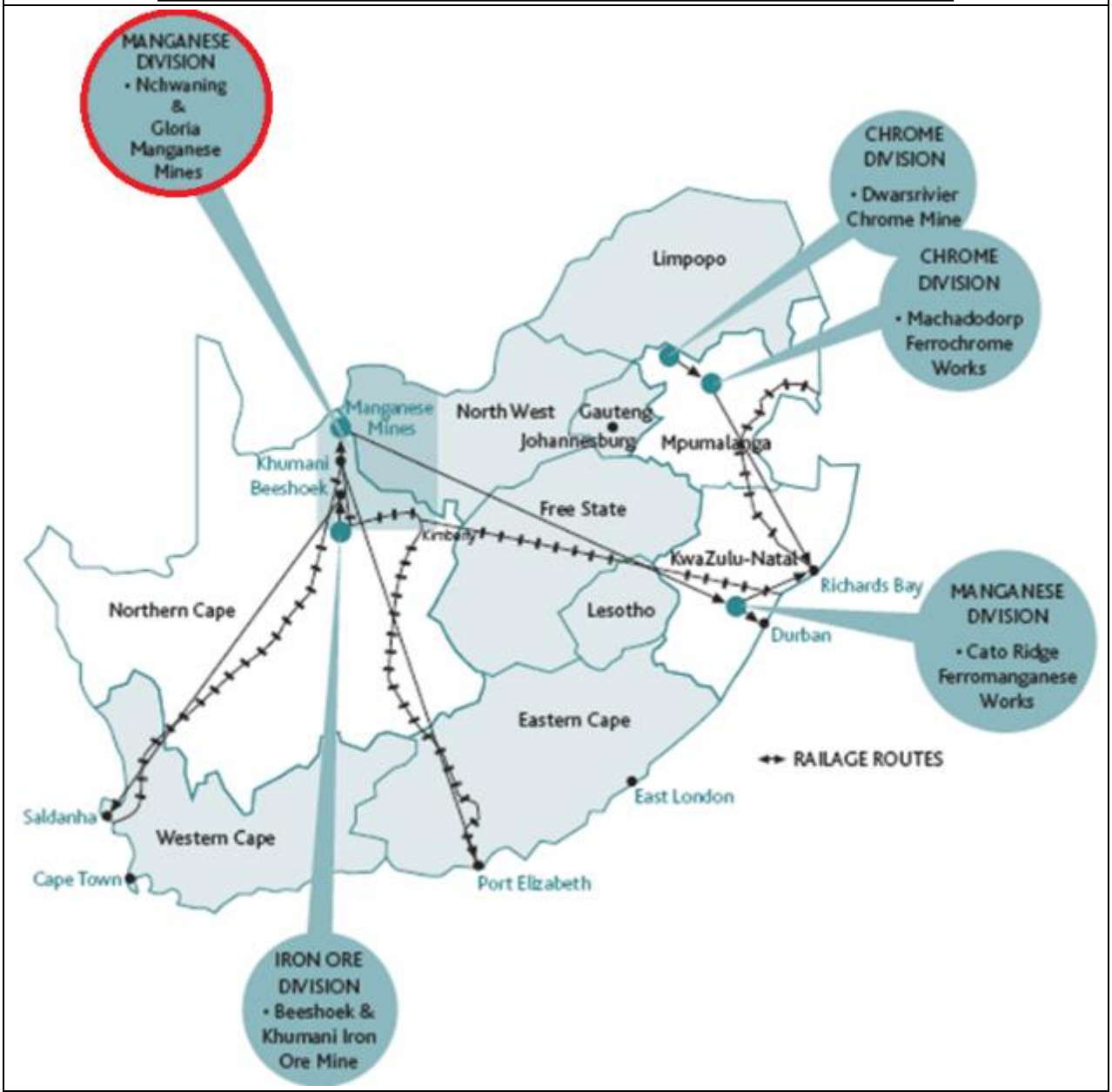


Figure 1-1: Overview of Assmang (Pty) Ltd South African Operations

1.2 REGIONAL LOCATION

BRMO is situated at Santoy in the Northern Cape Province, approximately 80 km north-west of the town of Kuruman and 12 kilometres north-west of Hotazel. BRMO falls within the jurisdiction of the John Taolo Gaetsewe District Municipality, and the Joe Morolong Local Municipality.

Latitude:	-27.170160^0 South
Longitude:	22.904857° East

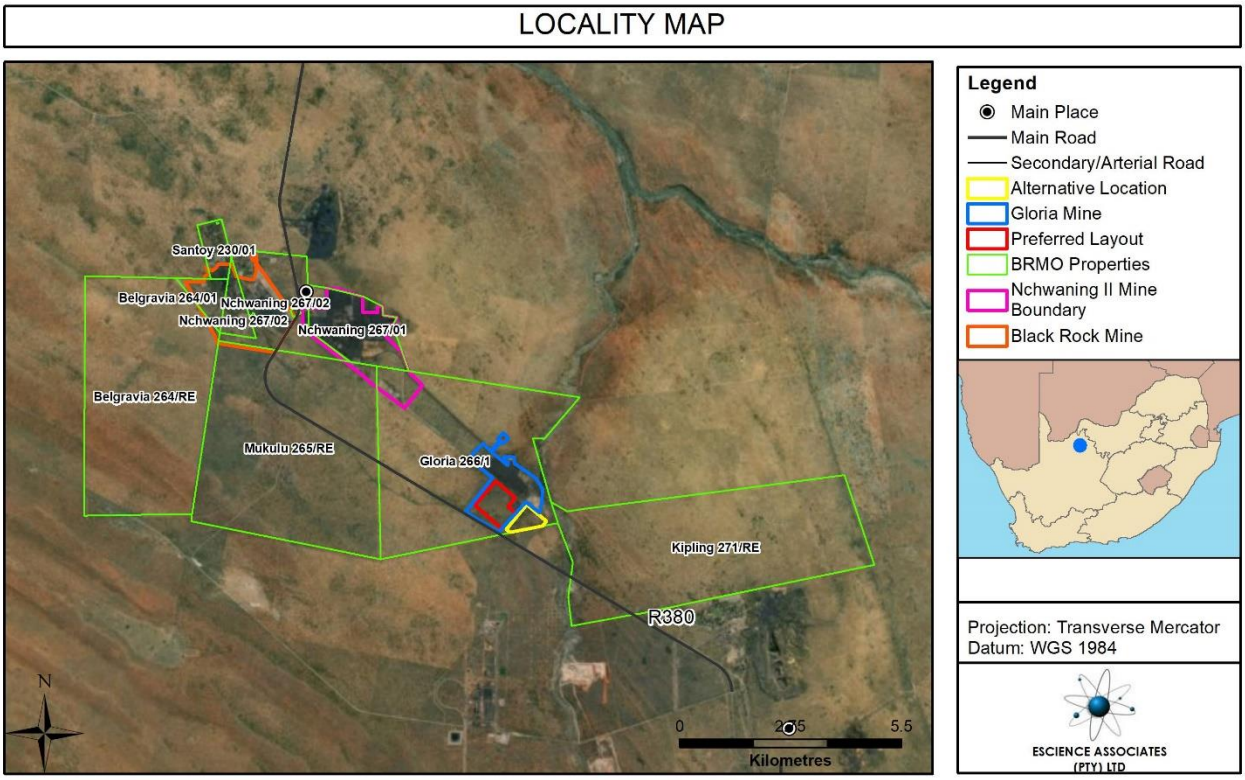


Figure 1-2: Location of Assmang Black Rock Mine Operations (BRMO)

1.3 ADMINISTRATIVE INFORMATION

The following section, and associated set of tables, provides pertinent administrative information pertaining to BRMO, the associated mine lease area, as well as the Environmental Assessment Practitioner who developed the Environmental Impact Report (Table 1-1 to Table 1-6).

Table 1-1: Name and Address of Mine	
Owner and Name of Mine	Assmang (Pty) Limited, Black Rock Mine Operations
Company Registration	1935/007343/06
Physical Address	Black Rock Mine Operations, Santoy, Northern Cape
Postal Address	PO Box 187, Santoy, Northern Cape, 8491
Telephone	053 751 5260
Fax	053 751 5555
Senior General Manager	Koos Janse van Vuuren

Table 1-2: Details of Environmental Specialist

Name	Tshifhiwa Ravele
Physical Address	Main Offices Black Rock Mine Operations, Santoy, Northern Cape
Postal Address	PO Box 187, Santoy, Northern Cape, 8491
Telephone	053 751 5302
Fax	053 751 5555
Email	tshifhiwar@brmo.co.za

Table 1-3: Details of EAP	
Name of Company	EScience Associates (Pty) Ltd
Contact Person	Mr. Abdul Ebrahim
Postal Address	PO Box 2950, Saxonwold, Johannesburg, 2132
Physical Address	9 Victoria Street, Oaklands, Johannesburg, 2192
Telephone	011 718 6380
Fax	072 268 1119
Email	abdul@escience.co.za
Qualifications	Certified EAP, BEng Honours Environmental Engineering
Curriculum Vitae	Refer to Appendix 1

Table 1-4: Details of the EAPs		
Name	Qualification	Experience
Abdul Ebrahim	BEng (Hons) Environmental Engineering Certified Environmental Assessment Practitioner (EAP) Member of the Engineering Council of South Africa	19 Years
James Pugin	MSc Archaeology BSc (Hons) Archaeology BA Geography and Archaeology	3 Years

Table 1-5: BRMO Mining Rights, Surface Rights, and Title Deed Description relevant to this application				
Mine	Farm Name	Title Deed	Surface and Mining Rights	SG 21 Key
Gloria	Ptn. 1 Gloria 266	No. 506 of 1966	Assmang (Pty) Ltd	C04100000000026600001

Table 1-6: Project Applicable Servitudes relevant to this application		
Mine	Servitude Type	Servitude No.
Gloria	Rail	K38/83S
Gloria	Water pipeline (Sedibeng Water Vaal-Gamagara Supply)	K36/1978S

1.4 LAND TENURE AND ADJACENT LAND USE

Assmang (Pty) Ltd holds both the surface and mining rights over the properties encompassing the greater BRMO and its constituent mining operations (i.e. Black Rock, Nchwaning, and Gloria Mines). The region surrounding BRMO is dominated by mining and agricultural (generally livestock production) land uses. Land in the immediate vicinity of BRMO that is not used for mining/industrial purposes, is utilised for livestock farming (i.e. sheep, goats, and cattle). Refer to Figure 1-3.

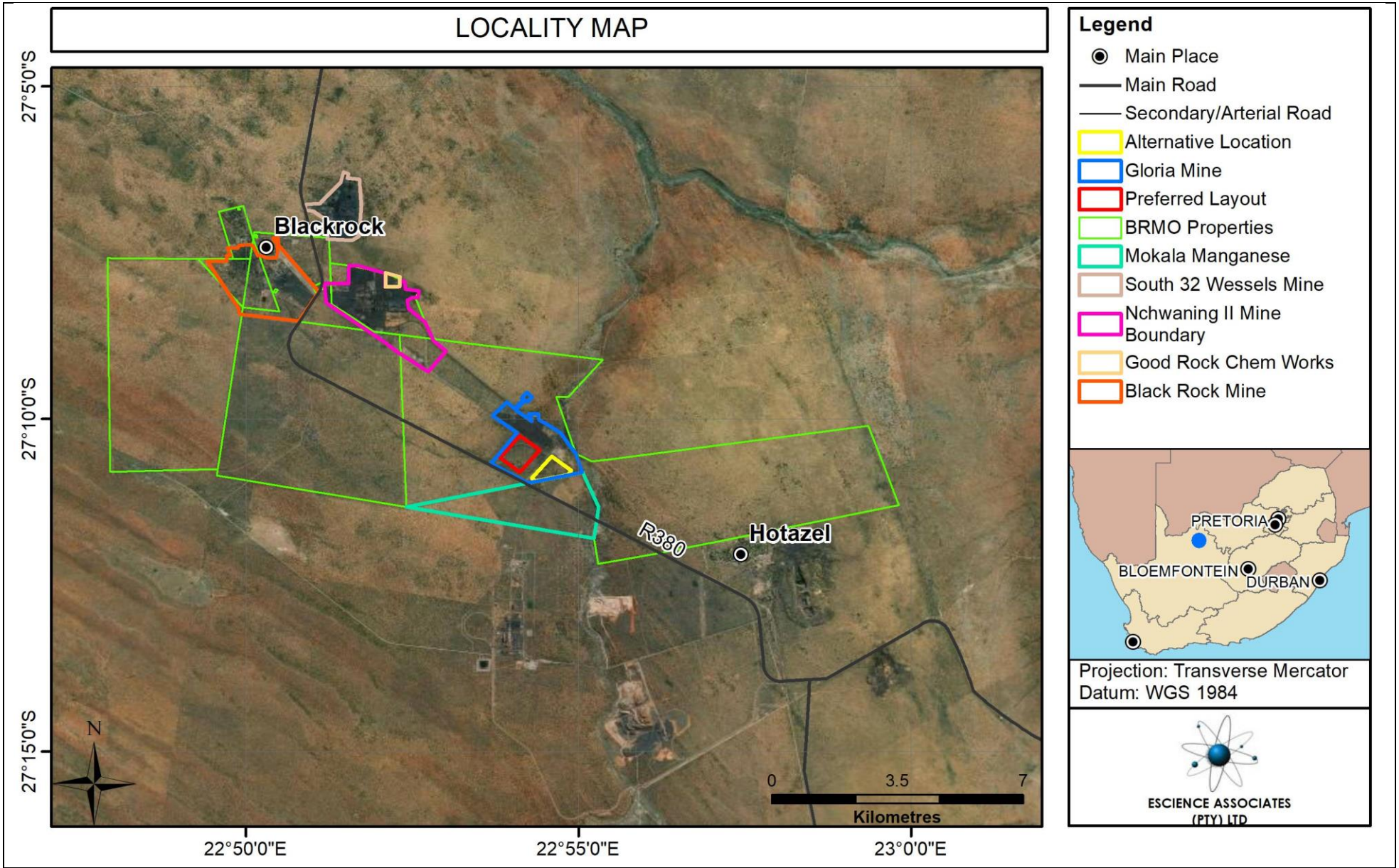


Figure 1-3: Surrounding Land Use

Table 1-7: Neighbouring Mining/Industrial Activity/ies	
Mine/Industry	Distance/Direction from BRMO
Good Rock (Pty) Ltd	Eastern boundary of Nchwaning II Mine
South 32 Wessels Manganese Mine	Approximately 1.3 km north of Nchwaning II Mine
Kalagadi Manganese Mine	Approximately 2.5 km south of Gloria Mine
South 32 Hotazel Manganese Mine	Approximately 7 km south east of Gloria Mine

Table 1-8: Neighbouring Towns	
Town	Distance/Direction from BRMO
Santoy (Black Rock Mine Village)	Adjacent to BRMO
Hotazel	Approximately 17 km south east of BRMO
Kuruman	Approximately 80 km south east of BRMO
Upington	Approximately 267 km south west of BRMO
Kimberley	Approximately 320 km south east of BRMO

1.5 SIGNIFICANT ENVIRONMENTAL FEATURES

BRMO is located within the Savannah biome and more specifically within the Eastern Kalahari Bushveld Bioregion with some incursion into Kalahari Duneveld. The site consists of transformed land (current and legacy mining, and related infrastructure), open veld (presently used, rented to farmers who graze livestock), the Belgravia Game Farm (the only on-site area presently considered of increased sensitivity), and limited riparian habitat (related to the Ga Magara River). There are several faunal and floral red data species inhabiting the area.

Soil fertility is low as is typical of sandy soils. The area for establishment of the proposed super fines storage facility was surveyed by auguring. Apart from the soil on the farm Perth, the soils in the area surveyed were deep yellowish-red sandy soils. Stone Age artefacts are located in and on the riverbanks of the Gamagara, and the likelihood of uncovering archaeological material is very high in the riverbanks.

1.6 PLANNED LIFE OF MINE

The planned life of the mine is approximately 20 years but may exceed this.

2 DESCRIPTION OF CURRENT AND PROPOSED ACTIVITIES

2.1 BACKGROUND

The general descriptions herein are intended to convey a broad understanding of the facilities and activities associated with the Gloria mine and the proposed development. These descriptions are not exhaustive. It should be noted that infrastructure typical of such mining activities is encountered on the site which may not be covered in specific detail herein. These facilities and infrastructure are subject to repairs, general maintenance, and upgrading, in accordance with standard practices, and thus will be altered from time to time. Current infrastructure is within the footprint of existing, historical, and/or authorised activities. Proposed infrastructure will require clearing of undisturbed land where it does not overlap with existing disturbed areas.

2.1.1 GLORIA MINE

Ore is mined at Gloria using underground bord and pillar methods, making use of trackless machines and underground conveyer systems. The thickness of the mined seams in conjunction with underground crushing ensures that waste rock is not unnecessarily brought to surface. At surface, the ore is crushed, and separated into various grades, which are stockpiled in preparation for transport off the site. Transport is via rail and road. Operations at Gloria were commissioned in 1975. Gloria complex is comprised of several mining and mining related activities, including:

- Offices, administration, and support facilities;
- Engineering services and facilities;
- Underground mining access shafts, vent shafts, and related infrastructure;
- Ore processing plant;
- Ore (including fines) storage and laydown areas;
- Stacking, reclaiming, and loading facilities, for transportation of ore;
- Current and historical tailings facilities;
- Contractor laydown areas;
- Contractor camps;
- Waste storage and separation facilities;
- Historical and current tailings storage facilities;
- Salvage yards;
- Potable water and process water storage and management facilities;
- A sewage treatment plant;
- Sub-stations and electrical works;
- Bulk fuel storage and refuelling station;
- Explosives magazines;
- Unpaved and paved roads connecting the above and other BRMO operations;
- Other ancillaries typical of such a mining operation.

2.1.1.1 Underground Activities

Ore is drilled, blasted, and crushed underground before being conveyed to the processing facilities on the surface. Operations underground consist mainly of:

- Drilling;
- Blasting;
- Crushing;
- Handling and loading of ore.

Supporting facilities underground include, *inter alia*:

- Water storage and reticulation systems;
- Engineering and support facilities;
- Fuel storage facilities and re-fuelling bays.

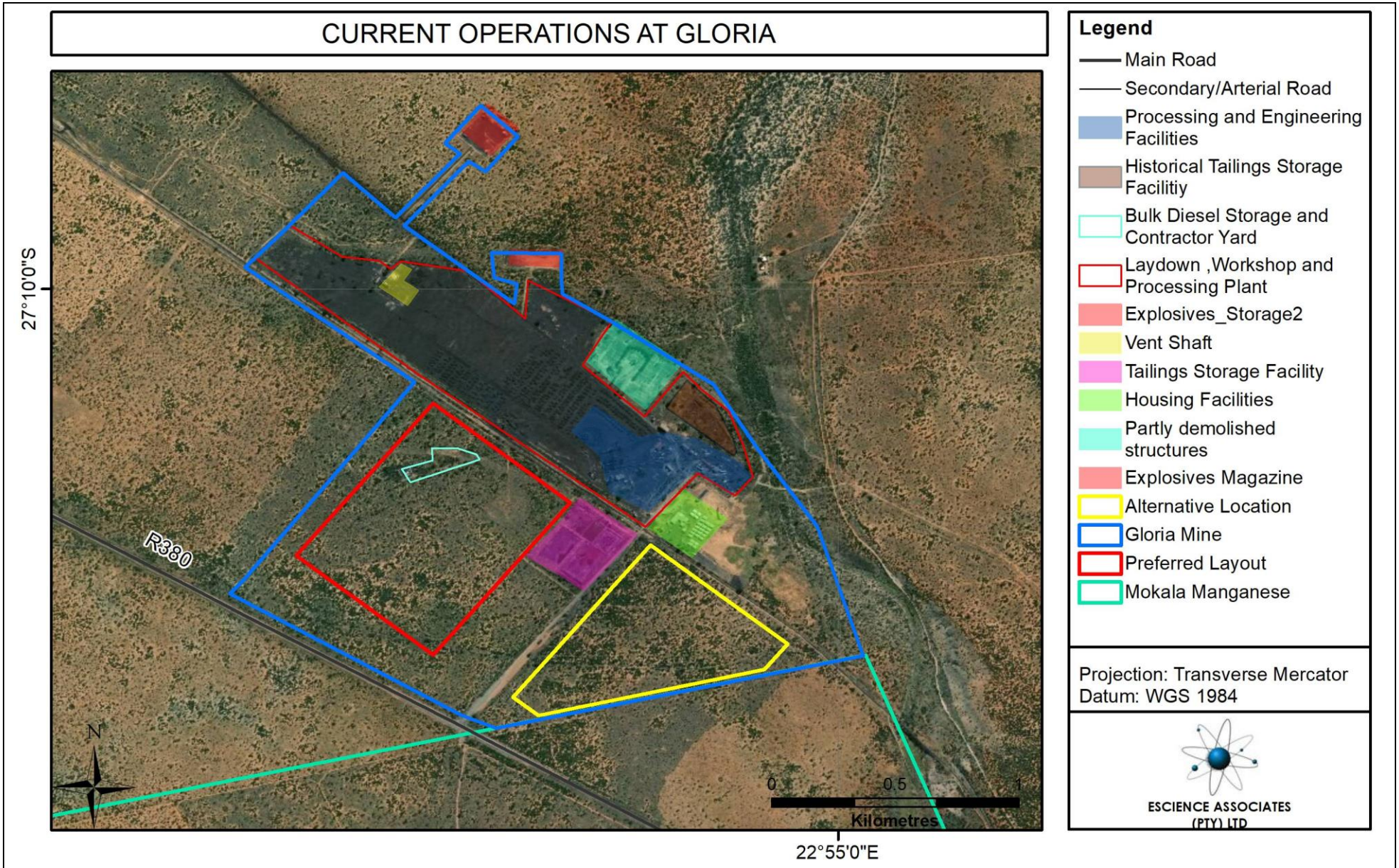


Figure 2-1: Current Operations at Gloria Mine

2.2 SCOPE OF THE PROPOSED ACTIVITIES

Manganese Ore is mechanically processed at BRMO. This includes crushing and screening, which inevitably generates ore fines, which are deposited as tailings. The fines are separated from other ore products during screening and washing. This fine material is transported hydraulically through suspension in process water to fines storage facilities. As technology improves, the amount of fines generated per tonne of product may improve, and in future the fines may be reclaimed for reprocessing.

The current tailings storage facilities (TSF) at the Gloria mine are approaching full capacity. In addition to this, various authorised upgrades are underway at the mine which will increase production capacity. Consequently, BRMO proposes to construct a new super fines storage facility (SFSF) at the Gloria mine to augment the existing TSF and cater for future increases in production rates. The project will include the establishment of two or more storage cells making up the SFSF, and required supplementary infrastructure, which include:

- A return water dam;
- Fines and water conveyance infrastructure (pipelines, pumps, et cetera and their related civil, mechanical, and electrical works);
- Access and maintenance roads;
- Fencing and access control;
- A contractor laydown area for the construction phase;
- Topsoil and subsoil stockpiles from excavations.

Figure 2-2 shows the basic extent of the preferred area within which the proposed activities will occur.

The proposed facility will have an airspace of 2 000 000 m^3 available for super fines deposition, whilst the return water dam will have 12 650 m^3 operational capacity for holding process water. The fundamental design parameters are outlined below in Table 2-1.

Table 2-1: Deposition Scenarios Proposed for Super Fines Storage Facility	
Slimes Deposition Rate	Maximum 180 000 tpa
Design Operational Life	30 years
Return Water Dam Capacity	12 650 m^3 + Freeboard
Design Storm Event	• 1 in 50-year, 24-hour = 102 mm • 1 in 100-year, 24-hour = 116 mm
Freeboard targets	Minimum freeboard to accommodate the 1 in 50-year, 24-hour storm volume plus 0.8 m dry freeboard on top of the normal operating level (excluding decant return).
SFSF Liner	Class C equivalent

2.2.1 CONSTRUCTION PHASE

The construction phase will broadly consist of:

- Removal and relocation of protected plant species;
- Clearing of remaining vegetation, and establishment of roads, contractor laydown area, and project service facilities;
- Excavation and stockpiling of topsoil;

- Excavation and stockpiling of subsoil;
- Site preparation (levelling, compaction, drainage layout, etc.) and establishment of civil structures for the SFSF and RWD;
- Liner installations;
- Installation of fines and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works);
- Commissioning;
- Erecting a fence around the SFSF.

2.2.2 OPERATIONAL PHASE

The operational phase will consist of:

- Deposition of super fines, and storage and reticulation of carrier water;
- General maintenance of the facility.

2.2.3 CLOSURE AND DECOMMISSIONING PHASE

The closure and decommissioning phase will broadly consist of:

- Shaping and capping of the storage facility;
- Removal of fines and water conveyance infrastructure, and any other structures (e.g. shelters for personnel, return water dam, etc.);
- Ripping and scarifying of roads, and other compacted footprints;
- Depositing of subsoil and topsoil, rehabilitation, and aftercare.

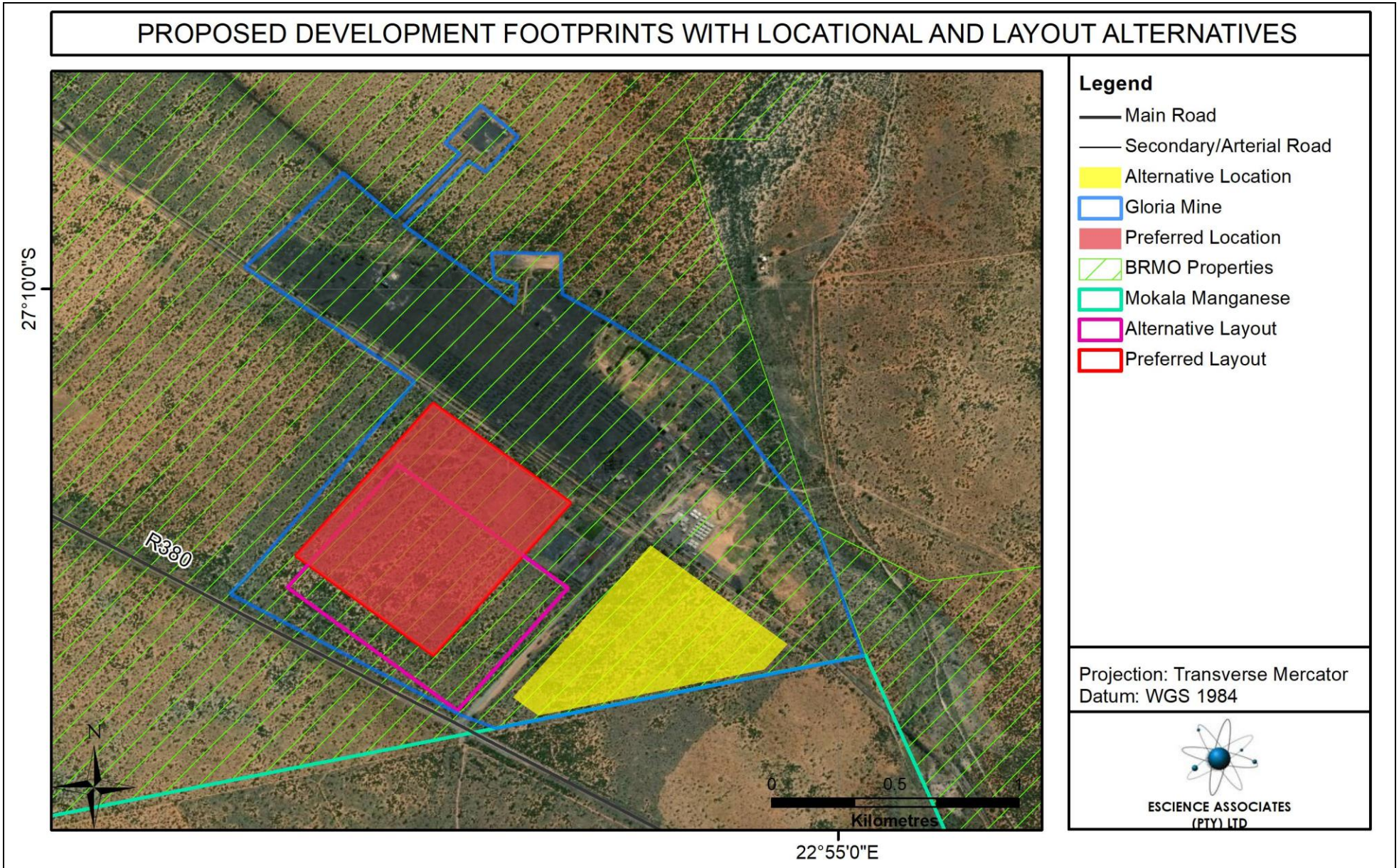


Figure 2-2: Proposed Activities (Preferred Location, Layout Alternatives, illustrated within Figure 2-4)

2.3 ALTERNATIVES CONSIDERED

The EIA regulations require that alternatives be considered. The regulations define "alternatives", in relation to a proposed activity, as different means of meeting the general purpose and requirements of the activity, which may include alternatives to the -

(a) property on which, or location where, the activity is proposed to be undertaken;
(b) type of activity to be undertaken;
(c) design or layout of the activity;
(d) technology to be used in the activity; or
(e) operational aspects of the activity;
and includes the option of not implementing the activity.

2.3.1 PROPERTY LOCATION

It must be noted that the proposed development is inherently concerned with the Gloria mine activities. Therefore, the activities cannot practically be located on a different property away from the ore process plant.

The proposed development is planned to take place within the current extent of the BRMO boundary. Figure 2-3 illustrates the envelopes for the location alternatives considered. Locations further north of the mine have also been considered but have been eliminated on the basis that they are further away from the existing infrastructure and provide no discernible environmental, nor engineering, advantage, in comparison with the final two location alternatives identified during Scoping.

2.3.2 LAYOUT ALTERNATIVES

The layout alternatives are illustrated in Figure 2-4. In essence, the positioning of the various facets of the proposed development has been considered in different orientations and layouts within the proposed footprint. This relates to layout alternatives within the preferred footprint as identified during the Scoping phase. Findings/Results?

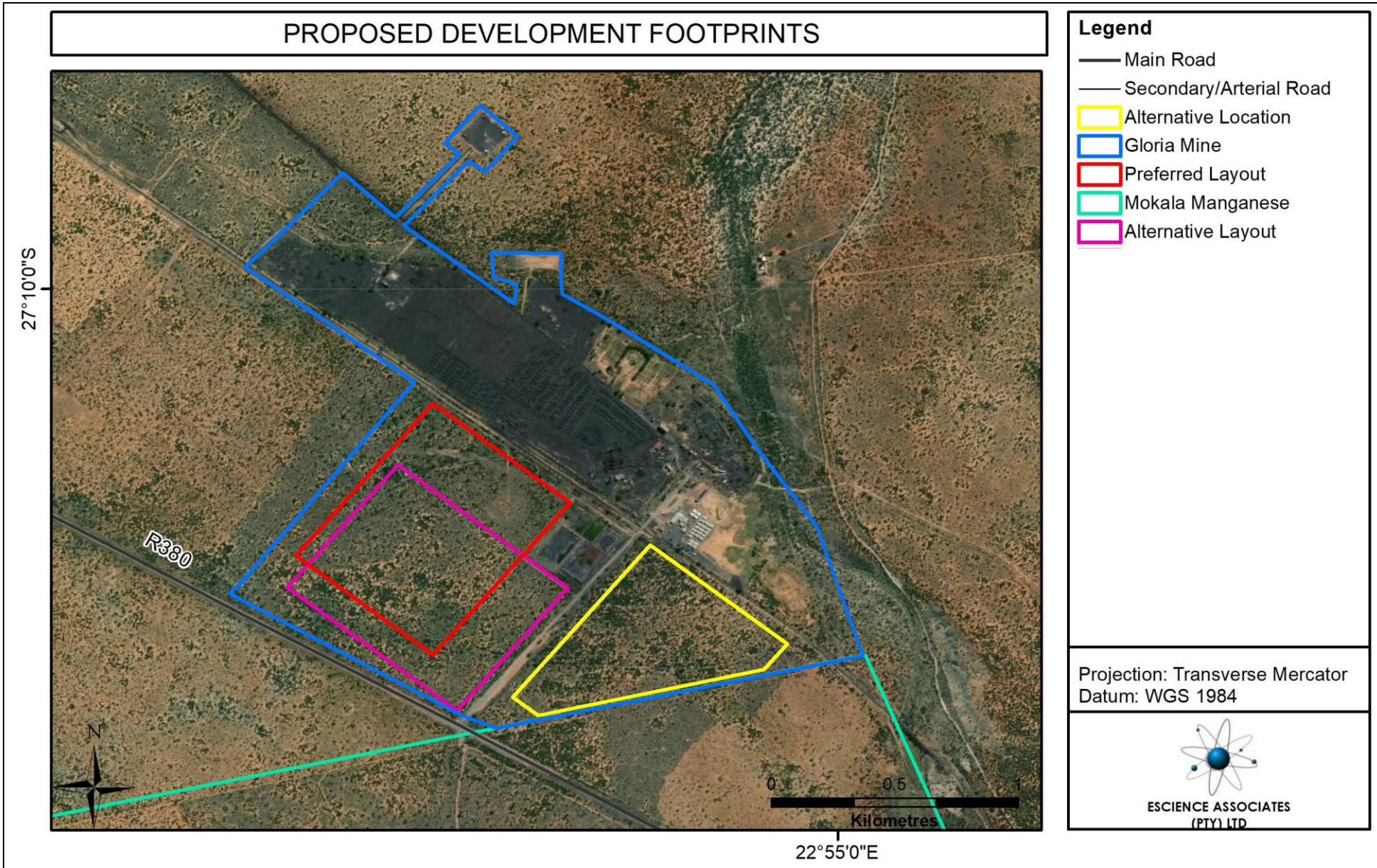


Figure 2-3: Proposed Location Alternatives

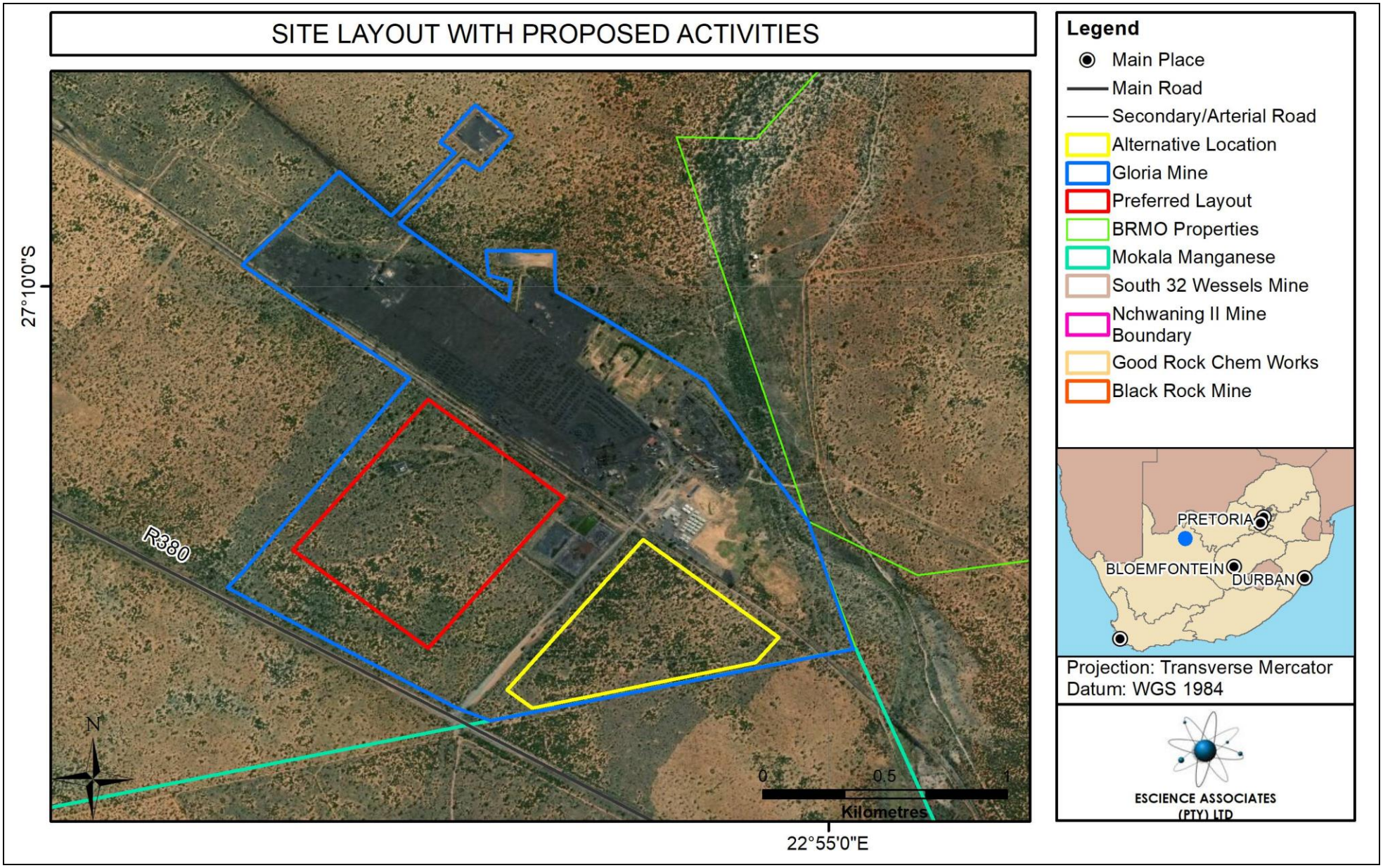

SITE LAYOUT WITH PROPOSED ACTIVITIES
27°10'0"S
22°55'0"E
R380
N
0
0.5
1
Kilometres
Legend
Main Place
Main Road
Secondary/Arterial Road
Alternative Location
Gloria Mine
Preferred Layout
BRMO Properties
Mokala Manganese
South 32 Wessels Mine
Nchwaning II Mine Boundary
Good Rock Chem Works
Black Rock Mine
PRETORIA
BLOEMFONTEIN
DURBAN
Projection: Transverse Mercator
Datum: WGS 1984
ESCIENCE ASSOCIATES (PTY) LTD

Figure 2-4: Proposed Layout Alternatives

2.3.3 TECHNOLOGICAL ALTERNATIVES

Technological alternatives available for the disposal of fines exist include the briquetting of fines or the continued use of facilities similar to those in operation.

The briquetting of fines material can be undertaken either by uniaxial pressing or via roll pressing. Various binders are required for the processes, such as lime, molasses, magnesium lignosulfonate, and bentonite. Concerns of storing for periods in excess of five weeks present issues associated with mildew formation, but as Black Rock is located in an area with a negative water balance, this is unlikely to be of concern. For this method to be effective, BRMO would require a press to bind the materials as well as the relevant binders in order for this to be effective.

Disposal of fines to tailings facilities is the method in place at Gloria and Nchwaning II. The additional benefit of this process is that there is existing institutional knowledge for this process of disposal.

Alternate technologies have been pursued previously, especially with regard to the previously authorised sinter plant development, but due to high capital and operational expenses, this development lapsed.

Therefore, based on the existing infrastructure and knowledge in place, the disposal to tailings is seen as the preferable method.

2.3.4 NO-GO ALTERNATIVE

In order for the mine to continue operating, the mine will be required to continue to deposit fines. At present, no feasible technologies have been identified, or developed, for preventing the generation of fines, or for alternatives to storage as planned. As the other current tailings facilities are reaching their capacities, the requirement for a new storage facility is critical for the continued operation of the mine.

The "No-Go Option" refers to the alternative of the proposed development not going ahead at all. The baseline status quo is maintained in this case. This would mean the continued use of the existing tailings until they reach capacity, at which point the mine would require an alternative method of fines management or would be forced to cease operations. The "No-Go" alternative, in this instance, is not seen as a viable alternative for continuation of the mine. However, the impact thereof will be assessed, as required by the EIA regulations.

3 POLICY AND LEGISLATIVE CONTEXT

This section summarises relevant environmental legislation applicable to the development of the proposed Super Fines Storage Facility and related infrastructure.

3.1 CONSTITUTION OF SOUTH AFRICA

Section 24 of the Constitution provides the following rights:
"Everyone has the right -

a. *to an environment that is not harmful to their health or well-being; and*
b. *to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -*
   i. *prevent pollution and ecological degradation;*
   ii. *promote conservation; and*
   iii. *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

Accordingly, legislative measures as summarised in ensuing sections have been promulgated.

3.2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

The National Environmental Management Act (NEMA), 1998 (Act 107 of 1998, as amended) is South Africa's overarching environmental legislation, and contains a comprehensive legal framework to give effect to the environmental rights contained in Section 24 of The Constitution. Section 2 of NEMA contains environmental principles that form the legislated foundation for sustainable environmental management in South Africa.

3.2.1 EIA & ENVIRONMENTAL AUTHORISATION

NEMA introduces the principle of integrated environmental management that is achieved through the environmental assessment process in Section 24, which stipulates that certain identified activities may not commence without an Environmental Authorisation from the Competent Authority, in this case the Department of Mineral Resources (DMR). Section 24(1) of NEMA requires applicants to consider, investigate, assess, and report the potential environmental impact of these activities. The requirements for the investigation, assessment, and communication of potential environmental impacts are contained in the so-called EIA Regulations (currently GN. R 982:2014 amended by GN. R 326:2017).

The Regulations identify specific activities that are either subject to a Basic Assessment process, or Scoping and EIA process (GN R. 983, GN R. 984 and GN R. 985; 4 December 2014, as amended by GN R.324, GN .R325, GN R.326 and GN R.327 of 2017 respectively). The listed activities relevant to the proposed development are presented in Table 3-1.

Table 3-1: NEMA Listed Activities
GN.R 983 – Listing Notice 1, as amended
Activity No. 10: The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more;

Table 3-1: NEMA Listed Activities
excluding where— (a) such infrastructure is for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area. REASON: Infrastructure will be required for transport of tailings and process water between the SFSF and the ore processing facilities. This included piping, pumping, and supporting infrastructure typically related to the transport of slurries and water in pipes.
Activity No. 24: The development of a road— (i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road— (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter. REASON: The SFSF, RWD, and soil stockpiles will require an access road and a service road around the site for maintenance and fire breaks and is anticipated to be a maximum of 5km long.
Activity No. 34: The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding— (i) where the facility, infrastructure, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day. REASON: The proposed development will result in an expansion of process water storage capacity, and fines deposition and storage capacity. Accordingly, an amendment of the mine's existing Water Use Licence, or a new Water Use Licence, is required per S22 of the National Water Act (Act 36 of 1998). It is notable that the SFSF is a listed activity in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008); however the return water dam is not.
Activity No. 46: The expansion and related operation of infrastructure for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes where the existing infrastructure—

Table 3-1: NEMA Listed Activities
(i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion— (aa) relates to the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes within a road reserve or railway line reserve; or (bb) will occur within an urban area. REASON: Upgrades to infrastructure for transport of tailings and process water between the Gloria plant and the SFSF may be required. These will fall within the existing disturbed mine footprint.
Activity No. 56: The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre— (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas. REASON: The final site of the proposed activities may require link roads from the existing road network at the mine to be widened at the junction with the access road for access of construction and maintenance vehicles and/or transfer of machinery.
GN.R 984:2014 – Listing Notice 2, as amended
Activity No. 6: The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding— • activities which are identified and included in Listing Notice 1 of 2014; • activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; • the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or • where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day. REASON: The proposed development requires a Water Use Licence for the storage of process water in the return water dam, and for the deposition of the fines, as it may detrimentally impact on a water resource. Accordingly, an amendment of the mine's existing Water Use Licence, or a new Water Use Licence, is required per S22 of the National Water Act (Act 36 of 1998). It is notable that the SFSF is a listed activity in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008); however the return water dam is not.
Activity No. 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for—

Table 3-1: NEMA Listed Activities
the undertaking of a linear activity; or (maintenance purposes undertaken in accordance with a maintenance management plan. REASON: The proposed development is expected to require the clearance of land of up to 30ha.

3.2.2 DUTY OF CARE

NEMA also places a duty of care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the Act states:

"28 (1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

(2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which-

(a) any activity or process is or was performed or undertaken; or

(b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to-

(a) investigate, assess and evaluate the impact on the environment;

(b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;

(c) cease, modify or control any act, activity or process causing the pollution or degradation;

(d) contain or prevent the movement of pollutants or the causant of degradation;

(e) eliminate any source of the pollution or degradation; or

(f) remedy the effects of the pollution or degradation."

Consequently, BRMO must take "reasonable steps" to prevent pollution or degradation of the environment which may result from the proposed activities. These reasonable steps include the investigation and evaluation of the potential impact, and identification of means to prevent an unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

3.3 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT 59 OF 2008)

3.3.1 DEFINITION OF WASTE

The NEM:WA defines 'Waste' as

"*(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or*

(b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered;

(i) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or,

(ii) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.".

Schedule 3 of the Act includes the following definition under CATEGORY A: Hazardous Waste:

"*hazardous waste" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste,* ***residue deposits*** *and* ***residue stockpiles*** *as outlined below:*

"residue deposits" *means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right;*

"residue stockpile" *means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act.*

Residue deposits and residue stockpiles include:

	(a) wastes from mineral excavation

1. Wastes resulting from exploration, mining, quarrying, and physical and chemical treatment of minerals	b) wastes from physical and chemical processing of metalliferous minerals
	(c) wastes from physical and chemical processing of nonmetalliferous minerals
	(d) wastes from drilling muds and other drilling operations

It is clear from the above that the proposed SFSF will be a residue stockpile, and is thus also a "waste" according to the Act.

3.3.2 GENERAL DUTY IN RESPECT OF WASTE MANAGEMENT

S16 of the Act requires as follows:

"(1) A holder of waste must, within the holder's power, take all reasonable measures to-

(a) avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;

(b) reduce, re-use, recycle and recover waste;

(c) where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;

(d) manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;

(e) prevent any employee or any person under his or her supervision from contravening this Act; and

(f) prevent the waste from being used for any unauthorised purpose.

(3) The measures contemplated in this section may include measures to-

(a) investigate, assess and evaluate the impact of the waste in question on health or the environment;

(b) cease, modify or control any act or process causing the pollution, environmental degradation or harm to health;

(c) comply with any norm or standard or prescribed management practice;

(d) eliminate any source of pollution or environmental degradation; and

(e) remedy the effects of the pollution or environmental degradation."

3.3.3 RESIDUE STOCKPILES AND RESIDUE DEPOSITS

According to S43A of NEMWA:
(1) Residue stockpiles and residue deposits must be managed in the prescribed manner on any site demarcated for that purpose in the environmental management plan or environmental management programme for that prospecting, mining, exploration or production operation.

(2) No person may temporarily or permanently deposit any residue stockpile or residue deposit on any site other than on a site contemplated in subsection (1).

Section 69(1) (1A) stipulates:
The Minister may make regulations regarding the management and control of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation.

The requirements are gazetted in GN.R 632 of 2015: Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015, subsequently amended by GN 990 of 2018.

3.3.4 WASTE MANAGEMENT LICENCING

According to Section 19(1) and 19(3) of the NEM:WA, the Minister may publish a list of Waste Management Activities that have, or are likely to have, a detrimental effect on the environment, and must specify whether a Waste Management Licence is required to conduct these activities. Under these provisions, a list of 'Category A', 'Category B', and 'Category C' Waste Management Activities have been published in General Notice No: 921 on 29 November 2013 (with subsequent amendments) as Schedule 1 to NEM:WA. Category A and B activities require a Waste Management Licence in terms of Section 20(b) of NEM: WA, whereas Category C activities require that the person conducting these activities complies with the relevant requirements or standards as stated in GN 921, as amended.

In terms of this notice, a person who wishes to commence, undertake, or conduct any of these listed activities must, as part of the Waste Management Licence application, conduct either a Basic Assessment process (for Category A activities), or a Scoping and EIA (for Category B activities), as stipulated in the EIA Regulations. Activities listed under Category C do not require a Basic Assessment, or Scoping and EIA. The licensing process for Waste Management Activities and the supporting information required is therefore the same as for activities listed in the EIA listing notices that require an Environmental Authorisation.

The establishment of a residue stockpile requires a Waste Management Licence. Other potentially applicable listed activities have also been identified, with respect to the proposed development, and are listed in Table 3-2 below. It must be noted that the manganese super fines are defined as a hazardous waste in Schedule 3 of NEM: WA.

Table 3-2: Listed Activities applicable to the Mine
GN. 921:2014: Category B
Activity No. 11: The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002). REASON: The SFSF will be a residue stockpile and may become a residue deposit at some time in the future. The material may also be reclaimed and reprocessed if this becomes feasible, based on the economic value of the material or its constituents, or if BRMO identifies or develops technology adequate for conversion of the material to a product of sufficient value.
Activity No. 10: The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).

Table 3-2: Listed Activities applicable to the Mine
Other Activities Which May Apply
Activity No. 1: The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage. REASON: Storage of manganese super fines in the SFSF may be considered storage of a hazardous waste. In particular, this is true if the fines will be reclaimed at some point in the future.
Activity No. 7: The disposal of any quantity of hazardous waste to land. REASON: Disposal of manganese super fines may be considered disposal of a hazardous waste.

3.3.5 WASTE ASSESSMENT

The National Norms and Standards for the Assessment of Waste for Landfill Disposal, published in GN 635 of 2013, prescribe the requirements for the assessment of waste prior to disposal to landfill. Although these regulations may not specifically apply to residue stockpiles and residue deposits, the requirements thereof will be considered for guideline purposes in this Scoping and EIA process. GN 635 requires that all wastes that are to be disposed of in landfills be assessed in terms of their composition and leaching properties. The total concentrations and leachable concentrations of specified analytes are used to assess the waste. These values are then compared to threshold values to determine the waste "type". The complete list of compounds that are to be assessed under these regulations is given in Table 3-3, along with the applicable leachable concentrations thresholds (LCT) and total concentration thresholds (TCT), used to define the waste "type". The leachable concentrations are of particular significance for mineral residue deposits and stockpiles.

Table 3-3: Total Concentration Thresholds and Leachable Concentration Thresholds

Elements & Chemical Substances in Waste	**Total Concentration Threshold (TCT) Limits (mg/kg)**			**Leachable Concentration Threshold (LCT) Limits (mg/l)**			
	TCT0	**TCT1**	**TCT2**	**LCT0**	**LCT1**	**LCT2**	**LCT3**
Metal Ions							
Arsenic (As)	5.8	500	2000	0.01	0.5	1	4
Boron (B)	150	15 000	60000	0.5	25	50	200
Barium (Ba)	62.5	6250	25000	0.7	35	70	280
Cadmium (Cd)	7.5	260	1040	0.003	0.15	0.3	1.2
Cobalt (Co)	50	5000	20000	0.5	25	50	200
Total Chromium (Cr)	46000	800000	N/A	0.1	5	10	40
Hexavalent Chromium (Cr(VI))	6.5	500	2000	0.05	2.5	5	20
Copper (Cu)	16	19500	78000	2	100	200	800
Mercury (Hg)	0.93	160	640	0.006	0.3	0.6	2.4
Manganese (Mn)	1000	25000	100000	0.5	25	50	200

Table 3-3: Total Concentration Thresholds and Leachable Concentration Thresholds							
Elements & Chemical Substances in Waste	**Total Concentration Threshold (TCT) Limits (mg/kg)**			**Leachable Concentration Threshold (LCT) Limits (mg/l)**			
	TCT0	**TCT1**	**TCT2**	**LCT0**	**LCT1**	**LCT2**	**LCT3**
Molybdenum (Mo)	40	1000	4000	0.07	3.5	7	28
Nickel (Ni)	91	10600	42400	0.07	3.5	7	28
Lead (Pb)	20	1900	7600	0.01	0.5	1	4
Antimony (Sb)	10	75	300	0.02	1	2	8
Selenium (Se)	10	50	200	0.01	0.5	1	4
Vanadium (V)	150	2680	10720	0.2	10	20	80
Zinc (Zn)	240	160000	640000	5	250	500	2000
Inorganic Anions							
TDS				1000	12500	25000	100000
Chloride				300	15000	30000	120000
Sulphate				250	12500	25000	100000
NO3 as Nitrate (N)				11	550	1100	4400
F Fluoride	100	10000	40000	1.5	75	150	600
CN Cyanide Total	14	10500	42000	0.07	3.5	7	28
Organics							
Benzene		10	40		0.01	0.02	0.08
Benzo(a)pyrene		1.7	6.8		0.035	0.07	0.28
Carbon tetrachloride		4	16		0.2	0.4	1.6
Chlorobenzene		8800	35200		5	10	40
Chloroform		700	2800		15	30	120
2-Chlorophenol		2100	8400		15	30	120
Di (2 ethylhexyl) phthalate		40	160		0.5	1	4
1,2-Dichlorobenzene		31900	127600		5	10	40
1,4-Dichlorobenzene		18400	73600		15	30	120
1,2-Dichloroethane		3.7	14.8		1.5	3	12
1,1-Dichloroethylene		150	600		0.35	0.7	2.8
1-2-Dichloroethylene		3750	15000		5	20	
Dichloromethane		16	64		0.5	2	
2,4-Dichlorophenol		800	3200		10	20	80
2,4-Dinitrotoluene		5.2	20.8		0.065	0.13	0.52
Ethylbenzene		540	2160		3.5	7	28
Formaldehyde		2000	8000		25	50	200
Hexachlorobutadiene		2.8	5.4		0.03	0.06	0.24
Methyl ethyl ketone		8000	32000		100	200	800

Table 3-3: Total Concentration Thresholds and Leachable Concentration Thresholds							
Elements & Chemical Substances in Waste	**Total Concentration Threshold (TCT) Limits (mg/kg)**			**Leachable Concentration Threshold (LCT) Limits (mg/l)**			
	TCT0	**TCT1**	**TCT2**	**LCT0**	**LCT1**	**LCT2**	**LCT3**
MTBE (Methyl t-butyl ether)		1435	5740		2.5	5	20
Nitrobenzene		45	180		1	2	8
PAHs (total)		50	200		N/A	N/A	N/A
C6 to C 9 Petroleum H/Cs		650	2600		N/A	N/A	N/A
C10 to C 36 Petroleum H/Cs		10000	40000		N/A	N/A	N/A
Phenols (total, non-halogenated)		560	2240		7	14	56
Polychlorinated biphenyls		12	48		0.025	0.05	0.2
Styrene		120	480		1	2	8
1,1,1,2-Tetrachloroethane		400	1600		5	10	40
1,1,2,2-Tetrachloroethane		5	20		0.65	1.3	5.3
Tetrachloroethylene		200	800		0.25	0.5	2
Toluene		1150	4600		35	70	280
Trichlorobenzenes (total)		3300	13200		3.5	7	28
1,1,1-Trichloroethane		1200	4800		15	30	120
1,1,2-Trichloroethane		48	192		0.6	1	4
Trichloroethylene		11600	46400		0.25	2	8
2,4,6-Trichlorophenol		1770	7080		10	20	80
Vinyl chloride		1.5	6		0.015	0.03	0.12
Xylenes (total)		890	3560		25	50	200
Pesticides							
Aldrin + Dieldrin	0.05	1.2	4.8		0.015	0.03	0.03
DDT + DDD + DDE	0.05	50	200		1	2	2
2,4-D	0.05	120	480		1.5	3	3
Chlordane	0.05	4	16		0.05	0.1	0.1
Heptachlor	0.05	1.2	4.8		0.015	0.03	0.03

Notably, Type 4 wastes have additional concentration limits that should not be exceeded, as presented in Table 3-4.

Table 3-4: Additional Concentration Limits Applicable to Type 4 Wastes	
Chemical Substance	**Concentration (mg/kg)**
Organics	
TOC	30 000 (3%)
BTEX	6
PCBS	1
Mineral oil (C10 to C40)	500
Pesticides	
Aldrin + Dieldrin	0.05
DDt + DDD + DDE	0.05
2,4-D	0.05
Chlorodane	0.05
Heptachlor	0.05

There are five waste types, numerically ordered from Type 0 to Type 4. Type 0 waste being most hazardous in respect of landfilling risk, and Type 4 being the least hazardous. The waste types are determined as shown in Table 3-5.

Table 3-5: Waste Type Classification of Waste According to Concentration Thresholds from the National Norms and Standards (GN 635 of 2013)		
Leachable Concentration	**Total Concentration**	**Waste Type**
LC ≤ LCT0	TC ≤ TCT0	Type 4
LCT0 < LC ≤ LCT1	TC ≤ TCT1	Type 3
LCT1 < LC ≤ LCT2	TC ≤ TCT1	Type 2
LCT2 < LC ≤ LCT3	TCT1 < TC ≤ TCT2	Type 1
LCT3 < LC	TCT2 < TC	Type 0

3.3.5.1 Waste Acceptance Criteria for Disposal to Landfill

The waste types determine the class of landfill to which they may be disposed. The National Norms and Standards for Disposal of Waste to Landfill, gazetted in GN 636 of 2013, stipulate the applicable classes, as presented in Table 3-6. It must be noted that the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015, GN.R 632 of 2015, subsequently amended by GN 990 of 2018, stipulate the means by which the pollution control, mitigation, and management measures must be determined for residue deposits and stockpiles. The leachable concentrations are of particular significance for mineral residue deposits and stockpiles.

Table 3-6: Landfill Requirements Based on Waste Type (per GN 636 of 2013)	
Waste Type	**Landfill Requirements**
Type 0	The disposal of Type 0 waste to landfill is not allowed. The waste must be treated and re-assessed in terms of the Norms and Standards for Assessment of Waste for Landfill Disposal.
Type 1	Type 1 waste may only be disposed of at a Class A landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a Hh/HH

Table 3-6: Landfill Requirements Based on Waste Type (per GN 636 of 2013)	
Waste Type	**Landfill Requirements**
	landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., Department of Water Affairs and Forestry, 1998).
Type 2	Type 2 waste may only be disposed of at a Class B landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB+ landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).
Type 3	Type 3 waste may only be disposed of at a Class C landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB+ landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).
Type 4	Type 4 waste may only be disposed of at a Class D landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).

3.4 AIR QUALITY

Air Quality Management in South Africa is primarily regulated through the National Environmental Air Quality Act (NEMAQA) {Act 39 of 2004, as amended}. The object of this Act is:

(a) to protect the environment by providing reasonable measures for—

(i) the protection and enhancement of the quality of air in the Republic;

(ii) the prevention of air pollution and ecological degradation; and

(iii) securing ecologically sustainable development while promoting justifiable economic and social development; and

(b) generally, to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

NEMAQA defines atmospheric emissions as:

"atmospheric emission" or "emission" means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution;

Air pollution as:

""air pollution" means any change in the composition of the air caused by smoke, soot, dust (including fly-ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;"

NEMAQA is an effects-based legislation; consequently, activities that result in atmospheric emissions are to be managed through the setting of environmental health based ambient air quality standards. Facilities with potential impacts on air quality should ideally be assessed, not only in terms of its individual contribution, but in terms of its additive contribution to baseline ambient air quality i.e. cumulative effects must be considered.

3.4.1 DUSTFALL AND DUST CONTROL REGULATIONS

Section 32 states that the Minister, or MEC, may prescribe measures relating to dust control; these have been published in terms of National Dust Control Regulations, GN. R 827 2013. The Regulations prescribe general measures for the control of dust in all areas. Dustfall Standards for Acceptable Dustfall Rates are given in Table 3-7, for residential and non-residential areas. The Regulations also provide a method to be used for measuring dustfall rate and guidelines for locating sampling points. The method to be used is AST D1739:1970, or an equivalent method approved by any internationally recognised body.

Table 3-7: GN. R827:2013 Acceptable Dust Fall Rates

Restriction Areas	Dustfall Rate (D) (mg/m^2/day, 30-days average)	Permitted Frequency of Exceeding Fall Rate
Residential area	D <600	Two within a year, not sequential months
Non-residential area	600< D <1200	Two within a year, not sequential months

These Regulations are of particular relevance to the construction and decommissioning activities for the proposed development. This is when potentially significant dust may be generated.

3.4.2 NATIONAL NORMS AND STANDARDS

According to S9 of NEMAQA:

"(1) The Minister, by notice in the Gazette-

(a) must identify substances or mixtures of substances in ambient air which through ambient concentrations, bioaccumulation, deposition or in any other way, present a threat to health, well-being or the environment or which the Minister reasonably believes present such a threat; and

(b) must, in respect of each of those substances or mixtures of substances, establish national standards for ambient air quality, including the permissible amount or concentration of each such substance or mixture of substances in ambient air; …"

The Minister of Water and Environmental Affairs published limits for ambient air quality in Government Notice № 1210 of 24 December 2009, in terms of S9(1) of NEMAQA, as shown in Table 3-8.

Table 3-8: National Ambient Air Quality Standards - GN 1210:2009			
Pollutant	Averaging Period	Concentration (µg/m³)	Permissible FOE*
PM_{10}	24-hours	75	4
	Annual	40	0
NO_2	1-hour	200	88
	Annual	40	0
SO_2	10-min (running)	500	526
	1-hour	350	88
	24-hours	125	4
	Annual	50	0
CO	1-hour	30	88
	8-hours (running)^	10	11
Pb	Annual	0.5	0
* FOE – Permitted Frequency of Exceedance in occurrences per year ^ Calculated on 1-Hourly Averages			

The Ministry of Water and Environmental Affairs further published limits for $PM_{2.5}$ on the 29th June 2012, in terms of S9(1) of NEMAQA, as shown in Table 3-9.

Table 3-9: National Ambient Air Quality Standards for $PM_{2.5}$ - GN 486:2012				
Pollutant	Averaging Period	Conc. µg/m³	Permissible FOE*	Compliance Date
$PM_{2.5}$	24-hours	60	4	Immediate
		40	4	01 January 2016
		25	4	01 January 2030
	Annual	25	0	Immediate
		20	0	01 January 2016
		15	0	01 January 2030
* FOE – Permitted Frequency of Exceedance in occurrences per year				

BRMO is required to ensure that the impacts from their proposed development does not result in an impact on ambient air quality exceeding these standards. Given the nature of the proposed activities, it is not foreseen that the emissions related hereto would potentially result in exceedance of these standards.

3.5 WATER USE

The National Water Act (NWA), 1998 (Act 36 of 1998), aims to manage national water resources in order to achieve sustainable use of water, for the benefit of all water users. This requires that the quality of water resources is protected, and integrated management of water resources takes place.

3.5.1 WATER USE LICENCE

In terms of the National Water Act, Act No. 36 of 1998 (NWA), a Water Use Licence is required for:

(a) taking water from a water resource;

(b) storing water;

(c) impeding or diverting the flow of water in a watercourse;

(d) engaging in a stream flow reduction activity contemplated in section 36;

(e) engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);

(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;

(g) disposing of waste in a manner which may detrimentally impact on a water resource;

(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;

(i) altering the bed, banks, course or characteristics of a watercourse;

(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and

(k) using water for recreational purposes.

The relevant water uses for the proposed super fines storage are as follows:

- *21 (g) disposing of waste in a manner which may detrimentally impact on a water resource:*
    - This relates to fines storage cells and the return water dam.
- *21 (b) storing water:*
    - This may relate to the return water dam. However, based on existing water use licensing for the BRMO's activities it is understood that 21(b) does not apply to process water and therefore only 21(g) is applicable to the return water dam.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (Section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns, controls, occupies, or uses the land in question, is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the Catchment Management Agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

3.5.2 GN. R. 704 – REGULATION OF MINE WATER MANAGEMENT

Regulation 704 of 4 June 1999 was promulgated under the NWA, with the primary goal of ensuring water resource protection from poorly effected mine water management. The requirements of GN.R. 704 must be seen as the minimum requirements to fulfil the above stated goal, and apply to BRMO's activities.

Notably, the proposed activities are well outside the 1:100yr flood lines of, and in excess of 100m from, the Gamagara River (refer to Figure 2-2).

3.6 BIODIVERSITY

Legislation of potential significance to BRMO's operations include:

- National Forests Act (Act No. 84 of 1998) {NFA};
- Conservation of Agricultural Resources Act (Act 43 of 1983);
- National Environmental Management: Biodiversity Act (Act 10 of 2004) {NEMBA};
- Northern Cape Nature Conservation Act (Act 109 of 2009).

3.6.1 NATIONAL FORESTS ACT (ACT NO. 84 OF 1998)

Various principles apply in terms of the NFA. Principle 3 and 6 in particular protect the forest resources, and the environmental and social functions thereof, amongst others. There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I) (d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of Section15(1) of the National Forests Act, 1998 "*no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated)*".

The occurrence of two such protected tree species, i.e. camel thorn (*Vachellia erioloba*) and grey camel thorn (*Vachellia haematoxylon*), has been confirmed at BRMO. Permits for the removal of relevant species will be applied for where applicable.

3.6.2 CONSERVATION OF AGRICULTURAL RESOURCES ACT (ACT 43 OF 1983)

As per the Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983), "Conservation" is defined as: "*in relation to the natural agricultural resources, includes the protection, recovery and reclamation of those resources*;".

The objectives of the CARA, as stated in Section 2 of the Act, entitled "Objects of Act", are:

"*The objects of this Act are to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants*."

The proposed development must meet these objectives as far as practicably possible. Of most significance to the project are the provisions stated in Regulation 5 of the Act for the "Prohibition of spreading weeds", which states that:

No person shall-
(a) sell, agree to sell or offer, advertise, keep, exhibit, transmit, send, convey or deliver for sale, or exchange for anything or dispose of to any person in any manner for a consideration, any weed; or

(b) in any other manner whatsoever disperse or cause or permit the dispersal of any weed from any place in the Republic to any other place in the Republic.

3.6.3 NATIONAL ENVIRONMENTAL MANAGEMENT: BIODIVERSITY ACT (ACT 10 OF 2004)

The National Environmental Management: Biodiversity Act (Act 10 Of 2004) (NEMBA) is the primary legislation governing biodiversity management in South Africa.

Section 2: "Objectives of the Act", states the following:

2. The objectives of this Act are-

a) within the framework of the National Environmental Management Act, to provide for-

(i) the management and conservation of biological diversity within the Republic and of the components of such biological diversity.

(ii) the use of indigenous biological resources in a sustainable manner; and

(iii) the fair and equitable sharing among stakeholders of benefits arising from bio-prospecting involving indigenous biological resources;

b) to give effect to ratified international agreements relating to biodiversity which are binding on the Republic;

c) to provide for co-operative governance in biodiversity management and conservation; and

d) to provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

Chapter 5 of NEMBA regulates activities involving invasive species, and lists duty of care as follows:

- the landowner/land user must take steps to control and eradicate the invasive species and prevent their spread, which includes targeting offspring, propagating material and regrowth, in order to prevent the production of offspring, formation of seed, regeneration or reestablishment;
- take all required steps to prevent or minimise harm to biodiversity; and
- ensure that actions taken to control/eradicate invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.

NEMBA requires that management of biodiversity takes place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.

Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

An amendment to the NEMBA has been promulgated, which lists 225 threatened ecosystems based on vegetation types present within these ecosystems. Should a project fall within a vegetation type or ecosystem that is listed, actions in terms of NEMBA are triggered. Based on the preliminary sensitivity screening undertaken for the proposed site, none of the threatened ecosystems occur within the study area.

The Alien and Invasive Species Regulations (GN.R 598 of 2014), and the Alien and Invasive Species Lists (GN 864 of 2016) are of particular significance with respect to the management of alien and invasive species. Categories according to NEMBA (Alien and Invasive Species Regulations, 2017) which are relevant to the proposed development, and the potential impact therefrom, include:

➢ Category 1a: Invasive species that require compulsory control;

➢ Category 1b: Invasive species that require control by means of an invasive species management programme.

3.6.4 NORTHERN CAPE NATURE CONSERVATION ACT (ACT 109 OF 2009)

The Northern Cape Nature Conservation Act (Act 109 of 2009) {NCNCA} for the sustainable utilisation of wild animals, aquatic biota, and plants, as well as permitting and trade regulations regarding wild fauna and flora within the province, is relevant.

The NCNCA makes provision for specially protected species of fauna and flora. According to Section 49 of the Act:

(1) No person may, without a permit -
(a) pick;
(b) import;
(c) export;
(d) transport;
(e) possess;
(f) cultivate; or
(g) trade in,
a specimen of a specially protected plant.

(2) The provisions of subsection (1) (e), in so far as they prohibit the possession of a specially protected plant, do not apply to a landowner who is in possession of a specially protected plant which grows in its natural habitat and which was not planted by human interference.

"Protected plant" means a species of plant listed as such in Schedule 2. There are various protected species listed in schedule 2 of the Act that apply to the site. These include, for example *Harpagophytum procumbens* (devil's claw) and *Boophone disticha* (Candelabra Flower). Permits for the removal, or relocation and transport, of relevant species will be applied for where applicable.

3.7 NATIONAL HERITAGE RESOURCES ACT (NHRA) (ACT 25 OF 1999)

The NHRA aims to promote good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy, so that it may be bequeathed to future generations.

The Act protects as cultural heritage resources such as:

a. Archaeological artefacts, rock structures, structures and sites older than 100 years;
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography;

c. Objects of decorative and visual arts;
d. Military objects, structures and sites older than 75 years;
e. Historical objects, structures and sites older than 60 years;
f. Proclaimed heritage sites;
g. Graveyards and graves older than 60 years;
h. Meteorites and fossils; and
i. Objects, structures and sites or scientific or technological value.

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area of interest, in particular as per section 38(1), any development categorised as:

(a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(b) the construction of a bridge or similar structure exceeding 50m in length;

(c) any development or other activity which will change the character of a site -

(i) exceeding 5 000m2 in extent; or

(ii) involving three or more existing erven or subdivisions thereof; or.

(iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or

(iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

(d) the re-zoning of a site exceeding 10 000m^2 in extent; or

(e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

Any person intending to undertake the above must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

The responsible Heritage Resources Authority must, within 14 days of receipt of the notification, indicate whether submission of an Impact Assessment Report is required, and specify the information to be contained in the report.

The responsible Heritage Resources Authority must then decide:
(a) whether or not the development may proceed;

(b) any limitations or conditions to be applied to the development;

(c) what general protections in terms of this Act apply, and what formal protections may be applied, to such heritage resources;

(d) whether compensatory action is required in respect of any heritage resources damaged or destroyed as a result of the development; and

(e) whether the appointment of specialists is required as a condition of approval of the proposal.

However, according to S38(8), the above does not apply where an Environmental Impact Assessment is required, provided that the consenting Authority must ensure that the evaluation fulfils the requirements of the relevant Heritage Resources Authority in terms of Subsection (3), and any comments and recommendations of the relevant Heritage Resources Authority with regard to such development have been taken into account prior to the granting of the consent.

3.7.1 STRUCTURES

Section 34 (1) of the NHRA states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial Heritage Resources Authority; where a structure means '*any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith'*.

"Alter" means '*any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means'*.

3.7.2 ARCHAEOLOGY, PALAEONTOLOGY, AND METEORITES

Section 35(4) of the Act deals with archaeology, palaeontology, and meteorites. The Act states that *no person may, without a permit issued by the responsible heritage resources authority (national or provincial):*

a) *Destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;*
b) *Destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;*
c) *Trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite;*
d) *Bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites; or*
e) *Alter or demolish any structure or part of a structure which is older than 60 years as protected.*

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

3.7.3 BURIAL GROUNDS AND GRAVES:

According to Section 36 (3) *no person may, without a permit issued by South African Heritage Resources Agency (SAHRA) or a provincial heritage resources authority:*

a) *destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;*
b) *destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or*
c) *bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.*

3.8 NOISE

The Noise Control Regulations (R 154 GG 13717 of 10 January 1992) promulgated in terms of ECA, defines:

- "Nuisance noise", as '*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person*'
- "Disturbing noise", as '*any noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*'.

Regulation 4 states '*No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof*.'

In addition, Section 28 of NEMA imposes a 'duty of care' on every person who may cause significant pollution to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment.

3.9 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (ACT 28 OF 2002)

BRMO has a new order mining right issued in terms of the MPRDA. The right covers all current BRMO operations, including the Gloria mine. No amendments are required to the mining right for the proposed development.

Notably, Section 1 of the Act defines:
"residue deposit" means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right, production right or an old order right;

"residue stockpile" means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential re-use, or which is disposed of, by the holder of a mining right, mining permit, production right or an old order tight;

Clearly, the super fines storage facility will be a residue stockpile. It may become a residue deposit at some time in the future upon closure if the material is not recovered.

4 NEED AND DESIRABILITY

This project supports the ultimate need and desirability of the greater BRMO; where the activities being applied for are supportive of the mining operations undertaken. The operation of the mine will continue to contribute towards the fiscus and employment within the area.

The need and desirability of the proposed development is deemed to be integrally linked with the ultimate need and desirability of the greater BRMO; where the activities being applied for are supportive of the mining operations undertaken. The activities' need and desirability thus lie in ensuring that the BRMO functions as an effective economic entity and thus contributes positively to continued employment in the region and contribution to the National GDP.

The activities being applied for do not necessarily have direct benefits to society in general, or the local communities in the vicinity thereof, but they do benefit society and surrounding communities indirectly through ensuring the efficient and effective functioning of the BRMO, such that the continued employment opportunities and contribution to National GDP that BRMO offers are realised.

Limited short term and medium term (6 months -18 months) employment for members of the local community (as available skills allow) would be created during the construction phase of the project.

The proposed facilities will be located adjacent to existing similar facilities, within BRMO's existing boundaries. Although there will be transformation of undisturbed land, this will occur within the mining right area, and is expansion of existing operations.

The ecological sustainability of the proposed development is addressed in the specialist assessments and the provisions of the Environmental Management Programme.

4.1 MUNICIPAL SPATIAL DEVELOPMENT FRAMEWORK

BRMO is located within the Gamagara Mining Corridor, as identified in the John Taolo Gaetsewe spatial development framework (SDF). According to the SDF, the Gamagara Mining Corridor that is currently loosely demarcated as an area stretching from Danielskuil and Postmasburg in the south to Hotazel and Moshaweng in the north, was identified as the area where a lack of infrastructure provision is causing serious constraints in the growth of the mining industry as well as limiting the economic development of the area.

The Gamagara Development Corridor is part of the Strategic Integrated Projects (SIPs). The SIPs are a product of the National Infrastructure Projects (NIP). The NIP was initiated to provide a background on cabinet's decision to establish a body to integrate and coordinate the long-term infrastructure build known as the Presidential Infrastructure Coordinating Council (PICC). The PICC presents the spatial mapping of infrastructure gaps which analyses future population growth, projected economic growth, and areas of the country which are not served with water, electricity, roads, sanitation, and communication.

Based on this work, eighteen (18) Strategic Integrated Projects (SIPs) have been developed and approved to support economic development and address service delivery in the poorest provinces. The Gamagara Development Corridor constitutes the SIP 3 (South-Eastern node & corridor development – Increase manganese rail capacity in the Northern Cape) and SIP 5 (Saldanha-Northern Cape development corridor - Expansion of iron ore mining production and beneficiation).

It is therefore clear that the sustainable operation and expansion of the BRMO's activities are desirable in terms of both the municipal SDF as well as the national SIPs. The proposed SFSF development is integral to the continued operation and increasing production capacity of the Gloria mine.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The description of the receiving environmental is described herein based on observations at the site, findings of the specialist assessments, and the findings of previous environmental impact assessments undertaken for the wider mine environmental management programme.

The area of interest is adjacent to the existing surface activities of the mine. Although some portions of the land have previously been disturbed, the area largely consists of undisturbed land. The area is classified as having natural/indigenous vegetation. The site is ***not*** located on a shallow water table, dolomitic, sinkhole, or doline areas, seasonally wet soils, unstable rocky slopes, or steep slopes with loose soil, dispersive soils, soils with high clay content, and/or an area sensitive to erosion.

5.1 PHYSICAL

5.1.1 CLIMATE

There are no South African Weather Stations (SAWS) proximal to the site, as such data for Kuruman is used to provide an overview of the climatology of the area. Kuruman is approximately 65km south-east of the BRMO operations. The meteorological conditions at this site may not be exactly representative of meteorological conditions at the site. However they are expected to be representative of the general conditions of the region.

5.1.2 WIND

The observed wind direction and wind speed are dominantly from the north-northwest, with an average wind speed of 4.1m/s (for the windier months of the year, July to January) (Figure 5-1). The length of the colour-coded line in the wind roses is proportional to the frequency of occurrence of wind blowing from that direction. Wind speed classes are also colour-coded, and the length of each class/category is proportional to the frequency of occurrence of wind speed.

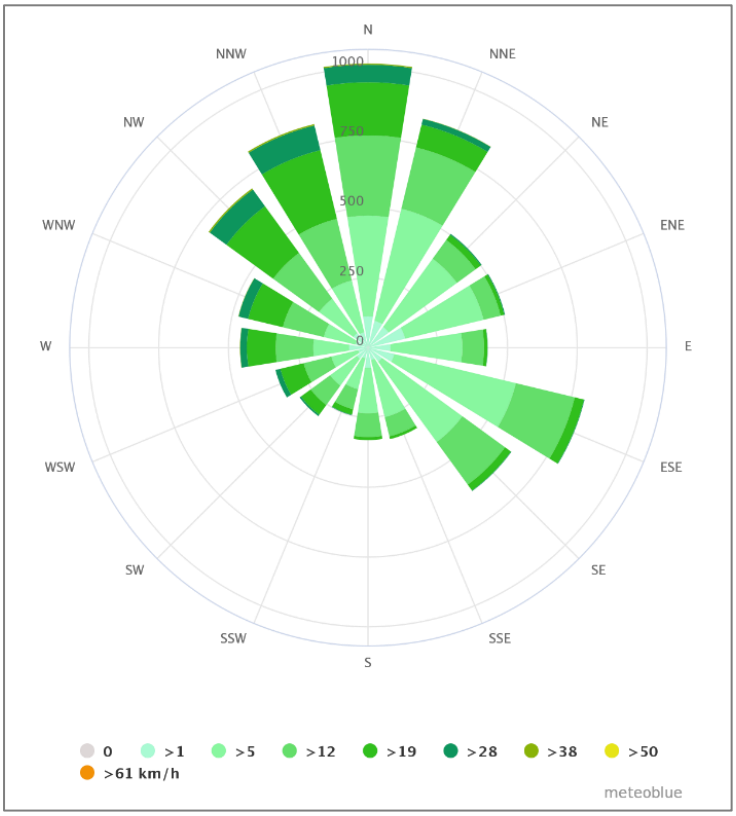


Figure 5-1: Annual Wind rose for Kuruman (https://www.meteoblue.com)

5.1.3 RAINFALL AND TEMPERATURE

Rainfall occurs predominantly in summer and autumn (Dec – Apr), while the least amount of rain falls in the months of May – Sep. The maximum daily temperature occurs in January/December, whilst the minimum daily temperature occurs in July/August for Kuruman (Figure 5-2). Temperatures are high in summer months, with a maximum temperature of around 32°C for Kuruman. Winter temperatures do drop below freezing. However, the average minimum temperature for Kuruman is 1°C.

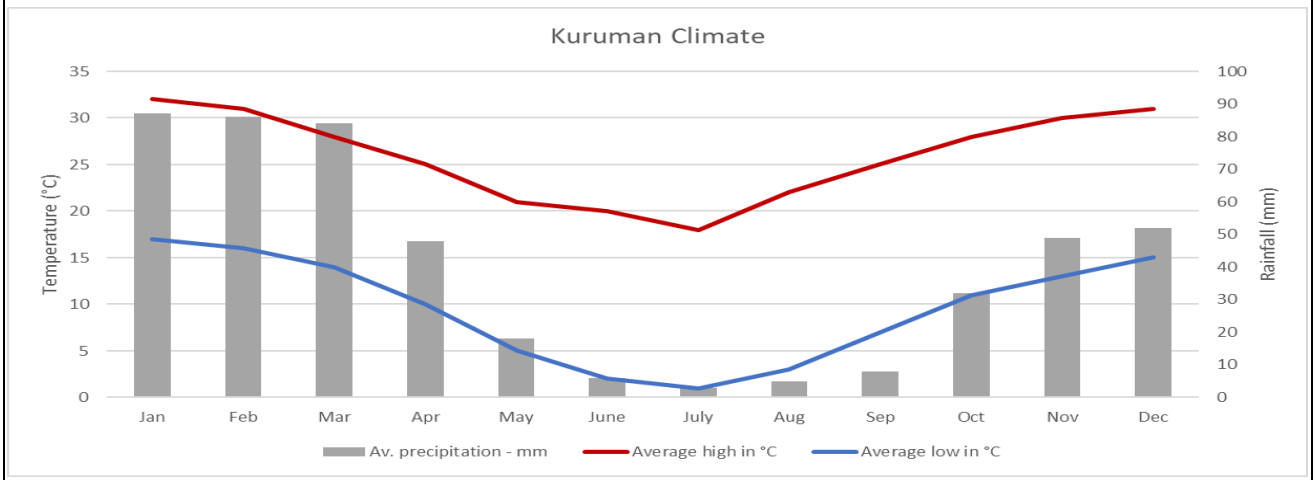


Figure 5-2: Monthly Average Temperature and Rainfall for Kuruman (https://www.climatedata.eu)

5.1.4 EVAPORATION AND CLIMATIC WATER BALANCE

The region is arid, with relatively high evaporation rates and low rainfall. Although site-specific data is not available, the mean annual precipitation versus evaporation rates can be estimated from mean rates from other stations in the area.

Average monthly rainfall and evaporation data for the area was obtained from the following Department of Water and Sanitation monitoring stations:

- Kuruman Station (D4E004), approximately 65 km south-east.
- Olifantshoek Station (D4E002), approximately 85 km north-west.

The average monthly and annual data is summarised in Table 5-1, and illustrated in Figure 5-3 and Figure 5-4.

Table 5-1: Precipitation and Evaporation Data						
Month	**Kuruman-D4E004**			**Olifantshoek-D4E002**		
	Rainfall (mm)	Evaporation (mm)	Climatic Water Balance (mm)	Rainfall (mm)	Evaporation (mm)	Climatic Water Balance (mm)
January	85.6	259	-173.4	59.6	276.1	-216.5
Feb	82.9	208.4	-125.5	52.1	221.6	-169.5
March	86.5	161.3	-74.8	63.3	191.9	-128.6
April	45.1	122.3	-77.2	33.4	139.8	-106.4
May	21.5	113.2	-91.7	14.1	105.3	-91.2
June	7.4	82.5	-75.1	5.3	79.8	-74.5
July	2.8	99.1	-96.3	3.2	90.7	-87.5
August	9.8	131.2	-121.4	5.5	132.6	-127.1
September	7.9	188.5	-180.6	5.8	180.3	-174.5
October	26.4	236.3	-209.9	19	234.9	-215.9
November	45.1	243.6	-198.5	27.4	266.6	-239.2
December	44.9	272.7	-227.8	32.7	293.2	-260.5
Annual	**465.9**	**2118.1**	-173.4	**321.4**	**2212.8**	-216.5
Annual Water Balance*	**-1652.2**			**-1891.4**		
* The climatic water balance is calculated as total rainfall - total evaporation.						

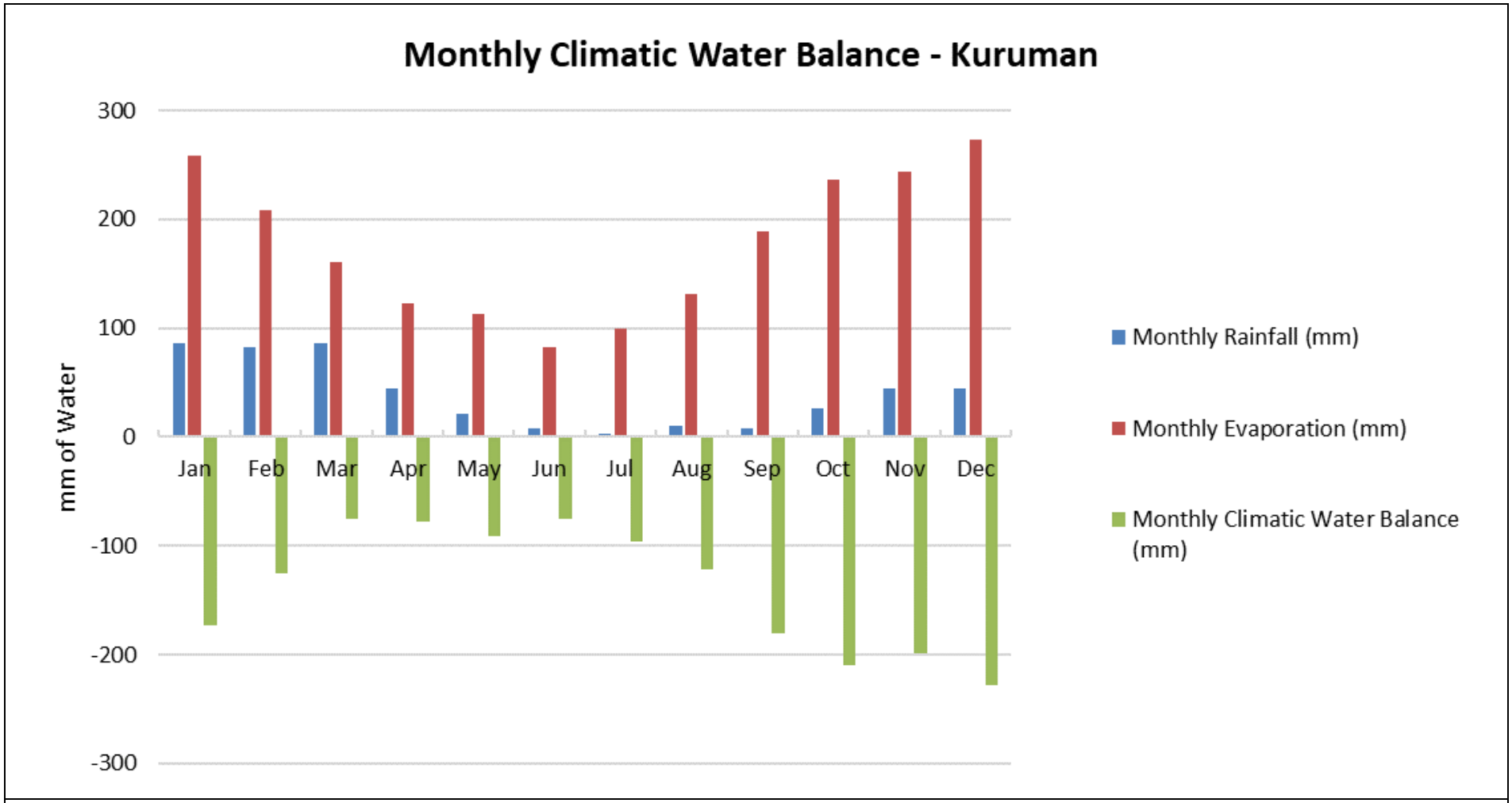


Figure 5-3: Climatic Water Balance - Kuruman

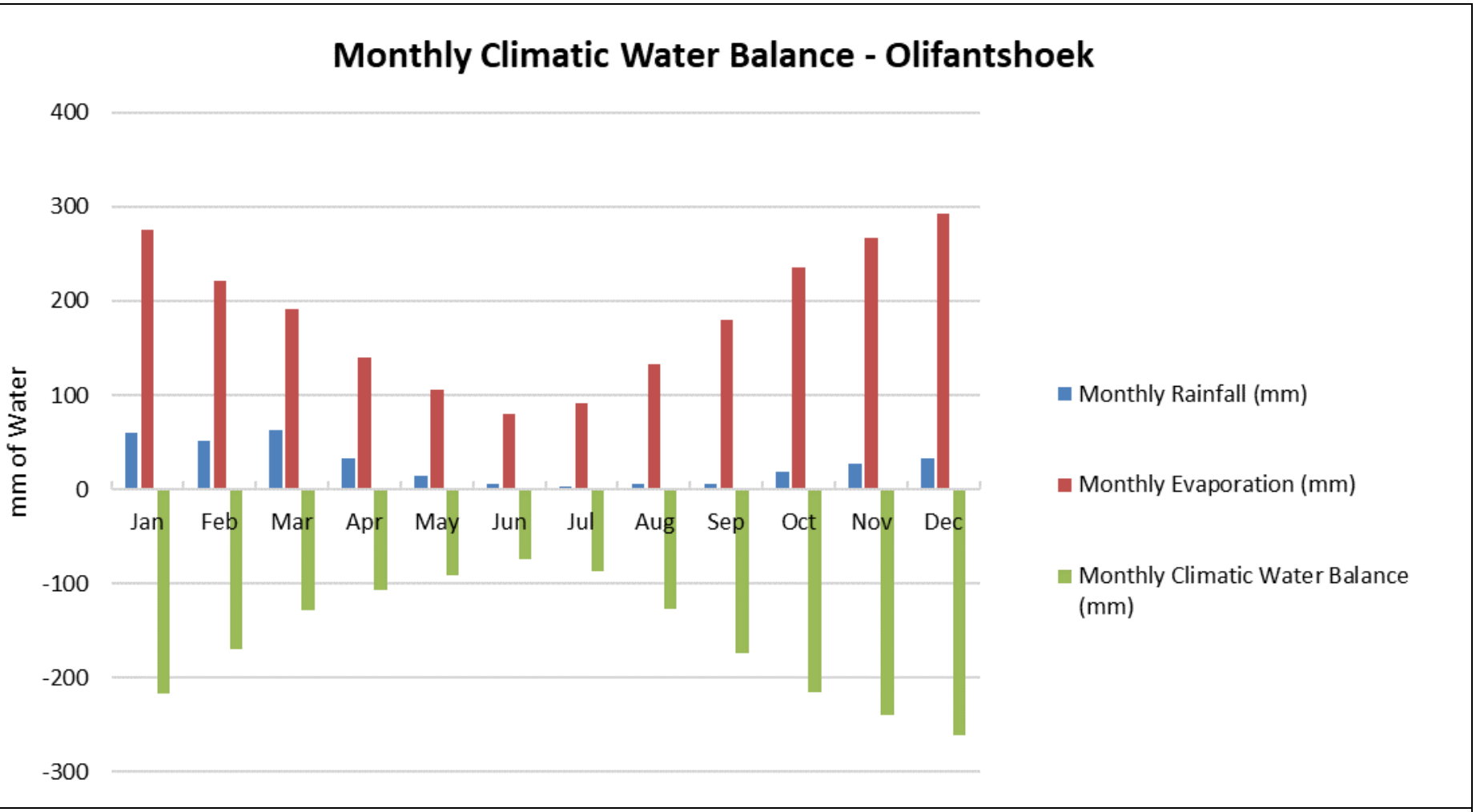


Figure 5-4: Climatic Water Balance - Olifantshoek

It is clear from the above that there is a significantly negative climatic water balance for the area. This is significant for the site, as it implies that there is limited potential for infiltration and leaching of material disposed, and significant potential for loss of water through evaporation, particularly over the long term.

5.1.5 SURFACE WATER AND WETLAND/RIPARIAN ZONES

The gradient of the site is flat, and the landform associated with the site is plain (refer to Figure 5-6). Notably the Gamagara River runs to the east of the site. However, there are no apparent drainage channels to the river. The Gamagara River and its associated wetland/riparian features (including a 32 m buffer zone) can be considered as an ecologically sensitive area in relation to the proposed development activities (Figure 5-5). The proposed activities will be well outside of this area, with the preferred site located approximately 900m west of the Gamagara River.

According to a hydrological assessment undertaken at BRMO (African Environmental Development, report number AED0201), the site is located in the arid and endorheic Kalahari Basin. It does not have any true surface water, although there are a few areas where quarries have intercepted the water table below a dry streambed, and this water was considered to be surface water (with certain reservations). The study further demonstrated that the area where the mine is located is very flat with low slopes and that in general, hardly any actual surface run-off would enter the Gamagara River. If indeed surface run-off did reach the river, it would rapidly be absorbed by the riverbed and become part of the groundwater environment. Due to the endorheic nature of the Kalahari Basin, any contamination of groundwater would remain there for an extremely long time. This places an extended responsibility on BRMO and the other mines operating in this area, as negligent actions on the part of the mines leading to contamination of groundwater, could be responsible for this contamination lingering in the groundwater for potentially millions of years.

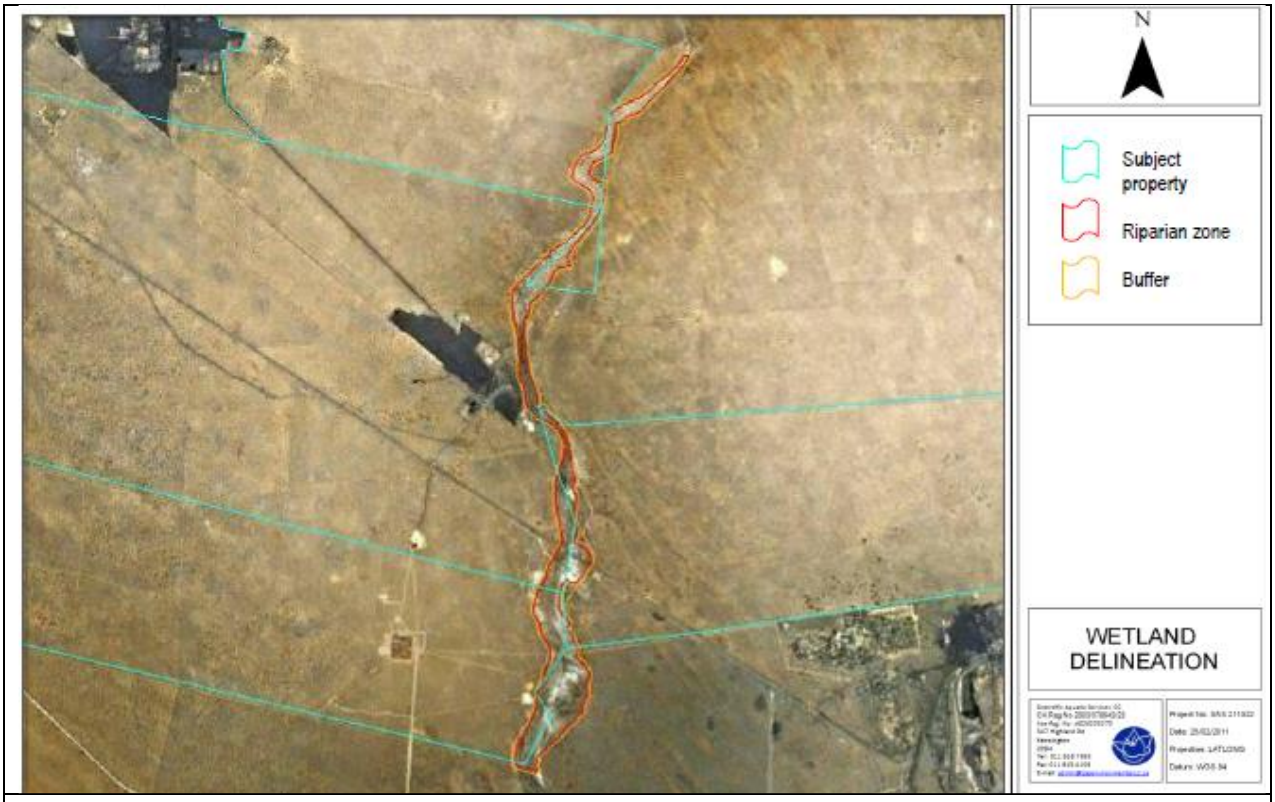


Figure 5-5: Gamagara River Wetland Delineation

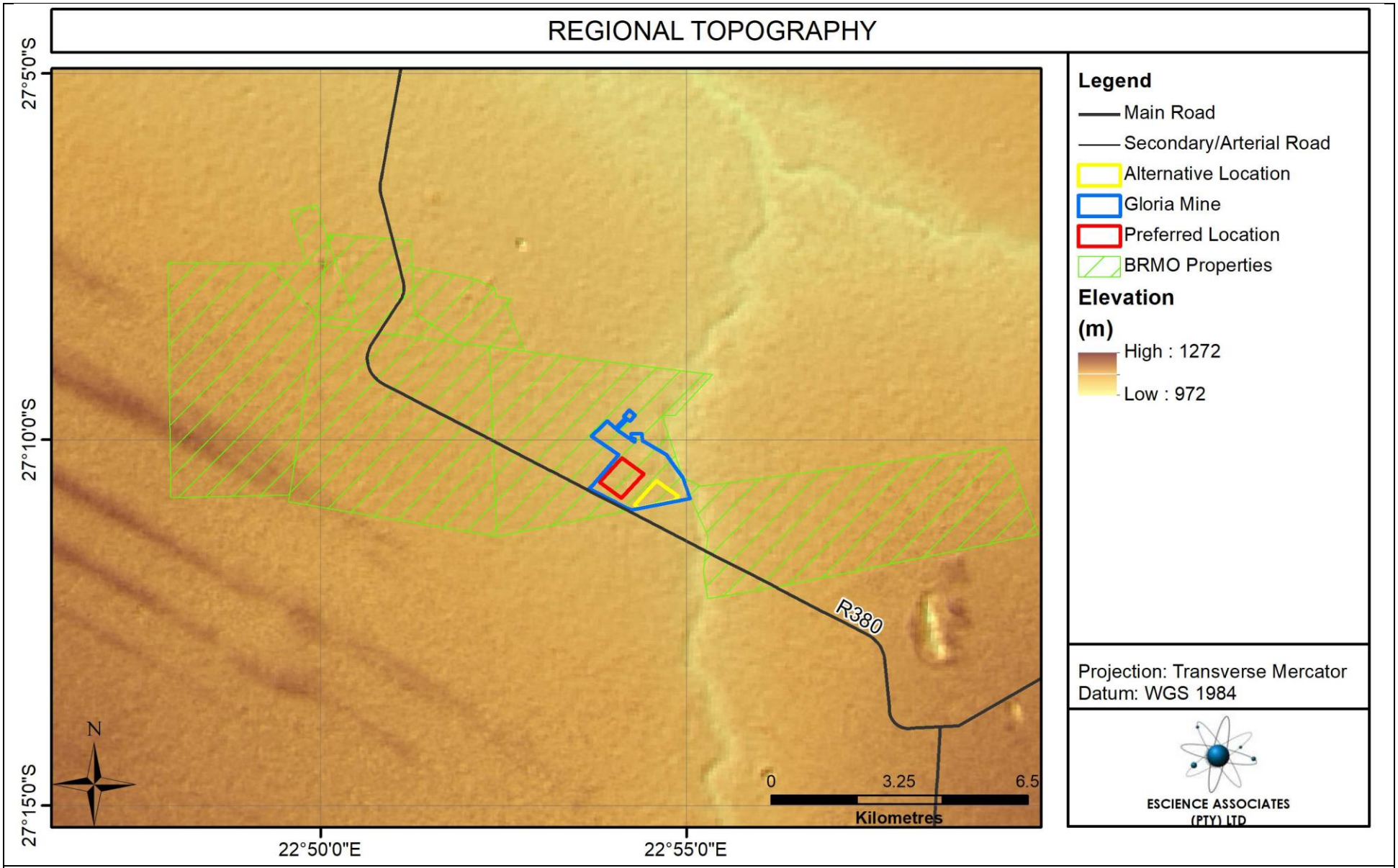


Figure 5-6: Regional Topography Displaying Relatively Flat Nature of the Region

5.1.6 GEOLOGICAL AND GEOHYDROLOGICAL SETTING

A summary of the geological and geohydrological setting is presented herein based on the specialist hydrogeological and geotechnical assessments undertaken at the site (refer to Appendix 3 for the specialists' reports), as well as previous specialist studies undertaken at BRMO (Geo Pollution Technologies, Report Reference Number: EBR-10-320, Envass report GEO- REP-107-08-19)).

The Kalahari Manganese Field (KMF), in the Kuruman area, has a covering of calcretized sediments of the Kalahari Group, which is comprised of aeolian, unconsolidated sand of the Gordonia Formation, non-conformably overlying calcified sand and gravel. The Kalahari Group is up to 125 m thick, underlain by a ~30 m thick red clay layer, and the Olifantshoek Supergroup. The Olifantshoek Supergroup is comprised of the shales and quartzites of the Lucknow Formation, underlain by the Mapedi Formation shale, with quartzite bands.

Regionally, the general area has a cover of predominantly Quaternary Surficial deposits of red to light orange coloured Aeolian (windblown) sands of the Kalahari Group, that extend- to depths of 20.0 m, and deeper in some places. The geology underlying the site comprises approximately 100 m of unconsolidated Kalahari Formation, consisting of fine Aeolian sand, gravels, calcrete, and clays. Figure 5-7 illustrates the general stratigraphy of the site.

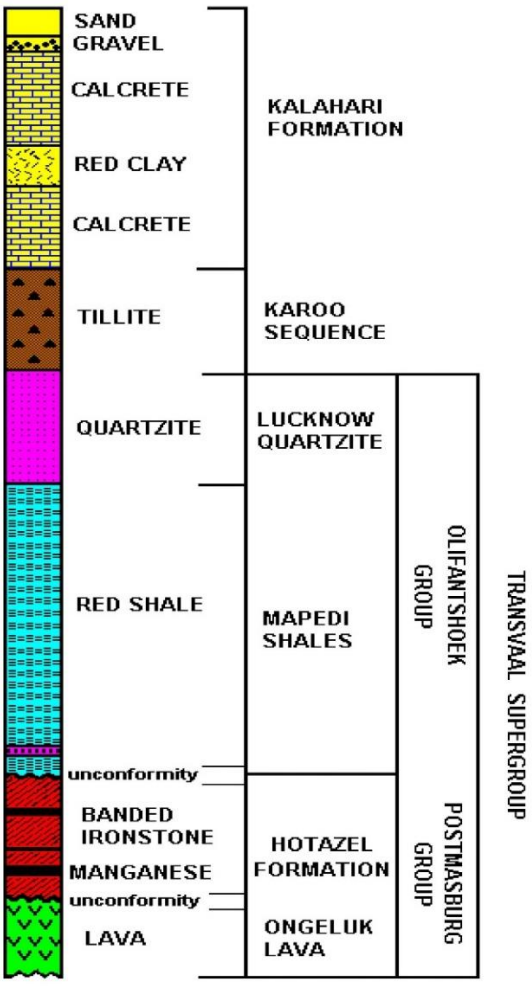


Figure 5-7: General Stratigraphy of the Site.

The entire Olifantshoek Supergroup, and the underlying Ongeluk Formation, have been influenced by the Kheis and Namaqualand orogenies, with thrust faulting within the area presenting evidence of compressional tectonics associated with the Kheis orogeny. The major thrust fault at Black Rock area is named the 'Kheis Thrust', which has a north-south trend and extends ~270 km north of the mine and south to the Rooinekke Mine. The site is situated within a large and imbricate thrust fault complex, where the Black Rock outcrop represents part of the thrust nappe structure.

From the thirty-five test pits excavated during the geotechnical assessment of the site, the site is generally underlain by poorly developed Topsoil / Aeolian soils from surface to an average depth of 0.3 m, underlain by orange brown to yellow brown silty fine sand to an average depth of 3.3 m. Pedogenic soils in the form of powder calcrete, nodular calcrete or strongly cemented fractured hardpan calcrete, are found underlying the Aeolian soils. Notably, no groundwater was noted in any of the test pits excavated.

According to the 1:500'000 Hydrogeological Map Series (2722 Kimberley), the site is underlain by intergranular aquifer units, with a median borehole yield between 0.1 and 0.2 l/s. Aquifers to the west and east of the site are mapped as intergranular and fractured aquifers, with the same median borehole yield. Most boreholes within the site region were drilled to depths between 60 and 150 m. Few boreholes were drilled deeper than 175 m, with the maximum borehole at a depth of 307 m. Water strikes within the site region were intersected predominantly between 40 and 70 m depths, with limited intersections after 125 m (i.e. approximate depth of the Kalahari Formation).

The top layer of aeolian sands is followed by calcrete of tertiary age. If weathered, the calcareous sands have high porosity and permeability. There is limited surface runoff in the Kalahari area, with high infiltration rates during precipitation. Due to the high porosity and permeability of the Kalahari sands, the calcrete deposit below the top layer of Kalahari sands acts like a "sponge".

5.1.6.1 Unsaturated Zone

The unsaturated zone in the mining area can be up to 40 metres thick (based on static groundwater levels from the monitoring as done by Black Rock), measured in the existing boreholes and consists of quaternary sediments at the top, underlain by tillite, shale and banded iron formation, with interbedded manganese ore bearing rock that become less weathered with depth.

5.1.6.2 Saturated Zone

In the saturated zone, at least two aquifer types may be inferred by the geohydrological specialist:

- A shallow aquifer formed in the weathered zone, perched on the fresh bedrock;
- An intermediate aquifer formed by fracturing of the underlying tillite, shales, iron formation, and manganese ore bearing layers.

Although these aquifers vary considerably regarding hydrogeological characteristics, they are seldom observed as isolated units. Usually, they would be highly interconnected by means of fractures and faults. Groundwater will thus flow through the system by means of the path of least resistance in a complicated manner that might include any of these components.

5.1.6.3 Shallow Perched Aquifer

A near surface weathered zone is comprised of transported quaternary sediments and in-situ weathered rock and is underlain by tillite, shales, iron formation, and manganese ore bearing rock. Groundwater flow patterns usually follow the topography, often coming very close to surface in topographic lows, sometimes even forming natural springs. The average groundwater recharge to the perched groundwater aquifer can reach up to 10% of the Mean Annual Precipitation (MAP) in the unconsolidated sand and calcrete.

5.1.6.4 Fractured Rock Aquifers

The host geology of the mining area consists of tillite, shales, and banded iron formation, with interbedded manganese ore bearing rock. Geology underlying the mining area consists mainly of lavas from the Ongeluk Formation. Most of the groundwater flow will be along the fracture zones that occur in the relatively competent host rock. The geology map does not indicate any major fracture zones in the mining area, but from specialist notes, it can be assumed that numerous major and minor fractures do exist in the host rock. These conductive zones effectively interconnect the strata, both vertically and horizontally into a single, but highly heterogeneous and anisotropic, unit. Major fault zones were, however, observed on the geology map, west of the mining area, running in a north-south direction.

5.1.6.5 Water Levels

Water level data is based on monitoring data that is undertaken by BRMO in accordance with the requirements of the mine's existing Water Use Licence. A total of 9 water levels are monitored. The water levels vary between 33.47 m and up to 101.10 m below ground level in the surrounding area.

Usually a good relationship should hold between topography and static groundwater level. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local hydrogeological heterogeneities. This general relationship for the BRMO shows a very poor correlation. A likely reason for this poor correlation could be water abstraction. The average depth to the groundwater level, in the intergranular and fractured aquifer, in the proposed area is 46 meters. Refer to Figure 5-8 and Figure 5-9, showing the borehole locations, groundwater levels, and direction of flow.

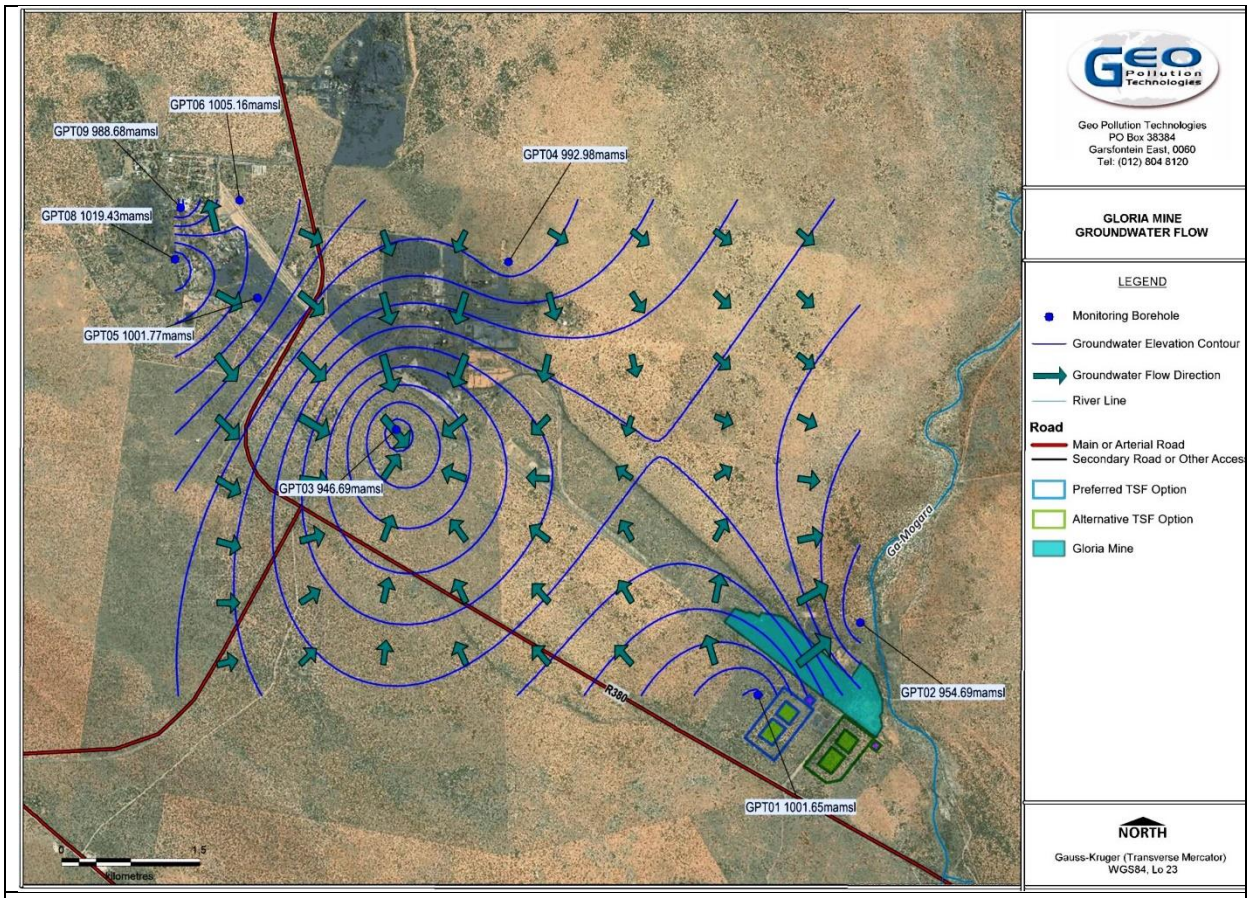


Figure 5-8: Borehole Locations and Groundwater Flow Directions

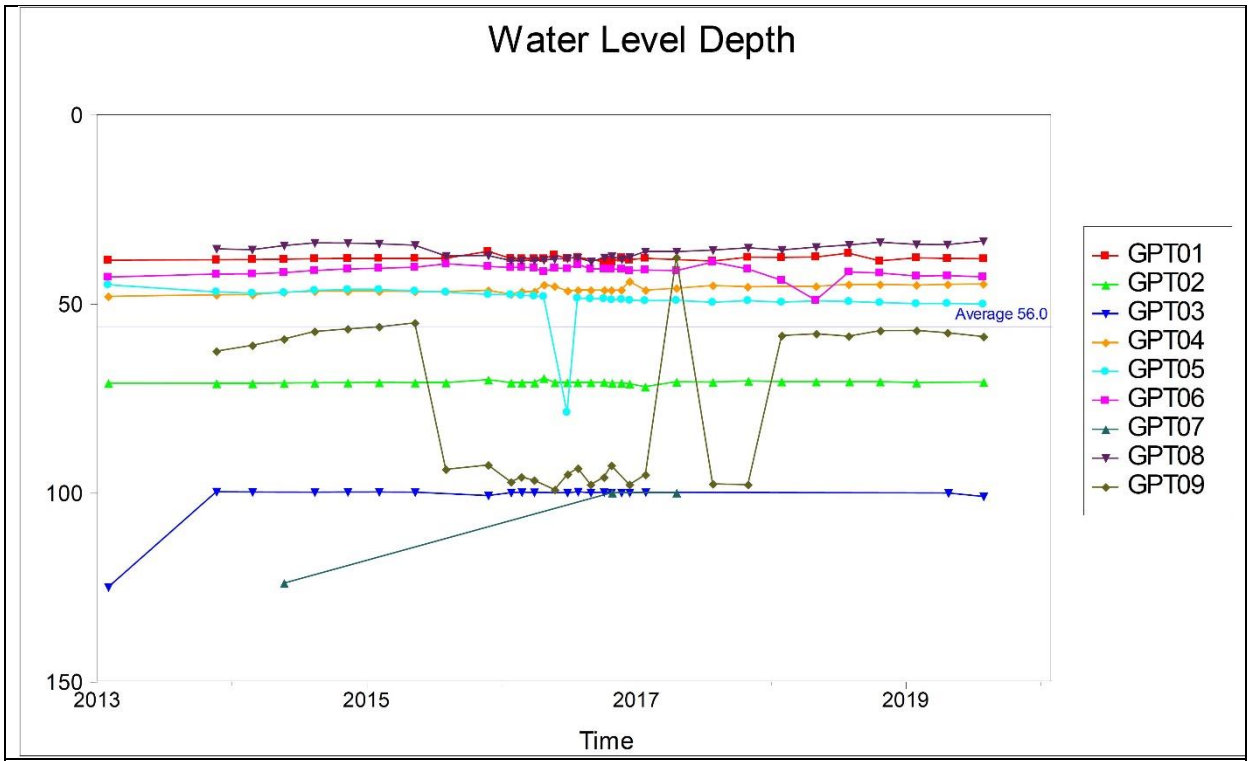


Figure 5-9: Groundwater Levels

5.1.6.6 Groundwater Quality

The water quality results for the monitoring boreholes are compared with the maximum recommended concentrations for domestic use as defined by the SANS 241-1: 2015

target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions, and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample (Table 2). The following is noted:

- TDS exceeds the allowable limit in samples GPT2, GPT8.
- Nitrate as N exceeds the allowable limit in samples GPT1, GPT2, GPT5, GPT6, GPT8, and GPT9.
- Sodium exceeds the allowable limit in samples GPT2, GPT4.
- Chloride exceeds the allowable limit in samples GPT04.
- Fluoride exceeds the allowable limit in samples GPT03.

All other monitored parameters are within the guidelines for the boreholes.

5.1.7 SOIL

A soil survey has previously been undertaken at BRMO to assess soil characteristics and establish how and to what depth topsoil should be removed to prepare the area, and how the removed soil should be stored and treated when reused to remediate the disturbed area after mine closure (Report: Soil Survey and Soil Management Program for the Black Rock Mine Operations Concerning Establishing A New Sinter Plant and Shaft Complex - Prof Claassens 2011). The area around Black Rock, in the vicinity where the mining operations are undertaken, consists mainly of Kalahari sand. Kalahari sand is typically homogenously very deep, with the exception of certain areas which are underlain by calcrete. Soil fertility is low, as is typical of sandy soils. Based on soil auguring undertaken, the soils in the area surveyed were deep yellowish-red sandy soils.

Due to a very low organic content, it was concluded that no specific recommendation on how deep the topsoil should be excavated to prepare the area, is necessary. Due to the texture of the soil and the size distribution it will not tend to compact while it is stockpiled, thus no special arrangements are necessary for stockpiling.

Although the soil is not very fertile, the stockpiled soils can be used as such to reclaim the disturbed area at mine closure. No fertilizer programme is recommended because it is assumed that the disturbed areas will be re-vegetated with natural grasses, which are adapted to the local environment.

5.2 BIOLOGICAL

As previously mentioned, the area affected is currently adjacent to the existing surface activities of the mine. Although some portions of the land have previously been disturbed, the area largely consist of undisturbed land. The area is classified as having natural/indigenous vegetation.

Based on the findings of the biodiversity assessment undertaken for this application, as well as previous assessments (Biodiversity Action Plan For The Assmang Black Rock Manganese Ore Mine authored by SAS Environmental, 2011, Report Reference № SAS 211022), the biodiversity of the area is described below.

The study area falls within an area that is currently not protected, in terms of the National Biodiversity Assessment (2011) Act/Regulations/Something. Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected", or "well-protected" based on the proportion of each ecosystem type that occurs within a protected area, recognised in the Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type. Ecosystems not occurring within any protected area, or where less than 5% of the biodiversity target has been met, are considered "not protected".

The surrounding area, in terms of the National Threatened Ecosystems database, is shown in Figure 5-10. The entire area is described as "lightly threatened".

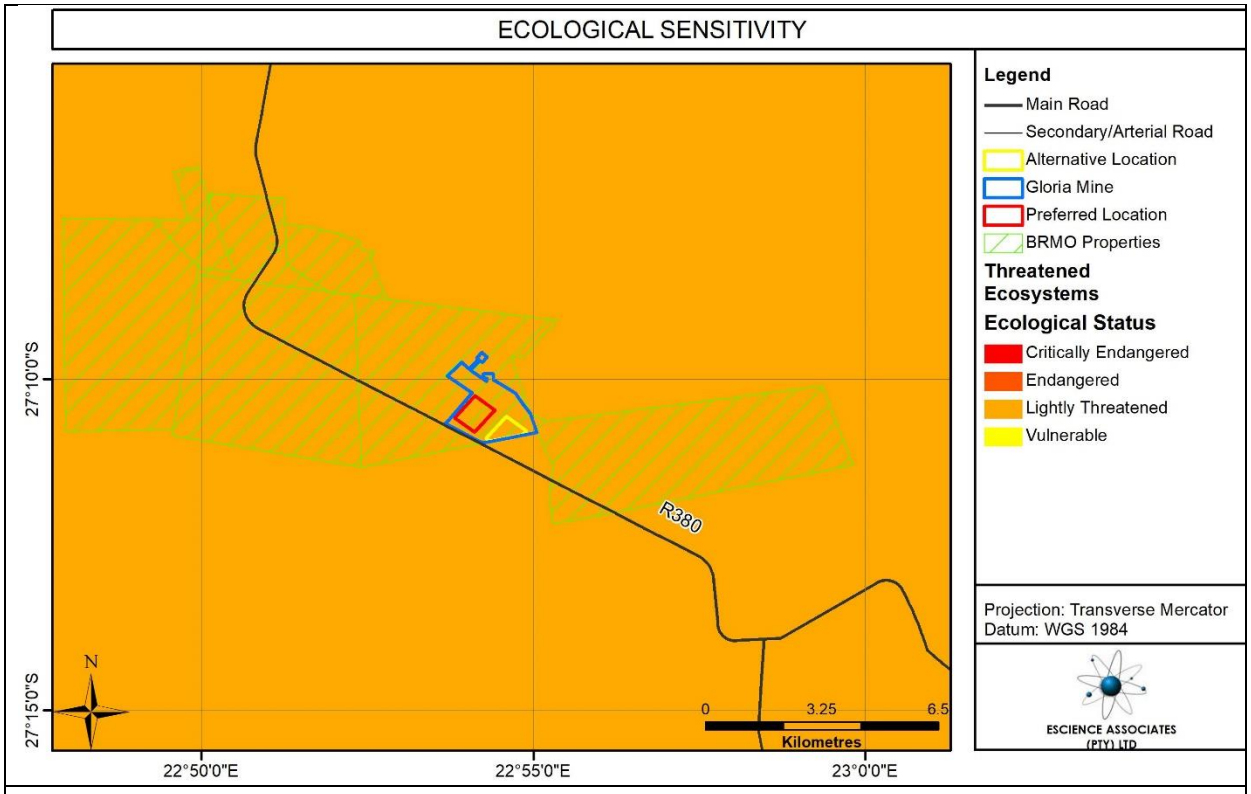


Figure 5-10: Map Reflecting Potential Environmental Sensitivities with the Proposed Activities.

5.2.1 BIODIVERSITY

BRMO is located within the Savannah biome, and more specifically within the Eastern Kalahari Bushveld Bioregion, with some incursion into Kalahari Duneveld, according to a biodiversity assessment undertaken by Scientific Aquatic Services (Report Reference: SAS 211022 dated in May 2011, refer to Figure 5-11). The site consists of transformed land (current and legacy mining, and related infrastructure), open veld (presently used, rented to farmers who graze livestock), the Belgravia Game Farm (the only on-site area presently considered of increased sensitivity), and limited riparian habitat (related to the Gamagara River).

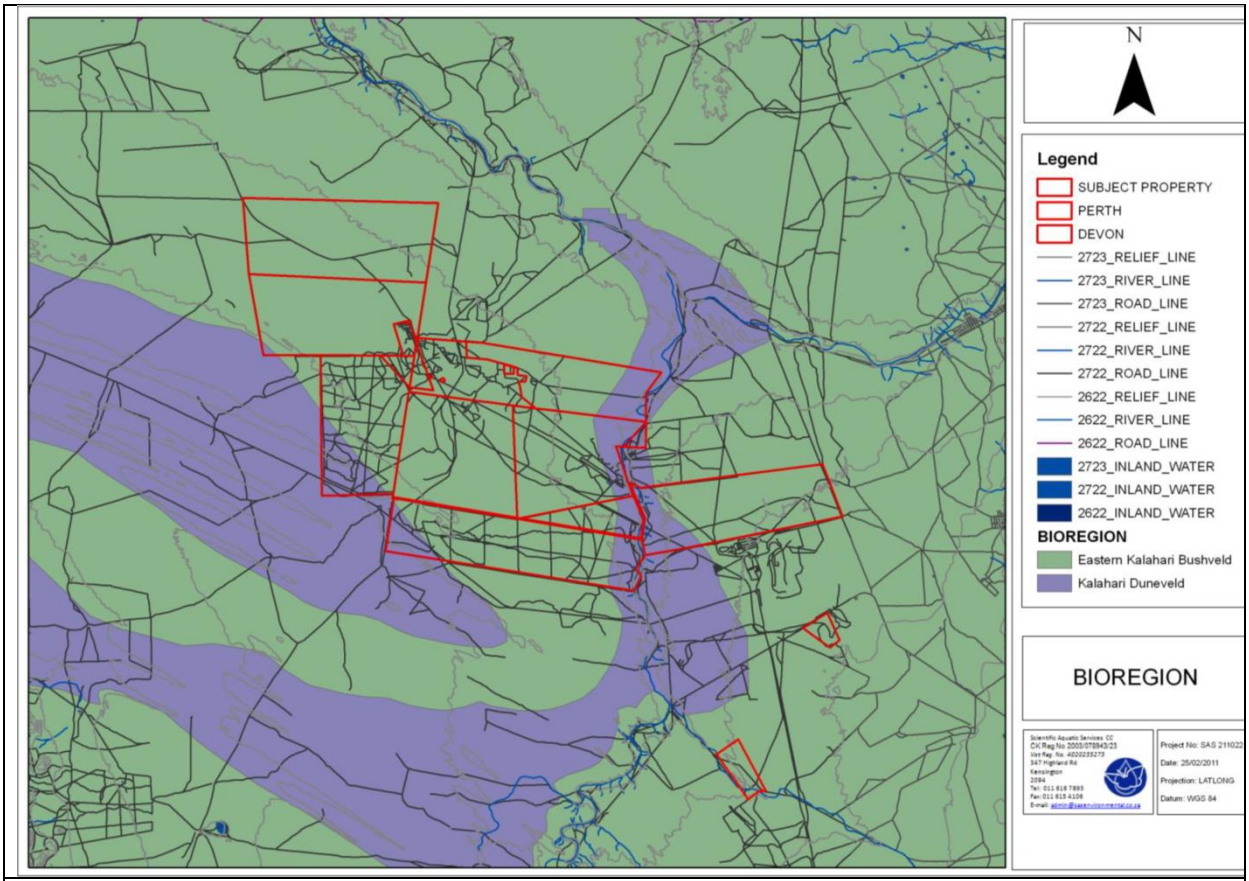


Figure 5-11: Biome (Scientific Aquatic Services. Report Reference: SAS 211022)

One broad habitat unit, namely the Kathu Bushveld, was identified for the majority of the preferred site and the alternative location. Small pockets of transformed areas were identified within the broader habitat unit of the preferred location and the alternative location. These vegetation transformations are associated with existing gravel roads leading to the existing TSF, as well as an existing fuel storage facility. Vegetation within the transformed habitat unit has been completely cleared, or is associated with limited vegetation cover.

The species composition and vegetation structure within the proposed site are typical of the Kathu Bushveld vegetation type. Bush encroachment of *Senegalia mellifera* (blackthorn or swarthaak) is noted within the Kathu Bushveld habitat unit associated with the preferred and alternative locations. Although individual species abundance differed for these vegetation communities, the species composition was similar, and both vegetation communities can be considered representative of the Kathu Bushveld vegetation type.

5.2.1.1 Floral Diversity

When the boundary of the assessment site is superimposed on the vegetation types of the surrounding area, it is evident that the subject property falls within the Kalahari Thornveld and Shrub Bushveld veld type, Kathu Bushveld vegetation type, and partly in the Gordonia Duneveld vegetation type.

Several red data listed (RDL)/protected floral species are documented within the area, as shown in Table 5-2. The species identified are expected to be found throughout the site. None of the listed species may be cut, removed, relocated, or destroyed, without

permits having been issued by the relevant competent authorities, in terms of the legislation listed in Table 5-2.

The floral sensitivity is documented by SAS in Figure 5-13: Faunal Sensitivity (Scientific Aquatic Services. Report Reference: SAS 219153), which demonstrates similar levels of floral sensitivity for both proposed sites.

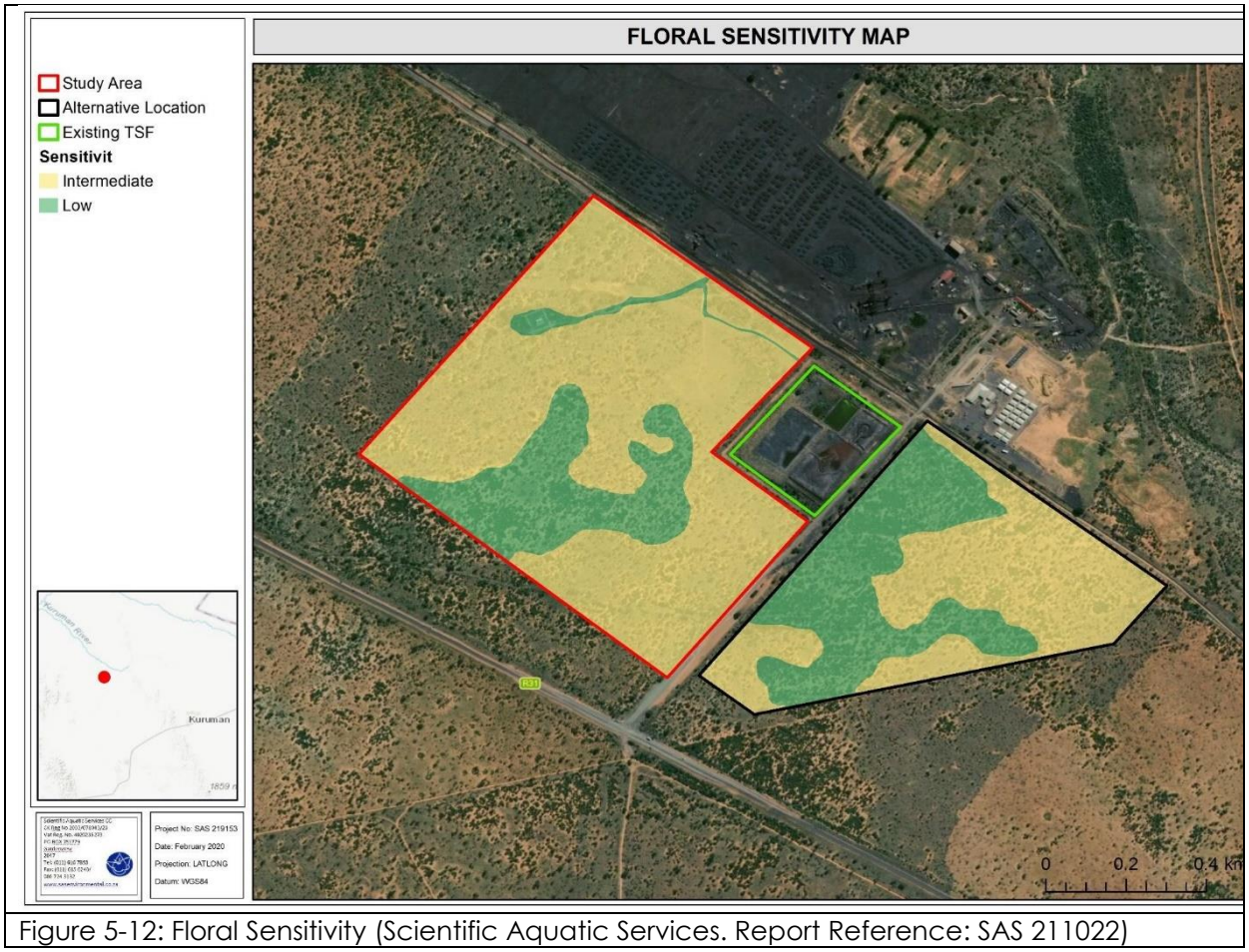


Figure 5-12: Floral Sensitivity (Scientific Aquatic Services. Report Reference: SAS 211022)

Protected species observed within the study areas are presented in Table 5-2.

Table 5-2: Protected species observed within the study area at the time of assessment or with increased likelihood to utilise the study area

Species	Status	Habitat Unit	POC
Vachellia erioloba	LC	Recorded within all habitat units during the assessment	100%
Vachellia haematoxylon	LC	Recorded within all habitat units during the assessment	100%
Boscia albitrunca	LC	Suitable habitat within the Kathu Bushveld, and observed in the surrounding region during the field assessment	60%
Harpagophytum procumbens	LC	Recorded within the Kathu Bushveld Habitat Unit	100%
Hoodia gordonii	DDD	Suitable habitat within the Kathu Bushveld	60%
Lessertia frutescens subsp. frutescens	LC	Suitable habitat within the Kathu Bushveld	60%

Boophone disticha	LC	Observed within the Kathu Bushveld and Degraded Bushveld Habitat	100%
Orbea sp.	LC	Recorded within the Kathu Bushveld	100%
Babiana hypogaea	LC	Previously recorded by STS in the vicinity of the study area. Suitable habitat within the Kathu Bushveld	60%
Boscia albitrunca	LC	Suitable habitat within the Kathu Bushveld, and observed in the surrounding region during the field assessment	60%
Nerine laticoma	LC	Suitable habitat within the Kathu Bushveld habitat unit	60%
Harpagophytum procumbens	LC	Recorded within the Kathu Bushveld Habitat Unit	100%

Medicinal plant species are not necessarily indigenous species, with many of them regarded as alien invasive weeds. The table below presents a list of dominant plant species with traditional medicinal value and the plant parts traditionally used, which were identified during the field assessment.

Table 5-3: Protected species observed within the study area at the time of assessment or with increased likelihood to utilise the study area

Species	**Name**	**Plant parts used**
Asparagus suaveolens	Wild Asparagus	Rhizomes and flashy roots
Dichrostachys cinerea	Sickle Bush	Roots
Elephantorrhiza elephantina	Eland's Bean	Roots
Tarchonanthus camphoratus	Camphor Bush	Leaves
Vachellia erioloba	Camel Thorn	Pods, Gum, Bark, Roots
Ziziphus mucronata	Buffalo Thorn	Roots, Bark and Leaves
Dicoma sp.		Leaves and Twigs
Harpagophytum procumbens	Devil's Claw	Roots
Salvia runcinata	Wild Sage	Leaves
Sansevieria aethiopica	Bowstring Hemp	Rhizomes and Leaves
Senna italica subsp. arachoides	Wild Senna	Leaves
Boophone disticha	Poison Bulb	Bulb Scales

Alien and invasive floral species are floral species of exotic origin which are invading previously pristine areas or ecological niches. Not all weeds are exotic in origin but, as these exotic plant species have very limited natural "check" mechanisms within the natural environment, they are often the most opportunistic and aggressively growing species within the ecosystem. They are often the most dominant and noticeable within an area. Disturbances of the ground through trampling, excavations, or landscaping often leads to the dominance of exotic pioneer species that rapidly dominate the area. Under natural conditions, these pioneer species are overtaken by sub-climax and climax species through natural veld succession. This process, however, takes many years to occur, with the natural vegetation never reaching the balanced, pristine species composition prior to the disturbance. There are many species of indigenous pioneer plants, but very few indigenous species can out-compete their more aggressively growing exotic counterparts.

During the floral assessment, dominant alien and invasive plant species were identified and are listed in Table 5-4.

Table 5-4: Dominant alien floral species identified during the field assessment with their invasive status as per NEMBA: Alien and Invasive Species Lists, GN R598 of 2016.

Scientific Name	Common Name	Origin	NEMBA Category	Habitat Unit
WOODY SPECIES				
Nicotiana glauca	Wild Tobacco	Argentina	1b	Kathu Bushveld Transformed Habitat
Prosopis glandulosa	Mesquite	Mexico	3	Kathu Bushveld Transformed Habitat
Echinopsis schickendantzii	Torch cactus	Argentina	1b	Transformed Habitat
FORB SPECIES				
Argemone ochroleuca	Mexican Poppy	Central America	1b	Kathu Bushveld Transformed Habitat
Chenopodium album	White goosefoot	Europe	N/C	Kathu Bushveld Transformed Habitat
GRAMINOID SPECIES				
Pennisetum setaceum	Fountain Grass	North Africa	1b	Transformed Habitat

5.2.1.2 Fauna

No mammal species of conservation concern (SCC) were recorded during the specialists' site assessments (winter and summer). The majority of mammal SCC in these arid regions are often secretive and not often seen, as such signs like scat, spoor, and in the case of some species, burrows, were searched for. Burrows were observed. However, many appeared inactive, as they were full of debris and were evidently not in use. Burrows that did show signs of activity were that of the common faunal species, *Hystrix africaeaustralis* (Porcupine), with no spoor of any SCC observed at these burrows. Furthermore, the overall location of the study area, and close proximity to the mine and mining activities, is likely to preclude mammal SCC from the area, as they will likely opt to utilise the more intact habitat to the south.

It is evident that, at some point in the past, vegetation clearance must have occurred in the central and eastern portions of the preferred site as this area is open and devoid of any medium to large shrubs. This was part of the originally authorised BRMO expansion. Additionally, the study area is bordered by the mine, the current TSF, a busy mine access road, and a national road to the west. The property is fenced in with a perimeter mesh wire fence, which limits species movement for all but the smallest species (mongooses and rodents), resulting in a loss of habitat connectivity with the surrounding natural areas.

Avifaunal SCC *Ardeotis kori* (Kori Bustard, NT) was observed foraging in the north western portion of the study area. It is however unlikely that this species will utilise the study area for breeding due to its small size, proximity to active mining areas, and the availability of more suitable habitat in the surrounding areas. Additionally, the following avifaunal SCC may also occur in the study area, although this species will likely only utilise the study area for foraging as opposed to breeding, namely *Neotis ludwigii* (Ludwig's Bustard, EN).

No reptile SCC were observed during the field assessment. The entire study area provides intermediate habitat availability for reptile species. The Kathu Bushveld unit is well utilised

by reptiles, as sufficient burrows and vegetation structure are available for habitation. However, rocky areas that would provide additional niche habitat are lacking. Adjacent mining activity edge effects, and continued human movement through the area, may impact on reptile occupancy of the site. However, many of the reptile species have already adapted to such, and the shift in occupancy rates is unlikely to be significant.

The area is not suitable habitat for amphibian species in any form. There are no permanent or seasonal streams or pans that may be utilised for breeding or temporary habitation. No insect SCC were observed during the site assessment nor are any likely to occur within the study area. No arachnid SCC were observed within the study area.

Habitat availability is considered intermediate. Vegetation disturbance in areas, and the dense stands of *Senegalia Mellifera,* does limit the overall provision of habitat for faunal species. The small size, decreased food resources, and continuous mining activities in the surrounding area, further lower the habitat suitability of the study area.

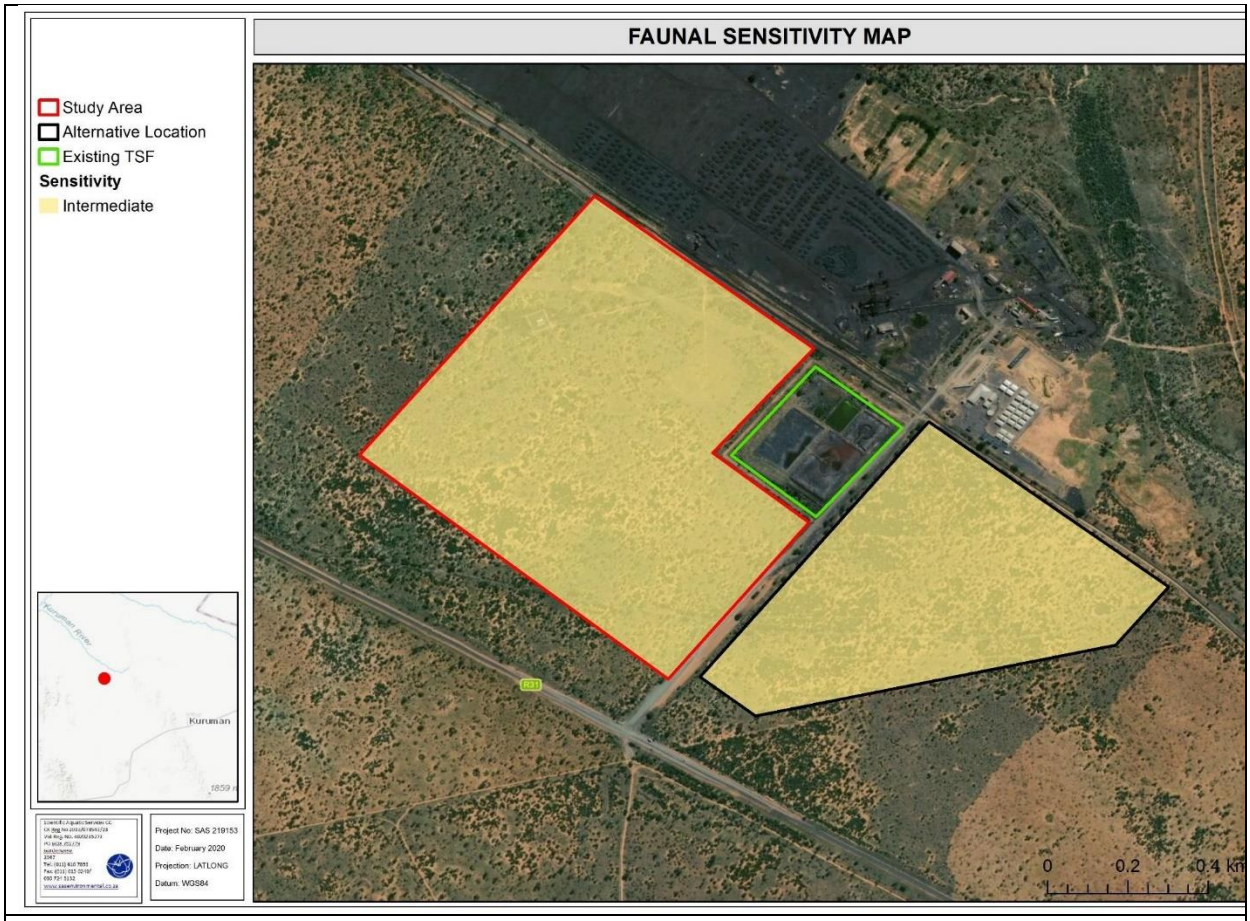


Figure 5-13: Faunal Sensitivity (Scientific Aquatic Services. Report Reference: SAS 219153)

5.3 SOCIO-ECONOMIC

The proposed development will have limited, if any, direct social and economic benefits to the area, with the exception of maintaining the economically sustainable operation of the mine by improving its efficiency and competitiveness. Further social attributes that may typically be affected would include noise, traffic, and light pollution, but these will be unchanged.

The proposed SFSF will replace the operation of the existing Gloria TFS, and thus there will be no direct creation of new job opportunities. Opportunities from the construction phase will be congruent with existing mine expansion activities that have been underway since 2013, thus it is not anticipated that there will new opportunities in this regard.

5.4 HERITAGE

5.4.1 ARCHAEOLOGICAL AND CULTURAL

In addition to the specialist assessment undertaken for the proposed sites, Heritage Impact Assessments have been undertaken at BRMO in 2009 (African Heritage Consultants CC, Cultural Heritage Impact Assessment, 2009) and 2011 (Archaetnos, Culture & Cultural report ASBR, 2011). Various sites of significance have been identified within the BRMO properties. These include:

- The Old Black Rock Mine works (otherwise referred to as the Black Rock Koppie) and associated infrastructure;
- Mine workers' cemetery;
- Sites of Stone Age origin in the Gamagara river basin;
- Farm cemetery on the farm Belgravia.

BRMO has subsequently developed a Heritage Management Plan. At present, all identified sites of heritage significance are outside the proposed location of the planned SFSF.

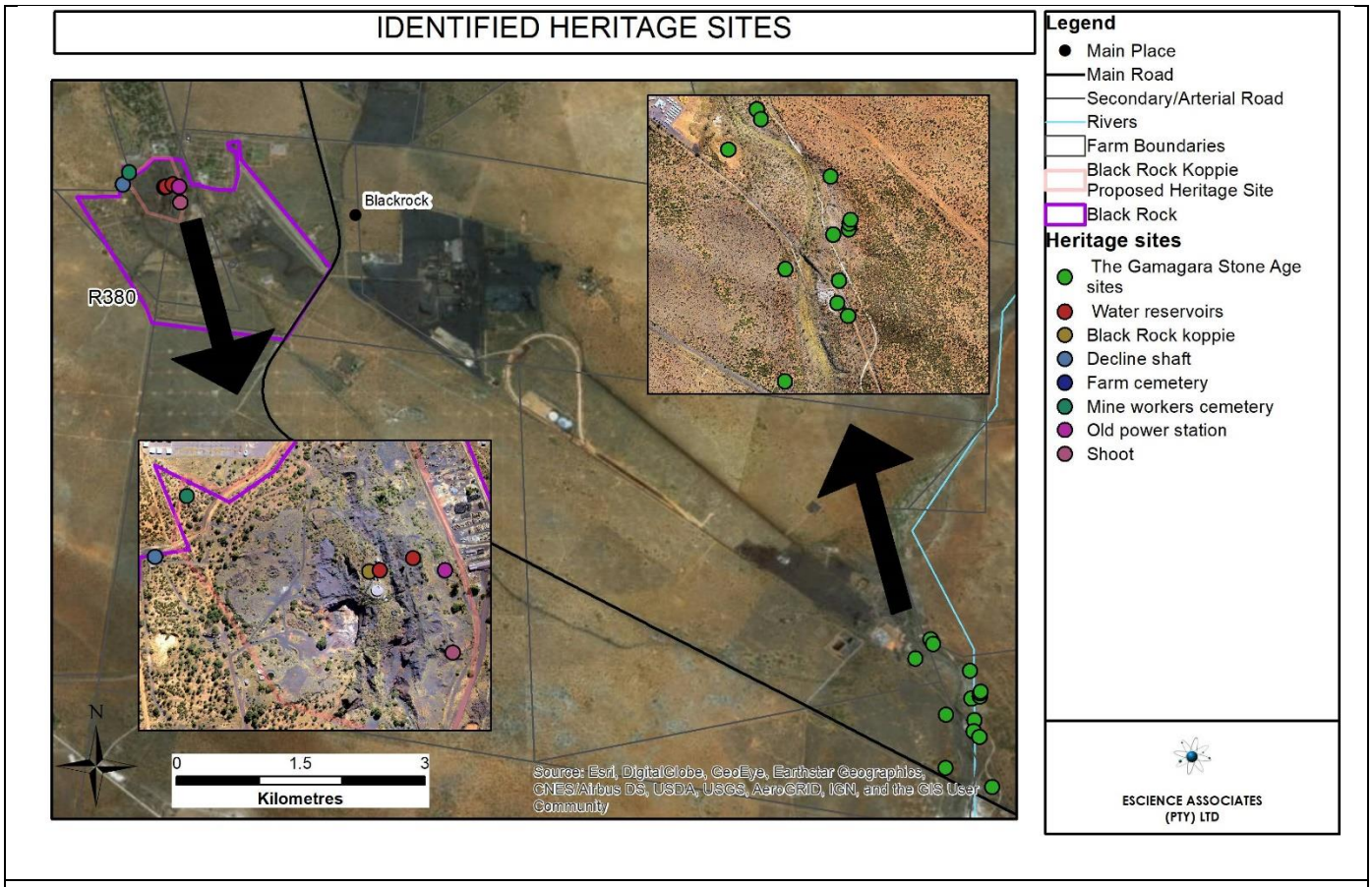


Figure 5-14: Identified Heritage Sites Within the Area.

Various Stone Age sites and scattered Stone Age material have been identified in the region. The Late Stone Age sites are associated with the San people. The specialist notes that the language group who occupied the Northern Cape is the /Auni-//Khomani and Eastern /Hoa. These people were hunters and gatherers, which means that they would have moved around, leaving little trace of their existence. Notably, No such heritage sites were identified during the site survey. The specialist notes that no Early or Middle Iron Age sites have been identified in the area of study, and the chances of finding any Iron Age remains in the study area are thus extremely slim, if not impossible.

5.4.2 PALAEONTOLOGICAL

According to the palaeontological specialist, BRMO is underlain by the Cretaceous to Tertiary Kalahari Formation (Qs) and underlying Griqualand West Basin rocks, Transvaal Supergroup of Vaalian age.

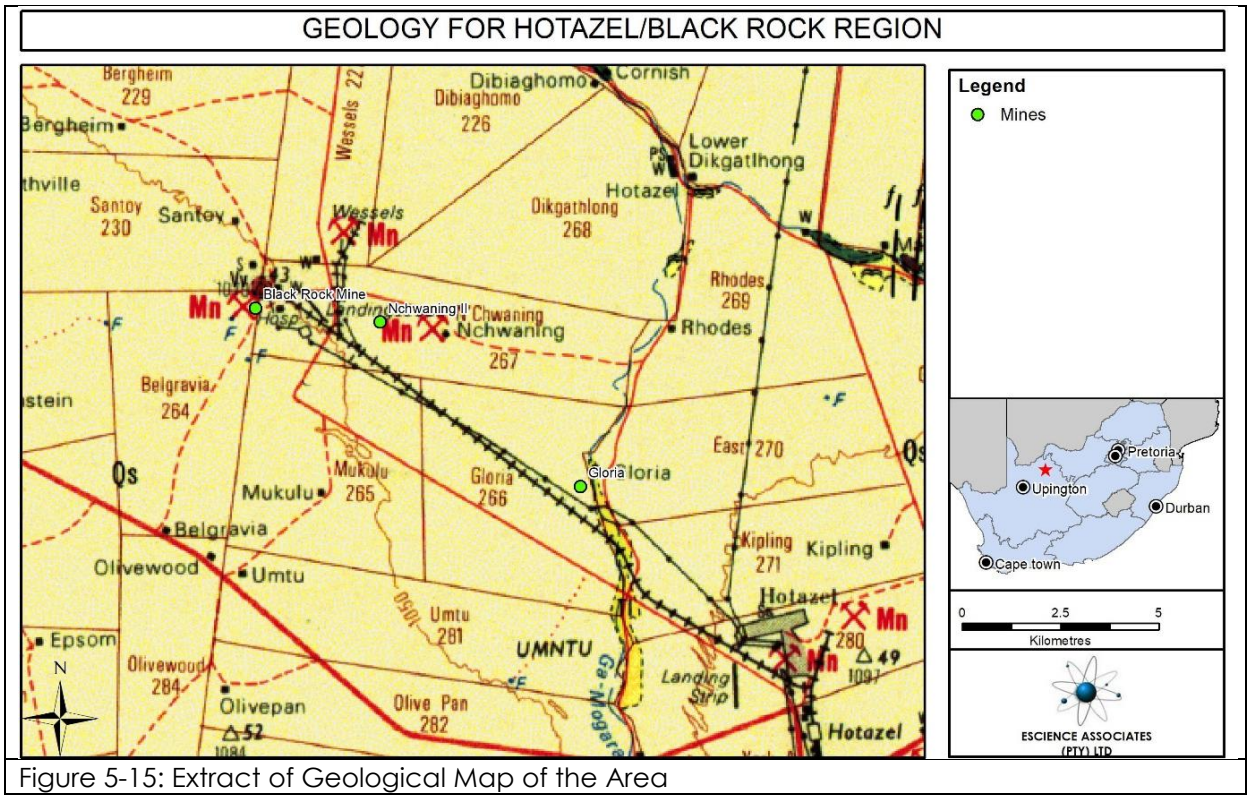


Figure 5-15: Extract of Geological Map of the Area

The Kalahari deposits are approximately Ca 65 – 2.5 million years old (Ma). The Cenozoic Kalahari Group is the most widespread body of terrestrial sediments in Southern Africa. The Cenozoic sands and calcretes of the Kalahari Group range in thickness from a few metres to more than 180 m (Partridge et al., 2006). The youngest formation of the Kalahari group is the Gordonia Formation, which is generally termed Kalahari Sand and comprises of red aeolian sands that covers most of the Kalahari Group sediments. The pan sediments of the area originated from the Gordonia Formation and contain white to brown fine grained silts, sands, and clays. Some of the pans consist of clayey material mixed with evaporates that show seasonal effects of shallow saline groundwaters. Quaternary alluvium, aeolian sands, surface limestone, silcrete, and terrace gravels are also included in the Kalahari Group (Kent 1980).

The fossil assemblages of the Kalahari are generally very low in diversity, and occur over a wide range, and thus the palaeontological diversity of this Group is low. These fossils represent terrestrial plants and animals with a close resemblance to living forms (refer to Table 5-5). Fossil assemblages include bivalves, diatoms, gastropod shells, ostracods, and trace fossils.

Table 5-5: Fossil Heritage (adapted from Almond and Pether 2009)

Subgroup/ Sequence	Group	Formation	Fossil Heritage	Comment
Tertiary-Quaternary	Kalahari	-	Terrestrial organisms	Trace fossils, ostracods, bivalves, gastropod shells, diatoms
Griqualand West Super Group	Campbell	Ghaapplato (Vgh)	Stromatolites	Cyanobacterial microfossils are present
-	Griquastad	Asbestos Hills	Stromatolites	Cynanobacterial microfossils are present

Hotazel is located in the Griqualand West Basin, Northern Cape Province, which consists of clastic sediments, as well as volcanic rocks, diamictites, and banded iron formations. Manganese deposits are present in the Hotazel Formation, upper Postmasburg Group (approximately 2222 Ma). The Vryburg Formation is the basal unit and overlies unconformably the granite and rocks of the Ventersdorp Supergroup. The Campbell Group overlies the Vryburg Formation and consists of the Schmidtsdrif Formation and the upper Ghaap Plateau Formation. The Griquatown Group is divided into two formations, namely the Asbestos Hills and Koegas Formations. The Gamagara Formation follows, and is positioned on, the Maremane Anticline, and is overlain by the Makganyene Formation. The Cox Group comprises of the lower Ongeluk Formation and the upper Voëlwater Formation. The Ongeluk Formation was deposited under water and reaches a thickness of between 400 and 900 m. This Formation is basal, and is mainly volcanic (Visser 1989). Manganese is present in the upper Voëlwater Formation (Snyman 1996). According to Kent (1980) and Snyman (1996), the Griqualand West Basin attains a maximum thickness of 4500 m.

Algal growth structures, also known as "Stromatolites", are fossil structures from the dolomites of the Transvaal Supergroup. Stromatolites are layered mounds, columns, and sheet-like sedimentary rocks. These structures were originally formed by the growth of layer upon layer of cyanobacteria, a single-celled photosynthesizing microbe. Cyanobacteria are prokaryotic cells (the simplest form of modern carbon-based life). Stromatolites are first found in Precambrian rocks, and are known as the earliest known fossils. The oxygen atmosphere that we depend on was generated by numerous cyanobacteria photosynthesizing during the Archaean and Proterozoic Era.

According to the SAHRIS palaeo-sensitivity map (Figure 5-16), there is very little chance of finding fossils in this area, and a desktop study of the area of interest is required.

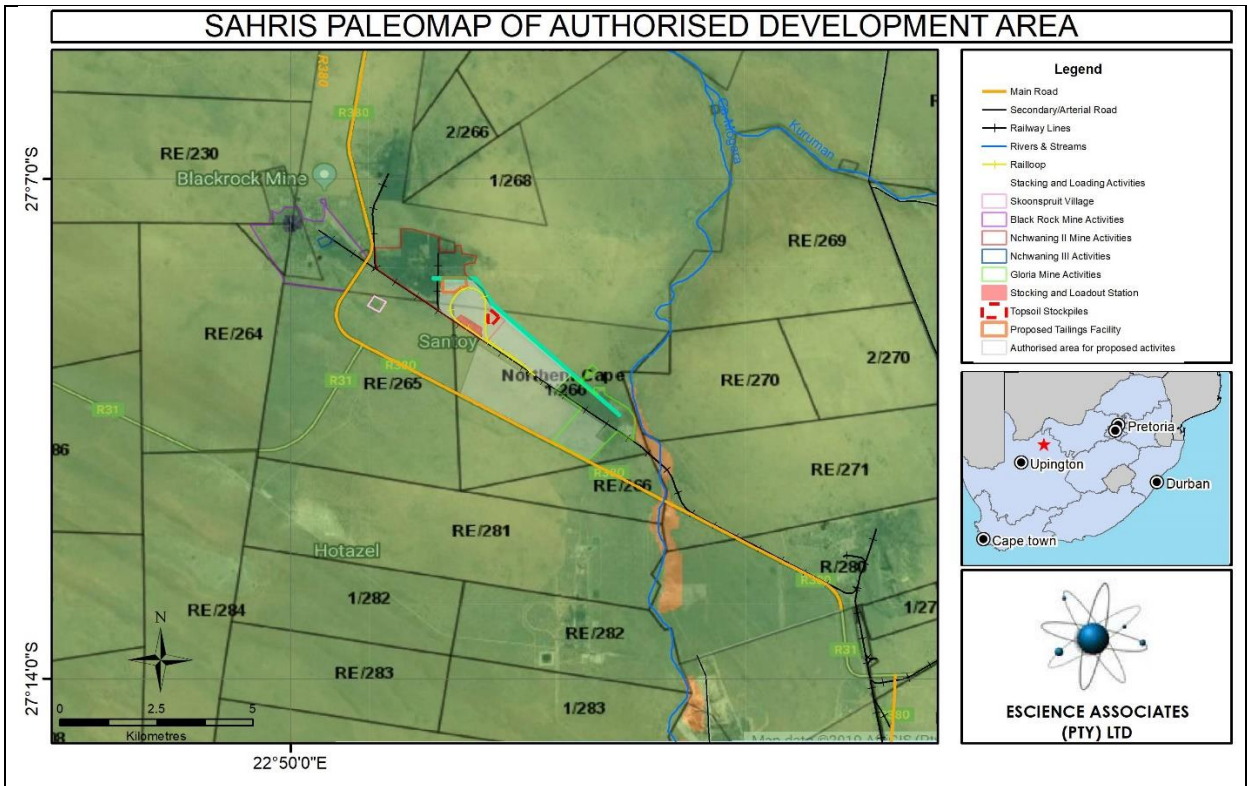


Figure 5-16: Extract of the 1: 250 000 SAHRIS Palaeo Map (Council of Geosciences)

5.5 CURRENT LAND USE

The current proposed sites are within the mining right area. All the alternatives fall within areas dominated by natural vegetation. As indicated in Figure 5-17 of this report, the region surrounding BRMO is dominated by mining, industrial, and agricultural (generally livestock production) land uses. Land in the immediate vicinity of BRMO that is not used for mining/industrial purposes, is utilised for livestock farming (i.e. sheep, goats, and cattle) and game farming (refer to Figure 5-18). The proposed site is currently reserved for mining activities.

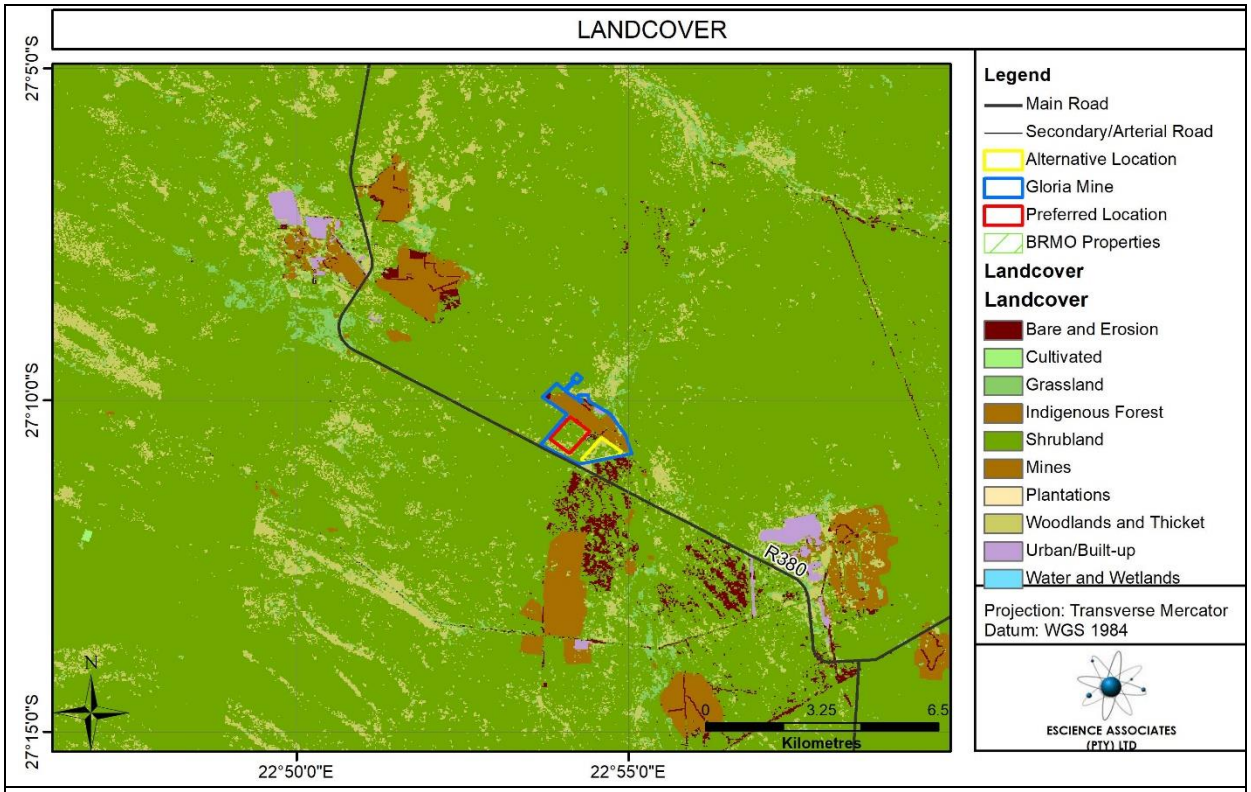


Figure 5-17: Land Cover at Gloria Mine and Surrounding Areas

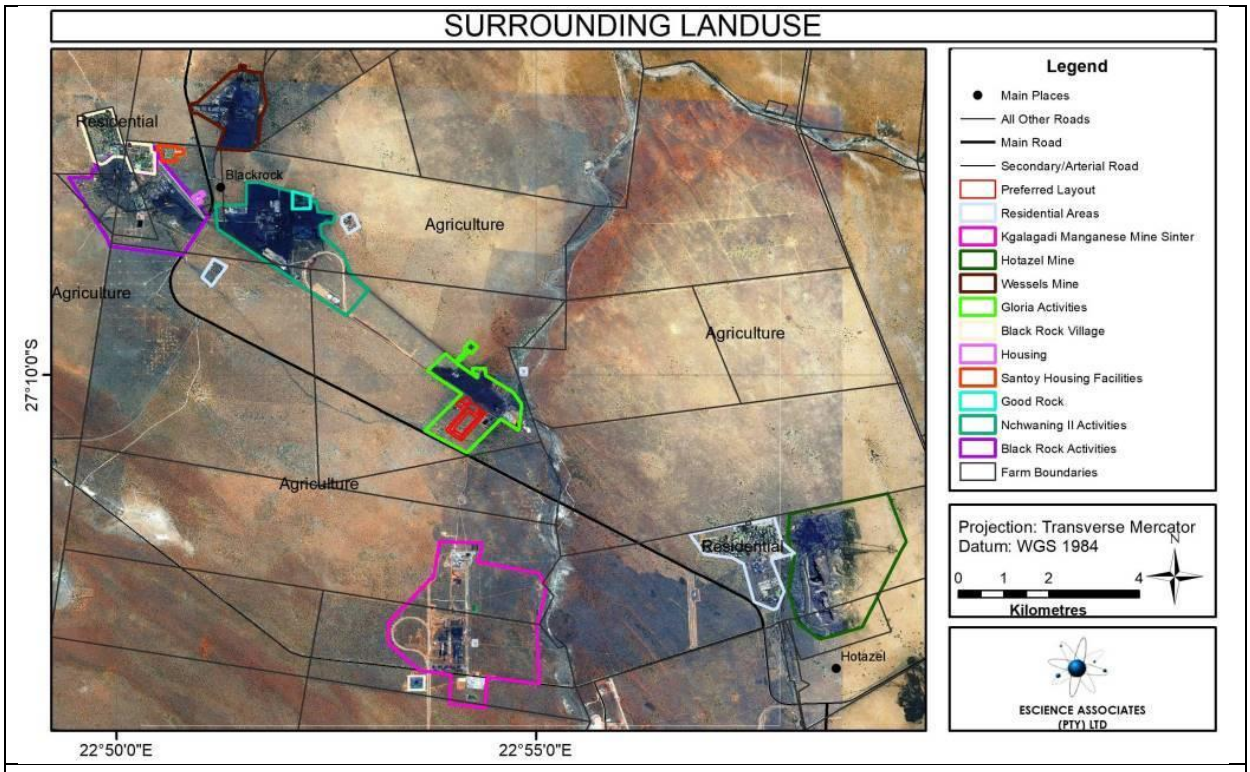


Figure 5-18: Land Use at Gloria Mine and Surrounding Areas

6 PUBLIC PARTICIPATION

6.1 INTRODUCTION

Public participation provides the opportunity for Interested and Affected Parties (IAPs) to participate in the Environmental Authorisation process on an informed basis, and to ensure that their concerns are considered during the Environmental Impact Assessment process. In so doing, a sense of ownership of the project is vested in both the project proponent and interested or affected parties. The Public Participation Process is aimed at achieving the following:

- Provide opportunities for IAPs to obtain information about the expected environmental impacts of the proposed development;
- Establish a formal platform for IAPs to raise queries and give input regarding the environmental impact of the project;
- Utilise the opportunity to formulate ways for reducing or mitigating any negative environmental impacts of the project, and for enhancing its benefits;
- Enable the applicant to consider the needs, preferences, and values of IAPs in their decisions;
- Ensure transparency and accountability in decision-making.

The public participation must include:

- Notification of the public and potential IAPs through newspaper advertisements;
- Notification of the public and potential IAPs using site notices;
- Notifying of specified IAPs, as stipulated in the EIA regulations, namely
    - the owners, occupiers, and persons in control of the site and, if the proponent or applicant is not the owner or person in control of the site, then owners, persons in control of, and occupiers of land adjacent to the site;
    - the municipal councillor of the ward;
    - the municipality which has jurisdiction in the area;
    - any organ of state having jurisdiction in respect of any aspect of the activity; and
    - any other party as required by the competent authority.
- Using reasonable alternative methods, as agreed to by the Competent Authority, in those instances where a person is desirous of, but unable to, participate in the process due to illiteracy, disability, or any other disadvantage.

The Scoping Report and the Environmental Impact Report have been availed to registered IAPs for comment and input. These comments and input must be considered accordingly, and addressed at each relevant stage in the process.

6.2 STAKEHOLDER NOTIFICATION

The public and stakeholder participation process to date has entailed the following:

- Advertising of the proposed activities and the associated S&EIR process in the Kalahari Bulletin on the 21st of March 2019 and in the Kathu Gazette on the 22nd of

March 2019. The adverts indicated where the written comments may be directed to, and who to contact in order to be registered as an IAP.
- Placement of site notices at a place conspicuous to the public at the BRMO entrance, Gloria Mine entrance, and the Black Rock Shopping Centre.
- Pre-identification and notification to Interested and Affected Parties based on the existing list of the mine's registered IAPs, including neighbouring landowners and occupiers, the ward councillor, the local municipality, the district municipality, the provincial environmental authority, and other stakeholders.
- Notifying of owners and occupiers of the land adjacent to the site where the activity is or is to be undertaken.
- Notifying relevant government stakeholders such as the municipal councillor of the ward, the local municipality, the district municipality, the provincial environmental authority, any other party required by the Competent Authority.
- Distribution of Scoping Report for public review between the 2nd of August 2019 and 30th of September 2019. Hard copies of the scoping report were distributed to several community representatives (See Appendix 1.4).

The following is to be conducted through the distribution of the Environmental Impact Report to registered Interested and Affected Parties, including:

- Notification and distribution of draft EIR to registered IAPs (including neighbouring landowners and occupiers, the ward councillor, the local municipality, the district municipality, the provincial environmental authority, and other stakeholders) for comment.

6.3 COMMENTS RECEIVED ON SCOPING REPORT

Comments on the Scoping Report were received from:

- The Competent Authority (See Appendix 3.3);
- Department of Water and Sanitation;
- South African Heritage Resource Agency;
- Leonora Cilliers and JW Van Wyk (on behalf of Mokala Manganese, adjacent landowner);
- Wonder Sigwebela (South32 Wessels Mine, adjacent landowner);
- Marcel Prinsloo.

A Comments and Responses Report was developed, which can be found as Appendix 2.

The Scoping Report was accepted by the Competent Authority on 29th of January 2020 (see Appendix 2).

6.4 COMMENTS RECEIVED ON ENVIRONMENTAL IMPACT REPORT

To be formulated upon receipt of comments from IAPs.

6.5 CONSULTATION WITH THE COMPETENT AUTHORITY

Table 6-1: Authority Consultation	
Process Phase	Details
Application	Lodge application and declaration of interest **- COMPLETE**

	Receive confirmation of application - **COMPLETE**
Scoping	Lodge Scoping Report (Including Plan of Study for EIA) - **COMPLETE**
	Consideration of Scoping Report and PoS for Environmental Impact Assessment - **COMPLETE**
	Receive confirmation of acceptance of Scoping Report and PoS EIA - **COMPLETE**
EIR	Lodge Environmental Impact Assessment Report - **CURRENT**
	Receive confirmation of acceptance of EIR - pending
	Decision on application – pending

All comments received by Interested and Affected Parties and key commenting authorities on the draft Environmental Impact Assessment Report (EIR) were addressed in the finalisation of the EIR (where relevant), and incorporated into a final Comments and Responses Report (Appendix 2), for the review and consideration of the Competent Authority.

7 LINING REQUIREMENTS

The proposed facility is subject to the requirements gazetted in GN.R 632 of 2015: Regulations Regarding The Planning And Management Of Residue Stockpiles And Residue Deposits, 2015, as amended. According to the Regulations Regarding The Planning And Management Of Residue Stockpiles And Residue Deposits, an assessment of impacts and analyses of risks relating to the management of residue stockpiles and residue deposits is required to:

- Identify and assess the environmental impacts arising from the establishment of residue stockpiles and residue deposits, as part of an environmental impact assessment.
- Analyse risk based on the characteristics and the classification set out in Regulation 4 and 5, in order to determine appropriate mitigation and management measures.
- Recommend pollution control measures suitable for a specific residue stockpile or residue deposit, on the basis of a risk analysis as contemplated in Regulations 4 and 5.

Accordingly an assessment was undertaken to inform appropriate lining requirement for the proposed SFSF, attached in Appendix 4. The risk assessment took various factors into consideration including:

- The physical and chemical characteristics of the fines.
- The propensity for leaching.
- The characteristics of the site and receiving environment.
- The findings of the geohydrological risk assessment.

A summary of the findings is presented herein.

7.1 RISK ASSESSMENT

A composite sample of fines, from the current deposition process, was assessed, in accordance with the leaching criteria in the National Norms and Standards for the Assessment of Waste for Landfill Disposal, published in GN 635 of 2013, for mono-disposal of non-putrescible waste.

Results from the leach test exceeded the relevant LCT0 values for barium (Ba), boron (B), and manganese (Mn). Nitrates also exceeded the LCT0 value, but this is likely due to nitrate residue adsorbed to the sample materials from blasting. All other analytes are below their LCT0 values. There were no exceedances of the LCT1 values. The results are presented Table 7-1 below. The materials are classified as a Type 3 waste, based on the leach results, implying that a Class C liner is applicable for the proposed facility.

Table 7-1: Tailings Leach Test Results

Analyte	**Units**	**LCT0**	**LCT1**	**LCT2**	**LCT3**	**Leach Results**
Metal Ions						

Table 7-1: Tailings Leach Test Results						
Analyte	**Units**	**LCT0**	**LCT1**	**LCT2**	**LCT3**	**Leach Results**
Arsenic, As	mg/L	0.01	0.5	1	4	BDL
Boron, B	mg/L	0.5	25	50	200	2.24
Barium, Ba	mg/L	0.7	35	70	280	4.03
Cadmium, Cd	mg/L	0.003	0.15	0.3	1.2	BDL
Cobalt, Co	mg/L	0.5	25	50	200	BDL
Chromium, Cr	mg/L	0.1	5	10	40	BDL
Hexavalent Chromium, Cr^{6+}	mg/L	0.05	2.5	5	20	BDL
Copper, Cu	mg/L	2	100	200	800	BDL
Mercury, Hg	mg/L	0.006	0.3	0.6	2.4	BDL
Manganese, Mn	mg/L	0.5	25	50	200	1.92
Molybdenum, Mo	mg/L	0.07	3.5	7	28	BDL
Nickel, Ni	mg/L	0.07	3.5	7	28	BDL
Lead, Pb	mg/L	0.01	0.5	1	4	BDL
Antimony, Sb	mg/L	0.02	1	2	8	BDL
Selenium, Se	mg/L	0.01	0.5	1	4	BDL
Vanadium, V	mg/L	0.2	10	20	80	BDL.
Zinc, Zn	mg/L	5	250	500	2 000	BDL
Iron, Fe	mg/L					BDL
Inorganic anions						
TDS	mg/L	1 000	12 500	25 000	100 000	-
Chloride, Cl	mg/L	300	15 000	30 000	120 000	140
Sulphate, SO_4	mg/L	250	12 500	25 000	100 000	120
Nitrate as nitrogen, NO_3 as N	mg/L	11	550	1 100	4 400	16
Total Fluoride	mg/L	1.5	75	150	600	<4.0
Total Cyanide	mg/L	0.07	3.5	7	28	-
Waste Type						***Type 3***

Compositional analyses of the materials were also undertaken. Total concentrations (TC) exceeding the relevant TCT0 values for arsenic (As), barium (Ba), and boron (B), are noted. These are reflected in the leaching results. Manganese (Mn) concentration represents the highest TC, being recorded at a concentration exceeding the TCT2 range. This is, of course, expected as the material is a manganese bearing ore. Refer to Table 7-2. It is notable that the manganese concentration in the leach results is low (much less than LCT1).

Table 7-2: Tailings Total Concentration Test (TCT) Results					
Constituents	**Units**	**TCT0**	**TCT1**	**TCT2**	**Tailings**
Metal Ions					
Arsenic, As	mg/kg	5.8	500	2 000	9.17
Boron, B	mg/kg	150	15 000	60 000	516
Barium, Ba	mg/kg	62.5	6250	25 000	2 894
Cadmium, Cd	mg/kg	7.5	260	1040	BDL
Cobalt, Co	mg/kg	50	5 000	20 000	49.37
Chromium, Cr	mg/kg	46 000	800 000	N/A	4.79
* Hexavalent Chromium, Cr^{6+}	mg/kg	6.5	500	2 000	4.79
Copper, Cu	mg/kg	16	19 500	78 000	BDL
Mercury, Hg	mg/kg	0.93	160	640	BDL
Manganese, Mn	mg/kg	1 000	25 000	100 000	373 200
Molybdenum, Mo	mg/kg	40	1 000	4 000	BDL
Nickel, Ni	mg/kg	91	10 600	42 400	12.77
Lead, Pb	mg/kg	20	1 900	7 600	BDL
Antimony, Sb	mg/kg	10	75	300	BDL
Selenium, Se	mg/kg	10	50	200	BDL
Vanadium, V	mg/kg	150	2680	10 20	BDL
Zinc, Zn	mg/kg	240	160 000	640 000	38.7
Iron, Fe	mg/kg				45 200
Inorganic anions					
TDS	mg/kg				
Chloride, Cl	mg/kg				
Sulphate, SO4	mg/kg				
Nitrate as nitrogen, NO3 as N	mg/kg				
Total Fluoride	mg/kg	100	10 000	40 000	-
Total Cyanide	mg/kg	14	10 500	42 000	-
Waste Type Category (including Mn)					*Type 0*
Waste Type Category (Excluding Mn)					*Type 3*

In cognisance of the total concentration results, in particular manganese, it is necessary to further review potential risk associated with the deposition of the materials. BRMO undertakes water quality monitoring, at various monitoring boreholes on the site, as well as from the existing Gloria TSF return water dam. The results for analytes of interest are presented below, along with relevant discussion of the significance thereof. It must be noted that borehole GPT01 is hydraulically up-stream of GPT02. The water level at GPT01 is approximately 40 mbgl, whereas GPT02 is approximately 70 mbgl, and ground level at

GPT02 is 14 m lower than at GPT01. Groundwater flow is noted to be approximately northerly.

7.1.1 MANGANESE

The manganese within the tailings material appears to be relatively immobile, based on the manganese concentrations in the return water, and the surrounding groundwater (refer to Figure 7-1 below). The monitoring results generally indicate low or undetectable concentrations. Notably, the leach results indicate a higher concentration of manganese in the sample leachate than in the return water at the site. It is expected that the return water is more representative of the actual potential for leaching of manganese. There is a negative water balance, and thus constant replenishment of process water lost to evaporation, implying that there should be a build-up of solutes over time. Thus, the low manganese concentration the return water further supports the expectation that potential for leaching is low, and the use of leaching as a basis for selecting the class of liner should suffice, from a precautionary perspective. It is notable that all the values are well below (less than 10% of) the LCT1 threshold of 25 mg/L.

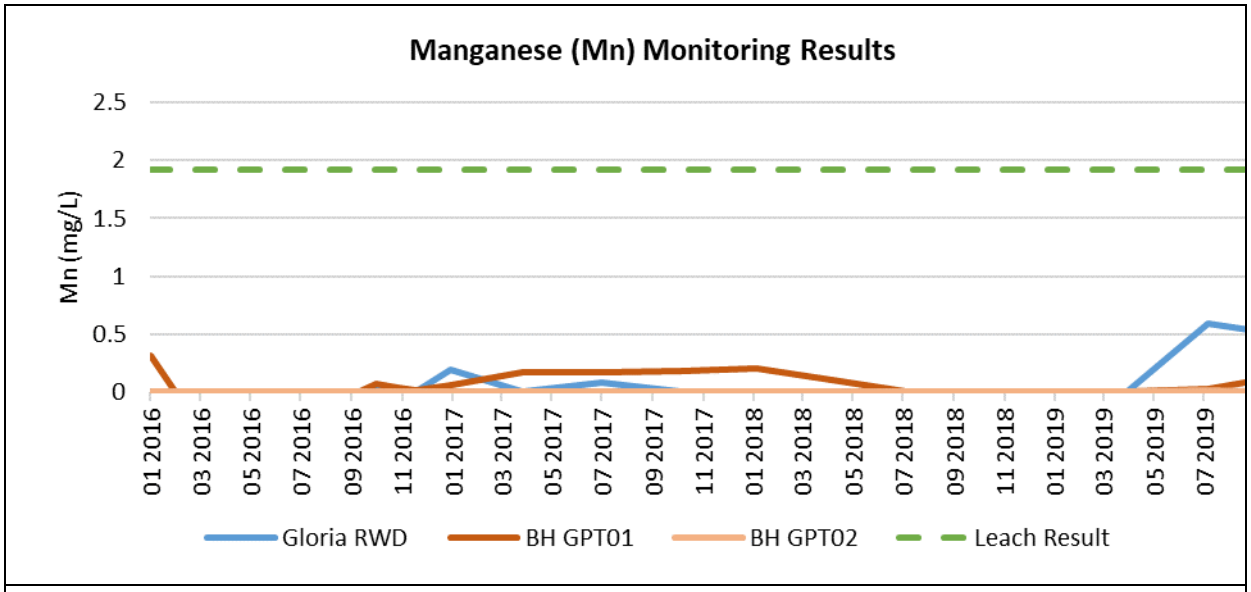


Figure 7-1: Manganese Monitoring Results, Gloria Boreholes and RWD

Further to the above, the borehole monitoring results for the rest of the site do not indicate manganese concentrations which can be associated with leaching from the existing unlined TSFs at the Nchwaning and Gloria mines. These unlined TSFs have been in operation for over 20 years. It is notable that the data does not present any evidence which would suggest that there are higher downstream concentrations of manganese in the groundwater than in the upstream groundwater. The differences in concentrations are random, with instances where upstream boreholes have higher concentrations than corresponding downstream boreholes. Refer to Figure 7-2 below.

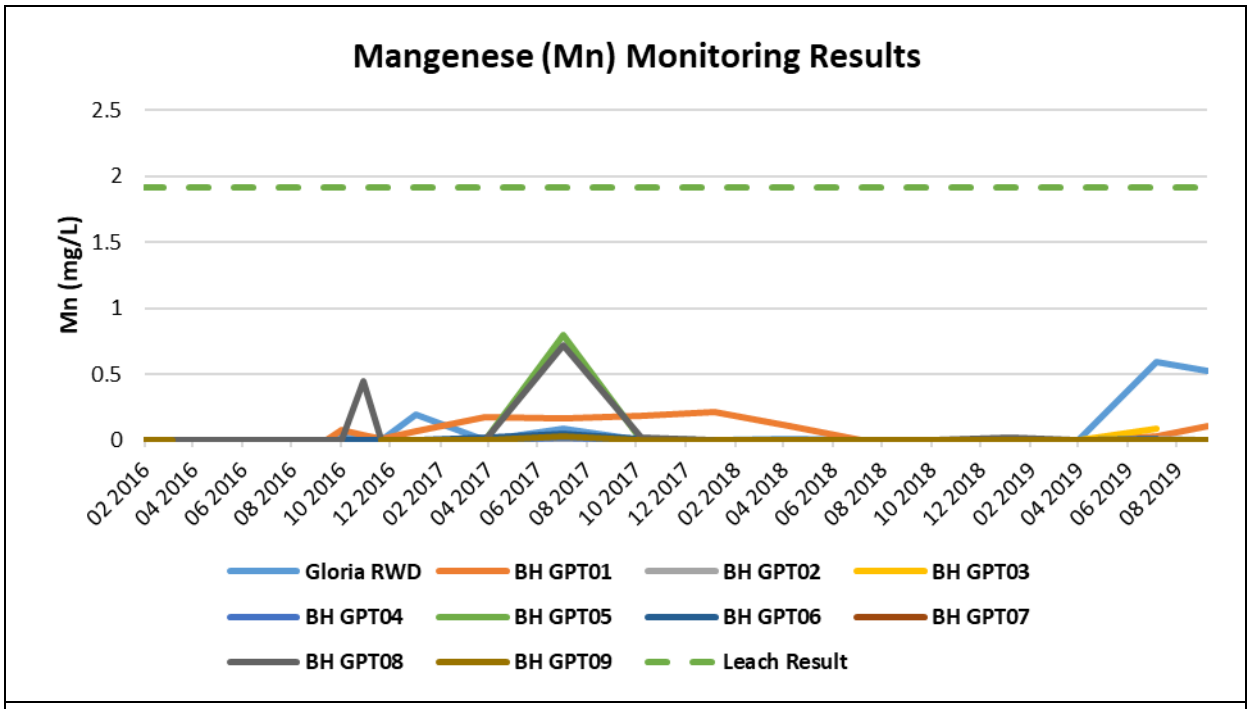


Figure 7-2: Manganese Monitoring Results, All BRMO Boreholes

7.1.2 BORON

Boron is present in concentrations, and leaches at a level that indicates that the materials should be classified as a Type 3 waste. Additionally, based on the boron concentrations in the return water (refer to Figure 7-1 above), the Type 3 three classification holds true.

The monitoring results generally indicate low concentrations of boron in the groundwater. Notably, the return water analyses indicate a higher concentration of boron than the leach results. As previously noted, there is a negative water balance, and thus constant replenishment of process water lost to evaporation, implying that there should be a build-up of solutes over time. The existing TSF has been in operation for over 20 years. This may explain the higher boron levels in the return water. It is notable that the all the values are still well below the LCT1 threshold of 25 mg/L.

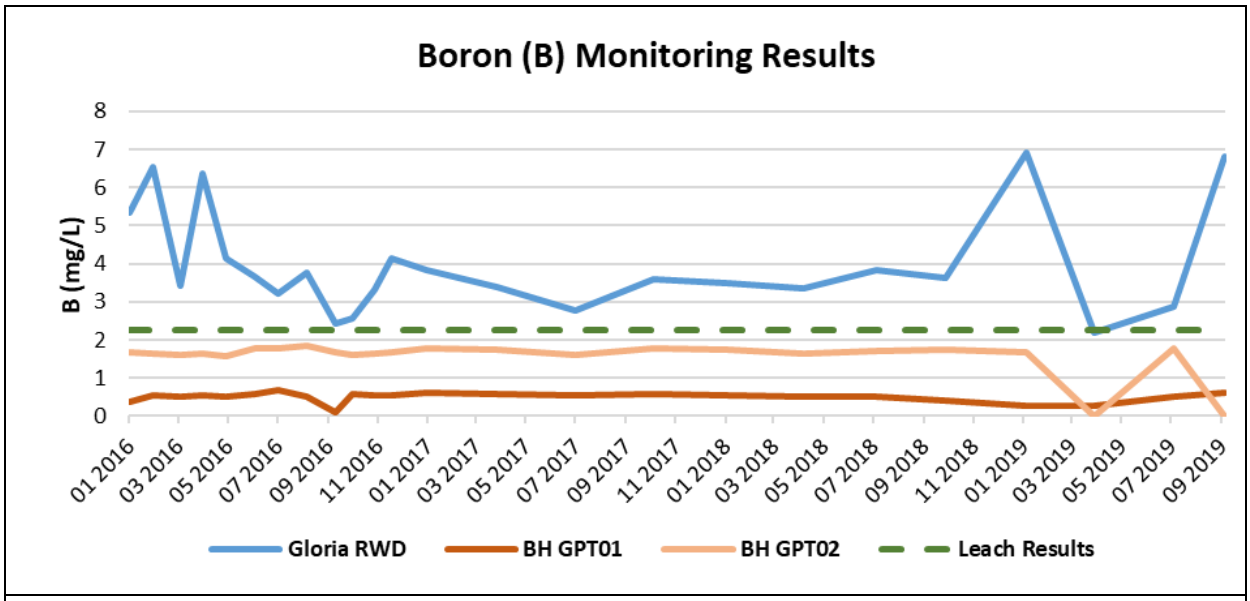


Figure 7-3: Boron Monitoring Results, Gloria Boreholes and RWD

As with manganese, the borehole monitoring results for the rest of the site do not indicate boron concentrations which can be associated with leaching from the existing unlined TSFs at the Nchwaning and Gloria mines. These unlined TSFs have been in operation for over 20 years. It is notable that the data does not present any evidence which would suggest that there are higher downstream concentrations of boron in the groundwater than in the upstream groundwater. The differences in concentrations are random, with instances where upstream boreholes have higher concentrations than corresponding downstream boreholes. Refer to Figure 7-4 below.

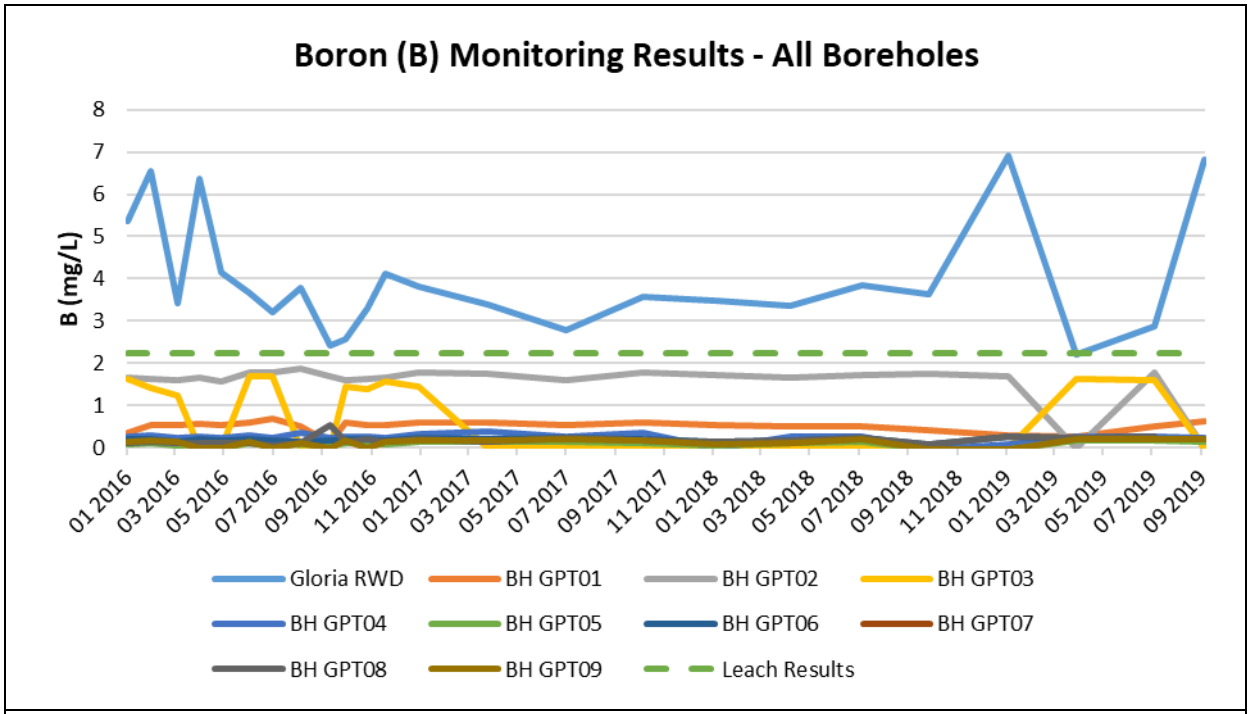


Figure 7-4: Boron Monitoring Results, All BRMO Boreholes

7.1.3 BARIUM

Barium is present in concentrations, and leaches at a level that indicates that the materials should be classified as a Type 3 waste. Barium concentrations in the return water (refer to Figure 7-1 above) are much lower than the leach results, and are, in fact, below the LCT0 of 0.7 mg/L. The monitoring results generally also indicate very low concentrations of boron in the groundwater. The conclusion, that a Type 3 classification applies, is still applicable, from a precautionary perspective.

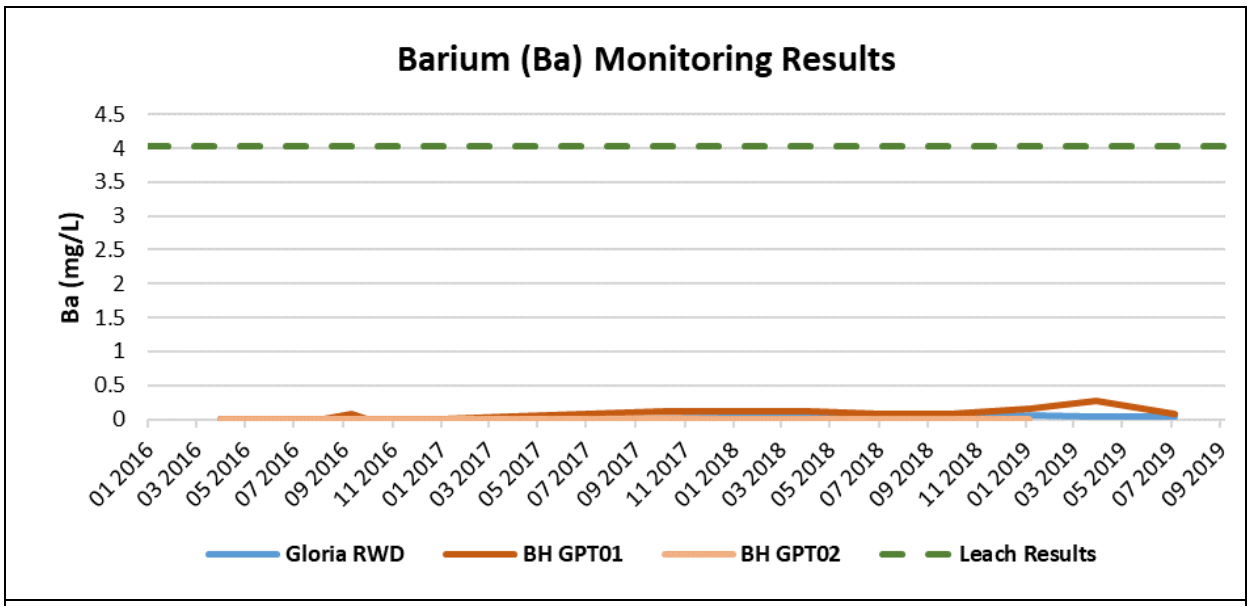


Figure 7-5: Barium Monitoring Results, Gloria Boreholes and RWD

As with manganese, the borehole monitoring results for the rest of the site do not indicate barium concentrations which can be associated with leaching from the existing unlined TSFs at the Nchwaning and Gloria mines. These unlined TSFs have been in operation for over 20 years. It is notable that the data does not present any evidence which would suggest that there are higher downstream concentrations of barium in the groundwater than in the upstream groundwater. The differences in concentrations are random, with instances where upstream boreholes have higher concentrations than corresponding downstream boreholes. Refer to Figure 7-6 below.

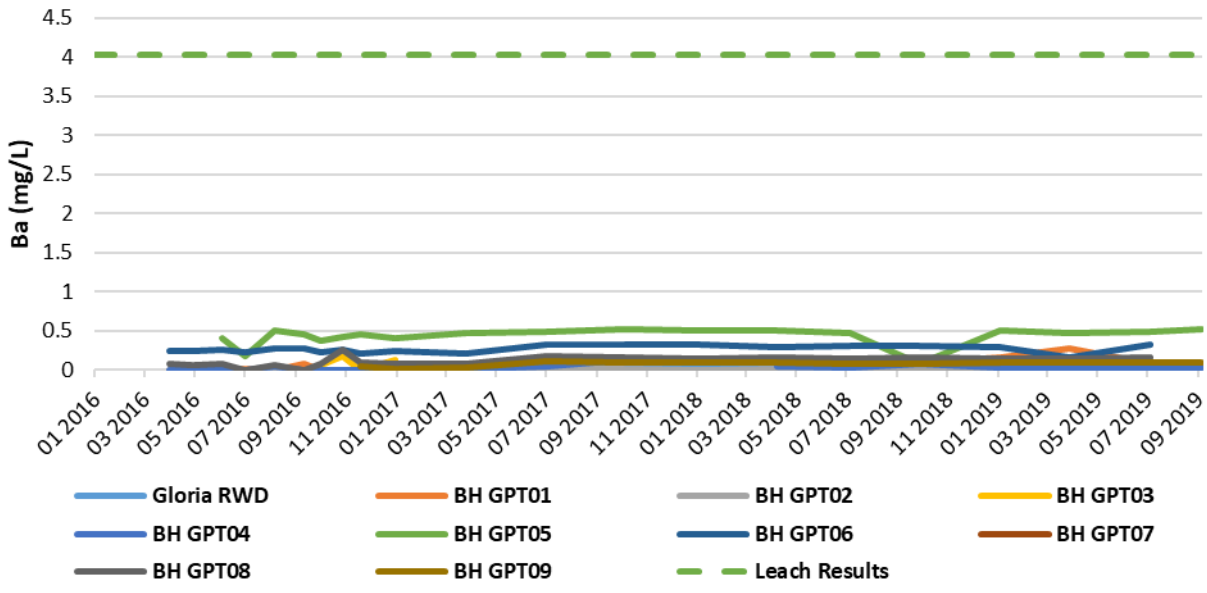


Figure 7-6: Barium Monitoring Results, All BRMO Boreholes

7.1.4 NITRATES

Nitrates are present in the leach at a level that indicates that the materials should be classified as a Type 3 waste. Additionally, based on the nitrate concentrations in the return water (refer to Figure 7-7 below), the Type 3 three classification holds true. The conclusion, that a Type 3 classification applies, is still applicable, from a precautionary perspective.

The monitoring results generally indicate potentially significant concentrations of nitrates in the groundwater. The borehole monitoring results for the rest of the site also indicate nitrate concentrations of potential significance. Refer to Figure 7-8 below. According to a BRMO geohydrological impact assessment, undertaken by Envass (Report Number: GEO-REP-107-18-19), in an effort to characterise potential nitrate sources at the site, isotopes were analysed in the water and soil samples taken at the site. The water isotope results were plotted against measured NO_3-N concentrations, and interpreted based on observations made by Tredoux (1993). All of the site borehole samples plotted within the soils sector of the diagram. The natural groundwater concentrations for the site area are expected to be elevated (Tredoux, 2009).

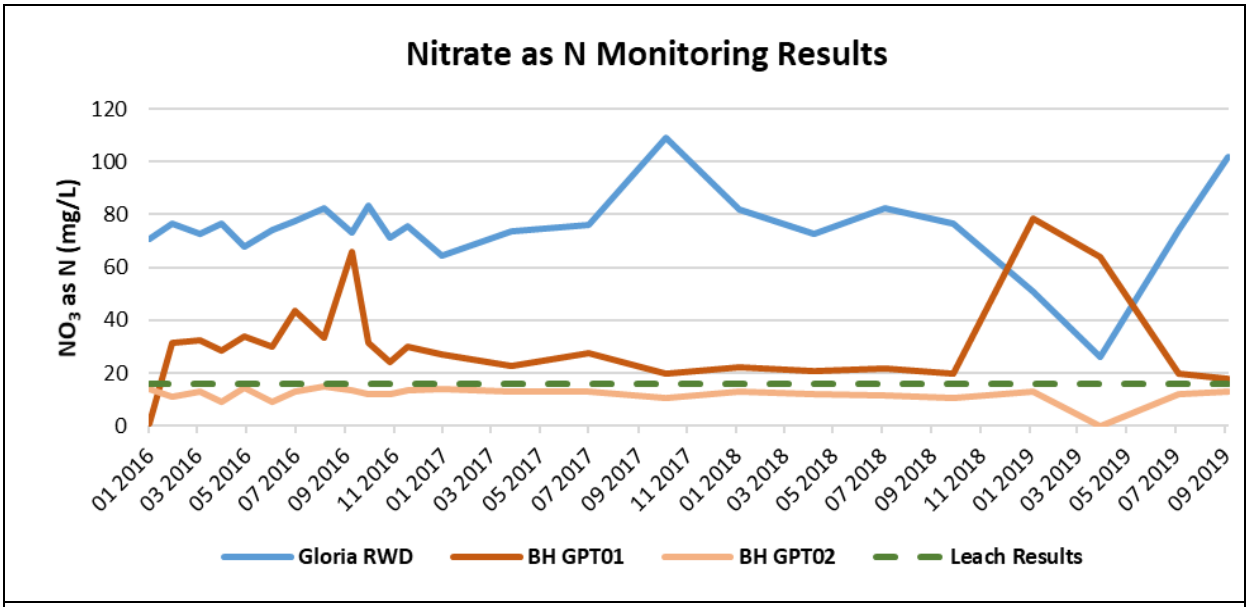


Figure 7-7: Nitrate Monitoring Results, Gloria Boreholes and RWD

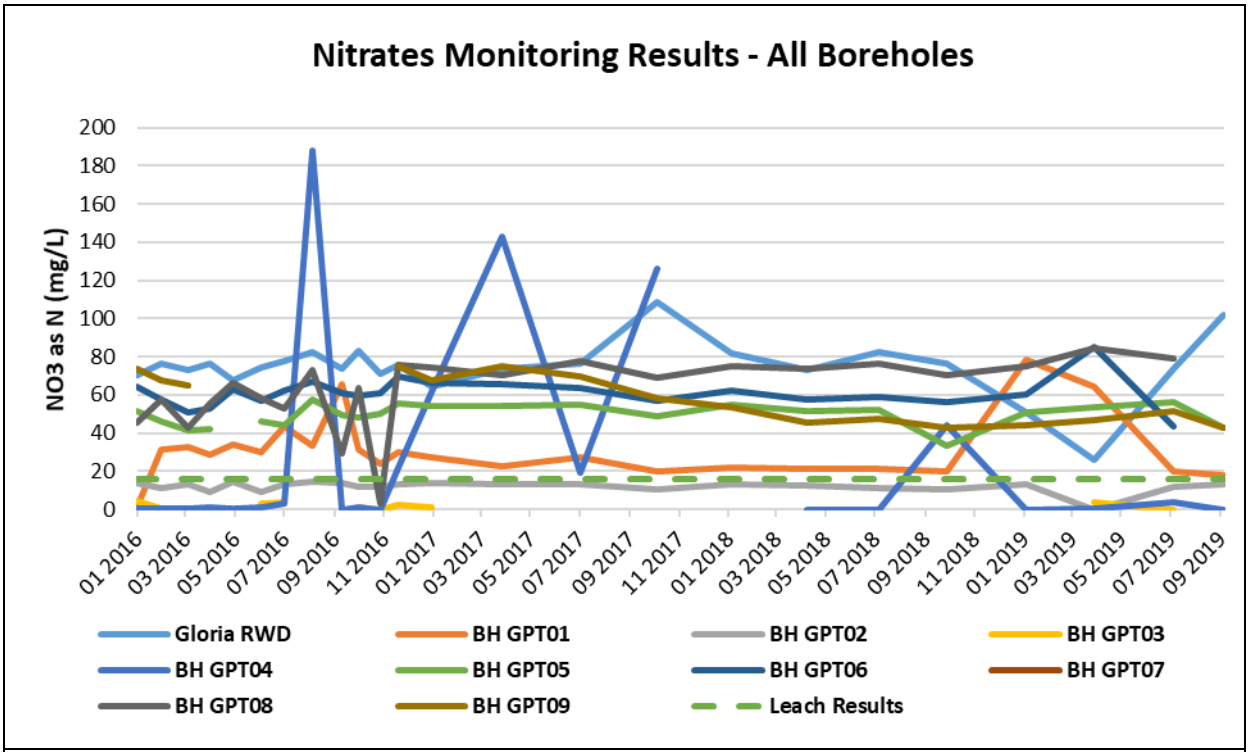


Figure 7-8: Nitrate Monitoring Results, All BRMO Boreholes

7.1.5 ACID GENERATION POTENTIAL

The pH of both the ground water and the return water is slightly alkaline, more so for the return water, and relatively consistent over the period reported (refer to Figure 7-9 below). Given that the ore is a carbonate ore, and that no potential acid generating minerals have been identified in the ore, the potential for generation of acid leach is negligible. This is reflected in the alkaline return water, which is recirculated for transporting tailings the existing TSF.

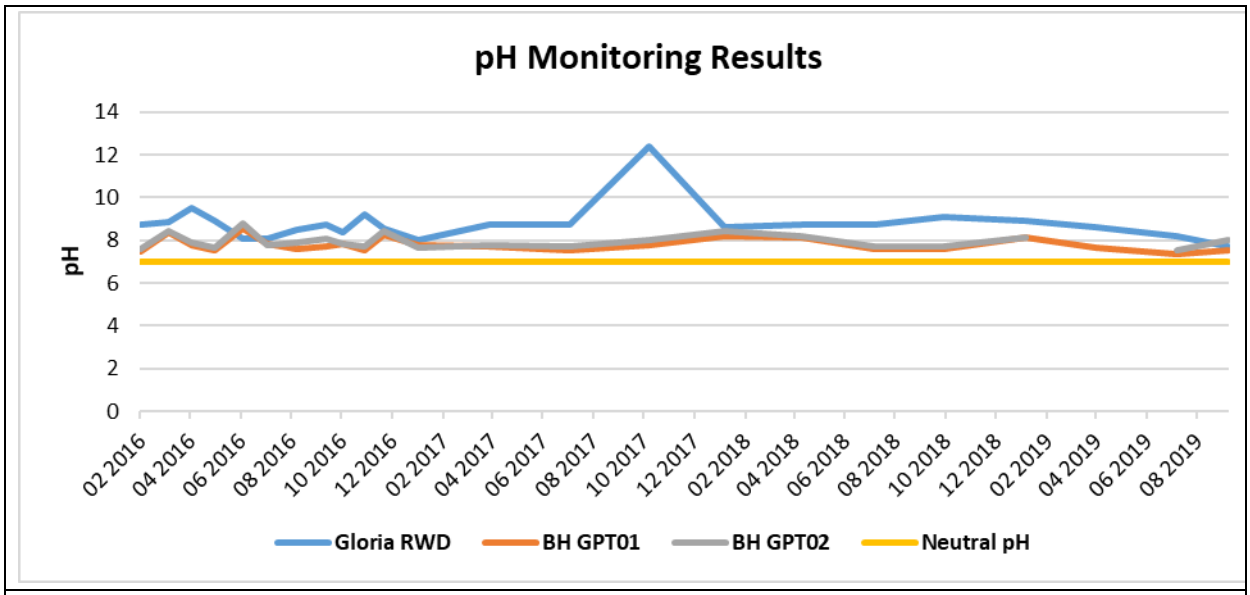


Figure 7-9: pH Monitoring Results, Gloria Boreholes and RWD

7.1.6 GROUNDWATER IMPACT ASSESSMENT

The finding of the geohydrologist are presented in 8.3.2 of this report. Of particular importance is that the assessment recommends that a Class C liner or equivalent be used.

7.1.7 OTHER RISKS

Surface water impact assessment is in alignment with the that presented in 8.3.3 of this report. The findings of the safety classification is also taken into account as per the Code of Practice for Mine Residue (SANS 10286), as presented in section 9.2.2 of this report.

7.2 CONCLUSIONS

In respect of lining for the proposed Gloria tailings facility, it is recommended that an equivalent Class C liner be approved, in cognisance of the risks assessed, in particular:

- The findings of the groundwater specialist's assessments and their recommendations.
- The findings of the waste type analysis.
- The leach results for tailings.
- Existing monitoring results for the site, which span over seven years.
- The climatic water balance, and the absence of evidence of surface water flow.

It is notable that, with exception of total manganese concentration in the fines, a Class C liner would be applicable, in terms of the NEMWA National Norms and Standards for Disposal of Waste to Landfill, gazetted in GN 636 of 2013, as informed by the National Norms and Standards for the Assessment of Waste for Landfill Disposal (GN 635 of 2013). It is, however, also notable that the manganese is not mobile, as evidenced in the leach tests, as well as the composition of carrier water currently in use for hydraulic transport of the fines to the current TSF. There is no evidence of significant manganese concentrations in the borehole monitoring data either, that can be attributed to leaching from existing tailings facilities at BRMO which are not lined and have been in existence for over 20 years.

It is also notable that, per the site's Water Use Licence:

- Condition 11.5 of Appendix IV of the existing WUL requires *"All authorised future expansion works must be lined in accordance with a Class C barrier system from Regulation 636 of National Environmental Management: Waste Act. Act No. 59 of 2008 or equivalent as a concrete structure above ground compliant with BS 8007 for retaining structures."*

The recommendations and management measures as detailed in the groundwater assessment (GPT, 2020) should be implemented unless otherwise stipulated by the site's Water Use Licence.

8 ENVIRONMENTAL ASPECTS & IMPACTS

Below is a detailed analysis/interrogation of environmental aspects, and their associated impacts relating to the proposed project. Differentiation is made between the significance of impact, and priority for the management of an impact, which is determined by impact significance, and existence/stipulations of applicable legislation. Note that this section indicates general mitigation measures, and these are then detailed in the Environmental Management Programme. Due to the relative proximity of the sites to each other and similarity of the features therein the impact assessment has been undertaken concurrently for the site alternatives, and the final confirmation of the preferred site as presented in section 9 of this report, where the potentially significant differences between the sites are noted as well the concern raised by the neighbouring Mokala Manganese mine with respect to proximity of the alternative site to their planned opencast mine.

8.1 METHODOLOGY

The findings and conclusion of the specialists apply where specialist assessments have been undertaken, as per the approved plan of study for EIA. The specialist assessments are attached in Appendix 3, and should be referred to where detailed review is desired. Cumulative impacts are addressed where relevant.

The following methodology is used to determine the significance of environmental impacts, where a specialist study was not deemed necessary as per the plan of study for EIA in the approved scoping report.

8.1.1 TYPE/NATURE OF IMPACTS

Potential environmental impacts may either have a positive or negative effect on the environment, and can in general be categorised as follows:

a. Direct/Primary Impacts

Primary impacts are caused directly due to the activity, and generally occur at the same time and at the place of the activity.

b. Indirect/Secondary Impacts

Secondary impacts induce changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken.

c. Cumulative Impacts

Cumulative impacts are those that result from the incremental impact of the activity on common resources, when added to the impacts of the other past, present, or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time, and can include both direct and indirect impacts.

8.1.2 DETERMINING SIGNIFICANCE

The following criteria were used to determine the significance of an impact. The scores associated with each of the levels within each criterion are indicated in brackets, after each description [like this].

8.1.2.1 Nature

Nature (N) considers whether the impact is:

- Positive [- ¼];
- Negative [+1].

8.1.2.2 Extent

Extent (E) considers whether the impact will occur:

- On site [1];
- Locally: within the vicinity of the site [2];
- Regionally: within the local municipality [3];
- Provincially: across the province [4];
- Nationally or internationally [5].

8.1.2.3 Duration

Duration (D) considers whether the impact will be:

- Very short term: a matter of days or less [1];
- Short term: a matter of weeks to months [2];
- Medium term: up to a year or two [3];
- Long term: up to 10 years [4];
- Very long term: 10 years or longer [5].

8.1.2.4 Intensity

Intensity (I) considers whether the impact will be:

- Negligible: there is an impact on the environment, but it is negligible, having no discernible effect [1];
- Minor: the impact alters the environment in such a way that the natural processes or functions are hardly affected; the system does however, become more sensitive to other impacts [2];
- Moderate: the environment is altered, but function and process continue, albeit in a modified way; the system is stressed but manages to continue, although not with the same strength as before [3];
- Major: the disturbance to the environment is enough to disrupt functions or processes, resulting in reduced diversity; the system has been damaged and is no longer what it used to be, but there are still remaining functions; the system will probably decline further without positive intervention [4];
- Severe: the disturbance to the environment destroys certain aspects and damages all others; the system is totally out of balance and will collapse without major intervention or rehabilitation [5].

8.1.2.5 Probability

Probability (P) considers whether the impact will be:

- Unlikely: the possibility of the impact occurring is very low, due either to the circumstances, design, or experience [1];
- Likely: there is a possibility that the impact will occur, to the extent that provisions must be made for it [2];

- Very likely: the impact will probably occur, but it is not certain [3];
- Definite: the impact will occur regardless of any prevention plans, and only mitigation can be used to manage the impact [4].

8.1.2.6 Mitigation or Enhancement

Mitigation (M) is about eliminating, minimising, or compensating for negative impacts, whereas enhancement (H) magnifies project benefits. This factor considers whether –

- A negative impact can be mitigated:
- Unmitigated: no mitigation is possible or planned [1];
- Slightly mitigated: a small reduction in the impact is likely [2];
- Moderately mitigated: the impact can be substantially mitigated, but the residual impact is still noticeable or significant (relative to the original impact) [3];
- Well mitigated: the impact can be mostly mitigated, and the residual impact is negligible or minor [4];

A positive impact can be enhanced:

- Unenhanced: no enhancement is possible or planned [1];
- Slightly enhanced: a small enhancement in the benefit is possible [2];
- Moderately enhanced: a noticeable enhancement is possible, which will increase the quantity or quality of the benefit in a significant way [3];
- Well enhanced: the benefit can be substantially enhanced to reach a far greater number of receptors or recipients and/or be of a much higher quality than the original benefit [4].

8.1.3 CALCULATING IMPACT SIGNIFICANCE

The table below summarises the scoring for all the criteria.

Table 8-1: Scoring for Significance Criteria

CRITERION	SCORES					
	- ¼	1	2	3	4	5
N-nature	positive	negative	-	-	-	-
E-extent	-	site	local	municipal	provincial	national
D-duration	-	very short	short	moderate	long	very long
I-intensity	-	negligible	minor	moderate	major	severe
P-probability	-	very unlikely	unlikely	likely	very likely	definite
M-mitigation	-	none	slight	moderate	good	-
H-enhancement	-	none	slight	moderate	good	-
R-reversibility	-	none	slight	moderate	good	-

Impact significance is a net result of all the above criteria. The formula proposed to calculate impact significance (S) is:

- For a negative impact: S = N x (E+D) x I x P ÷ ½(M+R); and
- For a positive impact: S = N x (E+D) x I x P x (H).

Negative impacts score from 2 to 200. Positive impacts score from – ½ to -200.

8.1.4 UNDERSTANDING IMPACT SIGNIFICANCE

The following is a guide to interpreting the final scores of an impact (for negative impacts):

Table 8-2: Final Significance Scoring		
Final Score (S)	Impact Significance	
0 – 10	Negligible	The impact should result in no appreciable damage to the environment, except where it has the opportunity to contribute to cumulative impacts.
10 – 20	Low	The impact will be noticeable but should be localised or occur over a limited time period, and not cause permanent or unacceptable changes; it should be addressed in an EMP and managed appropriately.
20 – 50	Moderate	The impact is significant and will affect the integrity of the environment; effort must be made to mitigate and reverse this impact. In addition, the project benefits must be shown to outweigh the impact.
50 – 100	High	The impact will affect the environment to such an extent that permanent damage is likely, and recovery will be slow and difficult; the impact is unacceptable without real mitigation or reversal plans. Project benefits must be proven to be very substantial; the approval of the project will be in jeopardy if this impact cannot be addressed.
100 – 200	Severe	The impact will result in large, permanent, and severe impacts, such as sterilising of essential environmental resources, local species extinctions, and/or eco-system collapse; project alternatives that are substantially different should be considered, otherwise the project should not be approved.

8.2 CONSTRUCTION PHASE IMPACTS

This phase of the project involves all those activities related to preparation of the site, and subsequent construction/establishment of the various project structures and associated surface infrastructure thereon, once prepared. It is envisaged that the construction period will last for approximately one year.

The construction phase will broadly consist of:

- Removal and relocation of protected plant species;
- Clearing of remaining vegetation, and establishment of roads, contractor laydown area(s), and project service facilities;
- Excavation and stockpiling of topsoil;
- Excavation and stockpiling of subsoil;
- Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for the SFSF and RWD;
- Liner installations;
- Installation of fines and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works);
- Commissioning;
- Erecting a fence around the SFSF.

8.2.1 ARCHAEOLOGICAL HERITAGE RESOURCES

A specialist Heritage Assessment was undertaken as per the approved plan of study for EIA. A survey of literature was undertaken, in order to obtain background information regarding the area. Field surveys were conducted according to generally accepted HIA

practices, and were aimed at locating all possible objects, sites, and features of cultural significance in the area of the proposed development.

No sites of cultural heritage importance were identified. However, Stone Age sites were previously identified in the wider geographical area. This implies that there is the possibility of uncovering sites, although it is important to note that such discoveries have not been reported during the excavations carried out for the wider BRMO expansion which commenced circa 2013, and the Gloria plant upgrade which is on-going in 2020.

8.2.1.1 Management and Mitigation

The specialist recommends as follows:

- This assessment report is seen as ample mitigation, and the development may therefore continue, but only after receiving the necessary approval from SAHRA.
- Any of the two proposed sites many be utilised.
- It should be remembered that due to archaeological sites being subterranean in essence, it is possible that all cultural sites may not have been identified. Care should therefore be taken when development work commences that, if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.
- Proposed management measures for potential impacts, which should be followed as Heritage Protocol and Chance Find Procedure :
    - Loose stone tools found are usually of minor significance and should just be left as it is.
    - Areas where a substantial number of stone tools are found together should be geo-referenced and left alone until such time as an archaeologist can visit the site to determine its significance.
    - Although chances of finding Iron Age remains are slim, it should be treated similar to the above. Potshards found out of context should be left alone, but areas with stone walling or substantial pottery and other cultural remains should be geo-referenced and left alone until investigated by an archaeologist.
    - All buildings and remains of buildings and other structures believed to be older than 60 years should be geo-referenced and left alone until and a heritage expert can be called in to determine the cultural significance thereof.
    - Graves should be left in situ, geo-referenced and left alone until investigated by an archaeologist.
    - Should any of the above be identified, the area should be demarcated to ensure no impact until further investigation has been done.

Mitigation should be in accordance with the recommendations by SAHRA, and in the event of archaeological/paleontological evidence being uncovered, the following is generally required in terms of the National Heritage Resources Act (Act 25 of 1999), but will be updated upon final input from SAHRA:

- 38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA.

- 38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA.
- 38(4)e – The following conditions apply with regards to the appointment of specialists: If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.

8.2.2 PALEONTOLOGICAL RESOURCES

A specialist paleontological desktop assessment was undertaken, as per the approved plan of study for EIA. The specialist notes that the site is completely underlain by the Cenozoic Kalahari Group, as well as underlying Griqualand West Basin rocks, Transvaal Supergroup. According to the Palaeo Map of the South African Heritage Resources Information System, the Palaeontological Sensitivity of the Kalahari Group is low, and the Griqualand West rocks of the Transvaal Supergroup is moderate.

The specialist concluded that the construction and operation of the Super Fines Storage Facility is deemed appropriate and feasible, and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised, as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

8.2.2.1 Management and Mitigation

If fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the Chance Find Protocol must be implemented by the ECO in charge of these developments. These discoveries must be secured (preferably in situ) and the ECO must alert SAHRA so that appropriate mitigation (e.g. documentation and collection) can be undertaken by a professional palaeontologist.

The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university), and all fieldwork and reports should meet the minimum standards for palaeontological impact studies, as developed by SAHRA.

Mitigation should be in accordance with the recommendations by SAHRA and, in the event of archaeological/paleontological evidence being uncovered, the following is generally required in terms of the National Heritage Resources Act (Act 25 of 1999), but will be updated upon final input from SAHRA:

- 38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA.

- 38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA.
- 38(4)e – The following conditions apply with regards to the appointment of specialists: If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.

8.2.3 BIODIVERSITY

A specialist biodiversity assessment was undertaken as per the approved plan of study for EIA. The specialist identified the environmental aspects and impacts, as summarised in Table 8-3 below.

Table 8-3: Biodiversity Activities And Aspects Register

Construction and Operational Phase
• Site clearing and the removal of vegetation. • **Impact:** Loss of faunal habitat and potential loss of faunal SCC.
• The proliferation of AIP species that colonise areas of increased disturbances, and that outcompete native species, including the further transformation of adjacent or nearby natural areas. • **Impact:** Loss of favourable faunal habitat outside of the direct development footprint, including a decrease in faunal diversity and potential loss of faunal SCC.
• Potential failure to concurrently rehabilitate bare areas or disturbed sites as soon as they become available, potentially resulting in proliferation of AIPs. • **Impact:** Long-term loss of favourable habitat for the establishment of faunal species, including a loss of faunal diversity.
• Potentially poorly managed edge effects: • Ineffective rehabilitation of compacted areas, bare soils, or eroded areas, leading to a continual proliferation of AIP species in disturbed areas, and subsequent spread to surrounding natural areas, altering the faunal habitat. • **Impact:** Loss of faunal habitat, diversity, and SCC within and adjacent to the footprint area of the SFSF. Loss of surrounding faunal diversity and faunal SCC through the displacement of indigenous flora by AIP species - especially in response to disturbance in natural areas.
• Habitat fragmentation, resulting from the expansion activities and poorly rehabilitated areas. • **Impact:** Long-term changes in faunal structure, altered genetic fitness, and potential loss of SCC.
• Potential overexploitation through the removal and/or collection/hunting of important or sensitive faunal SCC beyond the direct footprint area. • **Impact:** Local loss of faunal SCC abundance and diversity.
• Risk of contamination from all operational facilities may pollute the receiving environment. • **Impact:** Altered faunal habitat.
• Potential seepage affecting soils and the groundwater regime.

• **Impact:** Altered faunal habitat.
• Erosion as a result of mining development, stormwater runoff, and on-going disturbance of soils due to operational activities. • **Impact:** Leading to a loss of faunal habitat.
• Potential dumping of excavated and construction material outside of designated areas, promoting the establishment of AIPs. • **Impact:** Loss of faunal habitat, diversity, and SCC.
• Dust generated during construction and operational activities accumulating on the surrounding floral species, altering the photosynthetic ability of plants and potentially further decreasing optimal growing/re-establishing conditions. • **Impact:** Decline in plant functioning, leading to loss of faunal habitat and food resources.

8.2.3.1 Floral Impact

During the field assessment, a number of NFA and NCNCA protected floral species were observed throughout the study area, and include Vachellia erioloba, V. haematoxylon, Boophone disticha, Harpagophytum procumbens, and Orbea sp. Removal/ destruction of any of these will require permits from DAFF and NCDENC. Loss of individuals from the study area, although considered a high impact, is not considered detrimental for the conservation of these species within the province. Loss of individuals should still be minimised by implementing a rescue and relocation plan for herbaceous species, as well as by limiting the development footprint to what is essential, and actively managing edge effects on the surrounding natural area.

Even with mitigation, latent impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified, and which are relevant to the study area and proposed development:

- Continued loss and fragmentation of floral habitat of increased sensitivity, i.e. Kathu Bushveld;
- Continued loss of, and altered, floral species diversity;
- Alien and invasive plant proliferation, particularly in sensitive habitats where bare soils are left exposed; and,
- Permanent loss of floral SCC and loss/alteration of suitable habitat and resources (e.g. water and soil).

Table 8-4 below summarises the findings of the impact assessment undertaken, with reference to the perceived impacts stemming from the construction phase of the proposed development. The impacts are anticipated to be medium-low to low, provided the recommended mitigation is implemented.

Table 8-4: Impact Assessment - Biodiversity - Floral Diversity (Construction Phase)

Impact	**Habitat Unit**	**Unmanaged**	**Mitigated**
Impact on floral habitat and species diversity	Kathu Bushveld Habitat	Medium-high	Medium-Low
	Transformed Habitat	Low	Low
Impact on floral SCC	Kathu Bushveld Habitat	Medium-high	Medium-Low
	Transformed Habitat	Low	Very Low

8.2.3.2 Faunal Impact

Construction of the SFSF will result in the loss of faunal habitat of intermediate sensitivity within the study area (Kathu Bushveld Habitat) as a result of the clearing of natural vegetation within the footprint area. This loss of habitat and the current planned placement of the SFSF will further lead to the loss of habitat connectivity, whilst increased activities within the study area during all phases will likely lead to the further dispersal of faunal species out of the adjacent areas. The loss of habitat connectivity, and increased anthropogenic activities, in the study area will further impact on the overall ecological integrity of the study area.

Faunal diversity within the study area is considered to be intermediate for all faunal assemblages, except amphibians with a low diversity. The sensitivities are as a result of both the constant adjacent anthropogenic activities associated with the current mining operations within the general area, as well as the lower quality of habitat available to faunal species. The construction of the proposed SFSF will initially result in the loss of species diversity as a result of habitat clearing, as well as species relocating to areas away from the disturbance. During the operational phase, some of the species may return to the areas adjacent to the SFSF, provided there is still suitable habitat remaining.

Eight protected faunal species may inhabit different regions of the study area, namely *Ardeotis kori* (Kori Bustard), *Opistophthalmus ater* (CR, TOPS), *Opistophthalmus carinatus* (Protected, NCCA 2009), *Opistophthalmus wahlbergii* (Protected, NCCA 2009), Neotis ludwigii (Ludwig's Bustard, EN), *Chamaeleo dilepis* (Common flap-neck chameleon, Protected, NCCA 2009), and *Python sebae* (African rock python, Protected, NCCA 2009).

None of the avifaunal SCC are expected to utilise the study area for breeding. As such the development of the SFSF will only result in the loss of potential foraging grounds for these species. It must be noted, however, that the surrounding natural areas are likely to provide better, more suitable foraging grounds for these species, with the study area serving only as a secondary foraging ground. As such, the development of the SFSF is unlikely to significantly impact on these avifaunal SCC. Reptile and arachnid SCC may occur within the study area, and as such the clearance of vegetation, notably for these slow moving and often sedentary species, poses a significant risk, especially as the scorpions and *Python sebae* (African rock python) will often seek refuge in underground burrows when threatened or when resting. Earth moving activities will place these species in direct harm, and as such, suitable mitigation measures must be implemented in order to minimise these risks.

Table 8-5 below summarises the findings of the impact assessment undertaken with reference to the perceived impacts stemming from the construction phase of the proposed development. The impacts are anticipated to be medium-low to low, provided the recommended mitigation is implemented.

Table 8-5: Impact Assessment - Biodiversity - Faunal Resources (Construction Phase)			
Impact	Habitat Unit	Unmanaged	Mitigated
Kathu Bushveld Habitat	Loss of faunal habitat and ecological intensity	Medium-Low	Medium-Low
	Loss of faunal diversity	Medium-Low	Low

	Impact on faunal SCC	Medium-Low	Low

8.2.3.3 Findings and Conclusions

The assessment of the study area indicated that, overall, the site is considered to be of intermediate sensitivity for floral and faunal species.

During the field assessment, a number of NFA and NCNCA protected floral species were observed throughout the study area, and include Vachellia erioloba, V. haematoxylon, Boophone disticha, Harpagophytum procumbens, and Orbea sp. Removal/ destruction of any of these will require permits from DAFF and NCDENC. Loss of individuals from the study area, although considered a high impact, is not considered detrimental for the conservation of these species within the province. Loss of individuals should still be minimised by implementing a rescue and relocation plan for herbaceous species, as well as by limiting the development footprint to what is essential, and actively managing edge effects on the surrounding natural area.

Faunal diversity and occupancy of the study area was lower than expected, but this is likely a result of the study area location, being located adjacent to the existing tailings facility, an active mining area, and being bordered by three active roads, resulting in notable habitat fragmentation. This, combined with edge effects and anthropogenic activities in the surrounding areas, has likely resulted in many faunal species seeking habitat elsewhere, contributing to the decreased diversity and abundance observed. The study area holds the potential to provide habitat to several faunal SCC, of which one, Ardeotis kori (Kori Bustard), was observed foraging on site. It is imperative that cognisance of SCC be taken, and that all required management and mitigation measures are undertaken in order to limit impacts to these species.

The impacts associated with the proposed development range from low to medium-high for all phases of the development, prior to mitigation taking place. With mitigation fully implemented, all impacts can be reduced, most notably the extent thereof.

The objective of this study was to provide sufficient information on the floral and faunal ecology of the area, together with other studies on the physical and socio-cultural environment, for the EAP and the relevant authorities to apply the principles of Integrated Environmental Management (IEM), and the concepts of sustainable development. The need for conservation, as well as the risks to other spheres of the physical and socio-cultural environment, need to be compared and considered, along with the need to ensure the sustainable economic development of the country.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement an Integrated Environmental Management (IEM) plan, and to ensure that the best long-term use of the ecological resources in the area will be made in support of the principle of sustainable development.

8.2.3.3.1 Management and Mitigation

The following mitigation measures have been recommended by the biodiversity specialists:

<u>Preconstruction</u>

- Minimise loss of indigenous vegetation and faunal habitat where possible through effective planning and limitation of the SFSF footprint to what is essential.
- It is recommended that prior to the commencement of the site clearing, the footprint area be demarcated through the use of shade-net fencing / wooden poles to prevent habitat creep into surrounding natural areas.
- Where possible, and feasible, all access roads should be kept to existing roads so as to reduce fragmentation of existing natural habitat.
- Prior to the commencement of construction activities on site, an alien vegetation management plan should be compiled for implementation throughout all development phases.
- The necessary permits need to be obtained from DEFF and NCDENC prior to the implementation of rescue and relocation activities.
- Once all floral SCC and NCNCA protected floral species within the development footprint have been identified, a rescue and relocation plan should be designed for herbaceous species – this plan must give guidance on a species level with regards to their relocation potential and requirements. Rescue activities need to take place prior to the commencement of any construction activities. Rescue and transplanting of floral species should be overseen by a contractor/ mine employee, with assistance from a suitably qualified botanist. The success of rehabilitation actions needs to be monitored quarterly for a minimum period of one year, post-relocation.

Construction Phase

Development Footprint:

- The footprint areas of all surface infrastructure must be minimised to what is absolutely essential within the designated study area.
- Vegetation outside of the footprint area is not to be cleared.
- Vegetation clearance, and commencement of construction activities, should either be scheduled to coincide with low rainfall conditions, or dust suppression implemented.
- Excavated topsoil must be stored with associated native vegetation debris for subsequent use in rehabilitation.
- Contractor laydown areas and additional temporary infrastructure areas should be placed in previously disturbed sites, as far as possible.
- No dumping of general waste or construction material on site should take place.
- As such, it is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste.
- If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder faunal rehabilitation later down the line. Spill kits should be kept on site, within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil.

- Natural habitat outside of the direct footprint areas must be avoided, and no construction vehicles, personnel, or any other construction related activities are to encroach upon these areas.
- No hunting/trapping or collecting of faunal species is allowed.
- No informal fires by construction personnel are allowed.

Alien Vegetation:

- Edge effects of all construction activities, such as erosion and alien plant species proliferation, which may affect adjacent Kathu Bushveld, need to be strictly managed, adjacent to the natural portions of Kathu Bushveld;
- An Alien and Invasive Plant Management and Control Plan must be designed and implemented in order to monitor and control alien faunal recruitment; and
- Where areas are disturbed during construction activities, spread of alien invasive species within these areas should be continually monitored and controlled throughout the construction phase.

Floral SCC:

- No collection of floral SCC or medicinal floral species within the study area or larger region must be allowed by mining personnel.
- Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC and protected floral species outside of the proposed footprint area.

Dust:

- An effective Dust Management Plan must be designed and implemented in order to mitigate the impact of dust on flora throughout the construction phase.

Fire:

- No illicit fires must be allowed during the construction phases of the proposed mining development.

Rehabilitation:

- Any natural areas beyond the proposed footprint, that have been affected by the construction activities, must be rehabilitated using indigenous species.
- All soils compacted as a result of construction activities falling outside of the project area should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas.
- Revegetation of disturbed areas should be carried out in order to restore habitat availability and minimise soil erosion.
- When rehabilitating, it is imperative that as far as possible, the habitat that was present prior to disturbances is recreated, so that faunal species that were displaced by vegetation-clearing activities are able to recolonise the rehabilitated area.

8.2.4 WASTE MANAGEMENT AND DISPOSAL

8.2.4.1 General Waste

Nominal volumes of construction and installation waste will be generated during the establishment of the proposed activities and associated infrastructure. The waste would predominantly comprise of construction rubble, packaging, and fabrication waste/s. Steel and electric cabling waste is also expected from installation. Excavated topsoil and subsoil are not considered wastes, as these will be set aside for future rehabilitation of the mine.

8.2.4.1.1 Impact Discussion & Significance Assessment

General waste, which cannot feasibly be recycled, will be disposed of at the licenced BRMO landfill, located on site at the Black Rock mine. Waste which is disposed of will have an impact at a site extent. The intensity of the impact will, however, be low, relative to cumulative local and regional waste generation volumes.

Table 8-6: Impact Assessment - General Waste			
Nature (N)	Potential negative impact on water resource quality.		1
Extent (E)	Site: These activities will all occur within BRMO. BRMO operates a licensed general landfill that will receive all unrecyclable general waste.		1
Duration (D)	Long term: Waste will be permanently placed in a landfill. Besides the landfill, impact on soil and water is only expected in the event of incorrect storage, transportation, or disposal of waste.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants have very limited possibility of entering groundwater, and would be in small quantities, and of limited risk.		2
Probability (P)	Likely: The potential for incorrect storage of waste, without proper mitigation and management in place, is high.		3
Mitigation (M)	Can be well mitigated: Providing adequate waste storage skips and bins, which will largely eliminate the potential for soil and groundwater contamination. Disposal will be to the licenced BRMO landfill.		4
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Moderate	20
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	10

8.2.4.2 Hazardous Waste

Nominal volumes of construction and installation waste will be generated during the establishment of the proposed activity and associated infrastructure. It is likely that some hazardous waste will be generated that will be required to be disposed of to a licenced hazardous landfill. Such hazardous waste would consist, in the main, of empty containers of chemicals used during construction. The nature of the proposed development is such that very few hazardous chemicals are anticipated, and would consist, in the main, of chemicals such as paints, solvents, and cleaners. Vehicle and equipment maintenance

will not be undertaken on the site in general; however, used oil and other lubricants may be generated therefrom.

8.2.4.2.1 Impact Discussion & Significance Assessment

Waste which is disposed of, will have an impact at a provincial extent. The intensity of the impact will, however, be low relative to cumulative local and regional waste generation volumes.

Table 8-7: Impact Assessment - Hazardous Waste			
Nature (N)	Potential negative impact on water resource quality		1
Extent (E)	Provincial: Hazardous wastes are expected to be minimal. These will be managed via BRMO's hazardous waste transfer facility. Hazardous wastes would, however, be disposed of, or recycled, in other provinces, due to the lack of suitable facilities locally.		4
Duration (D)	Long term: Impact on soil and water is only expected in the event of a spill outside of the bunded storage areas or during transport. The subsequent impact on groundwater, for example, may remain for several years.		5
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected, mainly due to the low quantities.		1
Probability (P)	Likely: The potential for incorrect storage of waste, without proper mitigation and management in place, is high.		3
Mitigation (M)	Can be well mitigated: Providing adequate bunded facilities for storage will largely eliminate the potential for soil and groundwater contamination. Hazardous waste, such as used oil and lubricants, will in any case be stored in sealed drums/containers. Using a suitable waste management contractor, for transporting waste to licenced management facilities, will also effectively reduce risk.		4
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Moderate	36
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	18

8.2.4.3 Management and Mitigation of General and Hazardous Waste

The mine has a waste management procedure in place, addressing waste minimisation, reuse, recovery, and recycling, as well as temporary storage and disposal. The procedure must be adopted by contractors at the start of construction activities. The procedure is included in the EMPr.

Construction waste, which can be practically recycled, must be sorted and stored for that purpose. All construction and installation waste must be stored temporarily in a manner that protects groundwater and soil, and appropriately disposed of at a suitable, permitted/licensed, disposal site (i.e. where the waste in question is classified as general waste), or stored temporarily, prior to collection by a waste disposal contractor, in the event that hazardous waste is generated.

8.2.5 AIR QUALITY

During construction, the undertaking of ground preparation and civil works may lead to the generation of vehicle and wind entrained dust. The impacts thereof include:

- Dustfall accumulating on the surrounding floral species, altering the photosynthetic ability of plants, and potentially further decreasing optimal growing/re-establishing conditions. This may result in a decline in plant functioning, leading to loss of faunal habitat and food resources, as noted in the specialist biodiversity report.
- Impact on human receptors exposed to suspended particulates through inhalation.
- Nuisance effect of dustfall on buildings, vehicles, etc.

Although the impact is likely to be localised to the site, due the size of the area to be worked, dust suppression techniques such as wetting roads, or application of dust palliatives, may be required. Other emissions during construction, such as construction vehicle and machinery exhausts, are not anticipated to be significant. The cumulative impact is not anticipated to be significant as the exiting monitored dustfall from BRMO activities is within the limits stipulated in the National Dust Control Regulations (GN.R 827 2013).

8.2.5.1 Impact Discussion & Significance Assessment

The impact will be of a low intensity, and isolated to the site and its immediate surrounds. Effective mitigation, in the form of accepted dust suppression techniques, can be applied, but will not likely mitigate the potential occurrence of the impact in its entirety.

Table 8-8: Impact Assessment - Air Quality			
Nature (N)	Negative impact on ambient air quality.		1
Extent (E)	Locally: Localised to the site and immediate surrounds.		2
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected by dust and dust deposition.		2
Probability (P)	Definite: Construction activities and transport of materials will result in entrainment of particulate matter.		5
Mitigation (M)	Moderately mitigated: Effective dust suppression methods are readily available for transport, but less so for excavation and materials handling.		3
Reversibility (R)	Upon completion of construction, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	11

8.2.5.2 Management and Mitigation

The applicant must institute effective dust suppression measures on all un-surfaced access roads, for the duration of the construction phase, as per the requirements of the approved mine EMPr (DMR reference: NC 30/5/1/2/3/2/1/203 EM). Compliance with the National Dust Control Regulations (GN.R 827 2013) must be monitored. Monitoring of

dustfall at the boundary of Gloria Mine, adjacent to the proposed activities, is required in addition to existing dustfall monitoring. It is recommended that a dust monitoring station be located proximal to the junction of the access road and the R380, at the southernmost corner of the preferred site envelope, and that monitoring bucket BR-DB04 be relocated to the westernmost corner of the site envelope.

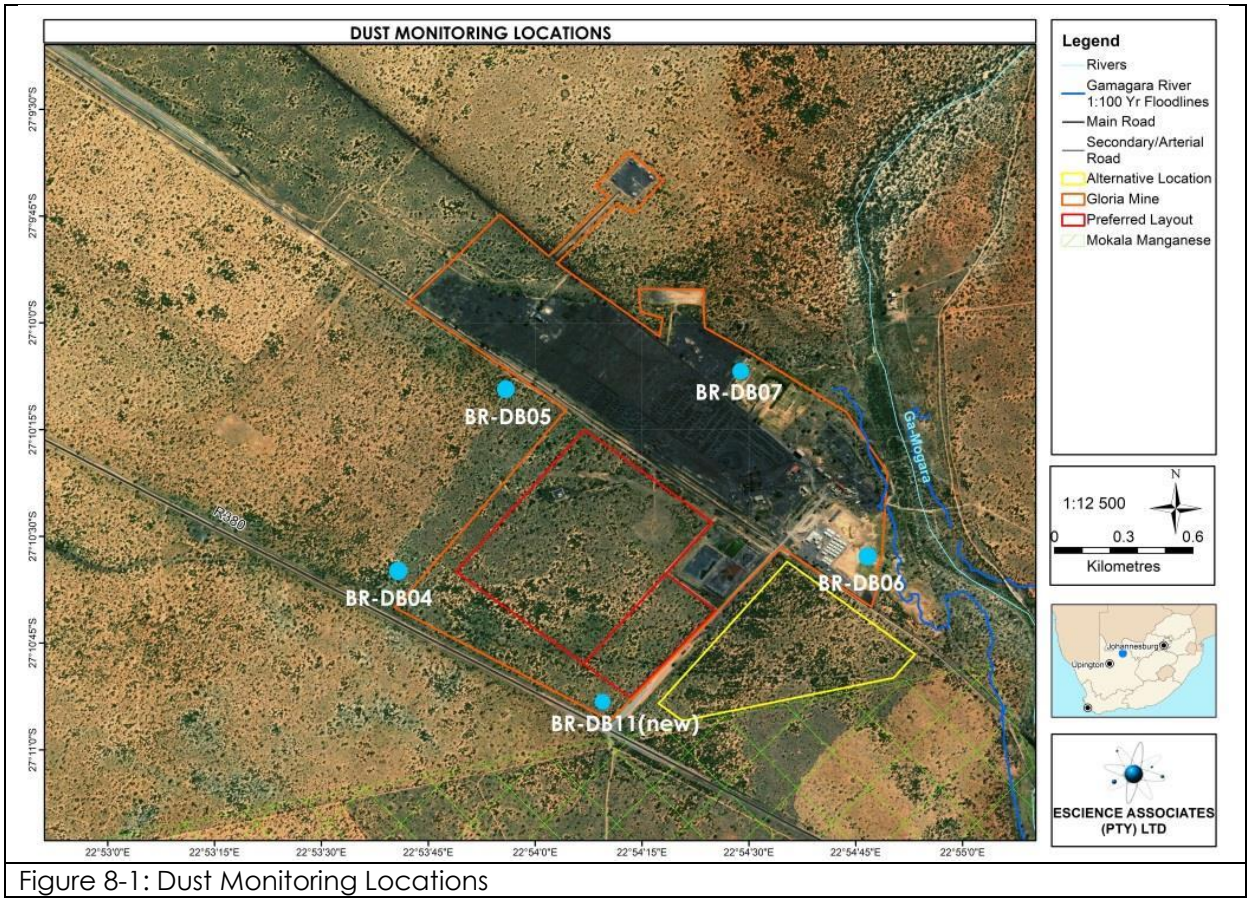


Figure 8-1: Dust Monitoring Locations

8.2.6 NOISE

The following activities will generate noise during the construction phase of the proposed facilities and infrastructure:

- Removal and transportation of topsoil from the footprint area;
- Earthmoving equipment at the footprint area;
- Hauling of material to and from the specific area;
- Building activities during construction of the proposed facilities.

8.2.6.1 Impact Discussion & Significance Assessment

Noise during preparation, excavation, installation, and assembly of proposed infrastructure and equipment, is expected to have no significant impact outside of the site, in cognisance of there being no proximal external receptors, and in cognisance of the existing noise levels and sources at the site.

In the context of the existing noise profile of the site (current mining and processes activities) and surrounds (neighbouring mines and roads), noise from construction is not expected to have a significant impact. The cumulative impact is accordingly not anticipated to be appreciably different to the current noise profile.

Table 8-9: Impact Assessment - Noise			
Nature (N)	Negative impact on site.		1
Extent (E)	On site: Localised to the site.		1
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Negligible: The facility is within a mining area, and there are no nearby noise receptors outside of the facility.		1
Probability (P)	Definite: Noise will be generated by excavation and other equipment and activities.		5
Mitigation (M)	Well mitigated: To be limited to normal working hours, in accordance with locally applicable by-laws.		4
Reversibility (R)	Irreversible: The status quo will revert upon completion of construction.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	15
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6

8.2.6.2 Management and Mitigation

Construction related activities should be limited to normal working hours.

8.2.7 SOCIO-ECONOMIC

During construction, there may be employment created for the construction industry. However, the scale of the project is such that contractors are likely to use existing employees. There will, however, be socio-economic benefits related to the supply of materials, and support necessary for the construction process.

8.2.7.1 Impact Discussion & Significance Assessment

The impact will be of a minor intensity and is expected to have a municipal extent. Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where it is practical. BRMO has an internal policy of preferential employment of people within the region.

Table 8-10: Impact Assessment - Socio-Economic		
Nature (N)	Positive impact on job creation.	-0.25
Extent (E)	Local: Expected to have an impact within the surrounds of the local municipality.	2
Duration (D)	Short Term: The duration of the construction is anticipated to be approximately one year.	2
Intensity (I)	Moderate: The number of jobs created will not be large and these jobs will be temporary. It is likely that contractors with existing employees will largely be used.	3
Probability (P)	Definite: Impact will occur.	5
Enhancement (H)	Moderate enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied.	3

Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).	Positive (Moderate)	-45

8.2.7.2 Enhancement

Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where practical.

8.2.8 VISUAL/AESTHETIC

Visual impacts from the construction are not anticipated to be of significance, as the facility will be located within a viewshed of existing mining activities and infrastructure visible from the R380. The activities are not expected to alter the sense of place, given that the mine has been in operation for several decades, and that other mining activities in the area are clearly visible from the road.

8.2.8.1 Impact Discussion & Significance Assessment

Table 8-11: Impact Assessment - Visual/Aesthetic			
Nature (N)	Negative impact.		1
Extent (E)	Local: The activities/facility will only be visible from R380 road adjacent to the BRMO property boundary.		2
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Negligible: No receptors are expected to be appreciably affected.		1
Probability (P)	Definite: The activities/facility will be visible from the site.		4
Mitigation (M)	Well mitigated: Grassing of the facilities' slopes will blend the facility with natural surrounding veld.		4
Reversibility (R)	Irreversible: If the facility is not removed prior to closure of the mine, then it will remain in perpetuity.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6

8.2.8.2 Management and Mitigation

Due to the negligible impacts to visual and aesthetics, no Management and Mitigation measures have been proposed.

8.2.9 SOIL CONTAMINATION AND COMPACTION

Impacts on soil from construction activities are generally associated with hydrocarbon spills affecting soil. The inappropriate storage, management, and handling of waste, fuel, or lubricants, during the construction period could result in potentially negative impacts on soil.

Contaminants from spillages, or inadequate storage, may enter the soil, and subsequently the groundwater environment through the infiltration, or contaminate surface run-off. Hydrocarbon spills are expected to be adsorbed to the soil, and thus are

not expected to migrate significantly, and can thus generally be cleaned up by removal of the affected soil. Spills from concrete batching or painting will likewise be removable too.

Soil compaction, from vehicles moving around the construction area, is also likely. However, these areas will largely become part of the permanent maintenance road and buffer around the facilities. Areas outside that footprint will be rehabilitated.

8.2.9.1 Impact Discussion & Significance Assessment

In the event that soil contamination occurs, there will be a long term impact if it is not remediated. However, the impact is anticipated to be minor, due to the small volumes and the remediation potential.

Table 8-12: Impact Assessment - Soil Contamination			
Nature (N)	Direct negative impact on the site.		1
Extent (E)	On site.		1
Duration (D)	Long term: Only if contaminated soil is not remediated, can the impact be expected to remain for a long period of time, depending on the nature of the contaminants.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants that may contaminate soil will be in small quantities.		2
Probability (P)	Very likely: The clearance of undisturbed land will occur. The probability of a significant spill taking place during construction is low. The probability of significant contamination from waste materials is also low, as the majority of wastes are not hazardous. Hazardous waste, such as used oil and lubricants, will in any case be stored in sealed drums/containers.		3
Mitigation (M)	Well mitigated: Providing adequate bunded facilities for storage will largely reduce the potential for contamination. There are many measures that can be implemented in order to prevent soil and groundwater contamination.		4
Reversibility (R)	Moderately reversible: The impact requires that effort is taken immediately after the impact.		3
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	15
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	9

8.2.9.2 Management and Mitigation

Management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post-impact remediation thereof. BRMO has spill management procedures, which include specification for bund walls. Mitigation measures to be implemented in this regard, include:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;

- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards, on impermeable surfaces, coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators;
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces; and
- Where hydrocarbon spills occur, the soil is to be removed for treatment or disposal as soon as practical.

8.2.10 GROUNDWATER CONTAMINATION

The inappropriate storage, management, and handling of waste, fuel, lubricants, and hazardous chemicals (e.g. paints, and solvents) during the construction period, could result in potentially negative impacts on soil and groundwater quality. Poorly managed construction vehicle maintenance procedures, and wash bays too, may impact negatively on groundwater quality. Contamination of this nature, associated with the construction phase of a project of this type, would typically be hydrocarbon based (i.e. petrol, diesel, and oil leaks and spillages to bare soil surfaces). It is notable that the depth to groundwater at the closest borehole (borehole GPT01, within the preferred location) is approximately 30 m below ground level.

Contaminants from spillages, or inadequate storage, may enter the soil, and subsequently the groundwater environment, through infiltration. Hydrocarbon spills are expected to be adsorbed to the soil, and thus are not expected to migrate significantly, and can thus generally be cleaned up by removal of the affected soil. Spills from concrete batching or painting will likewise be removable too. Given the low propensity for potential pollutant migration to groundwater, and the small quantities of pollutants, it is anticipated that the potential construction related impact would not impact appreciably on the existing groundwater quality and thus no cumulative impacts of significance are anticipated be removable too.

8.2.10.1 Impact Discussion & Significance Assessment

Groundwater contamination is likely to have a local impact, in the event that it occurs. However unlikely this contamination is to occur, if it does, it will be expected to have a minor impact.

Table 8-13: Impact Assessment - Groundwater Contamination		
Nature (N)	Negative impact on water resource quality.	1
Extent (E)	Locally: Localised to the site and immediate surrounds.	2
Duration (D)	Long term: Only if a plume enters groundwater will it be a long process to remediate contaminated groundwater.	4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants that may enter groundwater will be in small quantities.	2
Probability (P)	Unlikely: The probability of a significant spill taking place during construction is low. The probability of	2

	significant contamination from waste materials is also low, as the majority of wastes are not hazardous. Hazardous wastes, such used oil and lubricants, will in any case be stored in sealed drums/containers.		
Mitigation (M)	Well mitigated: Providing adequate bunded facilities for storage will largely reduce the potential for soil and groundwater contamination.		4
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	8

Management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post-impact remediation thereof. BRMO has spill management procedures, which include specification for bund walls. Mitigation measures to be implemented in this regard, include:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards, on impermeable surfaces, coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators;
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces or when leaks are observed; and
- Where hydrocarbon spills occur, the soil is to be removed for treatment or disposal as soon as practical.

8.2.11 GROUNDWATER INTERCEPTION AND ABSTRACTION

Monitoring borehole GPT01 is within the envelope of the preferred location. The depth to groundwater is approximately 30 m below ground level. During the geotechnical assessment, the test pits were advanced to an average depth of 4.9 m (with a minimum excavation depth of 3.5 m and a maximum depth of 5.3 m). No groundwater was noted in any of the test pits excavated. The depth of excavation for the SFSF is not expected to exceed 5 m. No abstraction of groundwater will be required.

8.2.11.1 Impact Discussion & Significance Assessment

Table 8-14: Impact Assessment - Groundwater Availability		
Nature (N)	Negative impact on water resource quality.	1
Extent (E)	Site: Localised to the site.	1
Duration (D)	Negligible: Groundwater will not be intercepted or abstracted.	1
Intensity (I)	Negligible: Groundwater will not be intercepted or abstracted.	1
Probability (P)	Negligible: Groundwater will not be intercepted or abstracted.	1

Mitigation (M)	Well mitigated: The depth of excavation will not intercept groundwater.		4
Reversibility (R)	Slightly reversible: If groundwater is intercepted and abstracted, the resulting drawdown will be long term, due to the low recharge rates in the area.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1

8.2.11.1.1 Management and Mitigation

No mitigation is required.

8.2.12 SURFACE WATER

Potential impacts to surface water from construction activities are generally associated with hydrocarbon spills affecting surface water. Given the aridity of the environment, there is no surface water at the site. The low rainfall, in combination with highly permeable soils, results in rapid infiltration of stormwater. There are no visible natural drainage channels at the site.

8.2.12.1 Impact Discussion & Significance Assessment

Table 8-15: Impact Assessment - Surface Water Contamination			
Nature (N)	Negative impact on water quality.		1
Extent (E)	Site: There is no evidence of natural surface water or drainage on the site.		1
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected.		2
Probability (P)	Very unlikely: There is no evidence of natural surface water or drainage on the site. The site has high infiltration and evaporation rates.		1
Mitigation (M)	Well mitigated: Effective procedures can be adopted to prevent contamination of surface water from the proposed activities.		3
Reversibility (R)	Upon completion of construction, the impacts on the status quo will remain until closure.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	6
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	3

8.2.12.2 Management and Mitigation

Management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post-impact remediation thereof. BRMO has spill management procedures, which include specification for bund walls. Mitigation measures to be implemented in this regard include:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Hazardous substances spill kits, to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards on impermeable surfaces, coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators;
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces, or when leaks are observed; and
- Where hydrocarbon spills occur, the soil is to be removed for treatment or disposal as soon as practical.

8.2.13 TRAFFIC

Vehicular movement is expected to largely be within BRMO. No significant changes to existing traffic are expected for the proposed scope of construction work. It is notable that contractors have accommodation on site, in established contractor camps. Traffic for the supply of liner materials, and construction vehicles, will largely be once-off events.

8.2.13.1 Impact Discussion & Significance Assessment

Table 8-16: Impact Assessment - Traffic			
Nature (N)	Negative impact on traffic in the area.		1
Extent (E)	Site: The majority of vehicular movement will be within the BRMO boundaries.		1
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Negligible: No external users are expected to be appreciably affected. The majority of vehicular movement will be within the BRMO boundaries.		1
Probability (P)	Negligible: The activities/facility will only be visible from the site.		1
Mitigation (M)	No mitigation required.		1
Reversibility (R)	Upon completion of construction, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	1.2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1

8.2.13.2 Management and Mitigation

Traffic impacts can be mitigated by transporting machinery and materials outside of peak travel times, therefore reducing traffic impact.

8.2.14 ODOUR

Besides fumes from diesel engines, no odour impact is expected.

8.2.14.1 Impact Discussion & Significance Assessment

The impact will be of a low intensity and isolated to the site and its immediate surrounds.

Table 8-17: Impact Assessment - Odour			
Nature (N)	Negative nuisance impact on ambient air quality.		1
Extent (E)	Site: Besides fumes from diesel engines, no odour impact is expected.		1
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Negligible: No natural processes or other receptors are expected to be appreciably affected.		1
Probability (P)	Negligible: No natural processes or other receptors are expected to be appreciably affected.		1
Mitigation (M)	No mitigation required.		1
Reversibility (R)	Upon completion of construction, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	1.2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1

8.2.14.2 Management and Mitigation

No mitigation is required.

8.3 OPERATIONAL PHASE IMPACTS

The operational phase of the proposed facilities and infrastructure will be associated with the on-going mining operations at BRMO, from the end of the construction period, up until the closure and decommissioning of the SFSF. The operational lifespan of the SFSF may reach 30 years.

In broad terms, the 'operational phase' of the project life-cycle includes, *inter alia*, the following broad activities:

- Deposition of fines;
- Reticulation of process water;
- Maintenance of the facilities and related infrastructure (piping, water reticulation equipment, service road, etc.).

All of the aforementioned operational activities have the potential to impact on one, or more, environmental parameters, as evaluated and described in the following sections.

8.3.1 BIODIVERSITY

The biodiversity impacts will largely stem from the construction period as previously summarised in Table 8-3. Concerns during the operational phase are expected to relate, in the main, to:

- Management of alien and invasive vegetation;
- Maintenance of the affected footprint;
- Prevention of contamination of soil, surface, and groundwater;
- Prevention of impacts from personnel on the surrounding environment; and,
- Prevention of fires.

8.3.1.1 Impact Discussion & Significance Assessment

The impacts to biodiversity, as assessed by the specialist, are presented in Table 8-18 and Table 8-19 below. The impacts are anticipated to be low to very low, provided the recommended mitigation measures are implemented.

Table 8-18: Impact Assessment - Biodiversity - Floral Diversity (Operational Phase)			
Impact	**Habitat Unit**	**Unmanaged**	**Mitigated**
Impact on floral habitat and species diversity	Kathu Bushveld Habitat	Medium-low	Low
	Transformed Habitat	Medium-low	Low
Impact on floral SCC	Kathu Bushveld Habitat	Medium-low	Low
	Transformed Habitat	Low	Very Low

Table 8-19: Impact Assessment - Biodiversity - Faunal Resources (Operational Phase)			
Impact	**Habitat Unit**	**Unmanaged**	**Mitigated**
Kathu Bushveld Habitat	Loss of faunal habitat and ecological intensity	Medium-Low	Medium-Low
	Loss of faunal diversity	Low	Low
	Impact on faunal SCC	Medium-Low	Low

8.3.1.2 Management and Mitigation of Biodiversity

The following mitigation measures have been recommended by the biodiversity specialists:

- Development footprint:
  - The footprint and daily operation of all surface infrastructure areas must be strictly monitored, to ensure that edge effects from the operational facilities do not affect the surrounding faunal habitat beyond the footprint; and
  - No hunting/trapping or collecting of faunal species is allowed.
- Alien Vegetation:
  - Edge effects of all operational activities, such as alien plant species proliferation, which may affect adjacent natural habitat within surrounding areas, need to be strictly managed, adjacent to the SFSF footprint;
  - On-going alien and invasive vegetation monitoring and eradication should take place throughout the operational phase of the SFSF, and the perimeters should be regularly checked during the operational phase for alien vegetation proliferation, to prevent spread into surrounding natural areas; and
  - Continue with and update the alien and invasive plant control plan accordingly.
- Faunal / Floral SCC:
  - No collection of firewood (as this often provides microhabitats for small insect and arachnids) or floral and faunal SCC is allowed by mining personnel;
  - Edge effect control needs to be implemented to ensure no further degradation and potential loss of SCC outside of the footprint area occurs; and

- It must be ensured that related operational activities are kept strictly within the footprint.

- Fire:
  - No illicit fires must be allowed during the operational phase of the proposed mining development;
  - Fire breaks should be maintained during the operational phase.
- Rehabilitation:
  - Rehabilitation of natural vegetation should proceed in accordance with a rehabilitation plan compiled by a suitable specialist. This rehabilitation plan should consider all development phases of the project, indicating rehabilitation actions to be undertaken during and once construction has been completed, for on-going rehabilitation during the operational phase of the project, as well as rehabilitation actions to be undertaken during the decommissioning phase; and
  - Rehabilitation must be implemented at all times, and disturbed areas must be rehabilitated as soon as such areas become available. This will not only reduce the total disturbance footprint but will also reduce the overall rehabilitation effort and cost.

8.3.2 GROUNDWATER CONTAMINATION

Impact on groundwater during the operational phase, from general maintenance activities and management of general waste produced by personnel, is anticipated to be negligible. The most potentially significant impact would be expected from seepage through the SFSF liner, or a failure of the liner resulting in infiltration to groundwater.

8.3.2.1 Impact Discussion & Significance Assessment

The geohydrology specialist modelled the potential plume, and assessed the risks related thereto using a source, pathway, receptor approach. Impacts to groundwater, resulting from the leaching of tailings, is considered below, although this is further analysed within the Liner Exemption specialist report in Appendix 4.

The planned SFSF was modelled as if it would not be lined, thereby presenting a worst-case scenario. Two potential SFSF positions were modelled: the preferred position, and the alternative position. From the modelling results, it was concluded that the preferred option would likely have the least potential impact on possible receptors, due it being further away from the Gamagara River. In both of the modelled locations, the depth to water level limits the risk to groundwater, in an event where a leakage would occur.

Based on the scenarios modelled, it the specialist concluded that:

- The preferred option is the recommended position for the SFSF location, mainly due to its distance from the Ga-Mogara River and the depth to groundwater in the area.
- If the Preferred SFSF Position is selected as the locality for the SFSF, little impact to sensitive groundwater receptors are predicted due to the depth to groundwater as a result of active dewatering. Contaminant that may emanate from the SFSF

would likely flow downwards towards the aquifer. The expected plume will only reach the river after 50 years.

- The alternative option is closer to the Ga-Mogara River and should a leakage form the tailings exist this could flow to the river before infiltrating to the deeper aquifer due to the presence of hardpan calcrete in the regolith layer. The predicted plume would reach the river within 10 years of operation.
- However, the deep groundwater levels likely mean that the Ga-Mogara River is unconnected to the aquifer. In the preferred scenario, the modelled contamination movement will not reach the river within 50 years. Due to the uncertainties in the water levels around the area and thus flow directions, this is an aspect that is worth further investigation.
- Due to the slow groundwater movement, no groundwater users are likely to be impacted. The only likely receptors will be the Ga-Mogara river, although as previously stated, this river is not connected to the aquifer due to the water level depth. The remaining receptors will be the monitoring boreholes GPT01 and GPT02. These are monitoring boreholes and are not used for any other purpose. These boreholes can thus be used to determine and confirm modelled impacts, should they exist.

The specialist concludes that from a hydrogeological perspective and based on the available information supplied by the applicant, it is recommended that the proposed preferred SFSF is authorised on condition that the lining requirements as set out in the waste classification (based on leach results[1]) are met, and that the proposed groundwater monitoring is conducted and reported as described in the DWAF Best Practice Guidelines A2: Water Management for Mine Residue Deposits. Further recommendations were made by the specialist which should be incorporated into the Environmental Management Programme and integrated water and waste management plan unless stipulated otherwise in the site's Water Use Licence.

8.3.2.1.1 Management and Mitigation

The specialist recommends that, even though the depth to groundwater limits risk, sound construction and management practices for the planned SFSF must still be adhered to, in order to limit risk to the underlying aquifer and the river. These include installing a suitable liner, as well as limiting stormwater ingress to the SFSF, and diverting storm water away from it. Furthermore, the results from the leaching analysis of the tailings material indicated that the tailings material exceeds the LCT0 threshold, requiring a class C or GLB lined facility.

The following recommendations are put forward:

- A system of storm water drains must be designed and constructed to ensure that all water that falls outside the area of the SFSF is diverted clear of the deposit.
- The boreholes GLBH01 and GLBH02 (refer to Figure 8-2) should be added to the current monitoring network. These should be monitored on a quarterly basis prior to construction, and during the operational phase, for the parameters recommended by the specialist, unless otherwise indicated in the Water Use Licence.
- The monitoring boreholes should be sited using geophysical methods, in order to identify geological structures that may act as preferential flow paths for contaminant transport.

[1] The classification referenced in the assessment (GPT 2020) is based on leach results for the fines.

- Monitoring boreholes' drilling should be supervised by a qualified hydrogeologist, and care should be taken to accurately log the geology during drilling, as well as for the appropriate construction of the boreholes.
- The aquifer parameters should be measured by conducting an aquifer test (pump test, slug test, etc.) on each of the newly drilled boreholes. Twenty-four-hour pumping tests are recommended. This information can be used to update the numerical model with accurately measured parameters.
- A hydrocensus, within a radius of 5 km around the boundary of the Gloria SFSF site, should be conducted every 2 years.
- A re-evaluation of the risk to the aquifer should be conducted every 2 years.

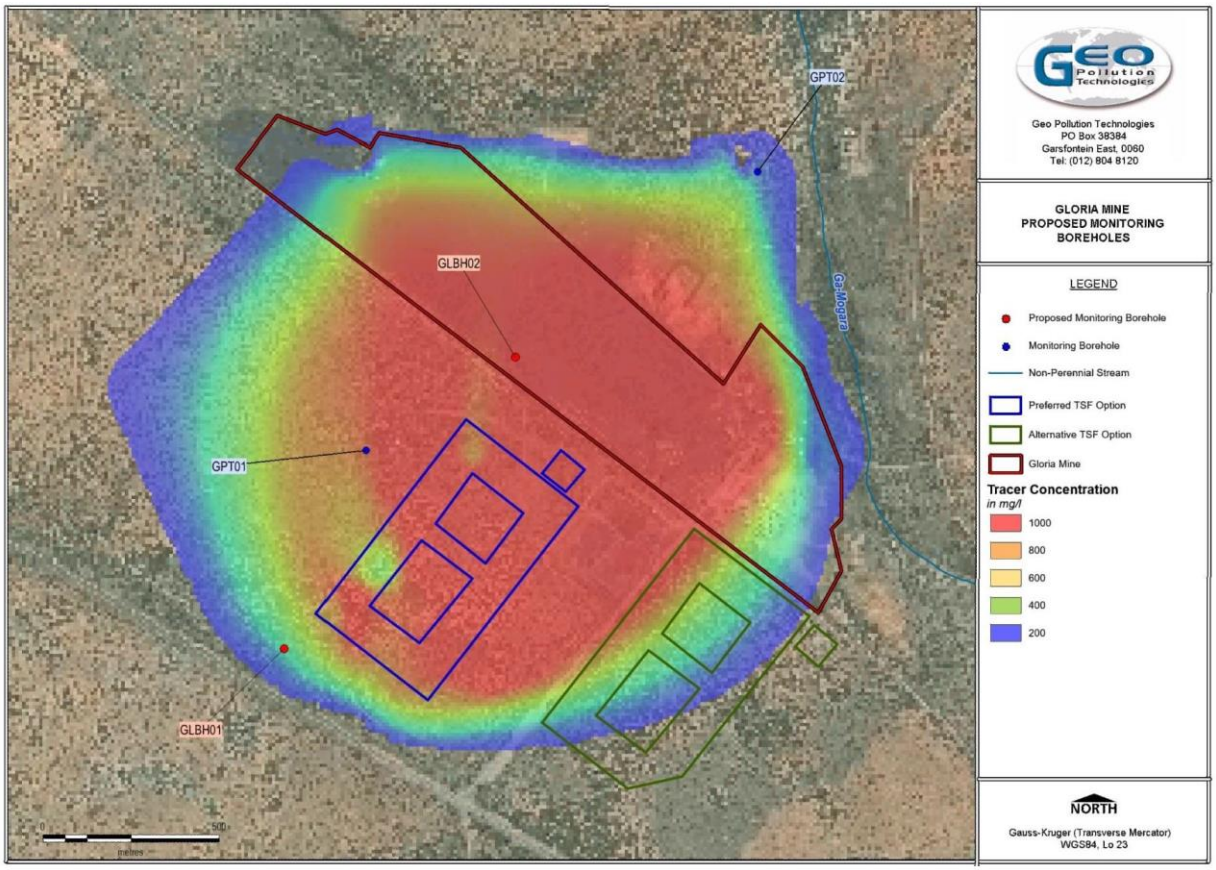


Figure 8-2: Monitoring Borehole Recommendations[1]

8.3.3 SURFACE WATER

Due to the low frequency of rainfall and absence of surface drainage, it is unlikely that there would be any long-term surface water impacts. The SFSF has also been designed to cater for a 1 in 100 year storm event (116mm in 24h), and thus overflow is highly unlikely. A minimum freeboard to accommodate the 1 in 50-year (102mm in 24h), 24-hour storm volume plus 0.8 m dry freeboard on top of the normal operating level (excluding decant return) has been incorporated into the design of the SFSF and return water dam.

[1] Note that the modelling results shown are for a tracer fluid at source concentration of 10 mg/L to illustrate potential plume. The source contaminant concentrations are much lower as detailed in the specialists report.

In the unlikely event of failure of the facility contents of the SFSS materials outflow, it is not expected that material would reach the Gamagara River, due to the distance from the preferred location to the river. The potential for dam failure is mitigated through the design of the facility by a competent registered engineer. The design engineer reports that the following national and international regulations and standards have been considered during the design:

- Code of Practice, Mine Residue, SANS 10286: 1998;
- Guidelines for the Compilation of a Mandatory Code of Practice on Mine Residue Deposits - Ref. No. DME 16/3/2/5-A1., 30 November 2000, Department of Minerals and Energy, Republic of South Africa;
- DWS, 2007., Best Practice Guideline A2: Water Management for Mine Residue Deposits;
- Government Notice R 632 (Government Gazette No. 10473, 24/07/2015 and as Amended GN990/2018 - 21 September 2018) pertaining to the National Environmental Management Waste Act (Act No. 59 of 2008) by the Department of Environmental Affairs, Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits from a Prospecting, Mining, Exploration, or Production Operation;
- DWS, 1999, Government Notice 704, Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources, Department of Water Affairs and Forestry, South Africa;
- Water Act 1956 (Act 54 of 1956) Regulation 9C - Dam Safety;
- Middleton, B.J. and Bailey, A.K. Water Resources of South Africa, 2005 study (WR2005), 2009. WRC Report No TT 382/08;
- Adamson, P.T., Southern African Storm Rainfall, Department of Environment Affairs, Technical Report TR102, Pretoria, 1981;
- Midgley, D.C., Pitman, W.V., Middleton, B.J. Surface Water Resources of South Africa, 1990. WRC Report No 298/2.1/94, Volume 2;
- Guidelines on the Safe Design and Operating Standards for Residue Storage - Department of Minerals and Energy (DME) Western Australia;
- Guidelines on the Development of an Operating Manual for Residue Storage - Department of Minerals and Energy (DME) Western Australia;
- A Guide to the Management of Residue Facilities - The Mining Association of Canada (MAC) - A Guide, released in September 1998 by the MAC to encourage mining companies to practice safe and environmentally responsible management of residue facilities through the development of customised, site-specific management systems;
- ICOLD Bulletin 139, Improving Tailings Dam Safety, 2011;
- Guidelines on the Safe Design and Operating Standards for Residue Storage - Department of Minerals and Energy (DME) Western Australia;
- Guidelines on the Development of an Operating Manual for Residue Storage - Department of Minerals and Energy (DME) Western Australia;
- A Guide to the Management of Residue Facilities - The Mining Association of Canada (MAC) - A Guide, released in September 1998 by the MAC to encourage mining companies to practise safe and environmentally responsible management of residue facilities through the development of customised, site-specific management systems.

All rainfall that falls inside the facility will be contained, and become part of the process water reticulation circuit. Water falling outside the facility will not be contaminated, as it will not come into contact with the super fines or the process water.

8.3.3.1 Impact Discussion & Significance Assessment – Surface Water

Table 8-20: Impact Assessment - Surface Water Contamination			
Nature (N)	Negative impact on water quality.		1
Extent (E)	Site: There is no evidence of natural surface water or drainage on the site, thus the impact is likely to remain within the site.		1
Duration (D)	Long term: In the unlikely event that dam failure occurs, the impact on surface water would be long term if the spillage is not removed.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected, as the leach tests show that significant leaching is expected.		2
Probability (P)	Very unlikely: Provided that facilities are built to the design standard, it is very unlikely there would be contamination of surface water or failure of the SFSF.		1
Mitigation (M)	Well mitigated: There are various regulatory requirements and design standards incorporated into the design.		3
Reversibility (R)	Reversibility potential is low, as water that is contaminated is unlikely to be easily remediated.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	10
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	5

8.3.3.2 Management and Mitigation

Given that the SFSF has been designed in accordance with the required regulatory standards and other applicable standards, it is not envisaged that any further mitigation is required. Overflow is highly unlikely, given that the facility has also been designed to cater for a 1 in 100 year storm event.

It must be noted that the facilities must maintain sufficient freeboard, to ensure that there is no overflow to the environment. Monitoring of freeboard is therefore necessary to ensure that freeboard is maintained.

8.3.4 SOIL CONTAMINATION

Similar factors, as contemplated for surface water, will apply to potential for soil contamination. Besides dam failure, the risk from other factors such as waste management during the operational phase, will be negligible (refer to section 8.3.5 below).

8.3.4.1 Impact Discussion & Significance Assessment

Table 8-21: Impact Assessment - Soil Contamination			
Nature (N)	Negative impact on water resource quality.		1
Extent (E)	Site: This would apply to soil beneath the site, and immediate surrounds, in the case of a spill or slippage.		1
Duration (D)	Long term: If the impacted area is not addressed.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants that may contaminate soil will be in small quantities, and leach tests show that there is low potential for contaminants leaching from the deposited fines.		2
Probability (P)	Low: Waste will be stored in bins, and the probability of dam failure is very low, as discussed in Section 8.3.3 above.		2
Mitigation (M)	Well mitigated: Effective design, monitoring, and management measures can prevent potentially significant impacts.		4
Reversibility (R)	Reversible: Affected soil may be removed.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	10

8.3.4.2 Management and Mitigation

The management measures applicable to groundwater, surface water, and waste management are applicable. Should soil contamination occur, then the contaminated soil should be removed and remediated, or disposed of to an appropriate facility, where applicable, unless the contamination can be demonstrated to be insignificant.

8.3.5 WASTE MANAGEMENT AND DISPOSAL

Waste management during the operational phase will consist of general waste from personnel operating the facility, and replaceable items such as hoses, piping, steel valves, electrical switchgear, etc., from maintenance of the facility. No hazardous waste of significance is anticipated, with the exception of occasionally used lubricant containers.

8.3.5.1 Impact Discussion & Significance Assessment – General Waste Disposal

General waste which cannot feasibly be recycled, will be disposed of at the licenced BRMO landfill, located onsite at the Black Rock mine. Waste which is disposed of will have impact at a site extent. The intensity of the impact will, however, be minor, relative to cumulative waste generation volumes at the site.

Table 8-22: Impact Assessment - General Waste		
Nature (N)	Potential negative impact on water resource quality.	1
Extent (E)	Site: These activities will all occur within BRMO. BRMO operates a licensed general landfill that will receive all unrecyclable general waste.	1

Duration (D)	Long term: Waste will be permanently placed in landfill. Besides the landfill, impact on soil and water is only expected in the event of incorrect storage, transportation, or disposal of waste.		4
Intensity (I)	Negligible: Very low quantities of waste will be generated by the operational phase of the facility. Natural processes or functions are not expected to be appreciably affected.		1
Probability (P)	Likely: The potential for incorrect storage and disposal of waste, without proper mitigation and management in place, is high.		3
Mitigation (M)	Can be well mitigated: Waste to be minimised as per BRMO waste minimisation plans, which is inclusive of different measures for different materials.		4
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	10
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	5

8.3.5.2 Management and Mitigation

The mine has a waste management procedure in place, addressing waste minimisation, reuse, recovery, and recycling, as well as temporary storage and disposal. The procedure is included in the EMPr.

8.3.6 AIR QUALITY

Super fines will be deposited as a slurry. No emissions of potential significance are anticipated.

Table 8-23: Impact Assessment - Air Quality			
Nature (N)	Negative impact on ambient air quality.		1
Extent (E)	Site: Within the site, if any impact at all.		1
Duration (D)	Long term: These impacts (if they occur) will occur as long as the facility is in operation.		4
Intensity (I)	Negligible: Natural processes or functions are not expected to be appreciably affected.		1
Probability (P)	Unlikely: No emissions of potential significance are expected during the operational phase.		1
Mitigation (M)	No mitigation: No potentially significant emissions are expected, thus no practical mitigation has been identified.		1
Reversibility (R)	Reversible: The status quo will return to the previous status quo upon cessation of operation.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	5
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	5

8.3.6.1 Management and Mitigation of Air Quality

Although no mitigation is proposed to prevent emissions, it is likely that the banks of the facility will be vegetated to improve bank stability, and also reduce the potential for wind entrained dust.

8.3.7 NOISE

No significant noise sources are envisaged during the operational phase.

Table 8-24: Impact Assessment - Noise			
Nature (N)	Negative impact on site.		1
Extent (E)	On site: Localised to the site.		1
Duration (D)	Very long term: The mine has a predicted lifespan past 2038.		5
Intensity (I)	Negligible: In the context of existing noise profile of the site and surrounds (neighbouring mine), noise from the above-mentioned sources is expected be negligible in comparison, thus having no discernible effect.		1
Probability (P)	Unlikely: It is unlikely that significant noise will be generated during the operational phase.		2
Mitigation (M)	Unmitigated: Mitigation is not practical.		1
Reversibility (R)	Reversible: The status quo will return to the previous status quo upon completion of construction.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	4.8
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	4.8

8.3.7.1 Management and Mitigation of Noise

Mitigation measures to reduce the impacts from noise are not required as no potentially significant impact is anticipated.

8.3.8 SOCIO-ECONOMIC

The SFSF is necessary for BRMO's continued operation of the Gloria mine. Thus, the facility is integral to maintaining existing jobs as well as the direct, and indirect, contributions BRMO has to the economy of the region, and the country as a whole.

Table 8-25: Impact Assessment - Socio-Economic		
Nature (N)	Positive impact, in terms of economic and employment sustainability.	-0.25
Extent (E)	Local: Expected to have an impact within the surrounds of the local municipality.	2
Duration (D)	Long term: The duration of operation of the facility.	4
Intensity (I)	Low: Potentially, there will be no new jobs, as existing employees from the current Gloria facility will be moved over as that facility reaches end of life.	1

Probability (P)	Definite		5
Enhancement (H)	Low: Potentially, there will be no new jobs as existing employees from the current Gloria facility will be moved over as that facility reaches end of life.		1
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).	Positive (Negligible)	-7.5

8.3.8.1 Enhancement

The operation of the Super Fines Storage Facility is not deemed to have a large positive impact in isolation, but rather it affords the continued operation of BRMO, and ensures job security to BRMO's employees, and continued contribution towards the GDP of the country, and sustained economic stimulus in the region.

8.3.9 ODOUR

No odour emissions of potential significance are anticipated. The super fines are odourless.

Table 8-26: Impact Assessment - Odour			
Nature (N)	Negative nuisance impact on ambient air quality.		1
Extent (E)	Site: No significant sources are anticipated. The material to be deposited is inorganic and odourless.		1
Duration (D)	Long term: The impact, if it is present, will persist for the duration of operation.		4
Intensity (I)	Negligible: No natural processes or other receptors are expected to be appreciably affected.		1
Probability (P)	Negligible: The material to be deposited is inorganic and odourless.		1
Mitigation (M)	No mitigation required.		1
Reversibility (R)	Not applicable.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	2

8.3.9.1 Management and Mitigation

Mitigation measures are not required, as no potentially significant impact is anticipated.

8.3.10 VISUAL/AESTHETIC

Visual impacts from the operation are not anticipated to be of significance, as the facility will be located within a viewshed of existing mining activities and infrastructure visible from the R380. The nearest edge of the SFSF is 180m from the R380. The maximum height above natural ground level will be 16.5m, but approximately 13.5m at the side closed to the road due to the natural slope pf the ground in a northerly direction. The facility is not expected to alter the sense of place, given that the mine has been in operation for

several decades, and that other mining activities in the area are clearly visible from the road.

8.3.10.1 Impact Discussion & Significance Assessment – Visual/Aesthetic

Table 8-27: Impact Assessment - Visual Aesthetic			
Nature (N)	Negative impact.		1
Extent (E)	Local: The activities/facility will only be visible from R380 road adjacent to the BRMO property boundary.		2
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.		2
Intensity (I)	Negligible: No receptors are expected to be appreciably affected.		1
Probability (P)	Definite: The activities/facility will be visible from the site.		4
Mitigation (M)	Well mitigated: Grassing of the facilities' slopes will blend the facility with natural surrounding veld.		4
Reversibility (R)	Irreversible: If the facility is not removed prior to closure of the mine, then it will remain in perpetuity.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6

8.3.10.2 Management and Mitigation

Due to the negligible impacts to visual and aesthetics, no Management and Mitigation measures have been proposed.

8.3.11 TRAFFIC

Impacts on traffic from the operation of the Super Fines Storage Facility are deemed to be negligible, as the deposition of tailings will be through established pipelines, which will not have any bearing on traffic on or around the facility. Traffic related to personnel driving to and from the site will be the same as for the existing TSF, which will be replaced by the proposed SFSF.

8.3.11.1 Impact Discussion & Significance Assessment

Table 8-28: Impact Assessment - Traffic		
Nature (N)	Negative impact on traffic in the area.	1
Extent (E)	Site: Vehicular movement, if any, will be within the BRMO boundaries.	1
Duration (D)	Long term: The impact will continue for the life of the facility.	4
Intensity (I)	Negligible: No external users are expected to be appreciably affected.	1
Probability (P)	Negligible: There will be no change.	1
Mitigation (M)	No mitigation required.	1

Reversibility (R)	Upon closure, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	2

8.3.11.2 Management and Mitigation

Due to the negligible impacts, no Management and Mitigation measures have been proposed.

8.3.12 HERITAGE RESOURCES (PALEONTOLOGICAL AND ARCHAEOLOGICAL)

Impacts, if any, would occur during construction. No impacts are expected during the operational phase, as there will be no excavations or further disturbance of land.

8.3.12.1.1 Impact Discussion & Significance Assessment

Table 8-29: Impact Assessment - Heritage Resources			
Nature (N)	Negative impact on heritage resources, if they are present.		1
Extent (E)	Locally: Localised to the site but may be of significance in respect of the wider heritage aspects of the surrounding area.		2
Duration (D)	Permanent: Once damaged or destroyed, the impact may be permanent.		5
Intensity (I)	Minor: Previous studies of the area have shown that the probability of significant finds is low.		2
Probability (P)	No probability of impact heritage resources, as any impact would have arisen during the construction phase of operations.		0
Mitigation (M)	Well mitigated: Adequate assessment and planning may be effective for identifying and protecting heritage resources.		3
Reversibility (R)	Not reversible.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	0
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	0

8.3.12.2 Management and Mitigation

No requirement for Management or Mitigation as impact is improbable.

8.4 CLOSURE AND POST CLOSURE PHASE IMPACTS

It is assumed that the fines will not be recovered and re-used, although the recovery and processing of the fines may become feasible at some time in the future as technology and market forces change. It is therefore assumed that the SFSF will reach its maximum

capacity, and subsequently be closed, and that the closed facility will remain in-situ in perpetuity.

The closure and decommissioning phase will broadly consist of:

- Shaping and capping of the storage facility;
- Removal of fines and water conveyance infrastructure, and any other structures (e.g. shelters for personnel, return water dam, piping and conveyancing equipment, steel structures, concrete footings, etc.);
- Ripping and scarifying of roads, and other compacted footprints;
- Depositing of subsoil and topsoil, on the exposed surfaces; and
- Rehabilitation and aftercare.

The impacts of this phase relate to closure activities, as well as potential latent post closure impacts. The closure objectives are presented below prior to the impact assessments. Refer to Appendix 5 for the full closure plan.

8.4.1.1 Closure Objectives

The closure objectives as approved within the approved mine-wide EMPR, will apply to the proposed SFSF as well. To ensure that the impacts associated with the mine as a whole are properly mitigated, managed, and/or avoided (where possible), a number of specific environmental objectives have been defined. The environmental objectives need to be attained and/or maintained to ensure satisfactory environmental management of the affected areas and the potential cumulative impacts on the surrounding environment.

The broad overall environmental objectives of mine closure are proposed as follows:

- To rehabilitate the disturbed areas to arable grazing land capable of at least supporting an extensive livestock production system;
- To restore the pre-development topography to the greatest extent that is practical and feasible at closure;
- To restore the site biodiversity and ecological system functioning to as close as practically possible to pre-development conditions;
- To ensure that the site is made safe; where such entails:
    - Remediation of contaminated land;
    - Effective sealing-off of shafts and declines; and
    - Effective removal and decommissioning of redundant structures and infrastructure;
- To ensure that final site shaping allows for free drainage of rainwater and the prevention of erosion;
- To ensure that the pollution generating potential of residue deposits and residue stockpiles is addressed through appropriate capping and closure thereof, where applicable;
- To ensure that there are no significant residual impacts on the underlying calcrete aquifer; and

- To ensure that significant entrainment of particulate matter is prevented through adequate land cover and shaping, where necessary.

Table 8-30: Environmental Objectives	
Topography	• To minimise topographic disturbances resulting from mining and expansion project related activities; • To minimise the potential impacts of the mining activities and project on surface hydrology; • To minimise the potential for soil erosion resultant from the creation of steep slopes; and • To ensure that any alteration to site topography, resultant from mining activities and the project, can be reversed to the extent that it does not conflict with end-use planning objectives for the site.
Soils	• To effectively mitigate potential soil contamination impacts; • To maintain the viability of the site soils (particularly topsoil) for future rehabilitation purposes; • To ameliorate any altered ecological, physical, and chemical properties of soils resulting from stripping, handling, and stockpiling of 'topsoil'; and • To install and maintain long-term erosion control measures.
Land Capability	• To restore the affected surfaces to arable land capability; and • To re-establish indigenous, pre-development, floral species that will stabilise the soils in the short term, and re-create the natural grassland and/or grazing lands in the long term, so that the area can be returned to its natural state as far as possible, and used for agricultural purposes.
Land Use	• To restore the affected surface area to pre-mining status, so that pre-mining land use activities can be resumed; and • To reduce the area that is to be disturbed, and contain the impacts on the natural habitat caused by the mechanised equipment.
Vegetation	• To minimise mining activities and project impact on the natural bio-diversity of the area, to the greatest extent that is practical; • To control the establishment and propagation of alien invasive vegetation within the development area; • To ensure that protected trees, removed during construction, are re-established at closure, and through concurrent rehabilitation efforts, in similar numbers; • To ensure that the impact of the mining activities and project on protected floral species is appropriately off-set for the operational lifespan thereof, and effectively remediated at closure; and • To re-introduce pioneer grass species for effective rehabilitation, such that will ensure natural succession over time.
Animal Life	• To minimise mining activities and project impacts on the natural bio-diversity of the area, to the greatest extent that is practical; and

	• To ensure the prevention of animal hunting and poaching throughout the life of mine.
Surface- and Ground Water	• To ensure that no mining and project activities, or infrastructure, negatively influence ground- or surface water quality, or quantity, to the extent that human health or livelihoods are negatively influenced; and • To pro-actively monitor the mining activities and project's impacts on ground- and surface water quality/quantity, such that pro-active measures can be instituted by the BRMO to mitigate such impacts, where identified.
Noise	• To reduce the impact of mining related noise on the overall environment, and within the proposed mining area in particular.
Socio-Economic	• To limit the socio-economic impacts as a result of cessation of the mining activities.
Maintenance	• To monitor and manage post-closure impacts, until closure is obtained.
Infrastructure	• To find alternative uses for mine infrastructure, or if not possible, to ensure that the components are properly considered within the rehabilitation plan, as stated.
Waste	• To minimise waste, and reduce/reuse/recycle where practical; and • To collect and dispose of all waste at a permitted disposal site, where waste recovery, recycling, or reuse alternatives are not reasonable or feasible.
Air Quality	• To minimise emissions where practical; and • To ensure that emissions of atmospheric pollutants and subsequent impact on ambient air quality is within acceptable standards.

8.4.2 GROUNDWATER CONTAMINATION

Upon closure and capping of the facility, the fines will remain in-situ. The propensity for release of leachate into the groundwater depends on various factors, namely:

- The integrity of the liner;
- The presence of water within the facility (interstitial water);
- The potential for infiltration of rainwater into the closed facility; and
- The propensity of the fines to be leached.

Plume modelling was undertaken for the geohydrological assessment, assuming no liners will be present. This effectively presents a worst-case scenario, with no containment of infiltration.

The geohydrological specialist modelled the potential plume, and assessed the risks related thereto using a source, pathway, receptor approach to assess potential Impacts to groundwater resulting from the leaching of tailings. The impact on potential receptors is concluded to be minimal.

8.4.2.1 Management and Mitigation

The site must be SFSF will be capped, rehabilitated and closed in compliance with the relevant provisions of Section 11 of the Department of Water Affairs & Forestry Minimum

Requirements for Waste Disposal by Landfill (2nd Edition, 1998. Post closure monitoring requirements are detailed in the Environmental Management Programme.

Further to this the specialist recommends:

- Upon decommissioning of the facility, the monitoring programme undertaken during the operational phase will need to be continued after decommissioning and during the closure phase.
- Monitoring will continue until the groundwater quality trends are within the RQO for the catchment and to ensure that sufficient information is available to calibrate and confirm the accuracy of the numerical model.
- The groundwater monitoring information should be used to update the numerical groundwater model used during the operations phase. The updated groundwater model will be used in the closure modelling and closure planning.

8.4.3 BIODIVERSITY

A specialist biodiversity assessment was undertaken, as per the approved plan of study for EIA. The specialist identified the environmental aspects and impacts, which are summarised in Table 8-31 below.

Table 8-31: Biodiversity Impacts - Decommissioning & Closure Phase

Decommissioning & Closure Phase
• Potential ineffective rehabilitation of exposed and impacted areas, potentially leading to a shift in vegetation type. • **Impact:** Permanent loss of faunal habitat, diversity, and SCC, and a higher likelihood of edge effect impacts on adjacent and nearby natural vegetation of increased sensitivity.

• Potential poor management and failure to monitor rehabilitation efforts, leading to:
  • Landscapes left fragmented, resulting in reduced dispersal capabilities of faunal species and a decrease in faunal diversity;
  • Compacted soils limiting the re-establishment of natural vegetation; and
  • Increased risk of erosion and AIP proliferation in areas left disturbed.
• **Impact:** Loss of faunal habitat and diversity. The above aspects will also have a notable impact on area utilisation by common faunal species and SCC.

• Potentially poorly implemented and monitored AIP management programme, leading to the reintroduction and proliferation of AIP species. • **Impact:** Permanent loss of surrounding natural faunal habitat, diversity, and SCC.
• On-going risk of contamination from mining facilities beyond closure. • **Impact:** Permanent impact on faunal habitat.

8.4.3.1 Impact Discussion and Significance

The BRMO land will revert to pre-mining agricultural land use, upon mine closure. Closure of the SFSF will include capping, shaping, and revegetation. The potential impacts, as identified and assessed by the specialists, are presented in Table 8-31 and Table 8-32 below.

Table 8-32: Impact Assessment - Biodiversity- Floral (Diversity Decommissioning and Closure Phase)			
Impact	**Habitat Unit**	**Unmanaged**	**Mitigated**
Impact on floral habitat and species diversity	Kathu Bushveld Habitat	Medium-low	Low
	Transformed Habitat	Low	Very Low
Impact on floral SCC	Kathu Bushveld Habitat	Low	Very Low
	Transformed Habitat	Low	Very Low

Table 8-33: Impact Assessment - Biodiversity - Faunal (Resources Decommissioning Phase)			
Impact	**Habitat Unit**	**Unmanaged**	**Mitigated**
Kathu Bushveld Habitat	Loss of faunal habitat and ecological intensity	Medium-Low	Low
	Loss of faunal diversity	Medium-Low	Low
	Impact on faunal SCC	Medium-Low	Low

8.4.3.2 Mitigation

The mitigation measures required to prevent/manage the impacts to biodiversity, include:

- Rehabilitation:
  - All infrastructure and operation footprints should be rehabilitated in accordance with a rehabilitation plan, compiled by a suitable specialist;
  - All rehabilitated areas should be rehabilitated to a point where natural processes will allow the ecological functioning and biodiversity of the area to be re-instated, as per the post-closure objective; and -
  - Rehabilitation efforts must be implemented for a period of at least five years after decommissioning and closure.
- Alien Vegetation:
  - Edge effects of decommissioning and closure activities, such as erosion and alien plant species proliferation, which may affect adjacent sensitive habitat, need to be strictly managed, adjacent to the footprint;
  - On-going alien and invasive vegetation monitoring and eradication should take place throughout the closure/decommissioning phase of the development, and the immediate surrounding area (30 m from the perimeters) should be regularly checked during the decommissioning phase for alien vegetation proliferation, to prevent spread into surrounding natural area; and
  - An Alien and Invasive Plant Management and Control Plan must be designed and implemented, in order to monitor and control alien faunal recruitment in disturbed areas. The alien floral control plan must be implemented for a period of at least five years after decommissioning and closure, to ensure faunal habitat is not degraded further.

8.4.3.3 Enhancement

Returning the biodiversity to a state prior to establishment is largely based on the reintroduction of indigenous plants and grasses. BRMO should consult a biodiversity specialist to determine the best possible grass mix, to return the area to a suitable state during closure planning.

8.4.4 HERITAGE RESOURCES – PALEONTOLOGICAL AND ARCHAEOLOGICAL

Impacts, if any, would be anticipated to occur during construction. However, there may be minor excavations or further disturbance of land during the shaping of the SFSF. Accordingly, the same precautions applicable to the construction phase apply here as well. It is important to note that the specialists' assessments covered both proposed site envelopes, as defined in the scoping phase, and thus are significantly wider than the actual facilities, and thus any disturbances during closure would be well within the assessed areas.

The paleontological assessment indicates that the probability of significant paleontological finds is low. The archaeological specialist indicates no sites of cultural heritage importance were identified during the site assessment. However, Stone Age sites were previously identified in the wider geographical area. This implies that there is the possibly of uncovering sites, although it is important to note that such discoveries have not been reported during the excavations carried out for the wider BRMO expansion that has taken place since 2013 and is on-going in 2020.

8.4.4.1 Management and Mitigation

The following measures have been recommended by the specialists:

- It should be remembered that due to archaeological sites being subterranean in essence, it is possible that all cultural sites may not have been identified. Care should therefore be taken when development work commences that, if any more artefacts are uncovered, a qualified archaeologist be called in to investigate.
- Proposed management measures for potential impacts, which should be followed as heritage protocol and Chance Find Procedure:
    - Loose stone tools found are usually of minor significance and should just be left as it is.
    - Areas where a substantial number of stone tools are found together should be geo-referenced, and left alone until such time as an archaeologist can visit the site to determine its significance.
    - Although chances of finding Iron Age remains are slim, it should be treated similar to the above. Potshards found out of context should be left alone, but areas with stone walling or substantial pottery, and other cultural remains, should be geo-referenced, and left alone until investigated by an archaeologist.
    - All buildings and remains of buildings and other structures, believed to be older than 60 years, should be geo-referenced, and left alone until a heritage expert can be called in to determine the cultural significance thereof.
    - Graves should be left in situ, geo-referenced, and left alone until investigated by an archaeologist.
    - Should any of the above be identified, the area should be demarcated, to ensure no impact until further investigation has been done.

- If fossil remains are discovered, either on the surface or exposed by fresh excavations, the Chance Find Protocol must be implemented by the ECO in charge of these developments. These discoveries ought to be secured (preferably in situ), and the ECO ought to alert SAHRA, so that appropriate mitigation (e.g. documentation and collection) can be undertaken by a professional palaeontologist.

- The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university), and all fieldwork and reports should meet the minimum standards for palaeontological impact studies, as developed by SAHRA.

Mitigation should be in accordance with the recommendations by SAHRA, and in the event of archaeological/paleontological evidence being uncovered, the following is generally required by the National Heritage Resources Act (Act 25 of 1999), but will be updated upon final input from SAHRA:

- 38(4)c(i) – If any evidence of archaeological sites or remains (e.g. remnants of stone-made structures, indigenous ceramics, bones, stone artefacts, ostrich eggshell fragments, charcoal and ash concentrations), fossils or other categories of heritage resources are found during the proposed development, SAHRA APM Unit must be alerted as per section 35(3) of the NHRA.
- 38(4)c(ii) – If unmarked human burials are uncovered, the SAHRA Burial Grounds and Graves (BGG) Unit (Thingahangwi Tshivhase/Mimi Seetelo 012 320 8490), must be alerted immediately as per section 36(6) of the NHRA.
- 38(4)e – The following conditions apply with regards to the appointment of specialists: If heritage resources are uncovered during the course of the development, a professional archaeologist or palaeontologist, depending on the nature of the finds, must be contracted as soon as possible to inspect the heritage resource. If the newly discovered heritage resources prove to be of archaeological or palaeontological significance, a Phase 2 rescue operation may be required subject to permits issued by SAHRA.

8.4.5 WASTE DISPOSAL

Decommissioning waste will largely consist of structural material, such as concrete and steel. It is expected that most, if not all, of the waste generated would be non-hazardous/general waste. Minor amounts of hazardous wastes, such as used lubricants, are anticipated.

8.4.5.1 Management and Disposal of General Waste

The generation of such waste could indirectly impact on the operational lifespan of a waste disposal facility, through the permanent occupation of remaining available airspace at such a facility. This general waste will be disposed of at the BRMO landfill at Black Rock Mine. The materials that can feasibly be recycled must be recycled.

Table 8-34: Impact Assessment - General Waste		
Nature (N)	Potential negative impact on water resource quality.	1

Extent (E)	Site: These activities will all occur within BRMO. BRMO operates a licensed general landfill that will receive all unrecyclable general waste.		1
Duration (D)	Long term: Waste will be permanently placed in landfill. Besides the landfill, impact on soil and water is only expected in the event of incorrect storage, transportation, or disposal of waste.		4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Contaminants that have very limited possibility of entering groundwater would be in small quantities and of limited risk.		2
Probability (P)	Likely: The potential for incorrect storage of waste, without proper mitigation and management in place, is high.		3
Mitigation (M)	Can be well mitigated: Providing adequate waste storage skips and bins, which will largely eliminate the potential for soil and groundwater contamination. Disposal will be to the licenced BRMO landfill. Where feasible, recyclable wastes must be recycled.		4
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Moderate	20
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	10

8.4.5.2 Management and Disposal of Hazardous Waste

Waste which is disposed of will have an impact at a provincial extent. The intensity of the impact will, however, be low relative to cumulative local and regional waste generation volumes.

Table 8-35: Impact Assessment - Hazardous Waste		
Nature (N)	Potential negative impact on water resource quality.	1
Extent (E)	Provincial: Hazardous wastes are expected to be minimal. These will be managed via BRMO's hazardous waste transfer facility. Hazardous wastes would, however, be disposed of or recycled in other provinces due to the lack of suitable facilities locally.	4
Duration (D)	Long term: Impact on soil and water is only expected in the event of a spill outside of the bunded storage areas or during transport. The subsequent impact on groundwater, for example, may remain for several years.	5
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected, mainly due to the low quantities.	1
Probability (P)	Likely: The potential for incorrect storage of waste, without proper mitigation and management in place, is high.	3
Mitigation (M)	Can be well mitigated: Providing adequate bunded facilities for storage will largely eliminate the potential for soil and groundwater contamination. Hazardous waste, such as used oil and lubricants, will in any case be stored in sealed drums/containers. Using a suitable waste management	4

	contractor, for transporting waste to licenced management facilities, will also effectively reduce risk.		
Reversibility (R)	Slightly reversible: Groundwater remediation is possible, but is a lengthy and costly process.		2
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Moderate	36
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	18

8.4.5.3 Management and Mitigation of General and Hazardous Waste

The mine has a waste management procedure in place, addressing waste minimisation, reuse, recovery, and recycling, as well as temporary storage and disposal. The procedure must be adopted by contractors at the start of construction activities. The procedure is included in the EMPr.

Waste which can be practically recycled, must be sorted and stored for that purpose. All construction and installation waste must be stored temporarily in a manner that protects groundwater and soil, and appropriately disposed of at a suitable, permitted/licensed, disposal site (i.e. where the waste in question is classified as general waste), or stored temporarily, prior to collection by a waste disposal contractor, in the event that hazardous waste is generated.

8.4.6 AIR QUALITY

During closure, the undertaking of civil works may lead to the generation of wheel entrained dust on unpaved surfaces, and wind entrained dust from excavations and handling of soil. The following activities will generate dust during the decommissioning and closure phase of the proposed plant and roads:

- Removal of topsoil and subsoil from stockpiles, and transportation to the area to be rehabilitated;
- Earthmoving equipment undertaking shaping and rehabilitation.

Although the impact is likely to be localised to the site, due the size of the area to be worked, dust suppression techniques such as wetting roads, or application of dust palliatives, may be required. Other emissions, such as from vehicle and machinery exhausts, are not anticipated to be significant.

Impacts to air quality during the post-decommissioning phase would occur if there was failure to revegetate the facility subsequent to capping. In the event that the facility is not vegetated, then there is a potential for wind-blown dust generation arising from the side walls of the facility. Vegetating the facility must be undertaken, in accordance with the closure plan.

Table 8-36: Impact Assessment - Air Quality		
Nature (N)	Negative impact on ambient air quality.	1
Extent (E)	Locally: Localised to the site and immediate surrounds.	2
Duration (D)	Long term: Closure activities anticipated to be up to 6 months.	2

Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected by dust and dust deposition.		2
Probability (P)	Definite: Closure activities and transport of materials will result in entrainment of particulate matter. Without adequate closure procedures, dust entrainment can occur over long periods after closure.		5
Mitigation (M)	Moderately mitigated: Effective dust suppression methods are readily available for transport, but less so for excavation and materials handling.		3
Reversibility (R)	Upon completion of closure phase activities, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Low	11

8.4.6.1 Management and Mitigation

The applicant must institute effective dust suppression measures on all un-surfaced access roads for the duration of the closure phase, as per the requirements of the approved mine EMPr (DMR reference: NC 30/5/1/2/3/2/1/203 EM). Compliance with the National Dust Control Regulations GN.R 827 2013, and associated thresholds must be monitored. The site must be vegetated, in accordance with the closure plan. Monitoring of dustfall, as set out in 8.2.5.2, must continue until the requirements of the closure plan have been met.

8.4.7 NOISE

The following activities will generate noise during the decommissioning and closure phase of the proposed plant and roads:

- Removal of topsoil and subsoil from stockpiles, and transportation to the area to be rehabilitated;
- Earthmoving equipment undertaking shaping and rehabilitation.

8.4.7.1 Impact Discussion & Significance Assessment

Noise propagation is expected to have no significant impact outside of the site, in cognisance of there being no proximal external receptors, and in cognisance of the existing noise levels and sources at the site.

Table 8-37: Impact Assessment - Noise		
Nature (N)	Negative impact on site.	1
Extent (E)	On site: Localised to the site.	1
Duration (D)	Short term: Decommissioning and primary rehabilitation activities anticipated to be up to 1 year.	2
Intensity (I)	Negligible: The facility is within a mining area, and there are no nearby noise receptors outside of the facility.	1

Probability (P)	Definite: Noise will be generated by excavation, and other equipment and activities.		5
Mitigation (M)	Well mitigated: To be limited to normal working hours, in accordance with locally applicable By-laws.		4
Reversibility (R)	Irreversible: The status quo will return to the previous status quo upon completion of closure phase activities.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	15
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	6

8.4.7.2 Management and Mitigation

Decommissioning and closure related activities should be limited to normal working hours.

8.4.8 SOCIO-ECONOMIC

During this phase, there may be employment created for the construction industry. However, the scale of the activities is such that contractors are likely to use existing employees. There will, however, be socio-economic benefits related to the supply of services and support necessary for the dismantling and decommissioning process, as well as the rehabilitation phase.

8.4.8.1 Impact Discussion & Significance Assessment

The impact will be of a minor intensity, and is expected to have a municipal extent. Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where it is practical. BRMO has an internal policy of preferential employment of people within the region.

Table 8-38: Impact Assessment - Socio-Economic			
Nature (N)	Positive impact on job creation.		-0.25
Extent (E)	Local: Expected to have an impact within the surrounds of the local municipality.		2
Duration (D)	Short term: The duration of the decommissioning and primary rehabilitation activities is expected to be about 1 year.		2
Intensity (I)	Moderate: The number of jobs created will not be large, and these jobs will be temporary. It is likely that contractors with existing employees will largely be used.		3
Probability (P)	Definite: Impact will occur.		5
Enhancement (H)	Moderate enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied.		3
Significance Rating - Positive Impact (S)	N x (E+D) x I x P x (H).	Positive (Moderate)	-45

8.4.8.2 Enhancement

Effective enhancement, in the form of the proponent making a concerted effort to employ workers from the surrounding areas, can be applied where practical.

8.4.9 ODOUR

Odour generation resulting from the decommissioning of the facility is negligible. Whilst there may be generation of vehicular fumes, these are not deemed to be of any significance. The materials deposited are odourless and are not expected to undergo any significant chemical transformations after closure that would generate odorous emissions.

Table 8-39: Impact Assessment - Odour			
Nature (N)	Negative nuisance impact on ambient air quality.		1
Extent (E)	Site: Besides fumes from diesel engines, no odour impact is expected.		1
Duration (D)	Short term: The duration of the decommissioning and primary rehabilitation activities is expected to be about 1 year.		2
Intensity (I)	Negligible: No natural processes or other receptors are expected to be appreciably affected.		1
Probability (P)	Negligible.		1
Mitigation (M)	No mitigation required.		1
Reversibility (R)	Upon completion of closure phase activities, the status quo is expected to revert.		4
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	1.2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1

8.4.9.1 Management and Mitigation

Due to the negligible impacts, no Management and Mitigation measures have been proposed.

8.4.10 VISUAL/AESTHETIC

Visual impacts from decommissioning activities are not anticipated to be of significance, and are unlikely to be visible from the nearest receptors travelling along the R380. Given the proliferation of mines in the area, it is not anticipated that the sense of place will be altered. Once rehabilitated, the facility will be less visible from all vantage points, and thus there would be a positive change in comparison to the construction, operational, and closure phase.

Table 8-40: Impact Assessment - Visual/Aesthetic		
Nature (N)	Negative impact.	1
Extent (E)	Local: The activities/facility will only be visible from R380 road adjacent to the BRMO property boundary.	2
Duration (D)	Short term: Construction phase anticipated to be up to 12 months.	2
Intensity (I)	Negligible: No receptors are expected to be appreciably affected.	1
Probability (P)	Definite: The activities/facility will be visible from the site.	4

Mitigation (M)	Well mitigated: Grassing of the facilities' slopes will blend the facility with natural surrounding veld.		4
Reversibility (R)	Irreversible: If the facility is not removed prior to closure of the mine, then it will remain in perpetuity.		1
Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Low	16
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	2

8.4.10.1 Management and Mitigation

Due to the negligible impacts to visual and aesthetics, no Management and Mitigation measures have been proposed. The proposed closure and rehabilitation measures in the closure plan will improve the visual impact.

8.4.11 SURFACE WATER

Impacts to surface water from decommissioning and closure activities are generally associated with potential hydrocarbon spills and water handling. Given the aridity of the environment, there is no surface water at the site. The low rainfall, in combination with highly permeable soils, results in rapid infiltration of storm water. There are no visible natural drainage channels at the site.

Post-closure surface water contamination would relate to rainfall on the SFSF, and subsequent run-off. Provided the site is capped in accordance with the DWAF Minimum Requirements for Waste Disposal by Landfill, as set out in the EMPr and closure plan, it is not anticipated there would be contaminated run-off. It is notable that leach tests indicate a low propensity of mobilisation of contaminants by contact with water.

Table 8-41: Impact Assessment - Surface Water Contamination		
Nature (N)	Negative impact on water quality.	1
Extent (E)	Site: There is no evidence of natural surface water or drainage on the site.	1
Duration (D)	Long term: If there are any impacts, they may continue in perpetuity if not addressed during the closure design.	4
Intensity (I)	Minor: Natural processes or functions are not expected to be appreciably affected. Leach tests indicate limited propensity for leaching from the super fines.	2
Probability (P)	Unlikely: There is no evidence of natural surface water or drainage on the site. The site has high infiltration and evaporation rates.	1
Mitigation (M)	Well mitigated: Effective procedures can be adopted to prevent contamination of surface water from the closure activities as well as post-closure.	3
Reversibility (R)	Upon completion of closure phase activities, the status quo is expected to revert.	4

Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	4
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	3

8.4.11.1 Management and Mitigation

Management actions should focus on the prevention of any such potential hydrocarbon contamination, rather than post-impact remediation thereof. BRMO has spill management procedures, which include specification for bund walls. Mitigation measures to be implemented in this regard, include:

- All hazardous substances to be stored within appropriately sized, impermeable, bund walls;
- Hazardous substances spill kits to be readily available at all points where hazardous substances will be stored and/or transferred (e.g. refuelling points);
- Vehicle and plant servicing to only take place in dedicated service yards, on impermeable surfaces, coupled with appropriate 'dirty' water containment systems/sumps and oil/water separators;
- Drip trays to be appropriately placed under vehicles and plant that over-night on bare soil surfaces, or when leaks are observed; and
- Where hydrocarbon spills occur, the soil is to be removed for treatment or disposal, as soon as practical.

The SFSF must be capped and rehabilitated in accordance with the EMPr and closure plan.

8.4.12 TRAFFIC

Vehicular movement is expected to largely be within BRMO. No significant changes to existing traffic are expected for the proposed scope of the decommissioning work. It is notable that contractors have accommodation on-site, in established contractor camps. Traffic for the supply of liner materials and construction vehicles will largely be once-off events.

8.4.12.1 Impact Discussion & Significance Assessment

Table 8-42: Impact Assessment - Traffic		
Nature (N)	Negative impact on traffic in the area.	1
Extent (E)	Site: The majority of vehicular movement will be within the BRMO boundaries.	1
Duration (D)	Short term: The decommissioning and primary rehabilitation phase anticipated to be up to 12 months.	2
Intensity (I)	Negligible: No external users are expected to be appreciably affected. The majority of vehicular movement will be within the BRMO boundaries.	1
Probability (P)	Negligible: The activities/facility will only be visible from the site.	1
Mitigation (M)	No mitigation required.	1
Reversibility (R)	Upon completion of closure, the status quo is expected to revert.	4

Significance Rating without Mitigation	N x (E+D) x I x P ÷ ½(R)	Negligible	1.2
Significance Rating with Mitigation	N x (E+D) x I x P ÷ ½(M+R)	Negligible	1

8.4.12.2 Management and Mitigation

Traffic impacts can be mitigated by transporting machinery and materials outside of peak travel times, therefore reducing traffic impact.

9 SITE SELECTION CONFIRMATION

Site selection was undertaken during the scoping phase, in accordance with regulation 3(1)(h) of EIA Regulations (GN.R 982 of 2014, as amended). Two potential sites were identified, being the preferred site adjacent to, and west of, the existing Gloria TSF and the alternative site to the east. Comments received from adjacent mining operator Mokala Manganese have profoundly affected the viability of the alternative site to the east of the existing TSF. It was noted that Mokala Manganese proposes to develop an open cast mine adjacent to the alternative site, and thus the alternative site presents a potential safety risk. It is also clear from the selection matrix in Table 9-1, that the western location should in any case be the preferred site.

The selection of potential sites for the SFSF was largely limited to areas proximal to the plant, and the Gamagara River eliminates possibilities to the east and north of the Gloria surface activities. Existing infrastructure and the existing Gloria TSF are significant factors in narrowing down potential sites to the two sites that were selected. Selection of the preferred site was undertaken using a first principles approach, based on:

1. Environmental impacts as considered in section 7 of this report;
2. Socio-economic impacts and constraints;
3. Design and operating constraints;
4. Capital and running cost considerations.

The scores in the adjacent columns, for each alternative, indicate whether the outcome is positive or negative for each aspect/criterion considered:

+1 indicates a net benefit or significant advantage over the other alternatives.

-1 indicates a net deterioration or significant disadvantage relative to the other alternatives.

0 indicates neutrality or comparative neutrality.

A cumulative sum at the bottom of the table indicates the net outcome of all considerations.

The assessment in Table 9-1 clearly indicates the preferable site, having considered numerous factors relevant to site selection, and the comments from the neighbouring Mokala Mine.

Table 9-1: Site Selection Matrix				
Consideration	Location 1 (Proposed Site)	Score	Location 2 (Alternate Site)	Score
Clearing of undisturbed land	Clearing required	-1	Clearing required, although to a lesser degree	+1
Removal of indigenous vegetation	Removal required	-1	Limited Removal required, although to a lesser degree	+1
Removal of protected plant biota	Removal/relocation of protected plants and trees may be required	-1	Less removal/relocation of protected plants and trees may be required	+1
Within 100 m of a natural drainage channel or water course other than a wetland	Located approximately 900 m west of the Gamagara River	+1	Located approximately 300 m west of the Gamagara River	+1
Within 500 m of a wetland, or riparian area	Located approximately 900 m west of the Gamagara River	+1	Located approximately 300 m west of the Gamagara River	-1
Comparative proximity to surface water	Located approximately 900 m west of the Gamagara River	+1	Located approximately 300 m west of the Gamagara River	-1
Proximity to seismic risk zones	None	+1	None	+1
Presence of dispersive soils	None	+1	None	+1
Geotechnical considerations	No significant issues identified	+1	Vegetation and surface characteristics imply greater presence of hardpan calcrete and thus more difficult excavation conditions	-1
Proximal to other receptors in event of dam failures or other catastrophic events	Further from neighbouring activities with less risk impacting their activities	+1	Closer to adjacent properties, with risk to their activities	-1
Underlain by unstable geology, dolomitic, or karst areas, where sinkholes and subsidence are likely	None	+1	None	+1
Comparative proximity to ground water resources	Nearest borehole (GPT01) indicates depth of to water in the order of 40 mbgl	+1	No boreholes in proximity, thus undetermined	0
Within a declared conservation area	None	+1	None	+1
Comparative proximity to heritage resources	Located approximately 900 m west of LSA sites in the Gamagara River	+1	Located approximately 300 m west of LSA sites in the Gamagara River	-1
Land use zoning	Mining	+1	Mining	+1
Within 100 m of human receptors	500 m from Gloria contractor camp	+1	80 m from Gloria contractor camp	-1
Surface gradient	Relatively flat	+1	Relatively flat	+1
Depth to bedrock	Anticipated to be over 50 m	+1	Anticipated to be over 50 m	+1
Servitudes within proposed site	None	+1	None	+1

Energy usage for pumping of water	Closer to existing water infrastructure, thus less energy required for water reticulation	+1	Further from existing infrastructure, thus more energy required for water reticulation	-1
Visual impact	Proximal to existing mine activities - no change to aesthetic profile expected	0	Proximal to existing mine activities - no change to aesthetic profile expected	0
Noise	Within existing mine activities - no change to noise profile expected	0	Within existing mine activities - no change to noise profile expected	0
Logistics – distance to other infrastructure	Closer to existing water infrastructure	+1	Further from existing infrastructure	-1
Installation cost	Lower costs relating to joining existing water and tailings transport infrastructure	+1	Higher costs relating to joining existing water and tailings transport infrastructure and potential presence of hardpan calcrete	-1
Running cost	Lower running cost due to lower energy requirements for transport of water and suspended fines	+1	Higher running cost due to higher energy requirements for transport of water and suspended fines	-1
Proximity to access road	Area adjacent to access road	+1	Area adjacent to access road	+1
Outcome	Location 1	+18	Location 2	+3

9.1 ADDITIONAL INPUT FROM SPECIALISTS

9.1.1 BIODIVERSITY SPECIALISTS (REPORT SAS 219153)

The alternative site is located to the south of the current study area, on the opposite side of the mine access road. Historical farming practices, likely grazing of livestock, has resulted in the notable disturbance of habitat and loss of the herbaceous layer. As such, the faunal diversity and abundance within this site is notably lower. Impacts on the floral and faunal habitat, species diversity and SCC within the alternative site, should the SFSF be located here, will likely be lower than that of the current proposed site.

9.1.2 ARCHAEOLOGIST (REPORT VAN VOLLENHOVEN 2019: 011928V)

The archaeological specialist notes that "Any of the two proposed sites [may] be utilised."

9.1.3 PALAEONTOLOGIST (REPORT BUTLER 2019: 401PIA)

The proposed construction of the Super Fines Storage Facility at the Assmang (Pty) Ltd, Black Rock Mining Operations at Hotazel, Northern Cape, is completely underlain by the Cenozoic Kalahari Group, as well as underlying Griqualand West Basin rocks, Transvaal Supergroup. According to the PalaeoMap of SAHRIS, the Palaeontological Sensitivity of the Kalahari Group is low, and the Griqualand West rocks of the Transvaal Supergroup is moderate.

It is therefore considered that the construction and operation of the Super Fines Storage Facility upgrade is deemed appropriate and feasible, and will not lead to detrimental impacts on the palaeontological resources of the area. Thus, the construction and operation of the facility may be authorised, as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

9.1.4 GEOTECHNICAL (REPORT SRK 2019: 547073)

The geotechnical investigation presents the results of an invasive geotechnical investigation, conducted for the preferred location. The geotechnical report confirms the suitability of the site, with no fatal flaws noted.

The specialist also notes, with regard to the alternative site, it would be anticipated that there would be more hardpan calcrete at the site (this is based on comparing vegetation and surface characteristics of this area on Google Earth and the site investigated). This may potentially lead to variations in excavation conditions (larger area requiring more difficult excavation conditions).

9.2 CONCERNS RAISED BY IAPS

Comments raised by IAPs which are of particular relevance the determining of the preferred site are addressed here. Note that recommended/requested mitigation measures are included in the EMPr where applicable.

9.2.1 DEPARTMENT OF WATER AND SANITATION (DWS)

Of particular reference to the proposed locations, the department noted in their comments to the scoping report:

"*Please note that our Department rates all perennial and non-perennial rivers together with all dry river beds and natural drainage and associated riparian areas extremely sensitive to*

development. An option of developing furthest away from the all water course would be the preferred option.

Please note that no development or prospecting/mining should be done within 100 m or 1:100 year flood line of any water course and 500m of wetlands without authorisation from our Department. The water courses should be delineated in order to provide appropriate buffer to maintain such water course. The delineation should be done according to the appropriate Department of Water and Sanitation's delineation document.

The construction camp shall not be located within the 1:100 year flood line or within 100 meters whatever is the greatest from any watercourse. Operation and storage of equipment within the riparian zone must be limited as far as possible."

The preferred location is 900m from the nearest watercourse, and thus meets the departments requirements set out above. There will not be any construction camp developed.

9.2.2 MOKALA MANGANESE (PTY) LTD

Of particular reference to the proposed locations, Mokala Manganese noted in their comments to the scoping report:

"*1. The proposed position of the super fines storage facilities is in close proximity to the R380 and the Mokala development. How will the dust from the storage facility be managed to ensure that it does not pollute the area and pose a hazard to traffic utilising the R380. The alternative location raises a concern for the sterilization of minerals at the Mokala open pit.*

2. The alternative location to the West should be considered.

3. A semi-quantitative dam break analysis must be carried out for the TSF. Mokala has a concern that should a dam breach occur the mining pit would be in the Zone of Influence."

The location to the west has accordingly been determined to the preferred site. A dam failure risk assessment was undertaken for the purposes of dam safety classification, by the appointed geotechnical design team which shows that the zone of influence will not intercept with Mokala Manganese's proposed opencast mine.

This classification defines the potential consequences of a failure of the storage facility. It is important to note that a storage facility that may be classified as having a "high" hazard rating may not have an associated "high" risk. The risks (or the likelihood of adverse impacts – that is, probability of occurrence x consequence of occurrence) can be reduced and minimised through the implementation of risk management techniques.

The Code of Practice for Mine Residue (SANS 10286) is utilised for classification purposes. SANS 10286 calls for a safety classification to differentiate between residue deposits of high, medium, and low hazard rating based on their potential to cause harm to life or property within the zone of influence. The classification should be based on the anticipated configuration of the storage facility at the end of its design life. The zone of influence is presented in Figure 9-1 below. The hazard rating for the SSF can be summarised as follows:

- Number of residents in zone of influence: Low
- Number of workers in zone of influence: High
- Value of third-party property in zone of influence: Low
- Depth to under-ground mine workings: Low

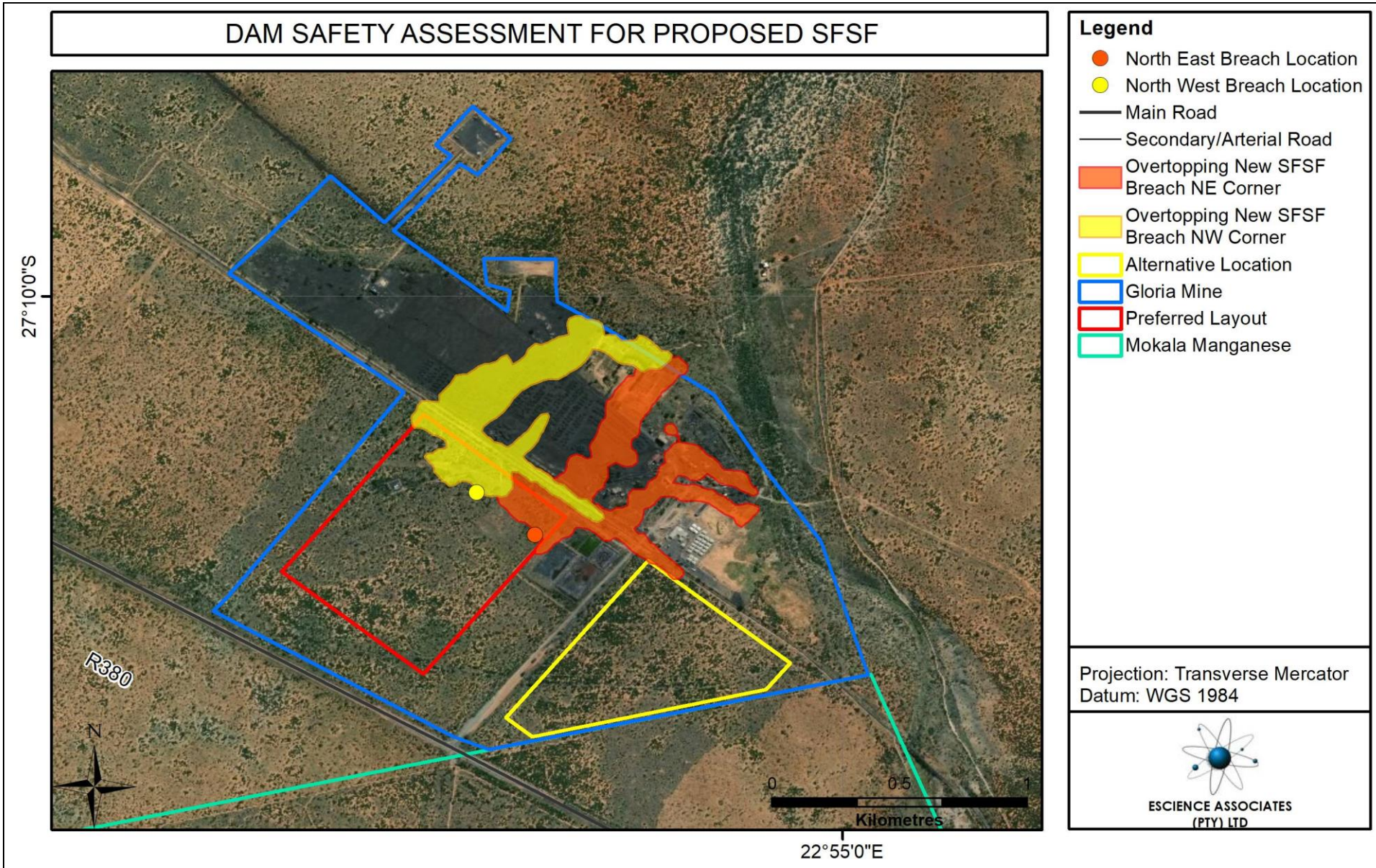


Figure 9-1: Zone of Influence

10 CONCLUSIONS AND EAP RECOMMENDATIONS

10.1 IMPACT SUMMARY

A summary of the impact assessment outcomes is presented in Table 10-1 below.

Table 10-1: Summary of Environmental Impact Assessment

Phase	Impact	Without Mitigation	With Mitigation
Construction	Management and Disposal of General Waste	Moderate	Low
	Management and Disposal of Hazardous Waste	Moderate	Low
	Air Quality	Low	Low
	Noise	Low	Negligible
	Socio-Economic	Positive (Moderate)	Not Applicable
	Visual/Aesthetic	Low	Negligible
	Odour	Negligible	Negligible
	Surface Water	Negligible	Negligible
	Traffic	Negligible	Negligible
	Groundwater Contamination	Low	Negligible
	Soil Contamination	Low	Negligible
	Groundwater Availability/Interception	Negligible	Negligible
	Heritage Resources (Archaeological)	Low	Negligible
	Heritage Resources (Paleontological)	Negligible	Negligible
	Biodiversity (Flora)	Medium-high	Medium-low
	Biodiversity (Fauna)	Medium-low	Medium-low
Operation	Management and Disposal of General Waste	Low	Negligible
	Management and Disposal of Hazardous Waste	Low	Negligible
	Air Quality	Negligible	Negligible
	Noise	Negligible	Negligible
	Socio-Economic	Positive (Negligible)	Not Applicable
	Odour	Negligible	Negligible
	Visual/Aesthetic	Low	Negligible
	Surface Water	Low	Negligible
	Traffic	Negligible	Negligible
	Biodiversity (Flora)	Medium-low	Medium-low
	Biodiversity (Fauna)	Medium-low	Medium-low
	Groundwater Contamination	Low	Low
	Soil Contamination	Low	Low

Table 10-1: Summary of Environmental Impact Assessment			
Phase	Impact	Without Mitigation	With Mitigation
	Heritage Resources (Archaeological)	Negligible	Negligible
	Heritage Resources (Paleontological)	Negligible	Negligible
Decommissioning	Management and Disposal of General Waste	Moderate	Low
	Management and Disposal of Hazardous Waste	Moderate	Low
	Air Quality	Low	Low
	Noise	Low	Negligible
	Socio-Economic	Positive (Moderate)	Not Applicable
	Odour	Negligible	Negligible
	Visual/Aesthetic	Low	Negligible
	Surface Water	Negligible	Negligible
	Traffic	Negligible	Negligible
	Groundwater Contamination	Low	Low
	Soil Contamination	Low	Low
	Biodiversity (Flora)	Medium-low	Medium-low
	Biodiversity (Fauna)	Medium-low	Medium-low
	Heritage Resources (Archaeological)	Negligible	Negligible
	Heritage Resources (Paleontological)	Negligible	Negligible

10.2 CONFIRMATION OF PREFERRED LOCATION

The preferred location as identified through the site selection matrix (refer to Table 9-19, in section 9 of the report) is confirmed in cognisance of the findings of the specialist assessments, the impact assessment, and the comments from interested and affected parties. The SFSF, Return Water Dam and related infrastructure will be located to the west of the existing Gloria TSF boundary and the soil stockpiles will be located to the south.

Mine	Farm Name	Title Deed	21 digit Surveyor General code
Gloria	Ptn. 1 Gloria 266	No. 506 of 1966	C04100000000026600001
Black Rock Mine Operations, Joe Morolong Local Municipality, John Taolo Gaetsewe District Municipality, Northern Cape			

Mine	Farm Name	Title Deed	21 digit Surveyor General code

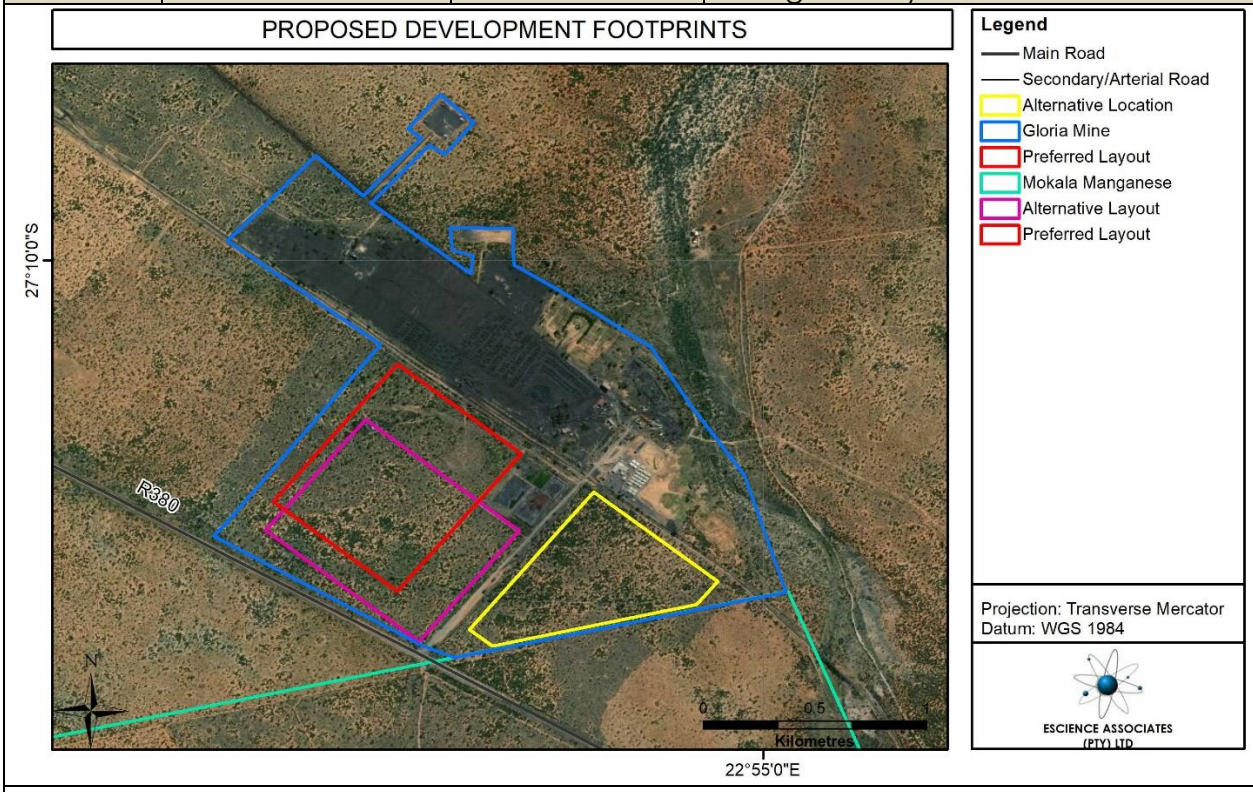


Figure 10-1: Preferred Location

10.3 CONCLUSIONS

The main objective of this assessment was to identify and discuss issues of potential environmental significance, and where possible, indicate the significance of those impacts and the mitigation required. The identification and assessment of environmental impacts, for each project phase, shows that these impacts can be effectively managed with the proposed mitigation measures in place. The measures are detailed in the Environmental Management Programme (Appendix 5).

In terms of the positioning of the Super Fines Storage Facility, it is in the EAPs view that, based on the findings of the various specialist studies, the impact assessment, the comments raised by interested and affected parties, and other infrastructural considerations, that the preferred location adjacent to the existing tailings facility be authorised.

It is the professional opinion of the EAP that the EIA process undertaken for the project to date has been procedurally correct, in terms of, *inter alia,* the requirements outlined in Government Notice No. 982 of 4 December 2014, as amended. The EAP, furthermore, believes that the significant issues that may potentially be realised, through the possible authorisation of the project by the Competent Authority, have indeed been identified to the best practical extent. The EAP also believes that the information provided in this Environmental Impact Report is sufficient/substantive for IAPs to contribute meaningfully to the EIA process (as required by Government Notice 982), and for the Competent Authority (DMR) to make an informed decision as to whether, or not activity should be authorised. It is, therefore, the EAP's recommendation that the competent authorise this activity.

11 AFFIRMATION BY EAP

EScience Associates (Pty) Ltd, as the Environmental Assessment Practitioner, led by Abdul Ebrahim, hereby affirms that:

- The information herein is true and correct to the best of our knowledge;
- The EAP has kept a register of all Interested and Affected Parties that participated in a public participation process;
- The EAP has ensured that information containing all relevant facts, in respect of the application, is distributed or made available to Interested and Affected Parties and the public, and that participation by Interested and Affected Parties has been facilitated in such a manner that all Interested and Affected Parties have been provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;

12 DECLARATION BY EAP

EScience Associates (Pty) Ltd, as the Environmental Assessment Practitioner, led by Abdul Ebrahim hereby affirms that:

- The information herein is true and correct to the best of our knowledge;
- The EAP has kept a register of all Interested and Affected Parties that participated in a public participation process;
- The EAP has ensured that information containing all relevant facts in respect of the application is distributed or made available to Interested and Affected Parties and the public, and that participation by Interested and Affected Parties has been facilitated in such a manner that all Interested and Affected Parties have been provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- The EAP has included all comments and inputs made by stakeholders and Interested and Affected Parties, as well as the Competent Authority. Responses to comments are appended to this Environmental Impact Report.

_____

NAME OF EAP

_____ _____

SIGNATURE OF EAP DATE

APPENDIX 1 – A3 LOCALITY MAP

APPENDIX 2 – PUBLIC PARTICIPATION

PROOF OF SITE NOTICES

PROOF OF NEWSPAPER ADVERTISEMENTS

LIST OF IDENTIFIED IAPS

PROOF OF DISTRIBUTION TO IAPS

COMMENTS AND RESPONSES FROM IAPS

APPENDIX 3 – SPECIALIST REPORTS

APPENDIX 4 – LINER EXEMPTION MOTIVATION

APPENDIX 5 – ENVIRONMENTAL MANAGEMENT PROGRAMME

APPENDIX 6 – EAP CVs

APPENDIX 7 – CLOSURE PLAN