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African Rainbow Minerals Limited,

– Machadodorp Works:

Proposed $MnSO_4$ Processing Plant at African Rainbow Minerals: Machadodorp Works (ARMMDW), Mpumalanga

Report Purpose

DRAFT Basic Assessment Report for Stakeholder Review and Comment

Report Status

DRAFT

Report Reference

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Tanja Bekker is registered as a Professional Natural Scientist in the field of Environmental Science with the South African Council for Natural Scientific Professions (SACNASP) and is also a Registered Environmental Assessment Practitioner (EAP) with the Environmental Assessment Practitioners Association of South Africa (EAPASA), a legal requirement stipulated by the National Environmental Management Act, 1998. She is further certified as an ISO 14001 Lead Auditor. Her qualifications include BSc. Earth Sciences (Geology and Geography), BSc. (Hons.) Geography and MSc. Environmental Management. In addition to her tertiary qualifications, she obtained a Certificate in Project Management, and completed the Management Advancement Programme at Wits Business School.

With more than 21 years' experience in environmental management and the consulting industry, she follows a methodical and practical approach in attending to environmental problems and identifying environmental solutions throughout the planning, initiation, operation and decommissioning or closure of projects.

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Quality Control

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Tanja Bekker	Inclusion of Stakeholder Comments		
Mpumalanga DARDLEA	Final Submission		

Executive Summary

Introduction

Smelting at African Rainbow Minerals: Machadodorp Works (ARMMDW, or alternatively "the Works") [previously owned by Assmang (Pty) Ltd (Assmang)] already commenced in 1972. In 1971, Assmang diversified into Low Carbon Ferrochrome with a new smelter plant located at Fairview near eNtokozweni (Machadodorp), Mpumalanga. Machadodorp Works (as the ARMMDW was previously known) opened in 1972 as a Low Carbon Ferrochrome producer with two (2) 24MVA SiCr Furnaces. By 2005, after several upgrades and modifications, Machadodorp Works had four (4) operating furnaces, a Metal Recovery Plant (MRP) and a Pelletising Plant in place.

In July 2010, Furnace 5 was successfully converted to High Carbon Ferromanganese. The first Manganese alloy from this furnace was exported in October of the same year. Since then, a further two (2) furnaces were successfully converted. Due to economic constraints at the time, ARMMDW temporarily suspended its core operations. Consequently, the following facilities have been placed on "care and maintenance" since end of April 2015: All four (4) of the electric furnaces; the raw materials handling system; the Pelletising Plant; and the Crushing, Screening and Dispatching Plant (CSD Plant). The only operational system up until end April 2023 on site was the MRP, operation of which has subsequently also been ceased.

Currently the only activities undertaken on site include the selling of Slag from the approved Slag facilities [excluded from the definition of a waste issued by the Department of Forestry, Fisheries and the Environment (DFFE) for Ferrochrome and Ferromanganese Slag, respectively: 12/9/11/L200702095913/6/N/Exclusion Application and 12/9/11/L200622135529/6/N/Exclusion Application] The Historic Slag Dump is being reworked, and new extensions are available for future disposal. In addition to this, ARMMDW is currently in the process of constructing a Reverse Osmosis Plant (RO Plant) [approved in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) under reference 05/X21F/ACFGI/8736, dated 5 February 2019 and the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) under reference 12/9/11/L891/6, dated 11 April 2016].

ARMMDW has previously operated under a 2011 Atmospheric Emission Licence (AEL), which was reviewed by the Nkangala District Municipality (Licensing Authority) and issued on 28 June 2019 under reference 17/04/AEL/MP314/11/01. This 2011 AEL was renewed for the purposes of Ownership Change on 10 December 2021 under reference 17/04/AEL/MP314/11/01.

Purpose of this report

Although the operation has initiated temporary cessation, the investigations in identifying more suitable, practical, and economically viable options for the running of the operation have not ceased. It is the aim of the operation to ensure that optimal production can continue in the future and that employment opportunities can be reinvested in. For this reason, a new project was approved on 16 April 2021 (reference 1/3/1/16/1N-253) by the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA). This project involves a new Smelt Direct Process, which will eliminate the current Sinter Plant, and make use of the furnace off gas to preheat pellets which will then be used as input into the furnaces. This project is currently in planning phase for implementation during 2024.

In addition to this, and as part of the ongoing strategy to revive ARMMDW, the development team has identified the opportunity to construct a new Manganese Sulphate ($MnSO_4$) Plant. This plant will rework the current Manganese Slag Stockpile (in line with the issued exemptions as presented before). The current Manganese Sla

Slag Stockpile can provide a sustainable supply of product for 8-12 years, whereafter the Works will source other identified slag feed producers to increase the life.

This will not only ensure a start-up of operations on site, but will also contribute substantially to minimise "wastes" in terms of the National Waste Management Strategy (NWMS) of South Africa. The outcome of this project will be the development of battery grade $MnSO_4$.

The proposed plant will include the following processes of the following:

- Milling
- Filtration
- Pugging
- Dead Burn
- Leaching
- Post-leach Filtration
- Precipitation, Thickening, and Filtration
- Recycling
- Crystallisation
- Crystal Drying and Decomposition
- Product Bagging
- Post-crystallisation Gas Scrubbing
- Use of reagents, chemicals, air abatement infrastructure and water.

NEM:AQA Listed Activities Triggered

The following activities are triggered in terms of the National Environmental Management: Air Quality Act (Act no. 39 of 2004) (NEM:AQA) with the Competent Authority being the Nkangala District Municipality, with offices located in Middelburg:

Applicable Listed Activities

- *Subcategory 7.2: Production of Acids*
    - All installations producing, **handling** and/or **using** more than 100 tons per annum of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.

- *Subcategory 7.1: Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide*
    - All installations **producing and/or using** more than 100 tons per annum of any of the listed compounds.

- *Subcategory 4.1: Drying and Calcining*
    - Drying and calcining of mineral solids including ore.
    - Facilities with capacity of more than 100 tons/month product.

  Or
- *Subcategory 5.2: Drying*
    - The drying of mineral solids including ore, using dedicated combustion installations.
    - Facilities with a capacity of more than 100 tons/month product.

- *Subcategory 4.20: Slag Processes*
  - The processing or recovery of metallurgical slag by the application of heat.
  - All installations.

EScience Associates (Pty) Ltd has been appointed as the independent specialist to conduct the Atmospheric Emission Impact Assessment, as well as the subsequent AEL Amendment. The amendment to the AEL further requires approval in terms of the 2014 National Environmental Management Act (107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations (as amended), with the Competent Authority being the Mpumalanga DARDLEA, Witbank.

NEMA Listing Activities Triggered

The proposed project triggers NEMA listed activities in terms of GN R983 (Listing Notice 1) and GN. R. 985 (Listing Notice 3) of December 2014, as amended, as activities that require Environmental Authorisation prior to the commencement thereof, as follows:

- NEMA GN R983, Listing Notice 1:
  - Activity 14: "The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."
    - *According to guidance received from the DFFE IQ Department, 2 May 2023, the following was stated in terms of the consideration of a combined capacity:*
    - *"Determining whether a facility or infrastructure would be considered individually, or combined, is a matter of implementation and is decided at the discretion of the relevant competent authority. If a reasonable geographic link exists between these areas where dangerous goods will be stored, or stored and handled, all these areas, combined, may be regarded a single facility or infrastructure for the storage, or storage and handling of dangerous goods. The combined capacity of such facility will then be considered in terms of the threshold of the relevant listed or specified activity. The competent authority must consider this on a case by case basis, as circumstances may vary between different scenarios (for example the distance between the areas in question, location, geology etc) and you are strongly advised to liaise with the relevant competent authority in order for them to make an informed recommendation in this regard."*
    - Based on the proposed design and location of the tanks (i.e. no interlinkages in terms of pipelines, individually bunded and contained areas, with tanks placed at least 800m apart) the tanks planned are not considered as combined tanks, but individual facilities. For this reason, a Basic Assessment is proposed. This will however be assessed by the relevant competent authority as well.
  - Activity 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 license or an amended permit or license in terms of national or provincial legislation governing the release of emissions, effluent or pollution".

The project further triggers Listing Notice 3, as a portion of the plant footprint is located in a Critical Biodiversity Area (CBA) as identified within the Mpumalanga Biodiversity Sector Plan (2014) as well as a National Protected Area Expansion Strategy (NPAES) Priority Focus Area (note that the project area is located within the Smelter boundary, next to the current Manganese Slag Stockpile and Railway Siding).

- NEMA GN R985, Listing Notice 3:

- Activity 4: The development of a road wider than 4 metres with a reserve less than 13,5 metres. Outside urban areas: Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.
- Activity 10: The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. Outside urban areas: Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.
- Activity 12: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan: Within critical biodiversity areas identified in bioregional plans

The application for the Environmental Authorisation Process was submitted to the DARDLEA on 5 June 2023 however acknowledged by the Competent Authority has not as yet been received. In the interim the Department relocated offices and requested the EAP to resubmit the application during a telephonic follow upon 5 July 2023. The DARDLEA provided the new address on 13 July 2023 and the application was resubmitted on 14 July 2023.

Need and Desirability

Since the end of April 2015, various facilities at ARMMDW have been placed on "care and maintenance". These included all four (4) of the electric furnaces at the Works; the raw materials handling system; the Pelletising Plant; and the CSD Plant. The current employment numbers have dwindled to about 20 full time personnel on site.

ARM is highly committed to ensure that the Works is operational and could once again contribute to improved Social and Economic Conditions within eNtokozweni and the greater Emakhazeni Local and Nkangala District Municipalities within the Mpumalanga Province. The ARMMDW has invested significant capital to investigate alternative options to recommence operations.

The $MnSO_4$ Processing Plant will allow for at least 8-12 years of operational life as a project on its own and further has the opportunity to source feed material from other mines or industries to continue producing. In addition to this, the project on its own will allow for 160 full time personnel and could provide further employment for more than 50 people in support services, such as garden maintenance, workshop management, general maintenance on site.

In addition to this, the fact that the Works has an existing Manganese Slag Stockpile and feasibilities have indicated that the process will be successful in producing battery grade $MnSO_4$, the project is an economic opportunity for the Works and the socio-economic setting.

The National Waste Management Strategy, 2020 specifically states that waste prevention is a priority in relation to hazardous waste, both in terms of amount and toxicity of waste that is disposed of to landfill. The NWMS 2020 is predicated on the insight that while waste is an environmental concern, it is also an important industry in which technology and innovation have a crucial role to play in creating a secondary resources economy.

The implementation of this project, will not only remove the current Manganese Slag Stockpile from site through the reworking process, but also offer the opportunity to other slag producers to reduce their waste footprint. A

further advantage to this process, is that no additional waste is produced. Product will either be in the form of $MnSO_4$ or by products for the use in construction or the fertiliser industry.

Potential Impacts

Construction of infrastructure

This phase will result in the following:

- Site preparation for the new Processing Plant, which will necessitate the relocation of the existing topsoil stockpile and management of alien and invasive plant species;
- Vegetation clearance to a small extent;
- Establishment of pipelines where required to supply water between the facilities and the RO Plant;
- Construction of the new Processing Plant;
- Construction of ancillary infrastructure such as offices, pipelines and stormwater management systems.

Impacts to be managed in this activity will involve:

- Clean and dirty water management;
- Noise management; and
- Dust control.

Construction Waste Generation and Disposal

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 steel, building rubble, packaging and fabrication waste/s. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of such waste could indirectly impact on the operational lifespan of the Municipal Waste Disposal Facility, through the permanent occupation of remaining available airspace at this facility. The same principle would apply to the applicable hazardous landfill facility/ies to which hazardous waste generated during construction will be taken for disposal.

Impacts to be managed in this activity will involve:

- Clean and dirty water management; and
- Unlawful waste disposal.

Operational Phase Activities

The operational phase will result in the movement of slag from suppliers or the Slag Stockpile to the plant, handling of chemicals and the general operation of the plant. Activities that must be managed include:

- Supply of chemicals;
- Storage of H_2SO_4 in tanks;
- Dirty water discharge to the RO Plant;
- Handling of Slag between the Slag Stockpile and processing plant;
- Operation of dirty water systems within the plant footprint; and
- Chemical management within the plant area.

Impacts to be managed in this activity will involve:

- Increase in water requirements;
- Release of Greenhouse Gasses;
- Alien Invasive Species Management;
- Chemical spills;
- Hydrocarbon spills during vehicle transport;
- Dust emissions due to the handling of slag;

- Slag Spills along conveyors; and
- Dirty water management.

Decommissioning Phase Activities

This phase will result in the following:

- Removal of infrastructure;
- Site preparation to achieve final land use;
- Vegetating of the footprint; and
- Clean and dirty water management.

Impacts to be managed in this activity will involve:

- Clean and dirty water management;
- Noise management;
- Dust control; and
- Alien and invasive species management.

Specific Recommendations for Environmental Management Programme (EMP) and Conditions of Authorisation

The following specific conditions are recommended for inclusion into the Environmental Authorisation:

- The project may only commence with the approval of the Environmental Authorisation, as well as the AEL.
- Water uses must comply with the specification of the issued Water Use Licences (WULs).
- No emissions may be allowed without the necessary AELs in place.
- A closed water circuit should be maintained as far as practically possible.
- Chemical Storage specific measures:
    - Tanks will be individually contained facilities, without pipeline interlinkages;
    - All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid.
    - Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume.
    - The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4 as opposed to the metal of carbon steel tanks.
    - The back up chemical storage and top up tanks will be placed about 800-1000m from each other;
    - The back up chemical storage and supply chemical storage tanks will be placed about 800-1000m from each other;
    - All tanks will be ventilated in terms of the required Safety Datasheets (SDSs) standards;
    - Strict storage requirements will be implemented (e.g. dry areas, with ventilation at floor level, spill collection, with strict prohibitions on storage requirements);
    - The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials;
    - Reactivity hazards will be considered and managed;
    - Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented;
    - Secondary containment must be provided to ensure that off-loading of solution occur within the bund wall; and
    - A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the Works.
- A Phase 1 Contaminated Land study must be conducted at the commencement of the Decommissioning Phase.

Reasoned Opinion in terms of EMPr Update

Since the end of April 2015, various facilities at ARMMDW have been placed on "care and maintenance". These included all four (4) of the electric furnaces at the Works; the raw materials handling system; the Pelletising Plant; and the CSD Plant. The only operational system since then has been the MRP and associated Slag Stockpiles (with the Historic Slag Dump being reworked, and new extensions available for future disposal). The current employment numbers have dwindled to about 20 full time personnel on site.

Currently the only activities undertaken on site include the selling of Slag from the approved Slag facilities [excluded from the definition of a waste issued by the DFFE for Ferrochrome and Ferromanganese Slag, respectively: 12/9/11/L200702095913/6/N/Exclusion Application and 12/9/11/L200622135529/6/N/Exclusion Application]. The Historic Slag Dump is being reworked, and new extensions are available for future disposal. In addition to this, ARMMDW is currently in the process of constructing a RO Plant [approved in terms of the NWA under reference 05/X21F/ACFGI/8736, dated 5 February 2019 and the NEMWA under reference 12/9/11/L891/6, dated 11 April 2016].

ARM is highly committed to ensure that the ARMMDW is operating in terms of all Environmental Authorisations requirements and specifically to have a facility which could once again contribute to improved Social and Economic Conditions within eNtokozweni and the greater Emakhazeni Local Municipality and Nkangala District Municipality within the Mpumalanga Province. The ARMMDW has invested significant capital to investigate alternative options to recommence operations.

Manganese has elemental qualities that have the potential to improve density, capacity, rechargeability, safety and battery longevity. Other than being an ingredient in potential alternatives to lithium-ion batteries, manganese is an important component of the two most commonly produced types of batteries available today. Lithium-ion-manganese-oxide (LMO) batteries are the type of batteries currently used to power almost everything rechargeable. Further considering an article published by Fastmarkets, 4 April 2022 (www.fastmarkets.com), an industry expert has warned that in the next ten years demand for high-purity manganese is likely to exceed supply unless more attention is paid to the battery-grade metal. The article states that manganese is widely used in steel production, accounting for more than 90% of global consumption.

Less than 2% of global consumption is converted into high-purity manganese for the battery sector. Many lithium-ion batteries, such as nickel-cobalt-manganese (NCM), use manganese sulphate as a raw material for the cathode precursor. The article stated that in the coming years, battery producers will be looking into reducing cobalt and nickel and increasing manganese consumption.

ARM mines and beneficiates iron ore, manganese ore, chrome ore, platinum group metals (PGMs), nickel and coal and also has a strategic investment in gold through Harmony Gold Mining Company (Harmony). One of the divisions within ARM is ARM Ferrous. ARM's ferrous metals interests are held through wholly owned ARM Ferrous which owns 50% of Assmang, a long-established miner and processor of metals for the world's steel industries. The other 50% of Assmang is held by Assore Ltd. Assmang's operating divisions are based on its two principal commodities: iron ore and manganese ore.

In addition to the mining of manganese, the ARMMDW itself has a Manganese Slag Stockpile with a capacity to supply more than 12 years of manganese slag suitable for battery grade $MnSO_4$.

Considering the above, and the fact that the Works have an existing Manganese Slag Stockpile and feasibilities have indicated that the process will be successful in producing battery grade $MnSO_4$, the project is an economic opportunity for the Works and the socio-economic setting.

In cognisance of the findings of the assessment, and that the project will contribute to the economic setting of the area without fatal flaws or significant impacts, with the required management measures, it is recommended that the proposed activities be authorised.

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1 INTRODUCTION AND BACKGROUND

This section provides background description of the activity, contact details of the company and person responsible for the implementation of the Environmental Management Programme (EMP), as well as a description of the property, and an outline of the specific purpose for the development of this report.

1.1 Activity Background

Smelting at African Rainbow Minerals: Machadodorp Works (ARMMDW or alternatively, the Works) [previously owned by Assmang (Pty) Ltd (Assmang)] already commenced in 1972. In 1971, Assmang diversified into Low Carbon Ferrochrome with a new smelter plant located at Fairview near eNtokozweni (Machadodorp), Mpumalanga. Machadodorp Works (as it was known at the time) opened in 1972 as a Low Carbon Ferrochrome producer with two (2) 24MVA SiCr Furnaces. By 2005, after several upgrades and modifications, Machadodorp Works had four (4) operating furnaces, a Metal Recovery Plant (MRP) and a Pelletising Plant in place. Please refer to Figures 1 - 5 for the Regional, Local and Cadastral Setting of the operation.

In July 2010, Furnace 5 was successfully converted to High Carbon Ferromanganese. The first Manganese alloy from this furnace was exported in October of the same year. Since then, a further two (2) furnaces were successfully converted. Due to economic constraints at the time, ARMMDW temporarily suspended its core operations. Consequently, the following facilities have been placed on "care and maintenance" since end of April 2015: All four (4) of the electric furnaces; the raw materials handling system; the Pelletising Plant; and the Crushing, Screening and Dispatching Plant (CSD Plant). The only operational system on site, up until end April 2023 was the MRP, operation of which has subsequently also been ceased.

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ARMMDW has previously operated under a 2011 Atmospheric Emissions Licence (AEL), which was reviewed by the Nkangala District Municipality (Licensing Authority) and issued on 28 June 2019 under reference 17/04/AEL/MP314/11/01. This 2011 AEL was renewed for the purposes of Ownership Change on 10 December 2021 under reference 17/04/AEL/MP314/11/01.

1.2 Environmental Authorisations

ARMMDW has been operating under various environmental, water and waste management authorisations. Please refer to the following table:

Table 1 List of Environmental Authorisations

#	Environmental Licences (Machadodorp Works)	Reference Number	Date of Licence	Authority	Validity of the Licence
1	Furnace 1 & Pelletising	14,25	Sunday, 02 March 2003	Mpumalanga Department of Agriculture, Rural	Y

#	Environmental Licences (Machadodorp Works)	Reference Number	Date of Licence	Authority	Validity of the Licence
				Development, Land and Environmental Affairs (DARDLEA)	
2	Upgrading of Storm Water System	17/2/22/1 NK 24	Friday, 04 April 2003	DARDLEA	Y
3	Rehabilitation of Historic Slag Dump	17/2/20/NK 13	Tuesday, 13 July 2004	DARDLEA	Y
4	Jigging Plant & 3MVA Furnace	17/2/221 NK 32	Thursday, 07 October 2004	DARDLEA	Y
5	Propane Gas Storage	17/2/1/7 MP-12	Wednesday, 19 December 2007	DARDLEA	Y
6	Brick Making	17/2/1/15 MP 27	Tuesday, 28 October 2008	DARDLEA	N - had to commence within two (2) years
7	Road Building Authorisation	17/2/1/15 MP 27	Thursday, 11 September 2008	DARDLEA	N
8	Road building from slag	17/2/1/15 MP 27	Thursday, 20 November 2008	DARDLEA	N - had to commence within two (2) years
9	Swing Capacity	17/2/2/1e MP-8	Thursday, 12 February 2009	DARDLEA	Y
10	Road Building Authorisation	17/2/1/15 MP 27	Friday, 27 March 2009	DARDLEA	N - Activity had to commence within two (2) years, and only if slag was delisted - this did not happen.
11	Slag Dump Extension	17/2/2/1(g) MP-3	Thursday, 16 April 2009	DARDLEA	Y
12	Recycling and Closure of Assmang Bag House Dust	17/2/1/1 MP-04	Friday, 05 June 2009	DARDLEA	N
13	Furnace 6 Authorisation	17/2/2/1(b)(C)(e) NK-1	Thursday, 25 February 2010	DARDLEA	N - had to commence within two (2) years
14	Waste Licence Bag House Storage	12/9/11/L131/6	Thursday, 18 March 2010	DFFE	N - This licence is no longer valid or required. The Baghouse Dust was removed and relocated to a lined cell in terms of a NEMWA Exemption on 20 December 2013. The new cell is included into the Integrated Waste Management Licence (IWML)
15	Air Pollution Prevention Plan	Certificate No. 424/4	Tuesday, 30 March 2010	-	This licence is no longer applicable, replaced with current AEL.
16	Furnace 1 & Pelletising (Swing Capacity)	AMENDMENT	Friday, 11 March 2011	DARDLEA	Y
17	Integrated Waste Management Licence (IWML)	12/9/11/L368/6	Tuesday, 27 September 2011	Department of Environmental, Forest and Fisheries (DEFF)	This licence was reviewed and updated in 2017.
18	Dump Dust Conveyor	17/2/3N - 129	Friday, 15 March 2013	DARDLEA	Y (Baghouse Dust); N (Dust Dump Conveyor & Dryer House)
19	Storm Water System Upgrade	17/2/3N-211	Wednesday, 11 December 2013	DARDLEA	Y
20	Bag House Dust relocation	12/9/11/L368/6/EXT	Friday, 20 December 2013	DFFE	Y
21	Atmospheric Emission Licence (AEL)	17/04/AEL/MP314/11/1	Monday, 31 March 2014	Nkangala District Municipality	This licence has been replaced by the current AEL.
22	Brine Ponds and Effluent Storage	12/9/11/L891/6	Monday, 11 April 2016	DFFE	Y (valid for 10 years, and then reviewed every 5 years)
23	Waste Management Licence (WML)	12/9/11/L368/6/R1	Tuesday, 20 June 2017	DFFE	Y
24	Water Use Licence (new) (WUL)	05/X21F/ACFG1/8736	05 February 2019	Inkomati-Usuthu Catchment Management Agency (IUCMA)/ Department of	Y

#	Environmental Licences (Machadodorp Works)	Reference Number	Date of Licence	Authority	Validity of the Licence
				Water and Sanitation (DWS)	
25	Atmospheric Emission Licence (AEL)	17/04/AEL/MP314/11/01	28 June 2019	Nkangala District Municipality	N
26	Rehabilitation Project and Implementation of Storm Water Management Channels	1/3/1/16/1N-163	29 October 2019	DARDLEA	Y
27	Smelt Direct Project	1/3/1/16/1N-253	16 April 2021	DARDLEA	Y
28	Atmospheric Emission Licence (AEL)	17/04/AEL/MP314/11/01	10 December 2021	Nkangala District Municipality	N

Note: #28 in specific is applicable to this Environmental Authorisation Application as the proposed project will involve National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA) listed activities.

Please refer to the following section providing further information in terms of the application.

1.3 Terms of Reference

1.3.1 History in terms of the Atmospheric Emissions Licence and Operational Status

ARMMDW has been operating under a 2014 Atmospheric Emissions Licence (AEL), which was reviewed by the Nkangala District Municipality (Licencing Authority), whereafter an amended AEL was issued in 2019 under Ref 17/04/AEL/MP314/11/01. This 2021 AEL makes provision for the following NEM:AQA activities:

Table 2: AEL approved activities

Category of Listed Activity	Sub-Category of the Listed Activity	Listed Activity Name	Description of the Listed Activity
4	4.5	Sinter Plant	Sinter Plants for agglomeration of fine ores using a heating process, including sinter cooling where applicable.
4	4.9	Ferro-Alloy Production	Production of alloys of iron with chromium manganese, silicon or vanadium, the separation of titanium slag from iron containing minerals using heat.
4	4.11	Agglomeration Operations	Production of pellets or briquettes using presses, inclined discs or rotating drums.
4	4.20	Slag Processes	The processing or recovery of metallurgical slag by the application of heat.
5	5.1	Storage and Handling of Ore and Coal	The storage and handling of ore and coal not situated on the premises of a mine or works as defined in the Mine Health and Safety Act 1996.

The baseline process is presented in the following diagram:

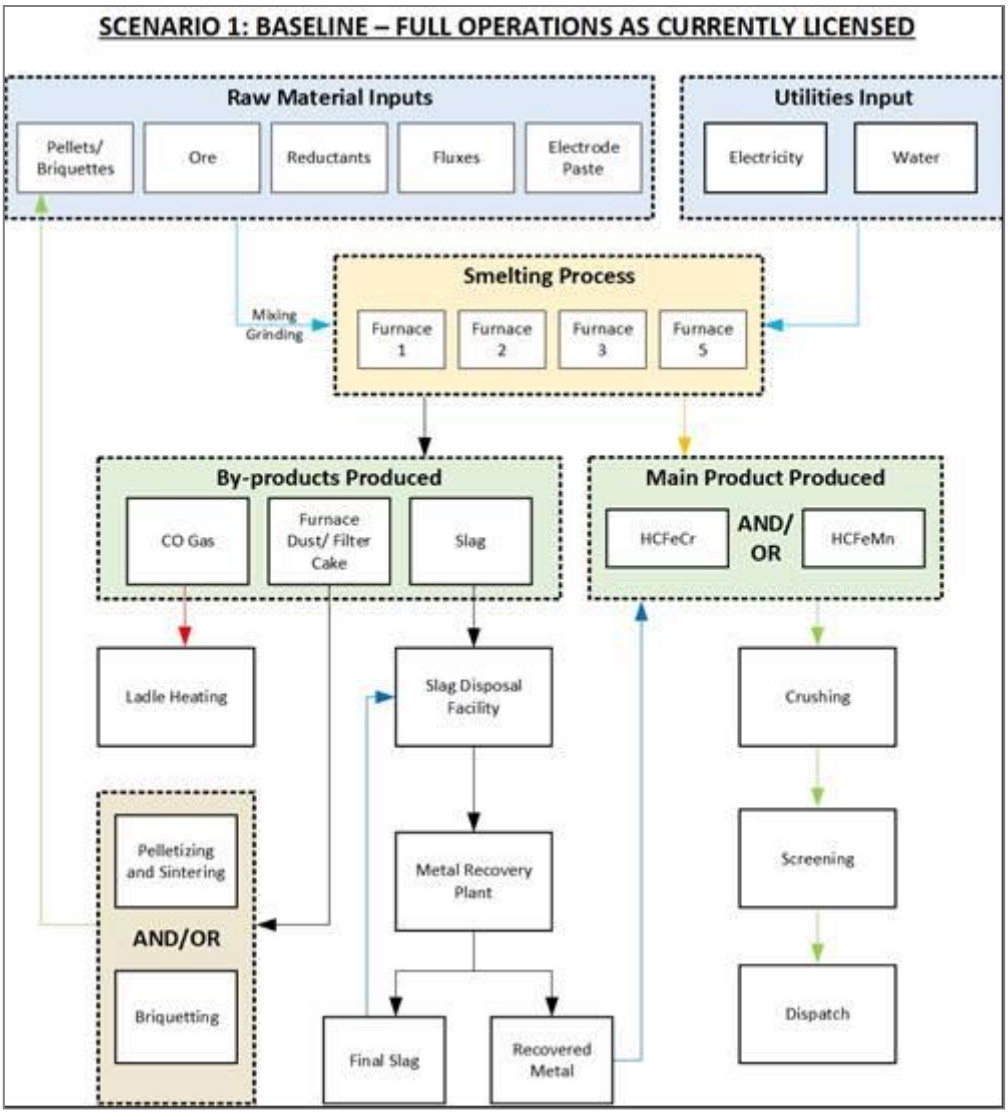


Diagram 1: Baseline approved process flow at the Machadodorp Works (AEL, 2019)

Although the operation has initiated temporary cessation, the investigations in identifying more suitable, practical, and economically viable options for the running of the operation have not ceased. It is the aim of the operation to ensure that optimal production can continue in the future and that employment opportunities can be reinvested in. For this reason, a new project was approved on 16 April 2021 (reference 1/3/1/16/1N-253) by the Mpumalanga DARDLEA. This project involves a new Smelt Direct Process, which will eliminate the current Sinter Plant, and make use of the furnace off gas to preheat pellets, which will then be used as input into the furnaces. This project is currently in planning phase for implementation during 2024.

1.3.2 Purpose of this Basic Assessment Report (BAR)

As part of the ongoing strategy to revive ARMMDW, the development team has identified the opportunity to construct a new Manganese Sulphate ($MnSO_4$) Plant. This plant will rework the current Manganese Slag Stockpile (in line with the issued exemptions as presented before). The current Manganese Slag Stockpile can provide a sustainable supply of product for eight (8) years, whereafter the Works will source other identified slag for a further twelve (12) years.

Construction of the proposed $MnSO_4$ Processing Plant will not only ensure a start-up of operations on site, but will also contribute substantially to minimise "wastes" in terms of the National Waste Management Strategy of South Africa. The outcome of this project will be the development of battery grade $MnSO_4$.

The proposed plant will include the following processes:

- Milling
- Filtration
- Pugging
- Dead Burn
- Leaching
- Post-leach Filtration
- Precipitation, Thickening, and Filtration
- Recycling
- Crystallisation
- Crystal Drying and Decomposition
- Product Bagging
- Post-crystallisation Gas Scrubbing
- Use of reagents, chemicals, air abatement infrastructure and water.

Please refer to Figure 5 for the key infrastructure associated with the proposed project in relation to the overall operation.

The project in question will require an amendment of the Atmospheric Emission Licence (AEL). The following additional activities listed in terms of Section 21 of NEM:AQA will be included into the site's AEL:

- *Subcategory 7.2: Production of Acids*
- All installations producing, **handling** and/or **using** more than 100 tons per annum of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.

- *Subcategory 7.1: Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide*
- All installations **producing and/or using** more than 100 tons per annum of any of the listed compounds.

- *Subcategory 4.1: Drying and Calcining.*
  Drying and calcining of mineral solids including ore.
- Facilities with capacity of more than 100 tons/month product.
  Or
- *Subcategory 5.2: Drying*.
  The drying of mineral solids including ore, using dedicated combustion installations.
- Facilities with a capacity of more than 100 tons/month product.

- *Subcategory 4.20: Slag Processes*.
  The processing or recovery of metallurgical slag by the application of heat.
- All installations.

Approval for the storage of Dangerous Goods as a listed activity in terms of the NEMA EIA Regulations will also be required.

Other activities will include:

- Transport of Slag between the Slag Stockpile and the Plant (truck and conveyor);
- Piping of Sulfuric Acid between the tanks and the Plant;
- Use of water supply from the RO Plant;
- Discharge of dirty water to the RO Plant.

The application for the Environmental Authorisation Process was submitted to the DARDLEA on 2 June 2023 and acknowledged by the Competent Authority on xxx with reference number: xxx.

1.4 Report Template

The National Environmental Management Act (Act No. 107 of 1998) (NEMA) Environmental Impact Assessment (EIA) Regulations (2014, as amended) has a standard template which prescribes the format of the Basic Assessment Report (BAR) which should be utilised when an application for environmental authorisation in terms of the NEMA has been submitted to the DARDLEA. This report comprises of the following Chapters:

- Chapter 1 – Introduction and background to the Project, including the Terms of Reference, project layout, landownership and administrative information in terms of the Proponent and Environmental Assessment Practitioner (EAP);
- Chapter 2 – Introduction to the proposed Project, including the required technical information, and specific management measures in terms of water, waste and storm water management;
- Chapter 3 – Presents the need and desirability of the Project;
- Chapter 4 – Presents a concise discussion on applicable enviro-legal considerations in the compilation of this Report;
- Chapter 5 – Presents a detailed description of the site-specific environmental conditions in which the proposed Project is planned;
- Chapter 6 – Details the Stakeholder Consultation Process followed;
- Chapter 7 – Presents the detailed Environmental Impact Assessment and outcomes of the key specialist investigation (Air Quality Impact Assessment);
- Chapter 8 – Provides a further motivation for the project, including the key alternatives considered;
- Chapter 9 – Presents the EMP and Action Plan which will become legally binding to the Proponent upon authorisation of this Project;
- Chapter 10 – Lists the key Assumptions and Uncertainties in terms of Specialists studies;
- Chapter 11 – Presents the Concluding Statement;
- Chapter 12 – Oath of Affirmation by the EAP;
- Chapter 13 – Signed Client Commitment; and
- Annexures.

1.5 Location of the Works

The ARMMDW is located on the Eastern Escarpment of Mpumalanga in South Africa, southwest of the town of eNtokozweni (Machadodorp) (refer to the following figures***Error! Reference source not found.***), a small rural farming town and support centre for the Works.

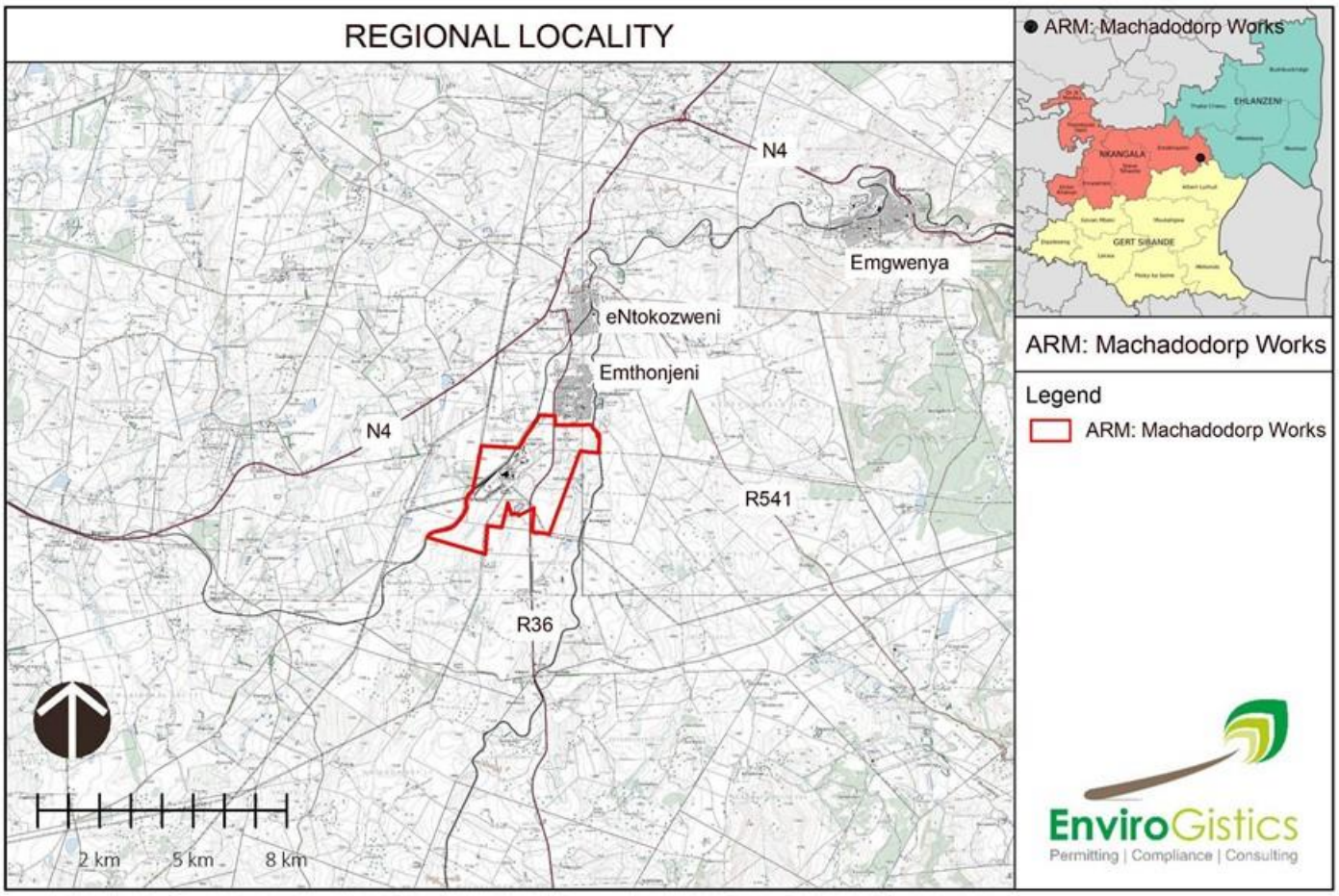


Figure 1: Regional Location of the Works

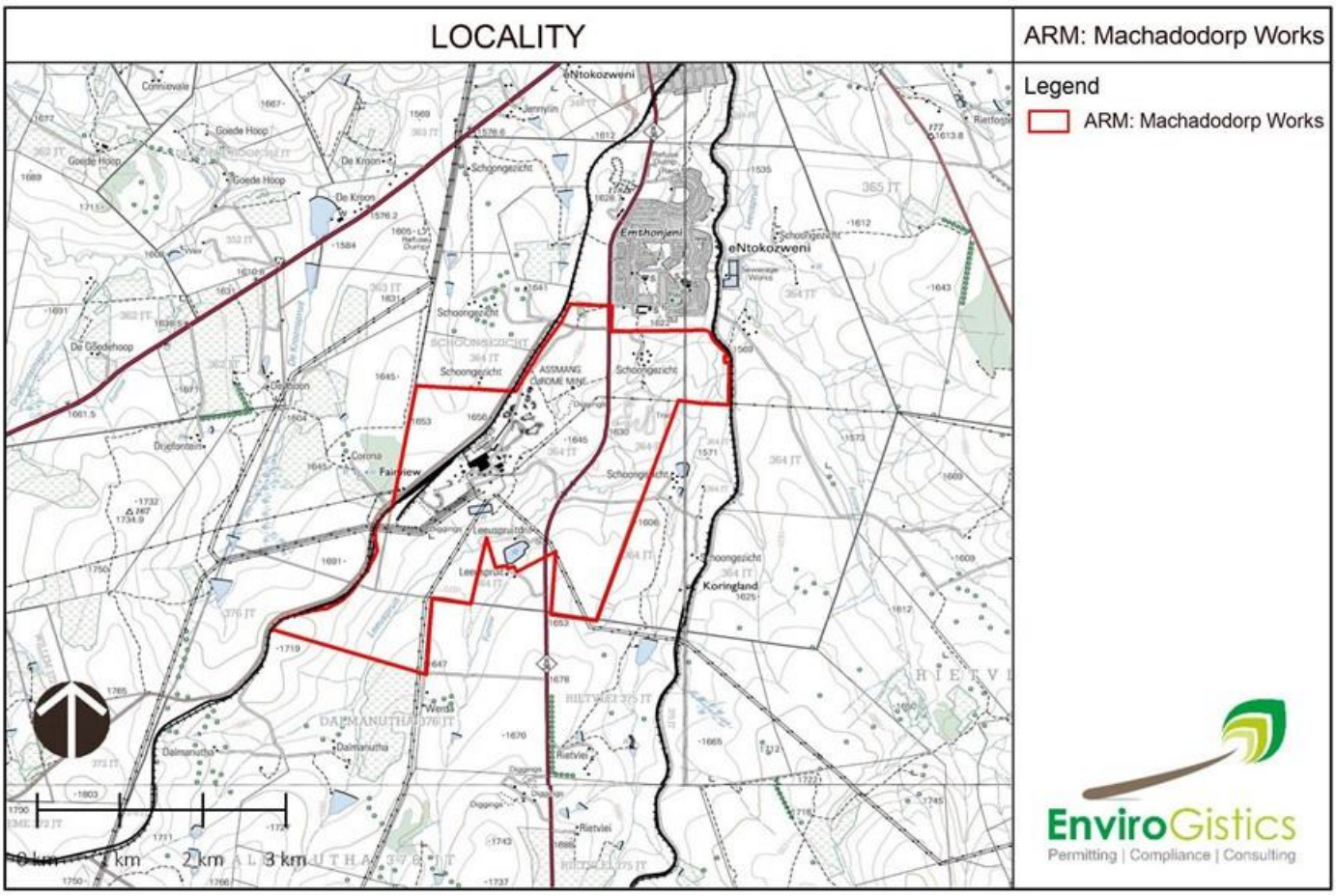


Figure 2: Local Setting of the Works

The ARMMDW falls under the jurisdiction of the Emakhazeni Local Municipality, which forms part of the Nkangala District Municipality (the latter being the Competent Authority for the purposes of the AEL). The ARMMDW is located on Portions 3, 4 and 9 (RE) of the Farm Schoongezicht 364JT, Portion RE of the Farm Dalmanutha 376JT and Portion 6 of the Farm De Kroon 363JT. The proposed Project itself is located on Portion 4 of the Farm Schoongezicht 364 JT and Portion 6 of the Farm De Kroon 363JT (refer to Figure 3).

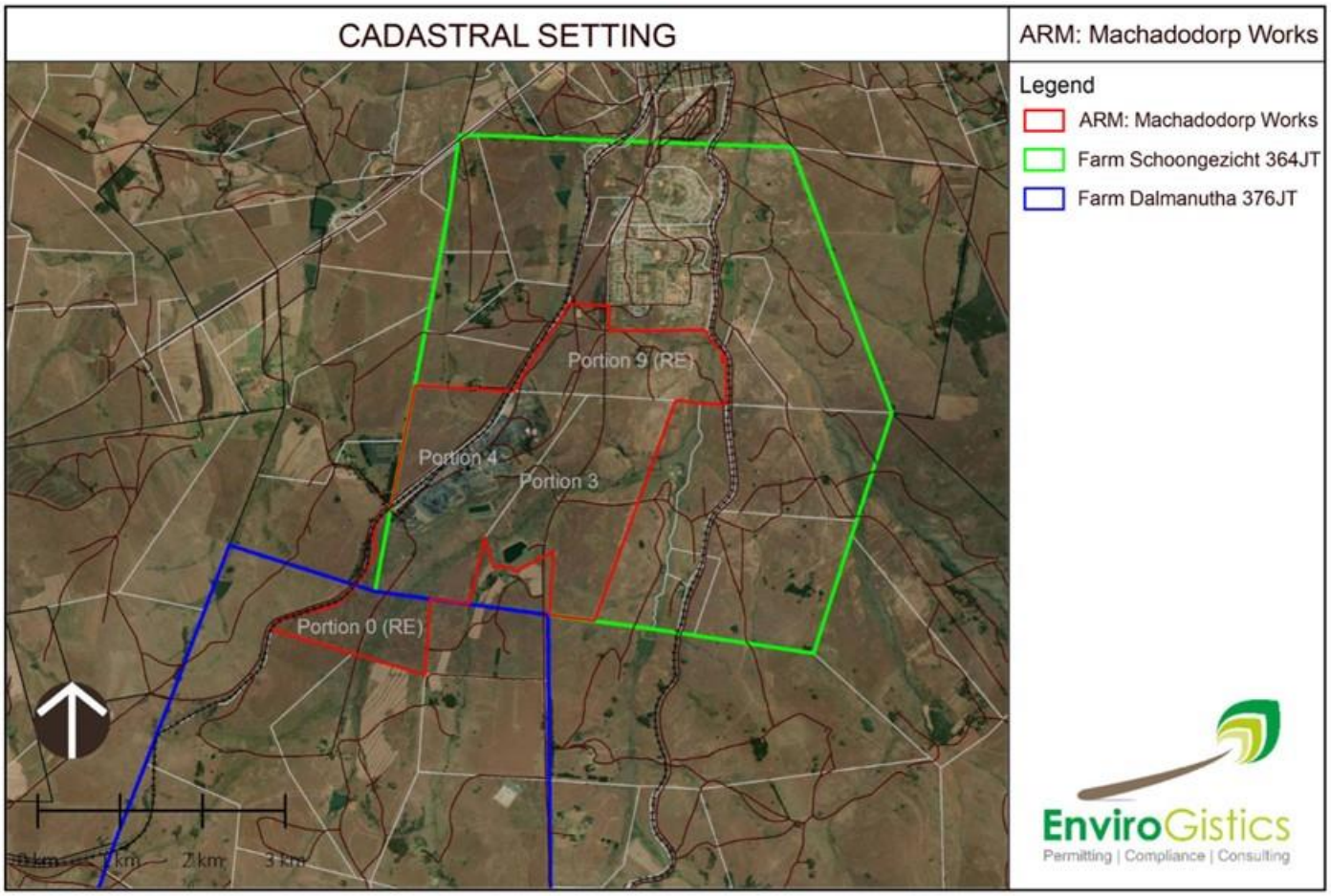


Figure 3: Cadastral Setting of ARMMDW

The ARMMDW is located between the N4 and R36 roadways. The overall area is characterised by farming, grazing activities, several Eskom Power Plants, as well as the ARMMDW itself. Various servitudes traverse the property, which specifically include Eskom powerlines and Transnet railway lines.

According to the Nkangala District Municipality Spatial Structure and Economic Activities as included in the Municipality's Integrated Development Plan (IDP), the area in which ARMMDW is located falls within an area of "extensive agriculture" with mining activities also indicated. In terms of the Spatial Development Plan (SDP) of the Nkangala District Municipality, the town of eNtokozweni is also demarcated as an industrial node. The Municipality Evaluation Roll issued to the facility, evaluates the facility in terms of mining (options are residential, agriculture or mining). Please refer to the following two (2) figures.

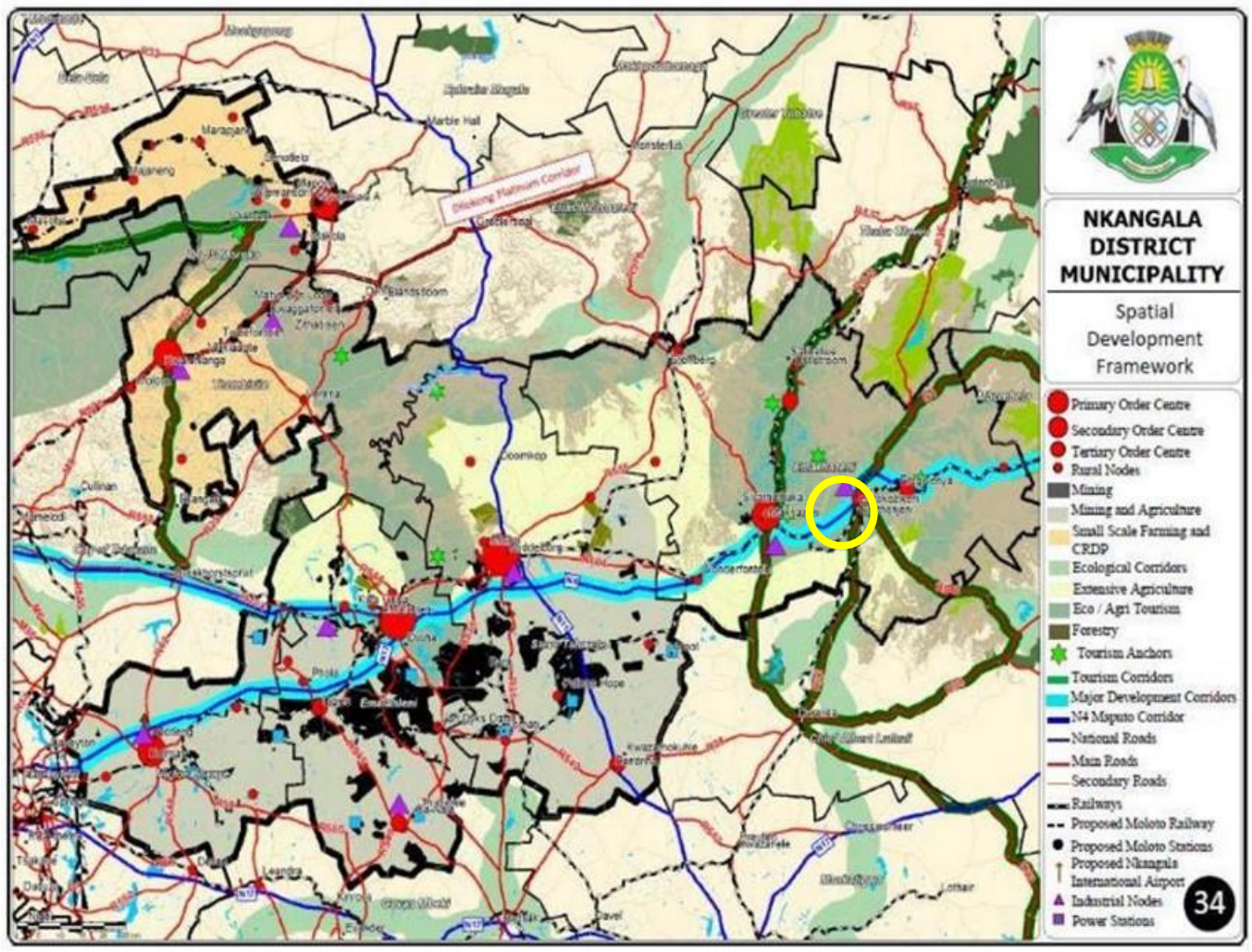


Figure 4: Nkangala District Municipality Spatial Structure and Economic Activities (Nkangala IDP 2019-2020)

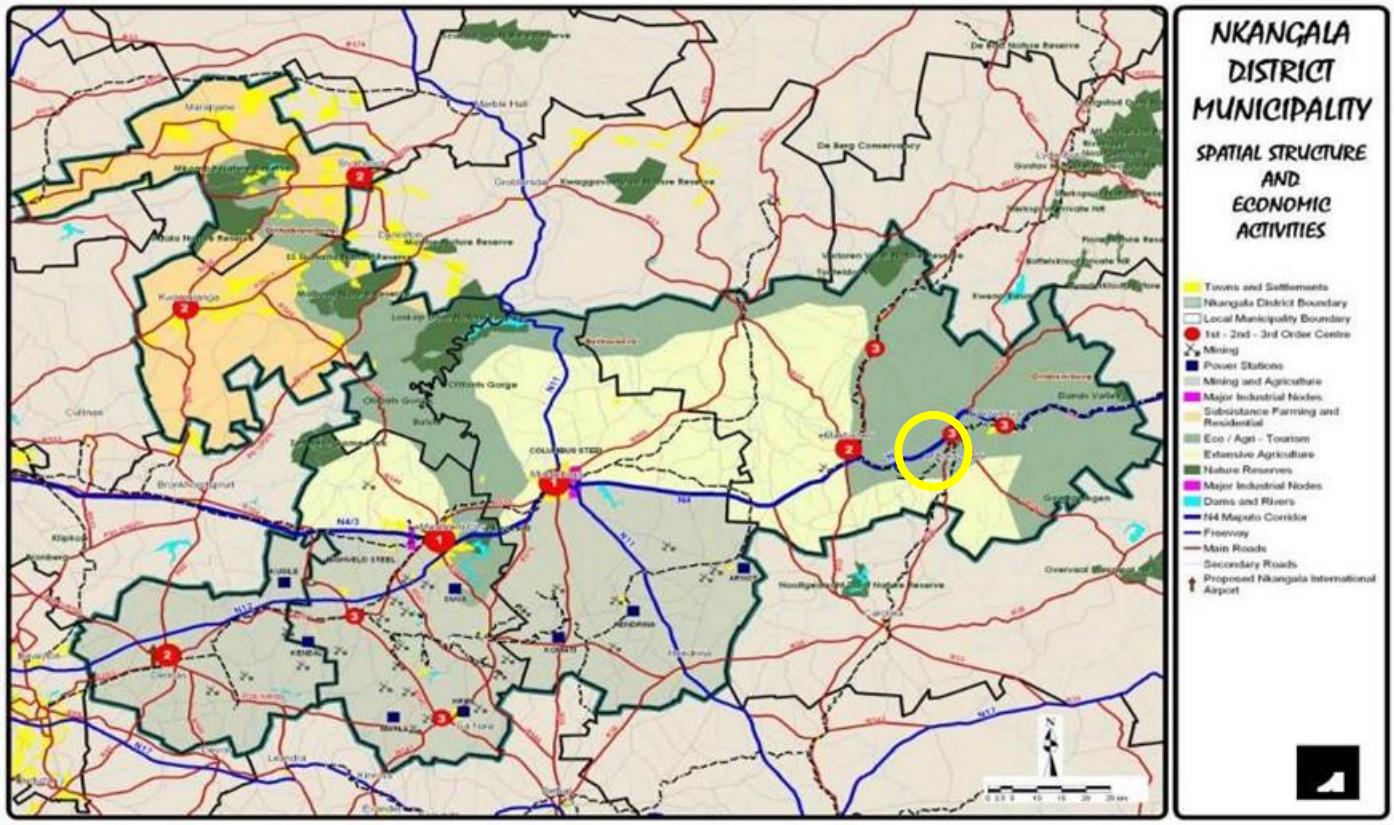


Figure 5: Nkangala District Municipality Spatial Development Framework (Nkangala IDP 2019-2020)

The ARMMDW falls in Quaternary Catchment X21F in the Inkomati Water Management Area (WMA) (WMA B3). The Leeuwspruit is located within the south and south-eastern portions of the property, flowing in a northerly direction into the Elands River. The confluence of the Leeuwspruit and the Elands River is approximately 8km north-northwest of the Works.

1.6 **Property Description**

1.6.1 Ownership of Surface Rights

As mentioned before, the ARMMDW is located on Portions 3, 4 and 9 (RE) of the Farm Schoongezicht 364JT, Portion RE of the Farm Dalmanutha 376JT, and Portion 6 of the Farm De Kroon 363JT. The Project in question is location Portion 4 of the farm Schoongezicht 364JT, owned by the Proponent, African Rainbow Minerals (Pty) Ltd (ARM).

Table 3: Property Description and Ownership

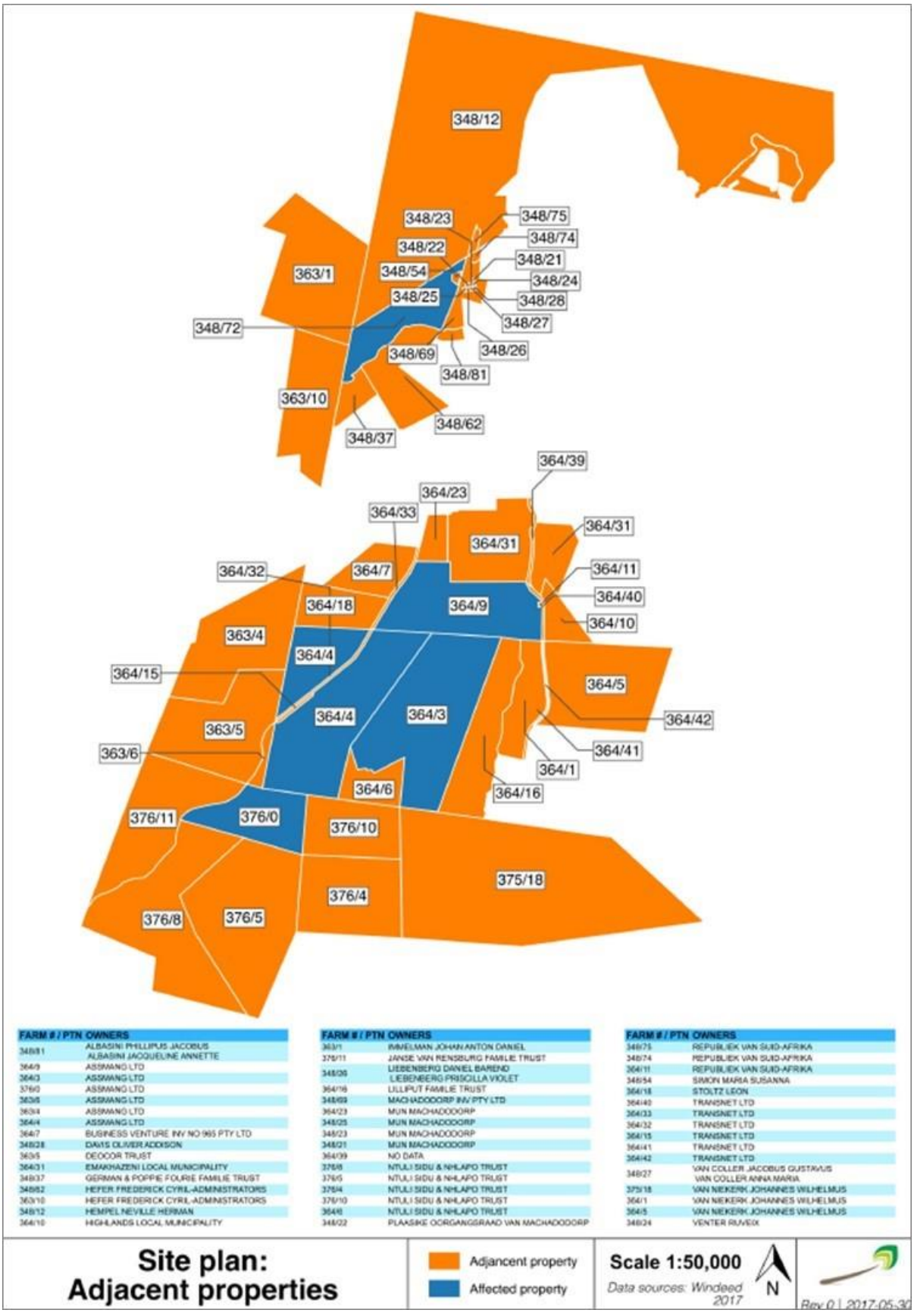
Farm Name	Farm Number	Registration Division	Portion Number	Property Extent (approx.)	LPI Code	Title Deed Number	Property Owner
Schoongezicht	364	JT	4	335.58ha	T0JT00000000036400004	T712/2020	ARM (Pty) Ltd
Schoongezicht	364	JT	3	295.36ha	T0JT00000000036400003	T712/2020	ARM (Pty) Ltd
Schoongezicht	364	JT	RE of 9	224.68ha	T0JT00000000036400009	T712/2020	ARM (Pty) Ltd
Dalmanutha	376	JT	RE	104.21ha	T0JT00000000037600000	T712/2020	ARM (Pty) Ltd
De Kroon	363	JT	6	13.19ha	T0JT00000000036300006	T712/2020	ARM (Pty) Ltd

The table below provides details of the property owners of farm portions surrounding ARMMDW.

Table 4: Details of the Ownership of Surrounding Farm Portions

Farm Name	Farm Number	Portion	Ownership (Source: Windeed 2017)
Dalmanutha	375	18	JW van Niekerk
Schoongezicht	364	6	Ntuli Sidu & Nhlapo Trust
Dalmanutha	376	10	Ntuli Sidu & Nhlapo Trust
Dalmanutha	376	4	Ntuli Sidu & Nhlapo Trust
Dalmanutha	376	5	Ntuli Sidu & Nhlapo Trust
Dalmanutha	376	8	Ntuli Sidu & Nhlapo Trust
Dalmanutha	376	11	Janse van Rensburg Familie Trust
De Kroon	363	5	Deocor Trust
De Kroon	363	4	ARM Pty Ltd
Schoongezicht	364	15	Transnet Ltd
Schoongezicht	364	32	Transnet Ltd
Schoongezicht	364	18	Leon Stoltz
Schoongezicht	364	7	Business Venture Inv No 965 (Pty) Ltd
Schoongezicht	364	33	Transnet Ltd
Schoongezicht	364	23	eNtokozweni Municipality
Schoongezicht	364	31	Emakhazeni Local Municipality
Schoongezicht	364	11	RSA
Schoongezicht	364	40	Transnet Ltd
Schoongezicht	364	10	Highlands Local Municipality
Schoongezicht	364	5	JW van Niekerk
Schoongezicht	364	42	Transnet Ltd
Schoongezicht	364	41	Transnet Ltd
Schoongezicht	364	1	JW van Niekerk
Schoongezicht	364	16	Lilliput Familie Trust

The following Figure breaks down the property ownership and the surrounding property ownership.



FARM # / PTN	OWNERS
348/81	ALBASINI PHILLIPUS JACOBUS ALBASINI JACQUELINE ANNETTE
364/9	ASSMANG LTD
364/3	ASSMANG LTD
376/0	ASSMANG LTD
363/6	ASSMANG LTD
363/4	ASSMANG LTD
364/4	ASSMANG LTD
364/7	BUSINESS VENTURE INV NO 985 PTY LTD
348/28	DAVIS OLIVER ADDISON
363/5	DEOCOR TRUST
364/31	EMAKHAZENI LOCAL MUNICIPALITY
348/37	GERMAN & POPPE FOURIE FAMILIE TRUST
348/82	HEFER FREDERICK CYRIL-ADMINISTRATORS
363/10	HEFER FREDERICK CYRIL-ADMINISTRATORS
348/12	HEMPEL NEVILLE HERMAN
364/10	HIGHLANDS LOCAL MUNICIPALITY

FARM # / PTN	OWNERS
363/1	IMMELMAN JOHAN ANTON DANIEL
376/11	JANSE VAN RENSBURG FAMILIE TRUST
348/26	LIEBENBERG DANIEL BAREND LIEBENBERG PRISCILLA VIOLET
364/16	LILLIPUT FAMILIE TRUST
348/69	MACHADODORP INV PTY LTD
364/23	MUN MACHADODORP
348/25	MUN MACHADODORP
348/23	MUN MACHADODORP
348/21	MUN MACHADODORP
364/39	NO DATA
376/8	NTULI SIDU & NHLAPO TRUST
376/5	NTULI SIDU & NHLAPO TRUST
376/4	NTULI SIDU & NHLAPO TRUST
376/10	NTULI SIDU & NHLAPO TRUST
364/6	NTULI SIDU & NHLAPO TRUST
348/22	PLAASKE OORGANGSRAAD VAN MACHADODORP

FARM # / PTN	OWNERS
348/75	REPUBLIEK VAN SUID-AFRIKA
348/74	REPUBLIEK VAN SUID-AFRIKA
364/11	REPUBLIEK VAN SUID-AFRIKA
348/54	SIMON MARIA SUSANNA
364/18	STOLTZ LEON
364/40	TRANSNET LTD
364/33	TRANSNET LTD
364/32	TRANSNET LTD
364/15	TRANSNET LTD
364/41	TRANSNET LTD
364/42	TRANSNET LTD
348/27	VAN COLLER JACOBUS GUSTAVUS VAN COLLER ANNA MARIA
375/18	VAN NIEKERK JOHANNES WILHELMUS
364/1	VAN NIEKERK JOHANNES WILHELMUS
364/5	VAN NIEKERK JOHANNES WILHELMUS
348/24	VENTER RUVEIX

Figure 6: Property Ownership and Surrounding Property Ownership.

1.7 Administrative Information

1.7.1 Details of the Proponent

The following table presents the contact details of the Proponent:

Table 5: Contact Details

Applicant:	African Rainbow Minerals: Machadodorp Works		
Trading name (if any):	African Rainbow Minerals: Machadodorp Works		
Contact person:	Willie Coetzer		
Physical address:	Approximately 650 metres west of the R36 between eNtokozweni (Machadodorp) and Carolina, about 1.5km southwest of Emthonjeni, and 4.5km south of eNtokozweni – Please refer to Figures 1 - 3. Co-ordinates: 25º 42' 58" S & 30º 13' 47" E		
Postal address:	PO Box 152, Machadodorp, Mpumalanga		
Postal code:	1170	**Cell:**	082 518 9421
Telephone:	013 256 5026	**Fax:**	013 256 5009
E-mail:	williec@armmdw.co.za		

1.7.2 Details of Environmental Assessment Practitioner

EnviroGistics (Pty) Ltd, established in 2015, provides Independent Environmental Planning, Permitting, and Consulting Services to a vast array of clients throughout the mining, construction and development industry. EnviroGistics' independence is ensured with Ms Tanja Bekker being both registered with the South African Council for Natural Scientific Professions (SACNASP), and the Environmental Assessment Practitioners Association of South Africa (EAPASA), complying with the highest requirements of the South African Environmental Legislation. The company holds no equity in this, or any other project. EnviroGistics operates with the goal of fulfilling its vision and mission, breaking away from a general consulting mould, striving to form an integral part of a project team. For this reason, clients are provided with experienced, practical, technically sound, independent, objective and value adding advice, ensuring support on environmental planning, permitting and compliance matters.

EnviroGistics is an independent company and has no vested interest in the outcome of the environmental assessment.

1.7.2.1 Expertise of the Environmental Assessment Practitioner

Ms. Bekker is registered as a Professional Natural Scientist in the field of Environmental Science with SACNASP and is also a registered Environmental Assessment Practitioner (EAP) with EAPASA, a legal requirement stipulated by NEMA. She is further certified as an ISO 14001 Lead Auditor. Her qualifications include BSc. Earth Sciences (Geology and Geography), BSc. (Hons.) Geography, and MSc. Environmental Management. In addition to these tertiary qualifications, she obtained a Certificate in Project Management, and completed the Management Advancement Programme at Wits Business School.

With more than 21 years' working experience in environmental management and the consulting industry and managing various Large Account Clients, she understands the South African Regulatory System, and can advise clients with due diligence on their environmental regulatory requirements and offer a solution driven service to their project life cycle. She is equipped with exceptional project management and coordination skills, which especially enhances the service she offers clients within the environmental permitting system.

Her key focus is environmental management and compliance with extensive experience in the mining industry. Project Management and Coordination of projects form a critical component of her duties, which include project planning, initiation of projects, client, authority and stakeholder consultation, specialist coordination, budget control, process control, quality control and timeframe management. Her interest lies in a client advisory capacity, being involved during due diligence investigations, pre-project development and assisting the client and engineering team in adding value to develop the project in an environmentally sustainable manner, considering client costs and liabilities, as well as considering the implication of environmental authorisation conditions and requirements on project deliverables. Her involvement in projects has spanned over the project life cycle from Due Diligence Investigations, Pre-Feasibility Investigations, Prospecting Right Applications, Mining Right Applications, Environmental Reporting and implementation and auditing of Environmental Management Plans and Authorisations.

Table 6: Details of the EAP

Name	Tanja Bekker
Designation	Environmental Assessment Practitioner
Postal Address	PO Box 22014, Helderkruin, 1733
Physical Address	64 Blouberg Street, Noordheuwel, Krugersdorp, 1739
Telephone Number	+27 (0) 82 412 1799
Cell Phone Number	+27 (0) 82 412 1799
Fax Number:	+ 27 (0) 86 551 5233
Email Address	tanja@envirogistics.co.za
Qualifications & Registrations	BSc. Geography and Geology BSc. (Hons) Geography Environmental Management (Cum Laude) MSc. Environmental Management Registered EAP with EAPASA (Reg No. 2019/306) Registered as a Professional Natural Scientist with SACNASP (Pr.Sci.Nat. Reg No. 400198/09) Member of the International Association for Impact Assessment (IAIA) Member of the Environmental Law Association (ELA)

1.7.3 Details of the Competent Authority

The following table provides the details of the Competent Authority for this Environmental Authorisation Process:

Table 7: Competent Authority (NEMA Process)

Competent Authority	Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA).
Telephone	013 692 5843
Physical Address	Corner Rosemead and Ryan Road Witbank, Mpumalanga
Postal Address	P. O. Box 7255, Witbank, 1035

Table 8: Competent Authority (AEL Process)

Competent Authority	Nkangala District Municipality
Telephone	013 249 2000
Physical Address	2A Walter Sisulu Street, Middelburg
Postal Address	PO Box 437, Middelburg, 1050

2 DISCRIPTION OF PROPOSED ACTIVITIES

2.1 Existing Plant

ARMMDW has previously operated under a 2011 Atmospheric Emission Licence (AEL), which was reviewed by the Nkangala District Municipality (Licencing Authority) and issued on 28 June 2019 under reference 17/04/AEL/MP314/11/01. This 2011 AEL was renewed for the purposes of Ownership Change on 10 December 2021 under reference 17/04/AEL/MP314/11/01.

Table 9: AEL approved activities

Category of Listed Activity	Sub-Category of the Listed Activity	Listed Activity Name	Description of the Listed Activity
4	4.5	Sinter Plant	Sinter Plants for agglomeration of fine ores using a heating process, including sinter cooling where applicable.
4	4.9	Ferro-Alloy Production	Production of alloys of iron with chromium manganese, silicon or vanadium, the separation of titanium slag from iron containing minerals using heat.
4	4.11	Agglomeration Operations	Production of pellets or briquettes using presses, inclined discs or rotating drums.
4	4.20	Slag Processes	The processing or recovery of metallurgical slag by the application of heat.
5	5.1	Storage and Handling of Ore and Coal	The storage and handling of ore and coal not situated on the premises of a mine or works as defined in the Mine Health and Safety Act 1996.

The baseline process is presented in the following diagram and illustrated in Figure 7:

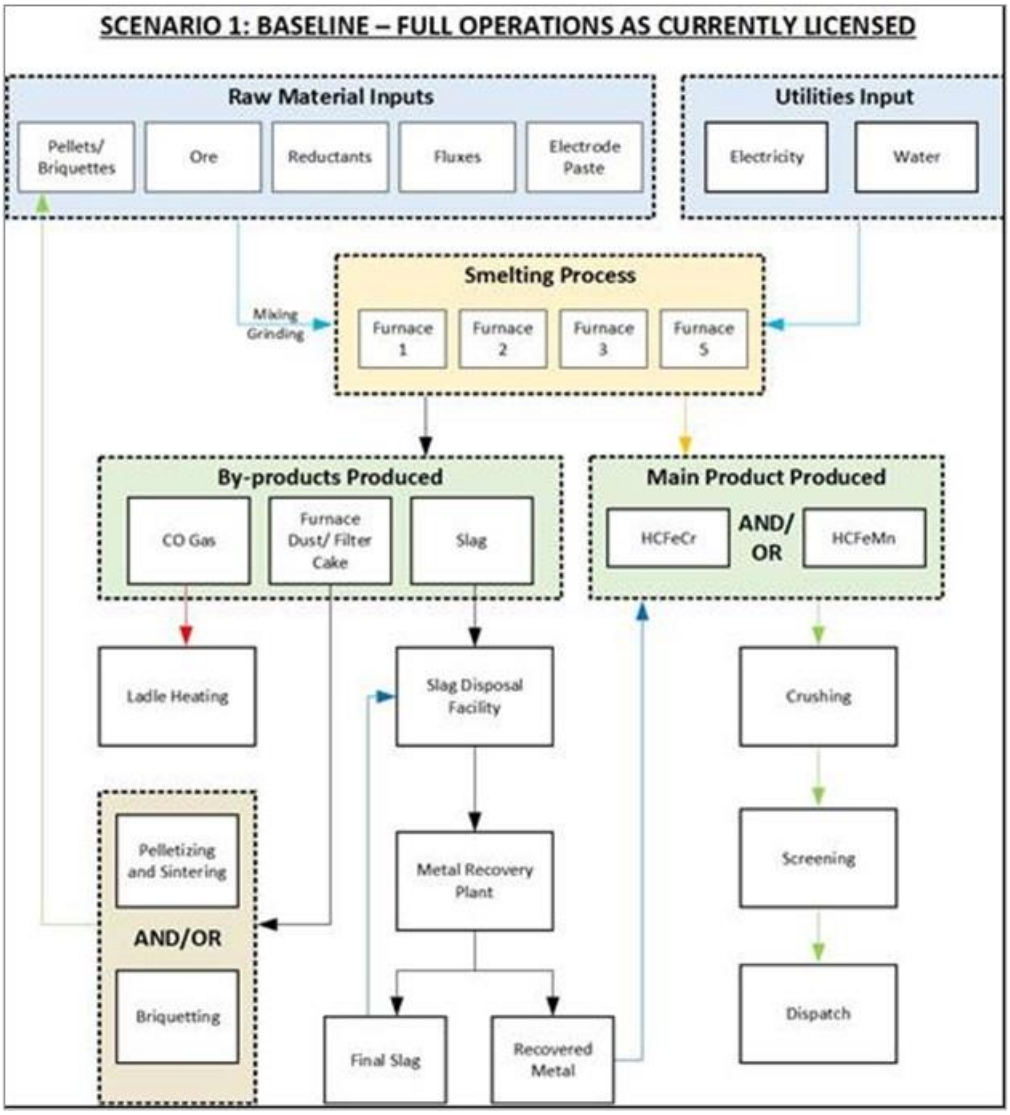


Diagram 2: Baseline approved process flow at the ARMMDW (AEL, 2021)

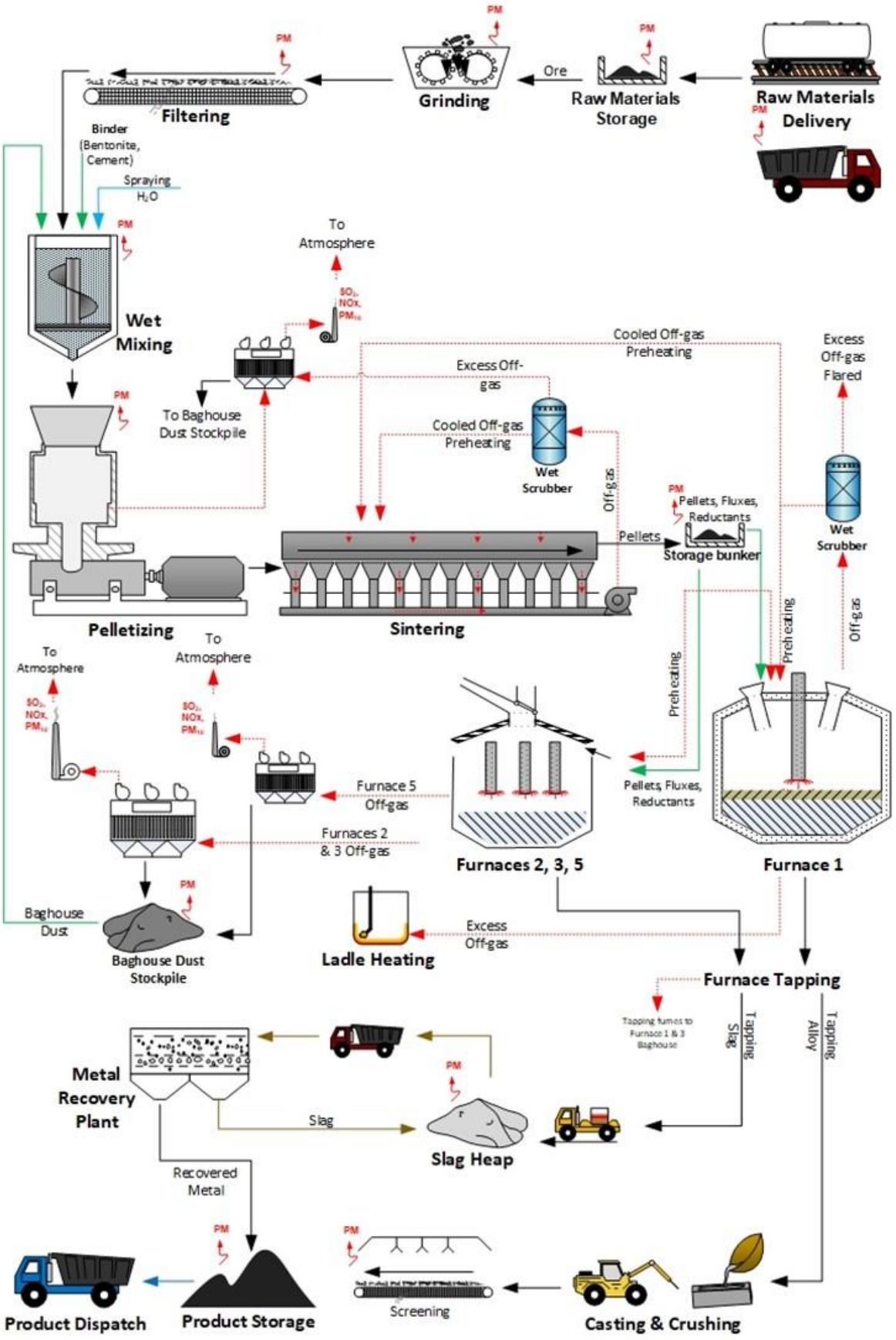


Figure 7: Full Plant Process Flow Diagram

2.2 Proposed Project Description

African Rainbow Minerals (ARM) is a leading South African diversified mining and minerals company with operations in South Africa and Malaysia. ARM mines and beneficiates iron ore, manganese ore, chrome ore, platinum group metals (PGMs), nickel and coal and also has a strategic investment in gold through Harmony Gold Mining Company. One of the divisions within ARM is ARM Ferrous. ARM's ferrous metals interests are held through wholly owned ARM Ferrous which owns 50% of Assmang (Pty) Ltd, a long-established miner and processor of metals for the world's steel industries. The other 50% of Assmang is held by Assore Ltd. Assmang's operating divisions are based on its two principal commodities: iron ore and manganese ore. The manganese operations, Gloria and Nchwaning, collectively Black Rock Mine, are situated in the Northern Cape province of South Africa, approximately 80km northwest of the town of Kuruman. Manganese ore is supplied locally to the Assmang-owned smelter Cato Ridge Ferromanganese Works, but is mainly exported through Gqeberha (Port Elizabeth) as well as Durban and Richards Bay. Historically manganese ore was also supplied to the Machadodorp Ferromanganese and Ferrochrome Works. ARMMDW was recovering ferrochrome and ferromanganese alloy from historical slag dumps through the Metal Recovery Plant (MRP). The ARM Ferrous division holds a 50% interest in Cato Ridge Alloys, Mizushima Ferroalloys Company and Sumitomo Corporation.

ARMMDW has embarked on a process to undertake a feasibility study for a proposed plant to be located in South Africa. This plant will rework the current Manganese Slag Stockpile (in line with the issued exemptions as presented before). The current Manganese Slag Stockpile can provide a sustainable supply of product for 8-12 years, whereafter the Works will source other identified product feed for further processing.

The construction of the Processing Plant will not only ensure a start-up of operations on site, but will also contribute substantially to minimise "wastes" in terms of the National Waste Management Strategy of South Africa. The outcome of this project will be the development of battery grade $MnSO_4$.

2.2.1 Details of the Plant

The proposed plant will comprise of the following processes (also refer to Figure 8 for the infrastructure and Figure 9 for the overall project location):

- Milling
- Filtration
- Pugging
- Dead Burn
- Leaching
- Post-leach Filtration
- Precipitation, Thickening, and Filtration
- Recycling
- Crystallisation
- Crystal Drying and Decomposition
- Product Bagging
- Post-crystallisation Gas Scrubbing
- Use of reagents, chemicals, air abatement infrastructure and water.

2.2.2 Details of the Main Chemical and Storage Requirements

The main chemical required in the leaching process is sulphuric acid (H_2SO_4). Concentrated H_2SO_4 (98%) is delivered to the plant by tanker and pumped into two dosing tanks. The H_2SO_4 is then pumped to the jarosite precipitation and pugging areas.

Three (3) individually contained tanks are proposed on site; one (1) supply tank, one (1) back-up tank, and one (1) top-up tank. Each tank will be managed as a separate tank and will have a capacity of less than 500m^3. For the operation of the proposed $MnSO_4$ Processing Plant, it is important that the plant have a supply of at least 2 700tons of H_2SO_4 on site., which will provide a two (2) weeks' supply. These tanks will be placed, operated and managed as individual containment facilities. The chemicals will be received by either rail or truck transport and offloaded into the top-up tank near the current Pelletising Plant from where it will be distributed to the plant via the supply tank. A back-up tank will likely be placed near the existing MRP should additional supply be required. Specific tank requirements include:

- Tanks will be individually contained facilities, without pipeline interlinkages.
- All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid (H_2SO_4).
- Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume.
- The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4, as opposed to the metal of carbon steel tanks.
- The backup chemical storage and top-up tanks will be placed about 800 - 1000m from each other.
- The back-up chemical storage and supply chemical storage tanks will be placed about 800 - 1000m from each other.
- All tanks will be ventilated in terms of the required Safety Datasheets (SDSs) standards.
- Strict storage requirements will be implemented (e.g. dry areas, with ventilation at floor level, spill collection.
- The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials.
- Reactivity hazards will be considered and managed.
- Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented.

2.2.3 Distribution of the chemicals on site

Key considerations in terms of the distribution of chemicals on site:

- The pipelines between the tanks will not be linked – i.e. separate lines to and from each of the tanks will be implemented. Containment will be present at any potential flange.
- Should pipelines be considered there will be two (2) pipelines between each of the tanks; one operational pipeline and one for back up purposes. These will be equipped with the necessary lock out/isolation mechanisms.
- Where the chemicals will be transported between the tanks (if required), this will be undertaken in terms of the required SDSs, and may include the implementation of non-metallic lining of packaging, stowing of chemicals "on deck only" filling instruction to ensure that no exceedance and/or spills occur. Specific dangerous chemical training will also be undertaken.
- The offloading of sulphuric acid (H_2SO_4) from tankers into the acid dosing tanks will be a manual process but the required safety interlocks and controls will be included. On sulphuric acid delivery, a transfer hose will be connected to the tanker and the contents drained via an offloading pump into one of the two sulphuric acid storage tanks. All sulphuric acid pumps can be isolated and drained via double block and bleed lines on suction and discharge sides of the pumps.

- Level instruments will be installed in sulphuric acid dosing tanks to measure and indicate the acid level. Alarms will be activated on low-low level status and high-high level status. Each dosing tank will have a temperature measuring instrument to monitor tank temperature.
- The flow rate of sulphuric acid to the various destinations will be controlled by flow controllers and valves in the receiving areas.

2.2.4 Plant Process

The following sequence is a high-level presentation of the plant process planned for the proposed project (please read with Figure 10 and Figure 11):

- Milling:
  - The slag will be reclaimed using a front-end loader (FEL) to the mill feed storage bin. The slag will be withdrawn from the storage bin onto a mill feed conveyor using a pan feeder and conveyed to the milling circuit.
  - Process water from the Reverse Osmosis Plant (RO Plant) will be added at the inlet of the ball mill in order to control the mill discharge slurry density.
  - The design capacity of the mill is 12 t/h. The mill will be an overflow type:
    - The mill will operate on a continuous basis.
    - A cyclone cluster of four (4) cyclones would be required.
  - Milling circuit spillage will be contained in a bunded area with a sloped-end floor to direct spillage to the spillage sump. The sump will have a vertical spindle pump and will pump spillage into the mill discharge sump.
  - Grinding media (steel balls) will be added to the ball mill using the ball loading hopper kibble. The kibble will be lifted by the crane (hoist) into the grinding media storage hopper. Steel balls will be withdrawn at controlled rates using the ball feeder onto the ball pocket conveyor feeding the ball using the ball mill.
  - The cyclone overflow will gravitate into an agitated thickener feed tank together with filtrate from the post-mill filtration circuit and flocculant. The flocculated slurry will then gravitate into the thickener feed well.
  - The thickener overflow solution will discharge into a thickener overflow tank and then be pumped to the milling circuit to be utilised as mill dilution water.
  - The thickener underflow slurry will be pumped to an agitated slurry storage tank and then pumped to the filter press for solid-liquid separation. The filter cycle operations involve filtration, pressing, drying and cake discharge stages. During the discharge stage the filter cloth is washed with raw water. The filter cake product is conveyed to the storage bunker before being reclaimed by an FEL and loaded to the pugging step.
  - The filtrate and spent wash water gravitate to the post-mill thickener feed tank.
- Infrastructure associated with the Plant and associated process:
  - Pugging/Conversion
    - Concentrated H_2SO_4 will be pumped to an in-line mixer where it is mixed with cooled dilute H_2SO_4.
    - Pugging/conversion involves the contact of the classification product with cold sulphuric acid (H_2SO_4) solution (5°C). Pugging with H_2SO_4 converts manganese oxide (MnO), aluminium oxide (Al_2O_3), magnesium oxide (MgO), ferric oxide (Fe_2O_3), sodium oxide (Na_2O) and potassium oxide (K_2O) in the slag to hydrated sulphates. The cooled diluted sulphuric acid is sprayed inside the pug mixer onto the filter cake solids. The pugging method applied minimises the H_2SO_4 consumption and the leaching time in comparison to the conventional acid leaching methods. For the cooling process heat exchangers and a chiller will be used to cool the diluted H_2SO_4 solution.
    - A bleed stream of the diluted H_2SO_4 is recirculated from the mixing tank into a heat exchanger for cooling and is then directed to the in-line mixer.
    - Fumes from the pugging mill are transferred to the leach scrubbing circuit.
    - The pugging mill product (pugging solids) is conveyed to the dead burn circuit.

- Dead Burn and leaching
  - The converted slag will be calcined at a high temperature to form insoluble anhydrite ($CaSO_4$), whereafter the dried solids will be repulped with water and cooled followed by a leaching process with water.
  - Off-gas from the dead burn kiln is directed to the leach scrubber.
  - Spent wash water from the post-leach filtration step is used together with raw water to repulp the calcined solids.
  - Spillage in the leach area will be contained in a bunded area and transferred into the first two leach tanks.
- Post-leach Filtration
  - Slurry exiting the leach circuit will be filtered. Filter residue which will be dried will exit the process circuit.
  - The leach filtrate at a low pH will still contain impurities, which will be removed via precipitation.
  - Primary filtrate forms the high-grade pregnant leach solution and is pumped to the next precipitation circuit for purification.
  - The washed filter cake is conveyed to a stockpile before being reclaimed by an FEL and bagged for sale. At the discharge-end of the belt filter, the filter cloth is washed with process water. The spent cloth wash water is directed to the process water tank.
  - Spillage will be contained in a bunded area, and a spillage pump will transfer spillage into the leach repulp tank.
- Precipitation, Thickening, and Filtration
  - A process of precipitation and filtration will be undertaken to remove further impurities of the leach and ensure that the desired pH is reached. This circuit consists of six agitated precipitation tanks in series.
  - Thickener underflow is pumped from the filter feed tank into the horizontal filter press. The filter cycle constitutes filtration, pressing, drying and cake discharge steps. The filter cake is washed with raw water and the washed filter cake is stockpiled before being sold. After the discharge stage, the filter cloth is washed with raw water. All filtrate streams exiting the filter press is discharged into a filtrate tank before being pumped to the jarosite precipitation thickener feed tank.
  - Blower air is injected into the first two tanks in order to oxidise iron in the filtrate.
  - Slurry from the last precipitation tank is pumped to a precipitation thickener feed tank.
  - Off-gases from the cake drying, dead burn, pugging, jarosite precipitation, and manganese sulphide precipitation circuits are received by the leach gas scrubber. The hazardous gases, namely, hydrogen sulphide (H_2S), sulphur dioxide (SO_2), and gaseous H_2SO_4 are scrubbed with solution from a recirculation tank.
  - Spillage will be contained in a bunded area, and a spillage pump will transfer spillage into the precipitation tanks.
  - Spillage within the filtration bund area is pumped to the thickener feed tank.
- Recycle
  - Solids removed from the circuit will be recycled to reduce the need for top up raw materials and incorporated into the process flow sheet.
  - It is in this process that abatement infrastructure like scrubbers will be used to restrict gas releases.
- Crystallisation
  - The feed liquid from the precipitation process will be subjected to a cooling evaporator step which will result in the formation of crystals. The crystals will be washed in a centrifuge to remove impurities.

- At this process the MnSO4 is recovered and recycled.
- The crystals are dewatered, washed and calcined at 450°C to produce $MnSO_4$.

- Crystal Drying and Decomposition
  - The washed crystals are fed into a calcining oven. Vent gas from the calciner is directed to the crystallisation gas scrubber, while the calcined solids (anhydrous manganese sulphate crystals) are transferred to the product bagging circuit.
- Product Bagging
  - The anhydrous manganese sulphate crystals are fed into a product bagging bin and loaded onto a bag filling conveyor via a screw feeder. The crystals are conveyed into concentrate bags before being weighed and transferred to bag storage via a bag roller conveyor.
- Post-crystallisation Gas Scrubbing
  - Vent gas from the crystal drying and decomposition area is received by the crystallisation gas scrubber. Filtrate from the post-scrubbing filtration circuit and raw water is added to the crystallisation gas scrubbing tank which also receives gas scrubber effluent. Slurry from the recirculation tank is pumped to the gas scrubber. A bleed stream from this tank is pumped to the post-scrubbing filtration circuit to recover the crystallised ammonium sulphate crystals. Hazardous gases, namely, NH_3, sulphur dioxide (SO_2) and nitrogen (N_2) are scrubbed in water to recover $(NH_4)_2SO_4$. Some moisture are released into the atmosphere, as the recycling of vapour will be implemented.
  - Spillage within the scrubbing bund area will gravitate to the post scrubbing filtration area spillage pump.
  - The bleed stream from the scrubbing recirculation tank is pumped into an agitated filter press feed tank before being pumped to a plate and frame filter press. The filter cycle constitutes filtration, pressing, drying and cake discharge steps. After the discharge stage, the filter cloth is washed with raw water. All liquors are discharged into the post-scrubbing filtration tank and then into the crystallisation gas scrubbing tank to be used as scrubbing solution. The filter cake is stockpiled, bagged and transferred to the fluoride recycling circuit.
  - Spillage in this area is contained in a bunded area and pumped to the filter press feed tank.
- Use of reagents, chemicals, air abatement infrastructure and water.

Figure 8: Location of the Processing Plan in relation of other key infrastructure

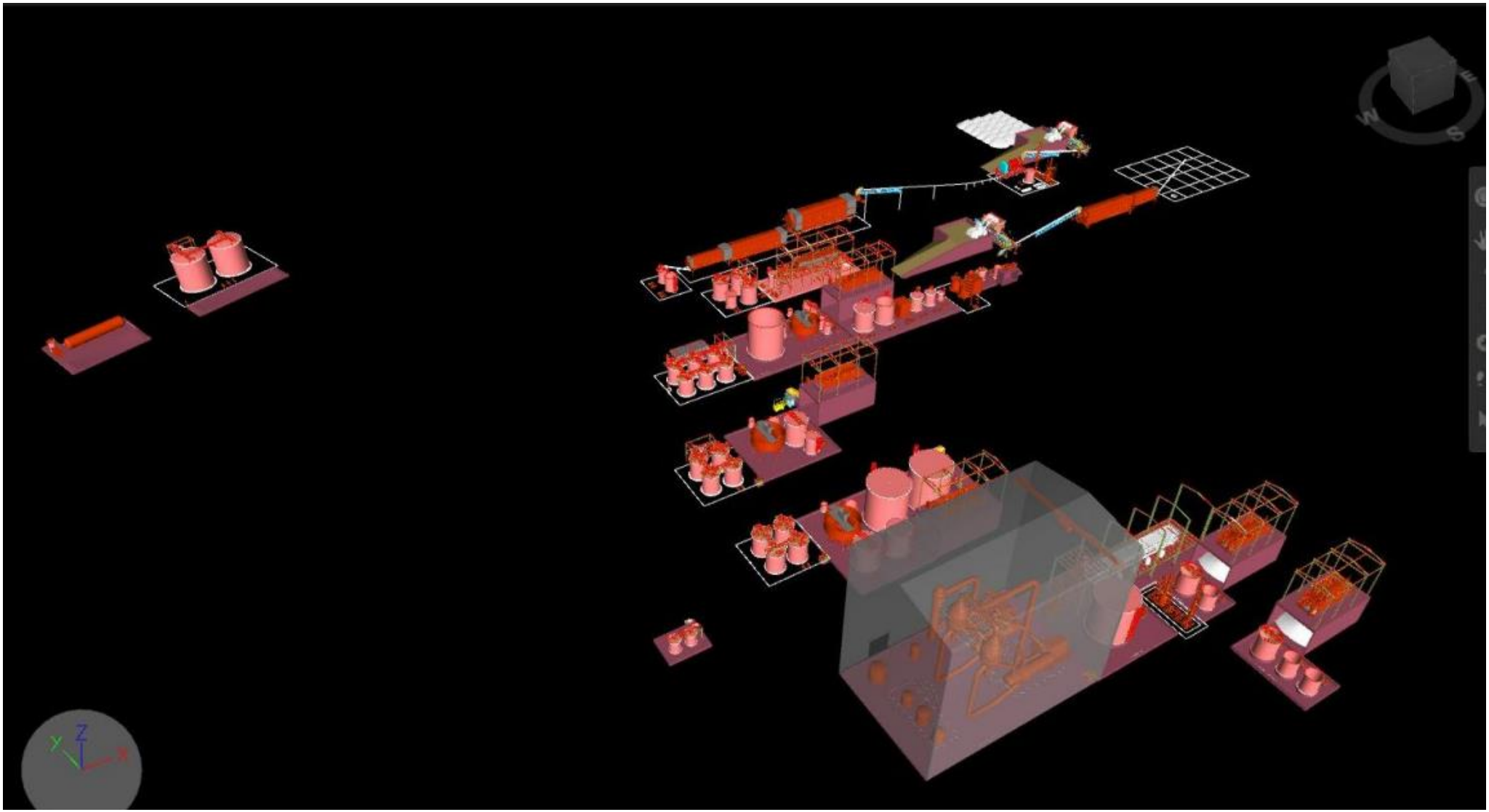


Figure 9: Proposed Process Plan layout

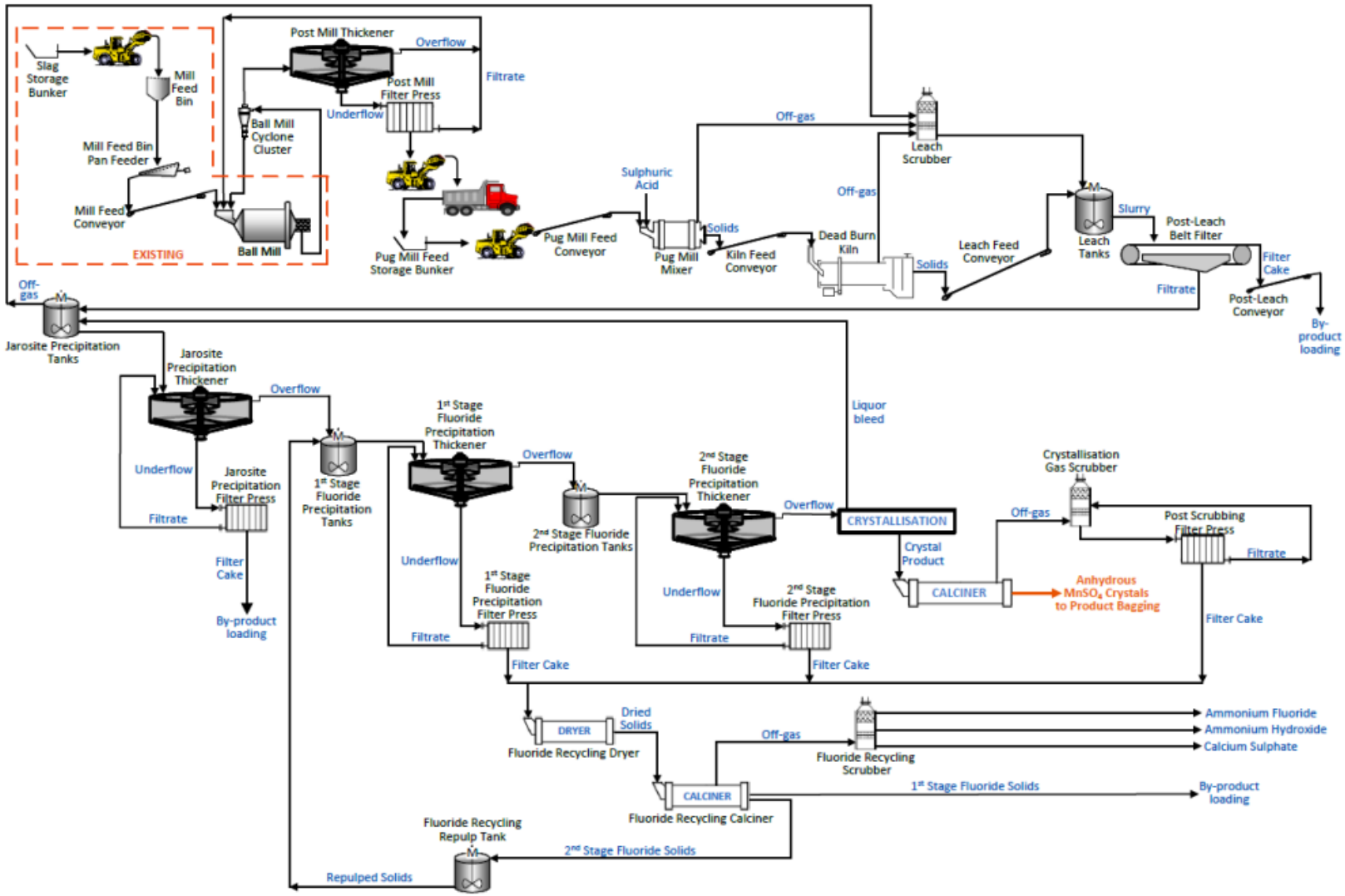


Figure 10: Process and Infrastructure illustration

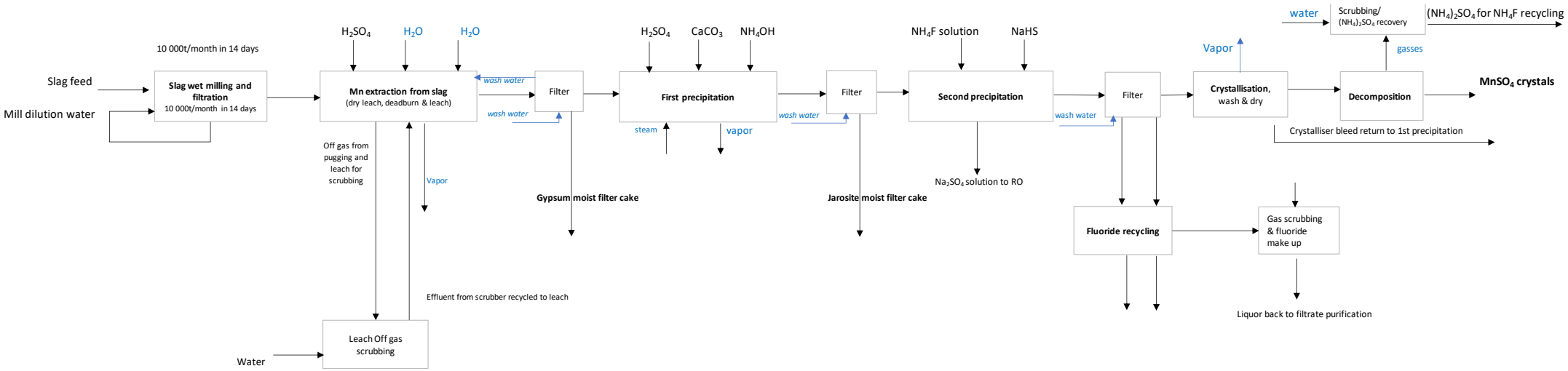


Figure 11: Proposed Process Flow

2.2.5 Air Emission Considerations

The primary product streams will be MnSO4, CaSO4. The primary reagent inputs to the process, besides the slag, are sulphuric acid, calcium carbonate, and sodium hydrosulphide.

The proposed plant will include processes that fall within the following activities listed into Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004): 1. Subcategory 7.2: Production of Acids 2. Subcategory 7.1: Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide 3. Subcategory 4.1: Drying and Calcining 4. Subcategory 4.20: Slag Processes.

All gases and vapours generated by the plant will be captured and recycled through the process via various closed loop scrubbing systems.

All thermal energy will be supplied by electricity and the inherent exothermic nature of some of the reactions i.e. there will be no combustion.

Based on the above, there will be no potentially significant emissions to atmosphere from the proposed plant.

2.2.6 Storm Water Management

The ARMMDW has an existing Storm Water Management System in place that channels potentially affected/ contaminated storm water from the operations to one of two existing, HDPE lined, Pollution Control Dams (PCDs) on the property. The Project will be located within the current Industrial Site. No additional Storm Water Management Systems will be required, as the facility itself will be enclosed in bunded areas, with spillage sump and pumps. Reagents will be reused in the circuit.

This infrastructure will link with the RO Plant, which will provide clean water to the plant. Any dirty water will revert back to the RO Plant for cleaning. The approved storm water management infrastructure includes:

- A concrete channel on the eastern periphery of the site;
- A PCD (purple catchment in the figure below);
- RO Plant infrastructure and Brine Ponds (it is currently foreseen that the RO Plant will receive water via PCDs 1 and 2);
- The Dam 1 - Dirty water from the furnaces are fed via concrete channels to a HDPE lined Dam 1 (orange catchment in the figure below); and
- The Dam 3 – Dirty water on the north-western periphery of the Works is captured in the HDPE lined Dam 2 (yellow catchment in the figure below).

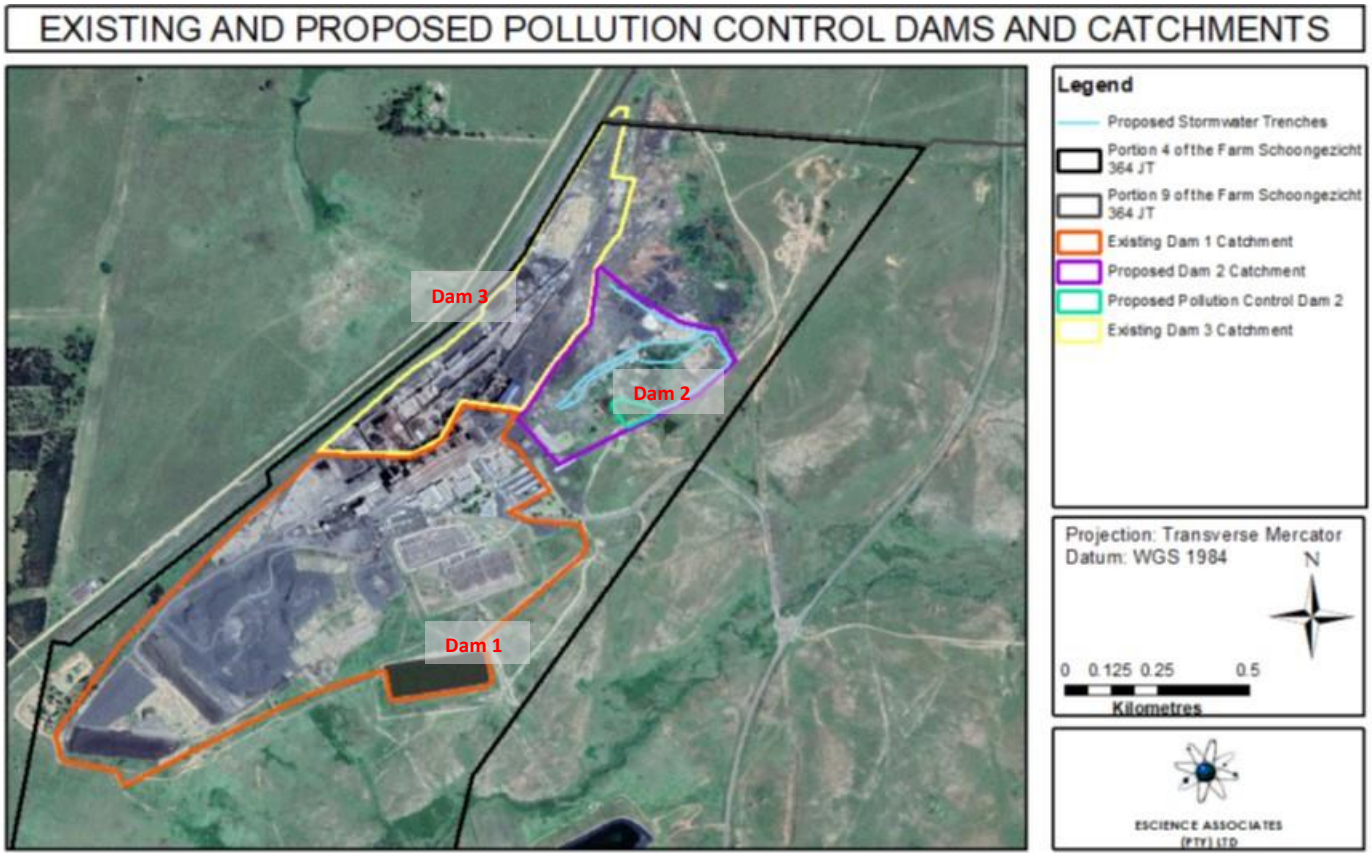


Figure 12: Approved Storm Water Management Systems in terms of demarcated catchment

2.2.7 Water Management

The total water demand for the project is indicated as 268 000m^3/a, which constitutes a 75% use when converted from m^3/hr to m^3/a. It should be noted that with the consideration of vapour recycling, this volume may reduce substantially. This will form part of the Water Conservation and Demand Management Strategy which will be developed by the site to reduce water usage.

The water demand for the $MnSO_4$ Recovery Project was provided by ARM and is summarised in the following table. The project required potable quality water, which will be mainly supplied from the RO plant.

Table 10: Project water demand

Project component	Water demand (m^3/hr)
Slag wet milling and filtration initial supply	11.11
Mn extraction from slag Feed 1	5.00
Mn extraction from slag Feed 2	8.00
Leach off gas scrubber	5.00
First precipitation (steam)	1.69
Gas scrubbing and fluoride makeup	5.00
Final scrubbing	5.68
Total water demand	**41.37**

A simplified process flow diagram for the $MnSO_4$ Recovery Project is presented in the following figure. The demand for the project will be met through the existing allocated ARMMDW water resources (surface water and groundwater) and return of vapour condensate from the process The surface water will be treated at the RO Plant and will be fed from the River Dam via Dam 1. Several discharges will take place from the project, including vapour loss and moisture entrained in product and by-products, discharge scrubbers and a small discharge to the RO plant.

Figure 13: Process flow diagram for the $MnSO_4$ Recovery Project

The water balance calculations for the $MnSO_4$ Recovery Project are based on the following:

- The estimation considers the maximum historical operational water use at the AMW, based on data between 2014 and 2023. The feed to the MRP via Dam 1 was however reduced as it is considered an over estimation of future use at the MRP.
- It was assumed that 50% of the vapour generated during the project can be condensated and returned to the project. ARM estimates that this percentage can be improved possibly to 90% recovery. Measures to achieve this are currently being evaluated.
- During calculations, typical dry weather runoff volumes were included. This is considered a conservative approach. A sensitivity analysis of the impact of runoff on water availability for the project is discussed below.
- The project requires potable quality water. The RO plant will therefore be used to generate good quality water for the project. This water will be sourced mainly from river water through Dam 1. The groundwater component to be supplied to the project is of a sufficient quality and does not need to be treated in the RO Plant.
- The water available in Dam 1 to the project is sourced from the Leeuspruit via the River Dam and River Tank.
- Groundwater will be sourced via the Borehole Tank to the project.

If 50% of the vapour generated in the project can be condensated and returned to the project, around 23% of the water demand for the project can be met through this reuse alone. If this percentage can be increased to 90% of vapour captured, it could contribute 109 028m^3/a of water to the project. This is equivalent to 41% of the water demand for the project. In turn, this will significantly reduce the demand on surface and groundwater for the project.

Based on the outcome of the assessment, it is recommended that 55% of the water demand for the project is sourced from the Leeuspruit. This is equivalent to around 146 800m^3/a of water, which is 13% of the typical dry available surface water in the stream after allocation of the ecological reserve. The surface water abstraction volume also represents 75% of the WUL allocated surface water resources to the ARMMDW.

For the purpose of the assessment completed in this report, it is estimated that 23% of the demand can be met through additional groundwater abstraction. This is equivalent to 60 571m^3/a of groundwater, which is co-incidentally the same as the assumed 50% vapour recaptured. This volume of additional groundwater is equivalent to 27% of the WUL allocated volume.

It is recommended that around 29% of the water demand for the project is sourced from groundwater. This is equivalent to 59% of the WUL allocated groundwater resources to the ARMMDW.

At present, it is likely that the discharge to the RO plant from the $MnSO_4$ Recovery Project would be available for reuse. At present, this is a very small volume. The RO design inflow volume is reported to be 183 456 (E-Science, 2015). The volume of effluent discharged from the $MnSO_4$ Recovery Project is very small based on the available dataset. There are however data gaps in this feed.

Table 11: Estimated water resource allocation for the project

Source	Estimated contribution volume (m^3/a)	% use of WUL allocation	% of demand
RO Plant permeate (surface water feed included)	146 857	75%	55%
Groundwater	60 571	27%	23%
Estimated vapour return	60 571	NA	23%
TOTAL	**268 000**		100%

Under the lowest runoff conditions, the project demand will have to be met through 28% from surface water and 49% from groundwater. This constitutes 85% of the allocated groundwater resources to the project. The volume of groundwater required to augment use from surface water gradually decreases to 14% of the total demand for typical wet rainfall conditions. Under very

high rainfall conditions, the total project demand can be met through water contained in Dam 1. Under these conditions care must be however taken to prevent overflow of the dam.

The sensitivity analysis confirms that the water demand for the project can be met during dry and wet periods through supplying water preferentially from Dam 1 and augmenting this water with groundwater, as required.

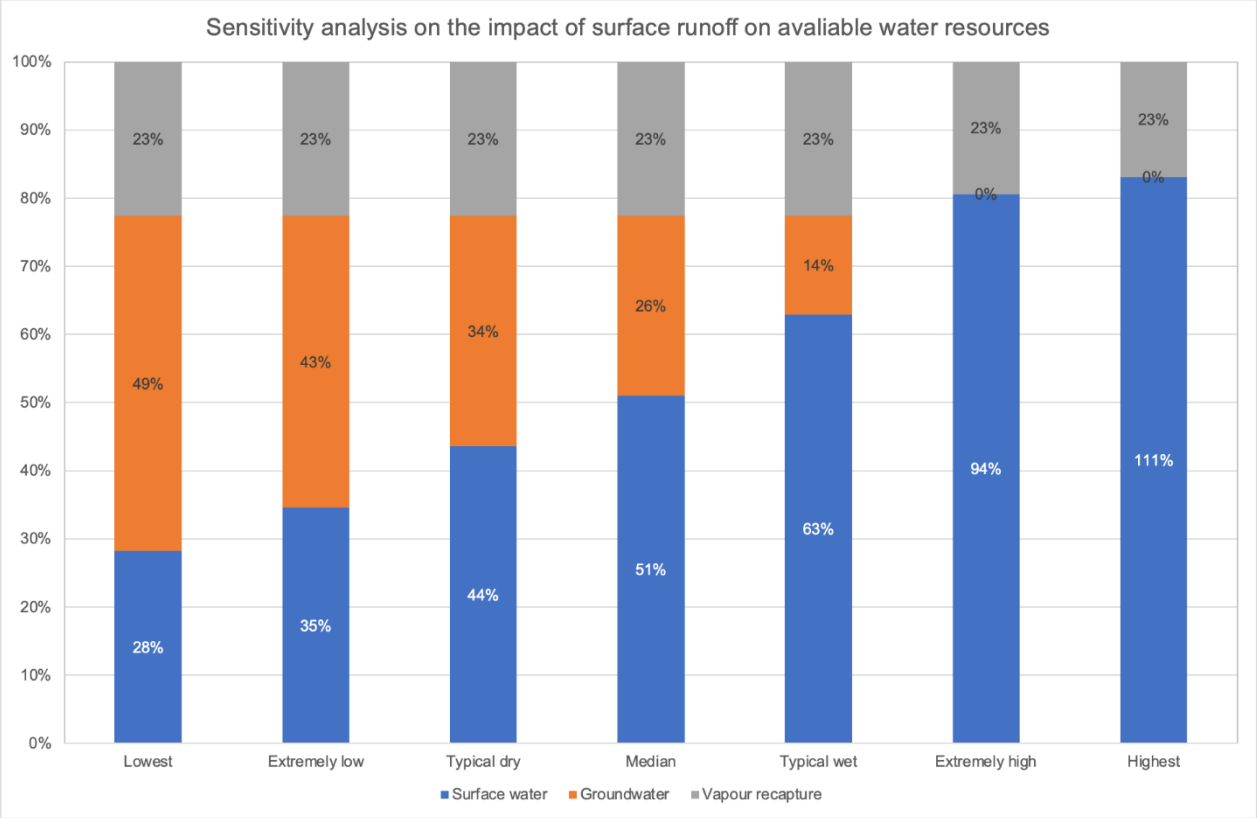


Figure 14: Runoff sensitivity analysis

2.2.8 Waste Management

ARMMDW has one Slag Stockpile (Historic Slag Dump) which is being reworked and, in some areas, rehabilitated. This Historic Slag Dump was permitted by KV3 Engineers in 2001. The Historic Slag Dump is permitted, in terms of its pollution potential, as a Hazardous Waste Site (H:H). Then there is the active Slag Stockpile area which is approved in the Waste Management Licence (WML), 2011 as updated 2017. This Slag Stockpile caters for both Chrome and Manganese Slag, although on separated lined areas on the western portion of the site. The 2019 Water Use Licence (WUL) allows for 360 000t/a deposition on the active Slag Stockpile.

No waste will be produced from the processing plant. All products and byproducts will be sold either for:

1. Battery grade manganese; or
2. Construction and Aggregate Industry.

2.3 **Listing Notices**

The proposed project includes activities that are listed in terms of GN R983 and GN R985, 2014, as amended in June 2021 (Listing Notices 1 and 3) as activities that require Environmental Authorisation prior to the commencement thereof, as detailed in the following table:

Table: Listed Activities applicable to the Proposed Project

Activity Number	Activity Description	Activity Location	Reason	Centre Coordinates	
NEMA Listing Notice 1					
14	Activity 14: "The development and related operation of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres."	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	Three (3) individually contained tanks are proposed on site; one (1) supply tank, one (1) back-up tank, and one (1) top-up tank. Each tank will be managed as a separate tank and will have a capacity of less than 500m^3. For the operation of the plant, it is important that the plant have a supply of at least 2 700tons of H_2SO_4 on site, which will provide a two (2) weeks' supply. Various options are currently under consideration for the placement of these tanks. ▪ These tanks will be placed in different areas on the overall site in separately contained areas (roofed, sunken bunded areas – bunded area to contain 110% of the tank capacity), at approximately 550m distances from each other. This will result in separate storage areas on different parts of the site (preferred and recommended option). ▪ One (1) of the tanks will be placed at the plant, and two (2) tanks will be placed at the offloading area about 1.5km from the plant. Again, all tanks, including those located at the plant, will be placed in individual roofed, sunken bunded areas – bunded area to contain 110% of the tank capacity.	Supply Tank 25°43'16.50"S Back-Up Tank 25°42'58.13"S Top-Up Tank 25°42'35.20"S	Supply Tank 30°13'5.45"E Back-Up Tank 30°13'32.26"E Top-Up Tank 30°13'49.25"E
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 license or an amended permit or license in terms of national or provincial legislation governing the release of emissions, effluent or pollution.	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	Amendment of the current AEL	25°43'15.54"S	30°13'4.93"E
NEMA Listing Notice 3					
4	NEMA Government Notice 985, Listing Notice 3: The development of a road wider than 4 metres with a reserve less than 13,5 metres. Outside urban areas: Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	Roads will be required to access the Processing Plant.	25°43'17.38"S	30°13'5.92"E
10	NEMA Government Notice 985, Listing Notice 3: The development and related operation of facilities or infrastructure for the storage,	Portion 4 of the Farm Schoongezicht 364 JT	Storage of chemical as presented above.	Supply Tank 25°43'16.50"S	Supply Tank 30°13'5.45"E

Activity Number	Activity Description	Activity Location	Reason	Centre Coordinates	
	or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. Outside urban areas: Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans.	Portion 6 of the Farm De Kroon 363JT			
12	NEMA Government Notice 985, Listing Notice 3: The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan: Within critical biodiversity areas identified in bioregional plans	Portion 6 of the Farm De Kroon 363JT	Although little natural vegetation is present, this activity is included as a portion of the plant footprint is located in a CBA. And NPAES Focus Area.	25°43'15.99"S	30°13'2.72"E
NEM:AQA Listed Activities					
Subcategory 7.2	*Production of Acids*	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	All installations producing, **handling** and/or **using** more than 100 tons per annum of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.	25°43'15.54"S	30°13'4.93"E
Subcategory 7.1	*Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide*	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	All installations **producing and/or using** more than 100 tons per annum of any of the listed compounds.		
Subcategory 4.20	*Slag Processes*	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	The processing or recovery of metallurgical slag by the application of heat. All installations.		
Subcategory 4.1 *Or* *Subcategory 5.2*	*Drying and Calcining* *Or* *The drying of mineral solids including ore, using dedicated combustion installations.*	Portion 4 of the Farm Schoongezicht 364 JT Portion 6 of the Farm De Kroon 363JT	Drying and calcining of mineral solids including ore. Facilities with capacity of more than 100 tons/month product. Or The drying of mineral solids including ore, using dedicated combustion installations. Facilities with a capacity of more than 100 tons/month product.		

It is important to note that Listing Notice 3: Activity 4, 10 and 12 were identified as part of the environmental setting desktop assessment.

3 NEED AND DESIRABILITY OF THE PROJECT

3.1 Need for the Project

Economic Benefit

According to the Manganese X Energy Corp (www.manganesexenergycorp.com), manganese has elemental qualities that have the potential to improve density, capacity, rechargeability, safety and battery longevity. Other than being an ingredient in potential alternatives to lithium-ion batteries, manganese is an important component of the two most commonly produced types of batteries available today. Lithium-ion-manganese-oxide (LMO) batteries are the type of batteries currently used to power almost everything rechargeable.

Further considering an article published by Fastmarkets, 4 April 2022 (www.fastmarkets.com), an industry expert has warned that in the next ten years demand for high-purity manganese is likely to exceed supply unless more attention is paid to the battery-grade metal. The article states that manganese is widely used in steel production, accounting for more than 90% of global consumption.

Less than 2% of global consumption is converted into high-purity manganese for the battery sector. Many lithium-ion batteries, such as nickel-cobalt-manganese (NCM), use manganese sulphate as a raw material for the cathode precursor. The article stated that in the coming years, battery producers will be looking into reducing cobalt and nickel and increasing manganese consumption. Considering the above, and the fact that the Works have an existing Manganese Slag Stockpile, and that feasibilities have indicated that the process will be successful in producing battery grade $MnSO_4$, the project is an economic opportunity for the Works and the socio-economic setting.

Social Benefit

Since the end of April 2015, various facilities at ARMMDW have been placed on "care and maintenance". These included all four (4) of the electric furnaces at the Works; the raw materials handling system; the Pelletising Plant; and the CSD Plant. The only operational system since then has been the MRP and associated Slag Stockpile (with the Historic Slag Dump being reworked, and new extensions available for future disposal). The current employment numbers have dwindled to about twenty (20) full time personnel on site.

ARM is highly committed to ensure that the Works is operational and could once again contribute to improved Social and Economic Conditions within eNtokozweni and the greater Emakhazeni Local and Nkangala District Municipalities within the Mpumalanga Province. The ARMMDW has invested significant capital to investigate alternative options to recommence operations.

The $MnSO_4$ Processing Plant will allow for at least twelve (12) years of operational life as a project on its own and further has the opportunity to source feed material from other mines or industry to continue producing. In addition to this, the project itself will allow for 160 full-time personnel and could provide further employment for more than 50 people in support services, such as garden maintenance, workshop management, and general maintenance on site.

Giving effect to Waste Reduction:

The NEMWA lists the key principles underpinning the Act in its Preamble; these include:
"*and whereas sustainable development requires that the generation of waste is avoided, or where it cannot be avoided, that it is* ***reduced, re-used, recycled or recovered*** *and only as a last resort treated and safely disposed of;*

*and whereas the **minimisation of pollution and the use of natural resources** through vigorous control, cleaner technologies, cleaner production and consumption practices, and waste minimisation are key to ensuring that the environment is protected from the impact of waste;*
*and whereas waste under certain circumstances **is a resource and offers economic opportunities**;"*

It can clearly be seen in the highlighted phrases that the re-use and the placement of economic value on a waste which has the added benefit of diverting waste from landfill will be viewed favorably in terms of the aims of the Act. In addition to this, the National Waste Management Strategy (NWMS) is a legislative requirement of NEMWA and gives effect to the objects of the Act. Organs of state and affected persons are obliged to give effect to the NWMS.

The Waste Management Hierarchy in the NWMS consists of options for waste management during the lifecycle of waste, arranged in **descending order of priority** and is summarised as follows:

- Waste avoidance and reduction;
- Re-use;
- Recycling;
- Recovery; and
- Treatment and disposal.

The foundation of the hierarchy, and the first choice of measures in waste management, is avoidance and reduction. This step aims for goods to be designed in a manner that minimises their waste components. Also, the reduction of the quantity and toxicity of waste generated during the production process is important.

The next stage of the hierarchy is re-using waste. Re-using an article removes it from the waste stream for use in a similar or different purpose without changing its form or properties. This second stage is in specific relevant to this project.

After re-use comes the recycling of waste, which involves separating articles from the waste stream and processing them as products or raw materials.

These first four stages of the waste management hierarchy are the foundation of cradle-to-cradle waste management. This approach seeks to re-use or recycle a product when it reaches the end of its life span. In this way, it becomes input for new products and materials. This cycle repeats itself until as small a portion as possible of the original product eventually enters the next level of the waste management hierarchy: recovery.

As a last resort, waste enters the lowest level of the hierarchy to be treated and/or disposed of, depending on the safest manner for its final disposal.

The current 2020 NWMS takes the above strategy further by also focussing on the Circular Economy (Figure 13).

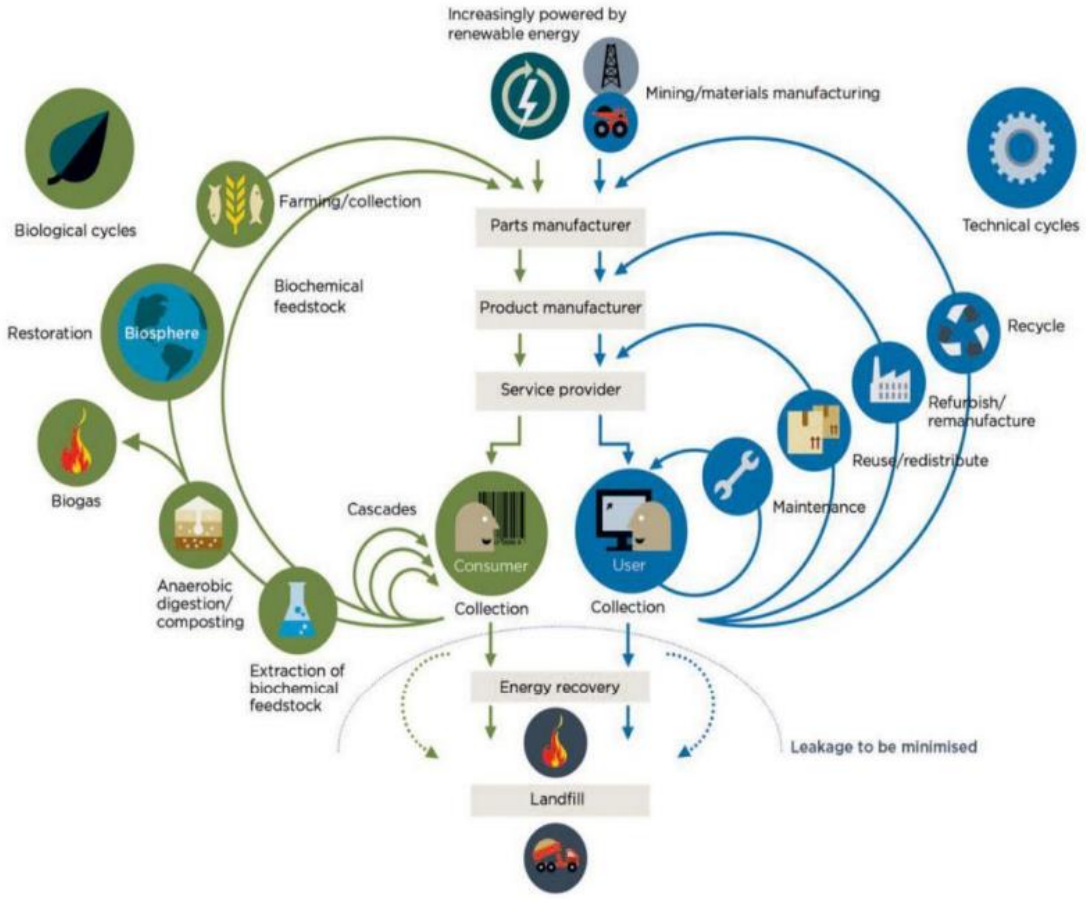


Figure 15: Butterfly Diagram on Circular Economy (NWMS, 2020)

A circular economy redefines economic growth by moving away from a take-make-waste industrial model to one that decouples economic activity from the environment and supports a just transition to renewable energy sources. The three key principles of a circular economy are: design out waste and pollution, keep products and materials in use and regenerate natural systems. The two (2) strategic entry points of the waste sector into waste minimisation and the circular economy is waste prevention and waste as a resource, as briefly explained below.

- Waste Prevention (as highlighted in the 2011 National Waste Management Strategy) – this emphasises avoiding and reducing waste before substances, materials and products are discarded.
- Waste as a Resource (key focus in the Strategy) – this focuses on stimulating a secondary resources economy based on recycling and recovery of materials and energy from waste i.e. interventions that take place after a product or material has become waste. Circularity can deliver substantial material savings throughout value chains and production processes, generate extra value, transformation of industry towards climate-neutrality, long-term competitiveness and unlock economic opportunities. In terms of the waste management hierarchy practices, recycling of waste for reuse and recovery of materials is prioritised over recovery of energy from waste. The main economic driver lies in exploiting the full potential value of waste (drawing the three earlier mentioned principles of the NEMWA close).

The NWMS, 2020 specifically states that waste prevention is a priority in relation to hazardous waste, both in terms of amount and toxicity of waste that is disposed of to landfill. The NWMS, 2020 is predicated on the insight that while waste is an environmental concern, it is also an important industry in which technology and innovation have a crucial role to play in creating a secondary resources economy.

The NWMS is structured around a framework of eight (8) goals, which are to:

- ***'promote waste minimisation, re-use, recycling and recovery of waste***
- *ensure the effective and efficient delivery of waste services*
- ***grow the contribution of the waste sector to the green economy***
- *ensure that people are aware of the impact of waste on their health, well-being and the environment*
- ***achieve integrated waste management planning***
- *ensure sound budgeting and financial management for waste services*
- *provide measures to remediate contaminated land*
- *establish effective compliance with and enforcement of the Waste Act*.'

The implementation of the proposed $MnSO_4$ processing plant and related infrastructure, will not only remove the current Manganese Slag Stockpile from site through the reworking process, but also offer the opportunity to other slag producers to reduce their waste footprint. A further advantage to this process, is that no additional waste is produced. Product will either be in the form of $MnSO_4$, for use in batteries or byproducts for the use in construction or the fertiliser industry.

4 POLICY AND LEGISLATIVE CONTEXT

The South African Environmental Setting is rapidly involving in terms of regulatory requirements. The role players in the decision-making process of the Environmental Authorisations who exercise control through both statutory and non-statutory instruments are located on Local, Provincial and National Levels.

The following presents the policy and legislative setting for the ARMMDW.

Table 12: Policy and Legislative Context

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT
1. Constitution of the Republic of South Africa (Act No. 108 of 1996) Environmental legislation is shaped by the Bill of Rights of the Constitution of the Republic of South Africa ("**Constitution**"). Section 24 of the Constitution, known as the '**Environmental Right**', guarantees every person the right to an environment that is not harmful to their health or well-being; provides for the protection of the environment against pollution; and degradation and centres sustainable development as the cornerstone of South Africa's environmental law regime. This right is binding on the State and people, both natural and juristic. In fulfilment of its constitutional mandate to take reasonable legislative measures that gives effect to section 24 of the Constitution, the government has promulgated several environmental laws. These laws provide a legal framework that embodies internationally recognised legal principles. The principal act governing activities that affect the environment is NEMA. ***Applicability to the BAR*** The implication of the BAR includes the obligation by the Licence Holder to ensure that the proposed project will not result in pollution and/or ecological degradation and that the activity is ecologically sustainable while promoting justifiable economic and social development.
2. National Environmental Management Act (Act No. 107 of 1998) (NEMA) In terms of sections 24(2) and 24D of the NEMA the Minister of Environmental Affairs (now the Department of Forestry, Fisheries and the Environment (DFFE)) promulgated certain activities that may not commence without an Environmental Authorisation. Activities promulgated in terms of GN R983 and GN R985 require a Basic Assessment process, while activities promulgated in terms of GN R984 require that a full Scoping and EIA process be conducted [GN R983, 984 and 985 promulgated under NEMA in Government Gazette (GG) 38282 of 4 December 2014 (as amended in 2021)]. The requirements for an EIA and Environmental Management Plan (EMP) are specified in Appendix 3 and Appendix 4 of GN R982 promulgated under NEMA in GG 38282 of 4 December 2014 (as amended on 11 June 2021). ***Applicability to the BAR*** This project triggers Listing Notice 1 of the EIA Regulations (2014, as amended 2021). The application for the Environmental Authorisation Process was submitted to the DARDLEA on 5 June 2023 and acknowledged by the Competent Authority on xxx with reference number: xxx.
3. EIA Regulations (2021 EIA Regulations) Chapter 6 of the EIA Regulations (2014 as amended 2021) provides for the requirements for the Public Participation Process (PPP), which must be carried out as part of the Environmental Authorisation Application process. In terms of Regulations 21 and 23, the outcome of the PPP must be reported in the BAR submitted to the Competent Authority. The PPP "*must give all potential or registered interested and affected parties, including the competent authority a period of at least 30 days to submit comments on each of the EMPr, scoping report and environmental impact assessment report, and where applicable the closure plan, as well as the report contemplated in regulation 32, if such reports or plans are submitted at different times*" (Regulation 40 (1)). The PPP must also: • provide access to all information that reasonably has or may have the potential to influence any decision regarding an application; • involve consultation with the Competent Authority, every state department that administers a law relating to the environment relevant to the application, all relevant organs of state and all potential, or where relevant, and registered Interested and Affected Parties (I&APs); and

- provide opportunity for I&APs to comment on reports and plans prior to submission of an application but must be provided with an opportunity to comment on such reports once an application has been submitted to the Competent Authority.

The process must include:

- notification of the application to all I&APs, as stipulated in Regulation 41;
- registration of all I&APs, as required in Regulations 42 and 43; and
- a record of comments and responses and records of meetings of and with I&APs, as outlined in Regulation 44.

Regulation 39 of the 2014 EIA Regulations as amended 2021) requires that:
"*(1) If the proponent is not the owner or person in control of the land on which the activity is to be undertaken, the proponent must, before applying for an environmental authorisation in respect of such activity, obtain the written consent of the landowner or person in control of the land to undertake such activity on that land.*

(2) Sub regulation (1) does not apply in respect of—
(a) linear activities;
(b) activities constituting, or activities directly related to prospecting or exploration of a mineral and petroleum resource or extraction and primary processing of a mineral or petroleum resource; and
(c) strategic integrated projects as contemplated in the Infrastructure Development Act, 2014."

Applicability to the BAR

For the proposed project, a PPP will be undertaken to make provision for the consultation process during the application for the Environmental Authorisation and AEL.

4. National Environmental Management: Air Quality Act (Act No. 39 of 2004) (NEM:AQA)

NEM:AQA was promulgated to ensure the protection and regulation of air quality and provide measures that will prevent pollution and promote sustainability. Under NEM:AQA, the Minister of Environmental Affairs (now Minister of Forestry, Fisheries and the Environment) must identify substances in ambient air which present a threat to health, well-being or the environment and establish national standards for ambient air quality, including the permissible quantity or concentration of each substance in ambient air.

The following regulations promulgated under NEM:AQA were considered for the proposed project:

- Listed Activities and Associated Minimum Emission Standards, published under GN R893 in GG 37054 of 22 November 2013, which lists activities that could result in atmospheric emissions requiring an Atmospheric Emission Licence (AEL) before being undertaken. Examples of such activities include:
  - the use of combustion installations;
  - storage of petroleum products;
  - slag processes;
  - carbonisation and coal gasification;
  - mineral processing; and
  - disposal of hazardous and general waste by way of incineration.
- National Dust Control Regulations, published under GN R827 in GG 36974 of 1 November 2013, provide that an acceptable dust fallout rate for a non-residential area is considered more than 600mg/m^2/day but less than 1 200mg/m^2/day (30-day average), with maximum allowable two exceedances per year, provided these exceedances do not take place in consecutive months. Where the dust fallout rate is exceeded, a dust fall monitoring programme, as prescribed in terms of the Regulations, must include:
  - the establishment of a network of dust monitoring points using method ASTM D1739:1970 (or an equivalent standard), sufficient in number to establish the contribution to dust fallout in residential and non-residential areas near the premises, monitor identified or likely sensitive receptor locations, and establish the baseline dust fall for the district; and
  - a schedule for submitting to the air quality officer dust fallout monitoring reports annually or at more frequent intervals if so, requested by the air quality officer.

- Greenhouse gases have been declared priority pollutants under the Declaration of Greenhouse Gases as Priority Air Pollutants published GN. R. 710 in GG 40996 of 21 July 2017, in terms of NEM:AQA, with reporting requirements for ARMMDW.

Applicability to the BAR

NEM:AQA was promulgated to ensure the protection and regulation of air quality and provide measures that will prevent pollution and promote sustainability. Under NEM:AQA, the Minister of Environmental Affairs (now Minister of Forestry, Fisheries and the Environment) must identify substances in ambient air which present a threat to health, well-being or the environment and establish national standards for ambient air quality, including the permissible quantity or concentration of each substance in ambient air. For the purposes of this Report an Atmospheric Emission Licence (please refer to Annexure 5 and Section 8.4 of this report.)

The proposed project triggers the following NEM:AQA activities:

- Applicable Listed Activities

Subcategory 7.2: Production of Acids
All installations producing, **handling** and/or **using** more than 100 tons per annum of hydrofluoric, hydrochloric, nitric and sulphuric acid (including oleum) in concentration exceeding 10%.

Subcategory 7.1: Production and or Use in Manufacturing of Ammonia, Fluorine, Fluorine Compounds, Chlorine, and Hydrogen Cyanide
All installations **producing and/or using** more than 100 tons per annum of any of the listed compounds.

Subcategory 4.1: Drying and Calcining.
Drying and calcining of mineral solids including ore.
Facilities with capacity of more than 100 tons/month product.
Or
Subcategory 5.2: Drying.
The drying of mineral solids including ore, using dedicated combustion installations.
Facilities with a capacity of more than 100 tons/month product.

Subcategory 4.20: Slag Processes.
The processing or recovery of metallurgical slag by the application of heat.
All installations.

5. National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA) and related legislation

In line with the Convention on Biological Diversity, the NEMBA aims to legally provide for biodiversity conservation, sustainable use and equitable access and benefit sharing. NEMBA creates a basic legal framework for the formation of a national biodiversity strategy and action plan and identification of biodiversity hotspots and bioregions, which may then be given legal recognition. It imposes obligations on landowners (state or private) regarding alien invasive species. It requires that provision is made by a site developer to remove any aliens which have been introduced to the site or are present on the site. As discussed below, the NEMBA also provides for the listing of Threatened Ecosystems and Threatened or Protected Species (TOPS).

Mpumalanga Biodiversity Sector Plan, 2014

The Mpumalanga Biodiversity Sector Plan is a comprehensive environmental inventory and spatial plan that is intended to guide conservation and land use decisions in support of sustainable development. The Mpumalanga Biodiversity Sector Plan maps the distribution of the Province's known biodiversity into several categories, such as Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs) and Other Natural Areas (ONAs). These are ranked according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each biodiversity feature.

National List of Ecosystems that are Threatened and in need of Protection (2022)

The NEMBA provides for the listing of threatened or protected ecosystems in one of four categories: 'Critically Endangered (CR)', 'Endangered (EN)', 'Vulnerable (VU)' and 'Protected'. Threatened ecosystems are listed in order to reduce the rate of ecosystem and species extinction by preventing further degradation and loss of structure, function and composition of threatened ecosystems. The purpose of listing protected ecosystems is primarily to conserve sites of exceptionally high conservation value.

Threatened or Protected Species Regulations (2015)

The NEMBA provides for listing of Threatened or Protected Species (TOPS). If a species is listed as threatened, it must be further classified as Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). In addition to these categories, protected species are defined as "any species which is of such high conservation value or national importance that it requires national protection". Species listed in this category may include, among others, species listed in terms of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Certain activities, referred to as Restricted Activities, are regulated on listed species using permits by a special set of regulations published under the Act. Restricted activities regulated under the Act are keeping, moving, having in possession, importing and exporting, and selling.

National Forests Act (Act No. 84 of 1998)

An updated list of protected tree species was published under section 12(1) (d) of the National Forests Act (Act No. 84 of 1998) on 25 March 2022. In terms of section 15(1) of this Act, 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 product derived from a protected tree, except under a licence or exemption granted by the Minister to an applicant and subject to such period and conditions as may be stipulated.

National Environmental Management: Protected Areas Act (Act No. 57 of 2003) (NEM:PAA)

The NEMPAA was promulgated in order to provide for (among other things) the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; for the establishment of a national Register of Protected Areas, and for the management of those areas in accordance with national norms and standards.

The National Protected Areas Expansion Strategy (NPAES; 2018)

Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large, protected areas. The focus areas were identified through a systematic biodiversity planning process undertaken as part of the development of the National Protected Area Expansion Strategy (NPAES, 2008).

Important Bird and Biodiversity Areas (IBA; 2015)

Various sites within the country have been identified as important for maintaining viable populations of endemic, range restricted and threatened bird species. The primary aim of the IBA programme is to ensure the long-term conservation of important avifaunal habitats. They also provide essential benefits to people, such as food, materials, water, climate regulation and flood attenuation, as well as opportunities for recreation and spiritual fulfilment. According to BirdLife South Africa, one-third of the 112 IBAs located within South Africa are under threat by invasive alien vegetation, habitat modification/ degradation and agricultural expansion (Marnewick et al., 2015). Further to this, 52% of IBAs fall outside formally Protected Areas, further complicating avian habitat conservation.

Alien and Invasive Species Regulations (2020)

The NEMBA Alien and Invasive Species Regulations (2020) aim to:

- Prevent the unauthorised introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur;
- Manage and control alien and invasive species, to prevent or minimise harm to the environment and biodiversity; and
- Eradicate alien and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien and invasive species categories according to the Alien and Invasive Species Regulations (2020) are as follows:

- Category 1a: Listed Invasive Species which must be combatted or eradicated. If an Invasive Species Management Programme has been developed, this must take place in accordance with such programme.
- Category 1b: Listed Invasive Species must be controlled. If an Invasive Species Management Programme has been developed, this must take place in accordance with such programme.
- Category 2: Invasive species that require a permit to carry out a restricted activity within an area, as specified in the permit.
- Category 3: Listed invasive species subject to certain exemptions and prohibitions. Any plant species identified as a Category 3 Listed Invasive Species that occurs in riparian areas, must, for the purpose of the regulation be considered to be a Category 1b Listed Invasive Species.

The NEMBA Alien and Invasive Species Lists (2020) include national lists of invasive species to be read together with the Alien and Invasive Species Regulations (2020).

Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA)

The objectives of CARA are to provide for the conservation of the natural agricultural resources through the maintenance of the production potential of land, through combating and prevention of erosion and weakening or destruction of the water sources, and through the protection of the vegetation and the combating of weeds and invader plants.

Amendments to regulations under the CARA provide for the declaration of weeds and invader plants, with weeds regarded as alien plants with no known useful economic purpose, while invader plants may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature. Declared weeds are described as Category 1 plants, while declared invader plants with a commercial or utility value are described as Category 2 plants and ornamental species as Category 3 plants. CARA indicates that Category 1 weeds are prohibited, and that Category 2 and 3 plants must be controlled.

CARA further provides a list of species identified as indicators of bush encroachment and requires landowners to combat bush encroachment where it occurs to prevent the deterioration of natural resources and also contains certain provisions which affect the burning of veld, whereby written permission from the relevant authority must be obtained prior to burning. In order to obtain such permission, it must be illustrated that the burning of veld is an accepted veld management practice within the particular area.

National Biodiversity Assessment (NBA; 2018)

The most recent National Biodiversity Assessment (NBA), dated 2018, is a collaborative effort to synthesise the best available science on South Africa's biodiversity. The NBA is used to inform policy in the biodiversity sector and other sectors that rely on or impact on natural resources, such as water, agriculture, mining and human settlements. The NBA provides information to help prioritise resources for managing and conserving biodiversity and provides context and information that underpins biodiversity inputs to land use planning processes (Skowno et al., 2019).

Applicability to the BAR

The ARMMDW is not located within a threatened ecosystem, and no indigenous forests occur in the project area.

A portion of the site is located within an area declared as a Critical Biodiversity Area (CBA): Irreplaceable. It must be noted that this overall area (considering the location of the railway lines and Slag Stockpiles) has been disturbed prior to implementation of the 2014 Mpumalanga Biodiversity Sector Plan with little natural vegetation present.

According to the most recently published South African Protected Area Database (SAPAD, 2023) and South African Conservation Area Database (SACAD, 2023) databases, the ARMMDW is not located within any protected areas, formal conservation areas, or IBAs, and no protected or conservation area are located in the vicinity. According to the NPAES database (2018), a portion of the site is located within an NPAES Focus Area.

The proposed activities will be undertaken within the footprint of the facility.

6. National Environmental Management: Waste Act (Act No. 59 of 2008) (NEMWA)

The purpose of NEMWA is to assist in regulating waste management; ensure the protection of human health; and prevent pollution and environmental degradation through sound waste management principles and guidelines. It furthermore provides for:

- national norms and standards for regulating the management of waste by all spheres of government;
- licensing and control of waste management activities;

- remediation of contaminated land;
- a national waste information system; and
- provision for compliance and enforcement.

The NEMWA defines waste broadly as "*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 reused, recycled or recovered*".

The NEMWA imposes a general duty upon waste holders to take reasonable measures to avoid waste generation and, where this is impossible, to: minimise the toxicity and quantities of waste generated; reuse, reduce, recycle and recover waste; and ensure that it is treated and disposed of in an environmentally-sound way. Failure to do so is a criminal offence, with a maximum fine of R10 million or imprisonment of up to 10 years, or both.

It is necessary to hold a WML for defined waste management activities.

ARMMDW has been successful in an application to exclude Slag from the definition of a waste issued by the Department of Forestry, Fisheries and the Environment (DFFE) for Ferrochrome and Ferromanganese Slag, respectively: 12/9/11/L200702095913/6/N/Exclusion Application and 12/9/11/L200622135529/6/N/Exclusion Application.

Applicability to the BAR

None.

7. National Heritage Resources Act (Act No. 25 of 1999) (NHRA)

The protection and management of South Africa's heritage resources are controlled by the NHRA**.** The national enforcing authority for the NHRA is the South African Heritage Resources Agency (SAHRA). In terms of the NHRA, historically important features such as graves, archaeology and fossil beds are protected. Similarly, culturally significant symbols, spaces and landscapes are also afforded protection. In terms of section 38 of the NHRA, SAHRA can call for a heritage impact assessment for certain categories of development. The activities identified in the NHRA requiring notification to SAHRA include:

Section 38 states:

"(1) (a): The construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;

(c): Any development or other activity which will change the character of a site

i. exceeding 5 000 m² 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 5 years; or

iv. the costs of which will exceed a sum in terms of regulations by SAHRA or a provincial heritage resource authority."

The NHRA however makes provision for the assessment of heritage impacts as part of an environmental authorisation process and, if such an assessment is deemed adequate by SAHRA, a separate application for consent under the NHRA is not required.

Applicability to the BAR

A Phase 1 heritage assessment has been conducted.

8. National Water Act (Act No. 36 of 1998) (NWA)

The NWA is the primary regulatory legislation controlling and managing the use of water resources and pollution thereof. It provides for fundamental reformation of legislation relating to water resource use. The preamble to the NWA recognises that the ultimate aim of water resource management is to achieve sustainable use of water for the benefit of all users and that water resources quality protection is necessary to ensure sustainability of the nation's water resources in the interests of all water users. The NWA's purpose is stated in section 2 and enforced by the DWS. Section 2 of the NWA relates to the following:

- Promoting the efficient, sustainable and beneficial use of water in the public interest;
- Facilitating social and economic development;
- Protecting aquatic and associated ecosystems and their biological diversity;
- Reducing and preventing pollution and degradation of water resources;
- Meeting international obligations.

The NWA presents strategies to facilitate sound management of water resources; provides for the protection of water resources; and regulates use of water by means of Catchment Management Agencies, Water User Associations, Advisory Committees and International Water Management. As the NWA is founded on the principle of trusteeship, the government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and industry (including mines) can only be entitled to use water if the use is permissible under the NWA.

In terms of section 21 of the NWA, certain consumptive and non-consumptive water uses are identified and can only commence once authorised. Where a water use constitutes a Scheduled 1 Use (permissible use without an authorisation requirement); permissible water use in terms of section 22 of the NWA; or is authorised in terms of a General Authorisation, a WUL is not required.

The NWA further requires that:

- a motivation in terms of section 27 be submitted as part of a water use licence application ("IWULA").
- the necessary water use application forms be compiled and submitted in support of the IWULA;
- the requirements of GN704 and detail surrounding these activities will be considered in the IWULA; and
- an integrated waste and water management plan be submitted in support of the IWULA.

Applicability to the BAR:

The Works has an approved WUL, 2008 and 2019, no additional water uses are required. There are no NFEPA and NWM5 wetlands in close proximity to this project area.

9. Other Legislation, Policy & Guidelines

Other legislation and associated regulations (where applicable) considered as part of the application process include:

- The National Development Plan 2030.
- National Veld and Forest Fire Act, 101 of 1998.
- Hazardous Substance Act, No 15 of 1973.
- Spatial Planning and Land Use Management Act, No 16 of 2013.

10. Provincial and Municipal Bylaws

According to the Local Municipality Integrated Development Plan Review Document (IDP, 2020-2021), there are four (4) strategic goals:

1. Provision of sustainable, quality and accessible basic services to all
2. Promote a diverse and inclusive economy that ensures growth and job creation
3. Promote a sustainable, safe and heathy environment
4. To work with communities to promote good, transparent, developmental, responsive and financially sustainable municipality.

According to the 2016 Community Survey (CS) of Stats SA, the five (5) leading challenges facing the municipality are the lack of safe and reliable water supply in line with Blue and Green Drop reports & scores of Municipalities, lack of/inadequate employment opportunities correlate with poverty driver information of the CS, inadequate housing, lack of reliable electricity supply, inadequate roads.

In terms of the economic setting of the municipality, the outcomes are that in 2014, the Emakhazeni Local Municipality achieved an annual growth rate of 1.26% which is a significant lower GDP growth than the Mpumalanga Province's 2.65%, but is lower than that of South Africa, where the 2014 GDP growth rate was 1.55%. Similar to the short-term growth rate of 2014, the longer-term average growth rate for Emakhazeni (2.46%) is also slightly lower than that of South Africa (2.94%). The economic growth in Emakhazeni peaked in 2010 at 7.96%.

Applicability to the BAR:

ARMMDW is committed to ensure that the protection of water, ecological and heritage resources receives the highest of attention. The proposed project will ensure the recommencement of operational activities on site and the provision of employment opportunities which forms a key role in the goals of the Municipality's IDP.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The following Chapter presents the current site-specific conditions in terms of the various Environmental Parameters.

5.1 Location and Site Description

The ARMMDW falls under the jurisdiction of the Emakhazeni Local Municipality, which forms part of the Nkangala District Municipality (the latter being the Competent Authority for the purposes of the AEL). ARMMDW is located on Portions 3, 4 and 9 (RE) of the Farm Schoongezicht 364JT, Portion RE of the Farm Dalmanutha 376JT and Portion 6 of the Farm De Kroon 363JT. The project itself is located on Portion 4 of the Farm Schoongezicht 364JT and the Farm De Kroon 363JT.

The land capability associated with the project has been altered to industrial land use and will remain as industrial land for the life of the installation.

Figure 16: Visual overview of the site

5.2 Regional Climate

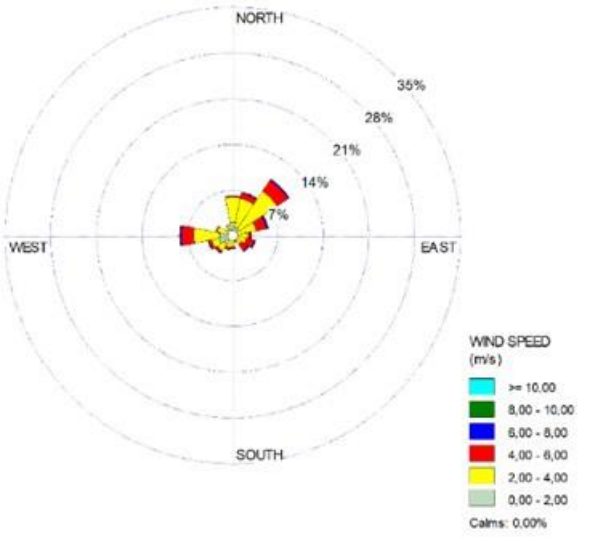
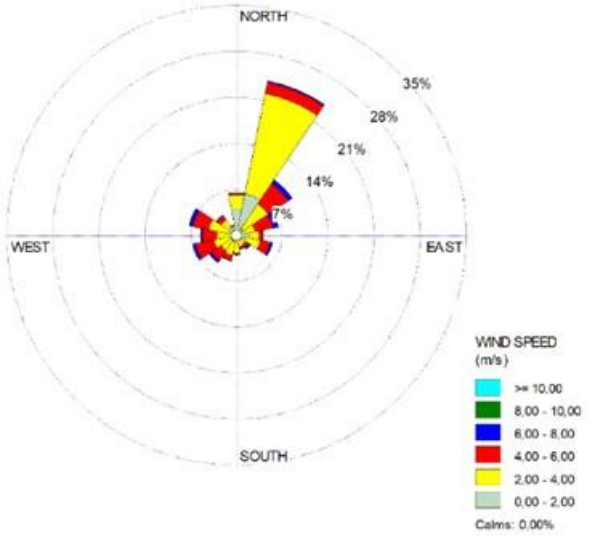
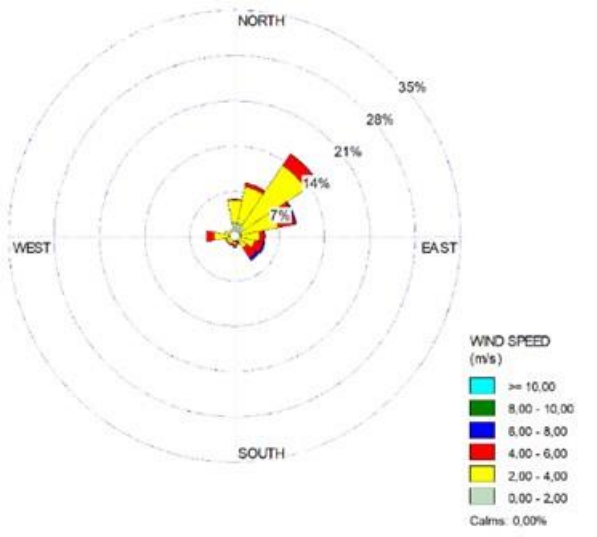
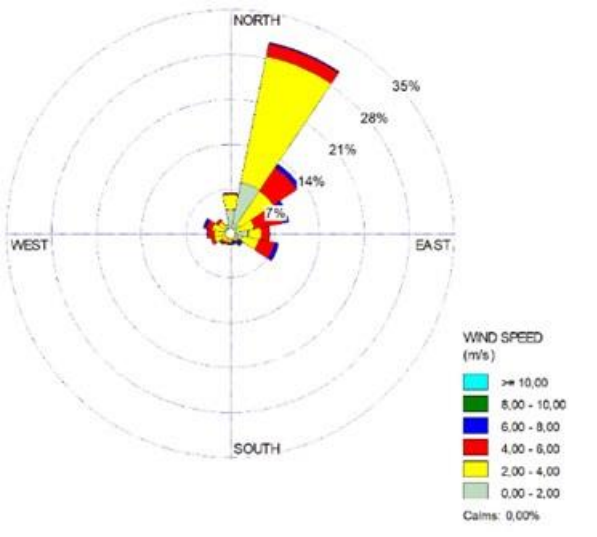
ARMMDW is situated on the edge of the escarpment within the Mpumalanga Province. The area typically receives summer rainfall in the form of thundershowers between the months of November and March and experiences cold winter nights and warm winter days. The climate can generally be defined as sub-humid and can be locally described as hot and dry.

5.2.1 Rainfall

Rainfall records for the Machadodorp weather station 05 174306 is most representative for the area. The annual average precipitation is 816.55 mm, and means annual evaporation is 1 658 mm (BAR, 2019).

5.2.2 Wind

The Machadodorp weather station is the nearest station to the ARMMDW, and an on-site station is used to improve the accuracy of the data. Wind direction and wind speed are dominant north-easterly and westerly wind components with an average wind speed of 2.89 m/s, for the period 2016 through to 2018 (please refer to figure below).

Measured	Modelled
	
Annual	
	
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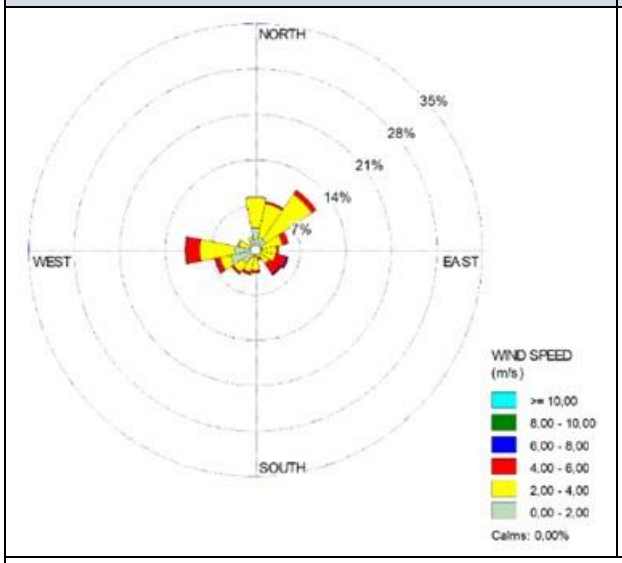	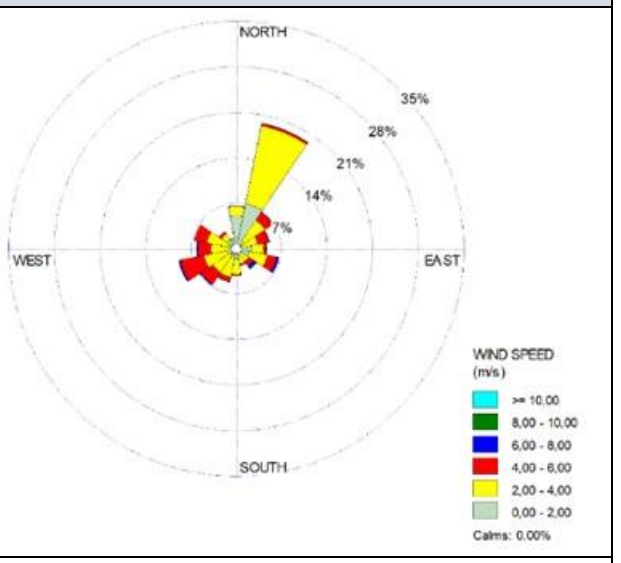
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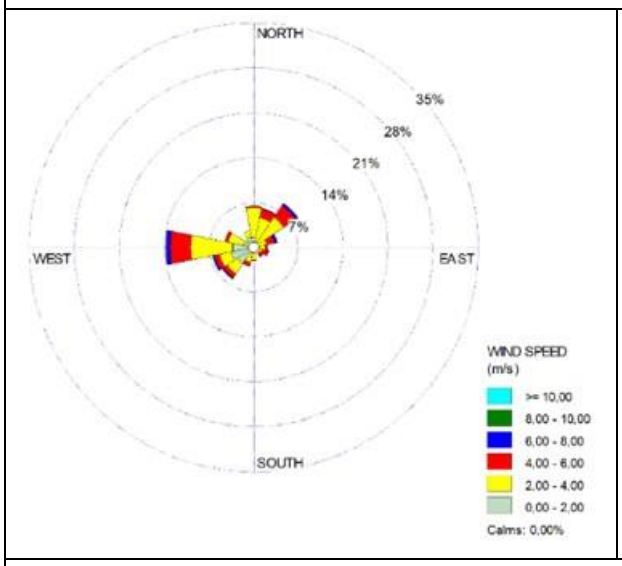
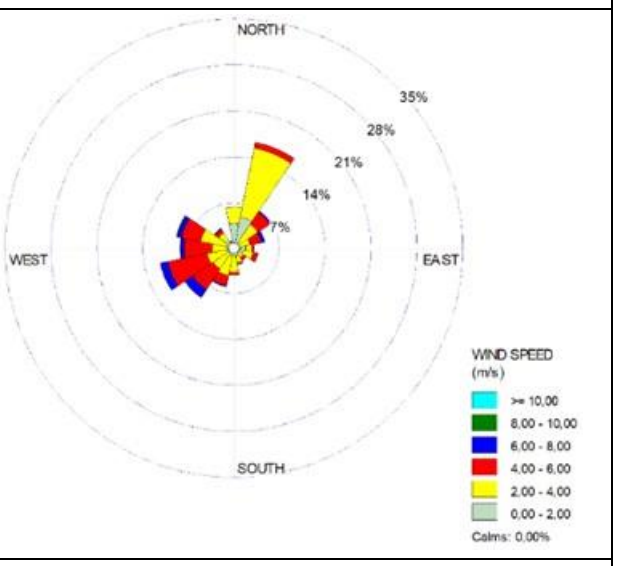
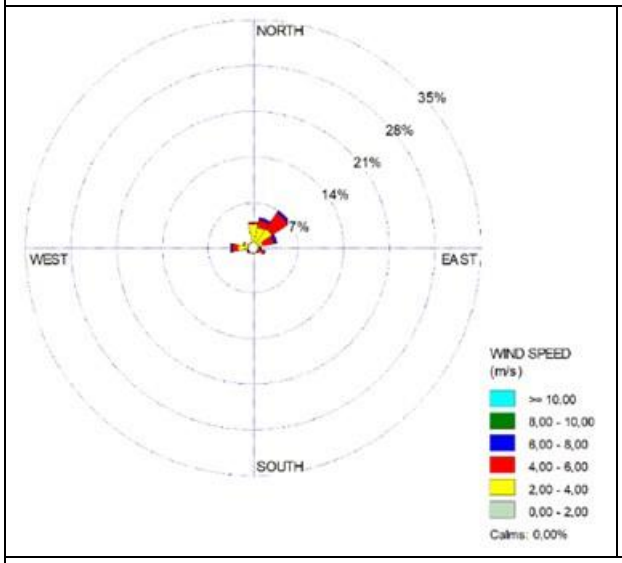
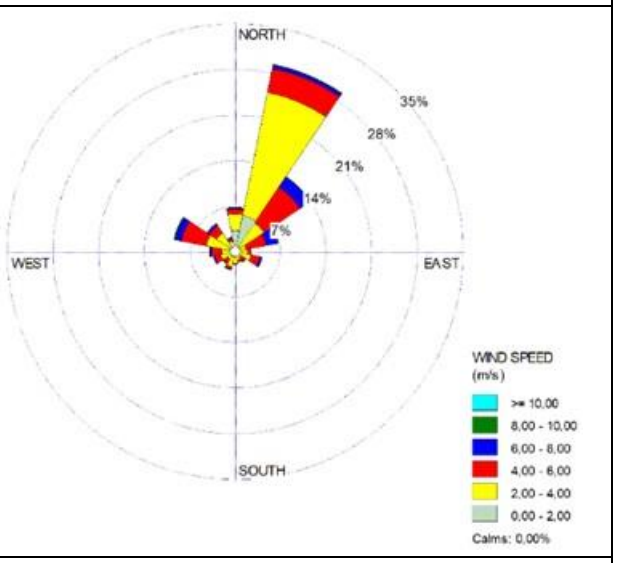
	
Winter	
	
Spring	

Figure 17: Wind rose comparison of measured versus modelled data for the Machadodorp AWS Station (2016 - 2018)

5.3 Topography

The proposed project is located mainly within the the existing infrastructure at the ARMMDW, at an elevation of approximately 1,670 metres above mean sea level (mamsl). The site is founded on sound and competent engineering materials that have been tested for their foundation properties (during the initial construction phase of the plant). The shales and mudstone lithologies are generally moderate to good founding materials. Existing licensed infrastructure is in place to protect any surface water or groundwater impacts, and the area is monitored on a regular basis in terms of the licence agreements with the relevant authorities. These results are submitted to the authorities as required. The topography of the site has been altered through industrial activities. The general slope of the ARMMDW property is approximately 2% to the southwest.

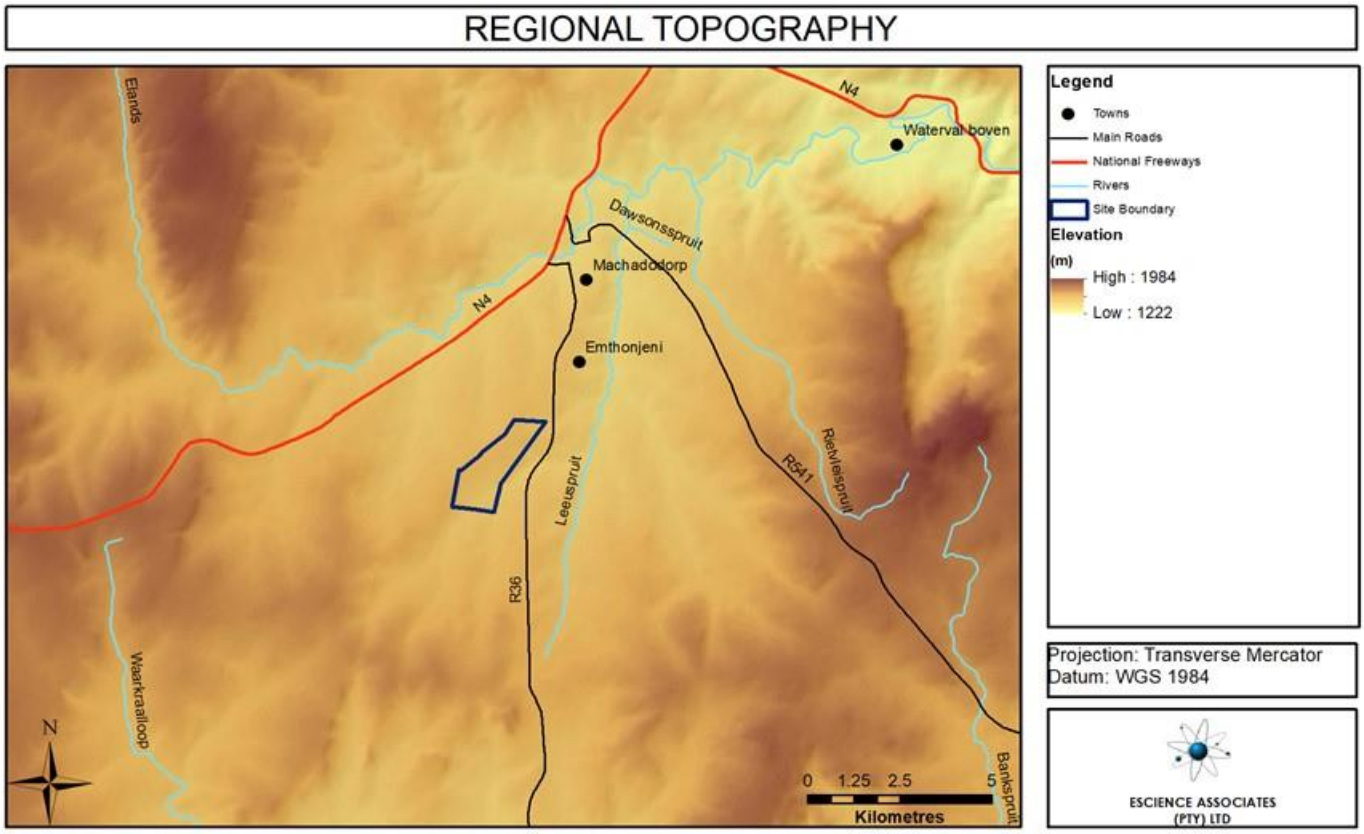


Figure 18: Topographical Map, EScience, 2019

5.4 Geology

The oldest rock formation in the Emakhazeni area belongs to the Barberton sequence. It is found in the eastern and northern areas as small outcrops of differentiated metamorphosed sediments, volcanic formations and intrusions of different ages. The eNtokozweni (Machadodorp) region is mainly underlain by shale formation, with the eastern side of the town underlain with basalt. The undulating topography of the nearby town of Emgwenya (Waterval-Boven), made up of hillcrests, troughs and valleys, is an expression of the underlying geology. The geology of the area comprises mainly sedimentary rocks and igneous intrusions. The sedimentary rocks are principally quartzite (belonging to the Transvaal Sequence: Pretoria Group) and alluvial soils. The intrusive rocks are mainly diabase outcrops, which occur between the quartzite bands. Iron deposits have also been found in the area. The eNtokozweni area is underlain by sediments of the Transvaal Group of rocks comprising predominantly shales and mudstones with interlayers of siltstone and in places sandstone lithologies. Dolerite and diabase dykes and sills have intruded these sediments. The regional dip is to the north at approximately 5º. The proposed project will have no additional impact on the geology of the area.

5.5 Soils

Soils in the area are the weathering product of Karoo sediments, primarily fine-grained siltstones and shales interbedded with some mudstone and sandstone. Three soil associations have been identified. Two of these associations are shallow fine textured soils and the other deep sandy soils of low natural fertility over iron hardpan (duricrust) (ESS, 2018).

The proposed activities will be undertaken mainly within the disturbed footprint of the facility. No additional surface areas will be disturbed as part of the proposed project.

5.6 Surface Water

5.6.1 Surface Water Setting

ARMMDW is located within the Leeuwspruit Elands River Catchment, which falls within the Inkomati WMA. The Leeuwspruit River passes the site approximately 300m on the south-east of the site and flows into the Elands River.

5.6.2 Surface Water Quality

Surface water quality is monitored on and around the site quarterly. Surface water samples are taken from Dam 1, Bass Dam, Leeuwspruit (up-stream), Leeuwspruit (down-stream), the sewage works and the spring below borehole MBH38 and analysed in terms of the South African Water Quality Guidelines (SAWQG).

The upstream and downstream water sampled in the Leeuwspruit indicate that the Works is not having any significant impact on the water quality of this receptor (stream), and that the source of the elevated bacteriological results recorded must be from outside the site boundary and area of influence.

According to the June 2023 Monitoring Results, the Leeuwspruit is sampled upstream (LSUS) of the smelter as well as downstream (LSDS) of the overall Works. The upstream sample provided an indication of the water quality of the 'incoming' water to the ARMMDW while LSDS is the most downstream point at which the water from the ARMMDW leaves the management area. The upstream water quality is compared to the downstream qualities as a management tool in assessing the possible impact (if any) of the smelter and its associated activities/facilities on the receiving environment.

Water quality at both sites was thus considered generally similar in the current assessment, both in terms of the concentrations, limit compliance, and detection limit profile, and suggests no additional impact from the smelter and its associated activities/facilities. Historically, the elevated iron (Fe) and aluminium (Al) were considered ambient for water associated with the local geology.

The proposed project will be managed and operated within the existing water circuit.

5.7 Groundwater

5.7.1 Groundwater Levels

ARMMDW monitors 37 boreholes across the operations. The locations of these boreholes are indicated on the following table and borehole details are presented in Table 16.

Analysis of the depth to groundwater in these boreholes suggest that there is no clear distinction between groundwater levels in the shallow and deep aquifers. This is demonstrated in Diagram 7, which shows the relationship between borehole elevation and the depth to groundwater. The shallow groundwater levels have a linear relationship with the topography, with a 98% correlation between the two datasets. This suggests that the water table in the shallow aquifer follows the topography closely and that groundwater discharges to the local streams as baseflow.

The groundwater levels in the deeper aquifer, however, do not exhibit a strong correlation with the topography.

Five of the deep boreholes (MBH20, 39D, 40D, 41D and 42D) have shallow groundwater levels, comparable to those in the shallow weathered aquifer.

The variation in groundwater level in the deep aquifer could be attributed to borehole construction, and specifically the placement of seals to separate the two aquifers in the deep boreholes. If the shallow aquifer is not sealed off in the borehole, the groundwater level will reflect conditions in both aquifers and would therefore rest higher than other boreholes that only target the deeper aquifer.

The average depth to groundwater in the shallow weathered aquifer is 4m. In the deeper fractured rock aquifer, the average depth to groundwater is 14m.

It is noted that four of the five boreholes with shallow groundwater levels are situated around the historical FeCr and new FeMn Slag Stockpiles. If high recharge rates occur from the Slag Stockpiles, groundwater levels may rise around the facilities, creating a mound.

Table 13: Groundwater monitoring borehole information

Groundwater Monitoring Points	Frequency ofSampling	Position	Co-ordinates	
			Latitude	Longitude
			South	East
DWAF	Quarterly	East of Raw Material Stockpiles	25º 42' 32.62"S	30º 14' 7.87"E
MBH 1	Quarterly	On Mr. Stoltz's Property	25º 42' 28.37"S	30º 13' 42.82"E
MBH 2	Quarterly	On Mr. Stoltz's Property	25º 42' 28.30"S	30º 13' 42.85"E
MBH 3	Quarterly	On Mr. Stoltz's Property	25º 42' 38.30"S	30º 13' 40.00"E
MBH 20	Quarterly	Next to Sewage Treatment Facility	25º 42' 52.78"S	30º 13' 53.54"E
MBH 34	Quarterly	North East of Dam 1	25º 43' 6.31"S	30º 13' 51.42"E
MBH 35	Quarterly	Next to Leeuspruit	25º 43' 22.44"S	30º 13' 49.87"E
MBH 36	Quarterly	North of Plant	25º 42' 42.16"S	30º 13' 36.88"E
MBH 37	Quarterly	North of Plant	25º 42' 49.86"S	30º 13' 28.24"E
MBH 38D	Quarterly	Downslope of Slag Dump	25º 43' 18.95"S	30º 13' 38.17"E
MBH 38S	Quarterly	Downslope of Slag Dump	25º 43' 18.98"S	30º 13' 38.32"E
MBH 39D	Quarterly	Downslope of Slag Dump	25º 43' 18.80"S	30º 13' 32.74"E
MBH 39S	Quarterly	Downslope of Slag Dump	25º 43' 18.84"S	30º 13' 32.63"E
MBH 40D	Quarterly	Downslope of Slag Dump	25º 42' 42.01"S	30º 13' 24.49"E
MBH 40S	Quarterly	Downslope of Slag Dump	25º 43' 15.31"S	30º 13' 27.59"E
MBH 41D	Quarterly	Downslope of Slag Dump Extension	25º 42' 41.47"S	30º 13' 24.20"E
MBH 41S	Quarterly	Downslope of Slag Dump Extension	25º 43' 22.69"S	30º 13' 18.55"E
MBH 42D	Quarterly	Upslope of Slag Dump Extension	25º 42' 27.25"S	30º 13' 27.80"E
MBH 42S	Quarterly	Upslope of Slag Dump Extension	25º 43' 10.63"S	30º 13' 9.80"E
Bass BH	Quarterly	Downslope of Bass Dam	25º 42' 52.170"S	30º 14' 3.477"E
Stoltz New BH	Quarterly	On Mr. Stoltz's Property	25º 42' 21.548"S	30º 13' 41.943"E
MBH45D	Quarterly	Downslope of Dam3	25º 42' 36.300"S	30º 13' 43.545"E
MBH45S	Quarterly	Downslope of Dam 3	25º 42' 36.336"S	30º 13' 9.880"E
MBH46D	Quarterly	Upslope of RO Plant	25°42'40.2"S	30°13'54.0"E
MBH46S	Quarterly	Upslope of RO Plant	25°42'40.2"S	30°13'54.0"E
MBH47D	Quarterly	Downslope of RO Plant	25°43'49.3"S	30°13'58.7"E
MBH47S	Quarterly	Downslope of RO Plant	25°43'49.3"S	30°13'58.7"E
MBH48D	Quarterly	Downslope of RO Plant	25°42'48.3"S	30°14'01.5"E
MBH48S	Quarterly	Downslope of RO Plant	25°42'48.3"S	30°14'01.5"E
AH15	Annually	All south to south-east of the main stormwater dam (Dam 1): • AH15 & AH16 located between Dam 1 and MBH 40S; • AH26 between Dam 1 and MBH 41S; • AH17 between Dam1 and MBH39D; • AH21 between Dam 1 and MBH 38S; • AH25, AH23, & AH30 between Dam 1 and SWUS (LSUS).	25°43'14.7"S	30°13'30.6"E
AH16	Annually		25°43'13.6"S	30°13'33.0"E
AH17	Annually		25°43'17.0"S	30°13'33.5"E
AH21	Annually		25°43'17.1"S	30°13'40.3"E
AH23	Annually		25°43'22.5"S	30°13'37.0"E
AH25	Annually		25°43'20.7"S	30°13'40.5"E
AH26	Annually		25°43'18.0"S	30°13'30.0"E
AH30	Annually		25°43'25.3"S	30°13'34.4"E

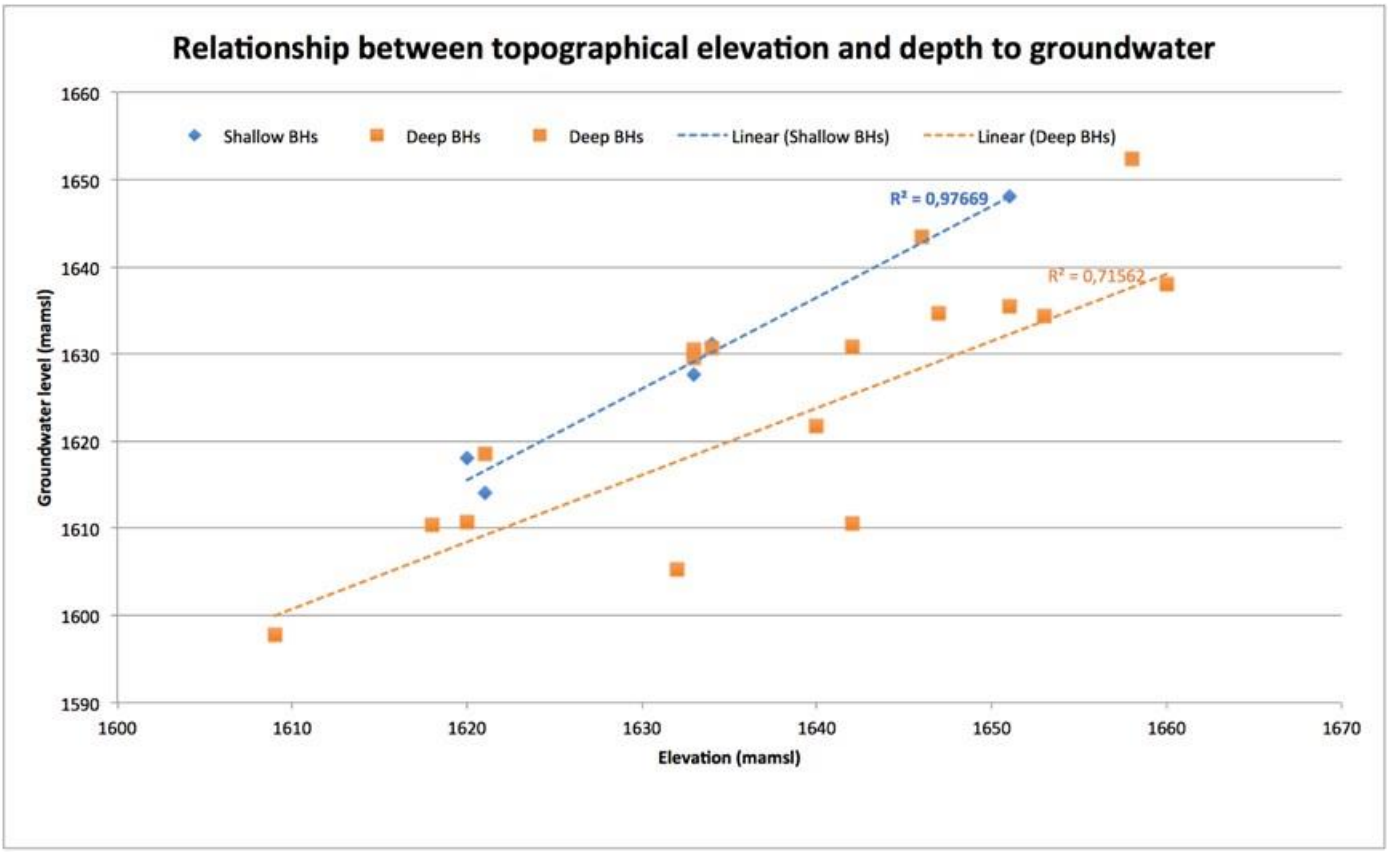


Diagram 3: Relationship between topographical elevation and depth to groundwater

5.7.2 Groundwater Flow

The most recent groundwater monitoring information was used to assess groundwater flow patterns in the shallow weathered and deeper fractured rock aquifers. The results are presented in Figures 17 and 18. The groundwater flow patterns will determine the direction and rate of spread of potential contamination from the site in future. For this reason, it is important to study these flow patterns closely.

Figure 19 shows that groundwater in the shallow weathered aquifer flows both in a southerly direction towards the Leeuwspruit, but also in a westerly direction off site. This is due the fact that the ARMMDW is situated on a water divide which runs roughly along the northern boundary of the site. The flow of groundwater in the shallow aquifer in the northern part of the project site is not well defined, as there are only two shallow boreholes present in this area. The small number of datapoints to characterise groundwater flow patterns in the shallow weathered aquifer also makes it difficult to determine whether or not a groundwater mound has formed around the Slag Stockpile area.

The groundwater flow gradient is around 0,05 (1:20) in the shallow aquifer.

Groundwater flow patterns in the deeper fractured rock aquifer show similar trends around the Slag Stockpile area, as shown in Figure 20. Groundwater flows from the FeCr and FeMn Slag Stockpiles towards the Leeuwspruit at a gradient of 0,06 (1:17).

Groundwater flow patterns in the deeper fractured rock aquifer in the north-eastern section of the ARMMDW site show the presence of the water divide that coincides roughly with the northern boundary of the project area. The water divide is more clearly identified in this area due to the fact that monitoring is done in boreholes north of the site. Groundwater flow to the Leeuwspruit in a southerly direction. It is possible that some contamination may drain in a northerly direction from the Pelletising Plant receiving area, the Baghouse Dust area and the final product/furnace areas.

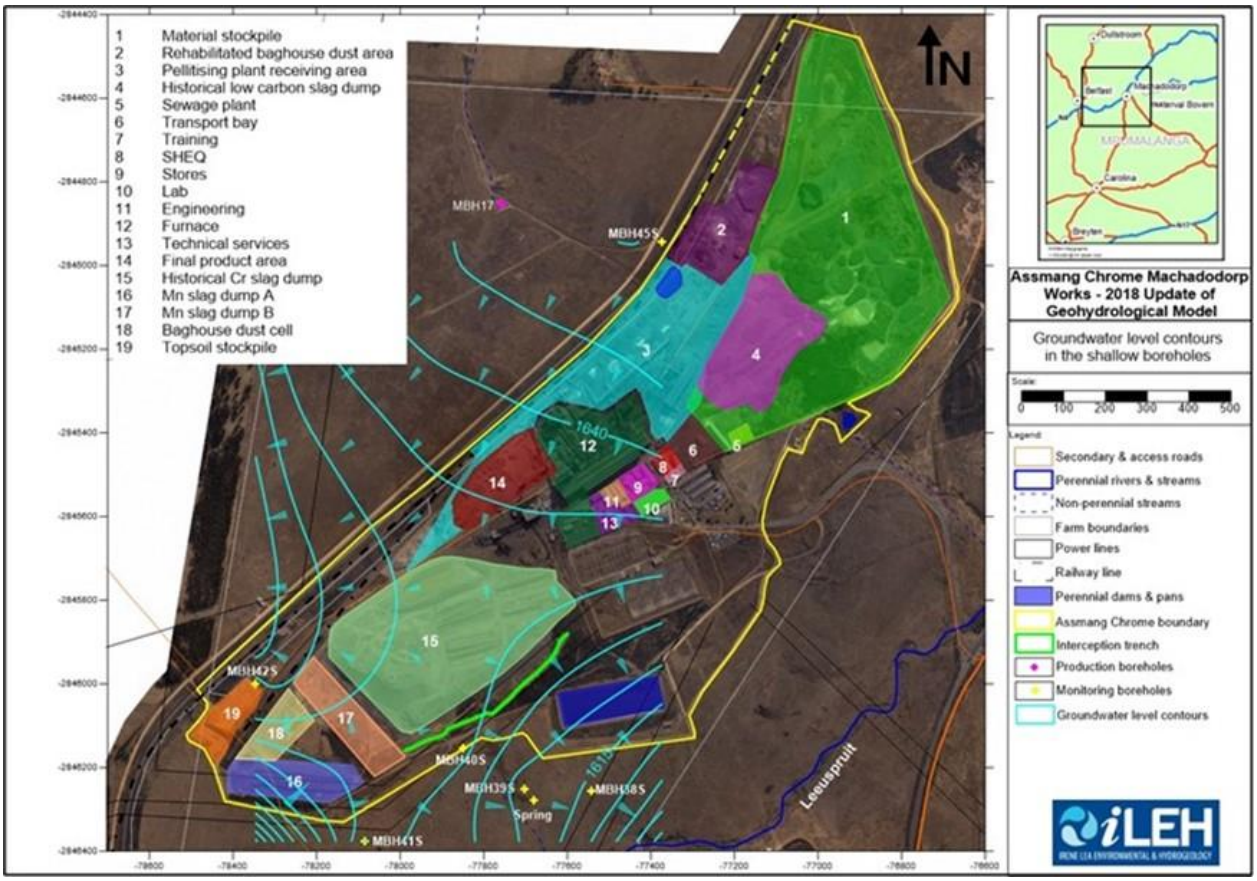


Figure 19: Groundwater level contours in the shallow weathered aquifer

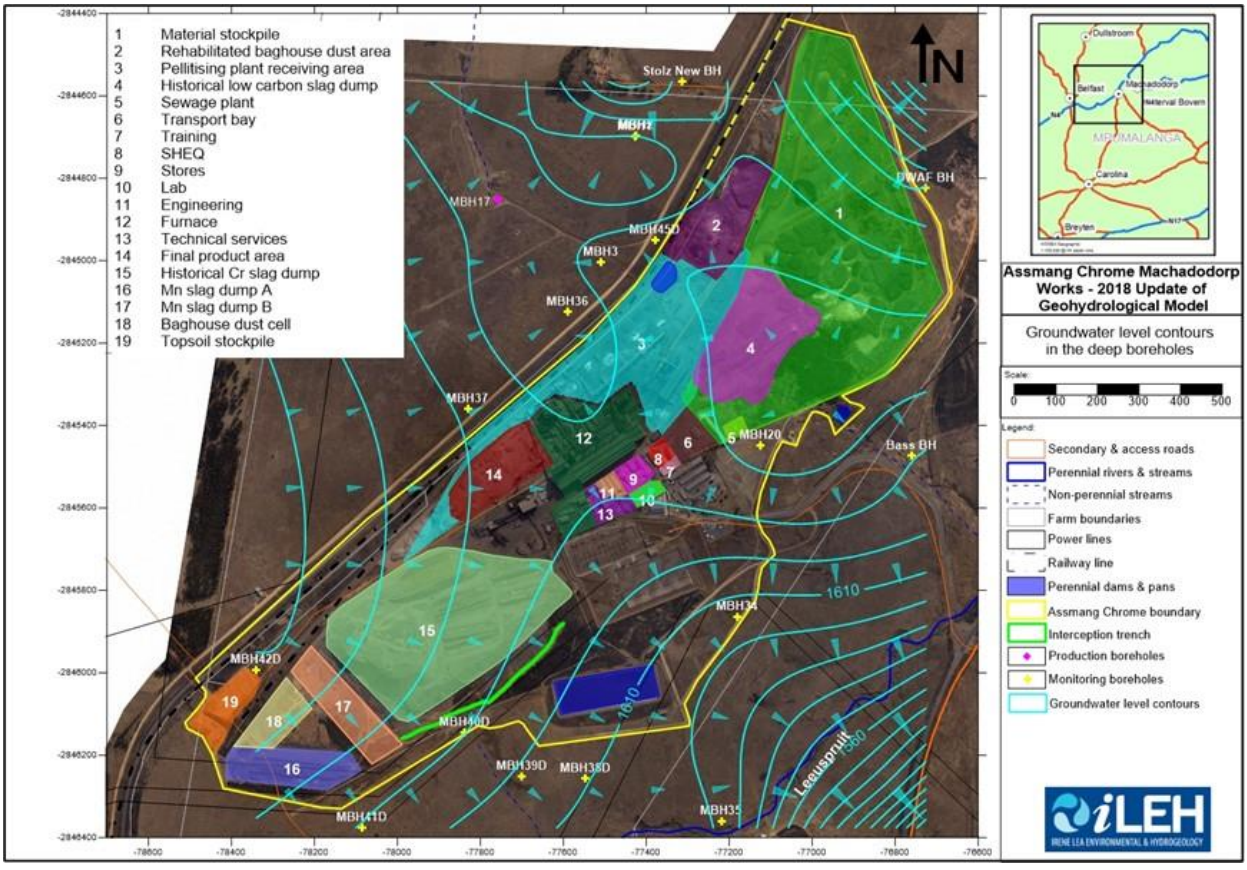
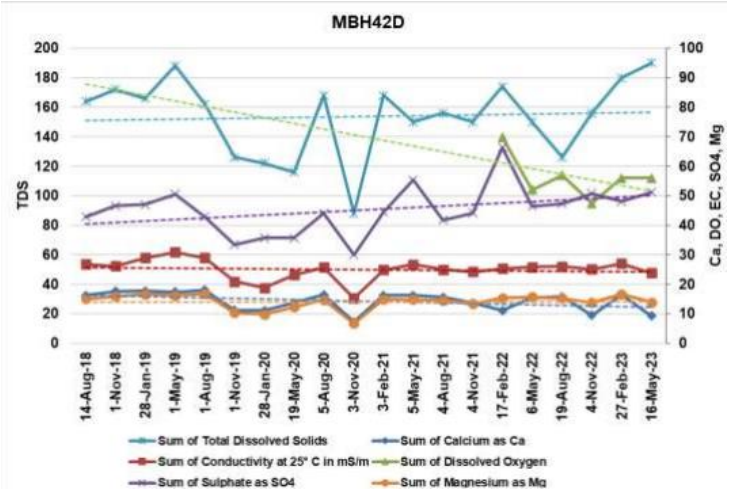


Figure 20: Groundwater level contours in the deeper fractured rock aquifer

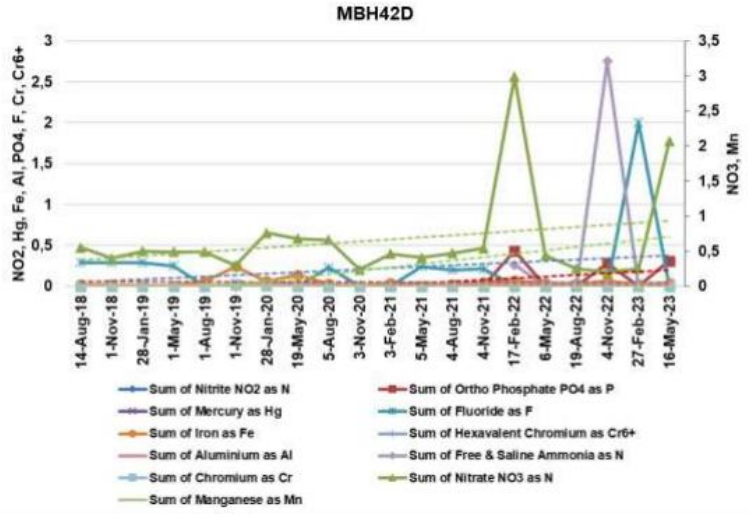
5.7.3 Groundwater Quality

Please refer to the Figure 21 for the location of the groundwater monitoring points.

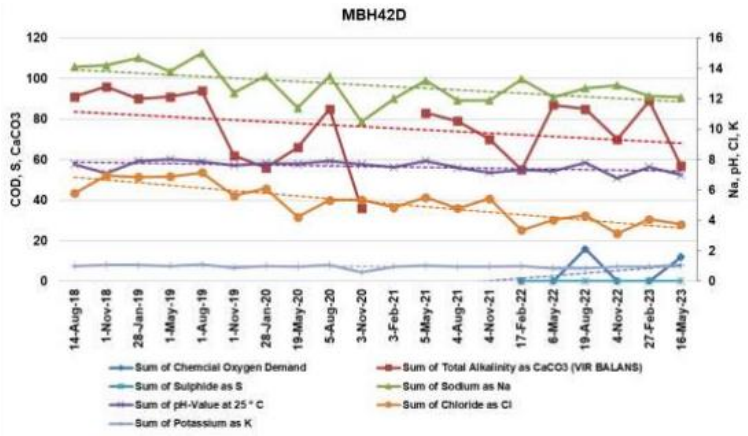
The project area will be located next to borehole M42D&S. These boreholes were considered as the least concern in terms of water quality. Please see the following graphs presenting the water quality of these two (2) boreholes.



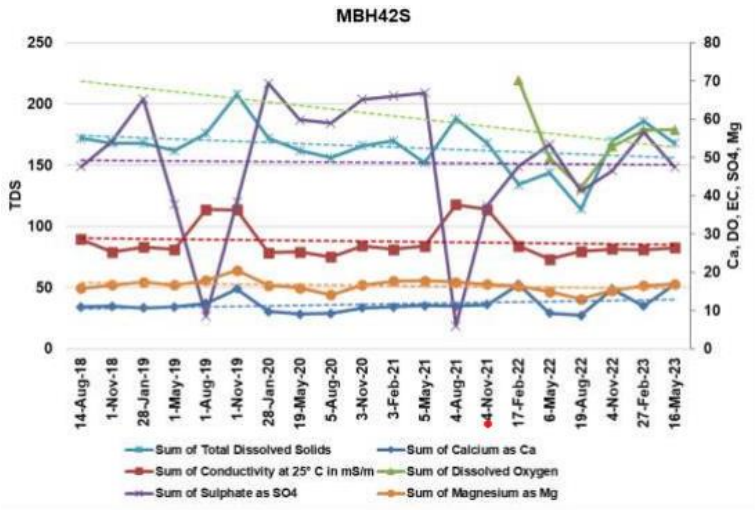
Graph 1: Borehole MBH42D Monitoring Graphs 1



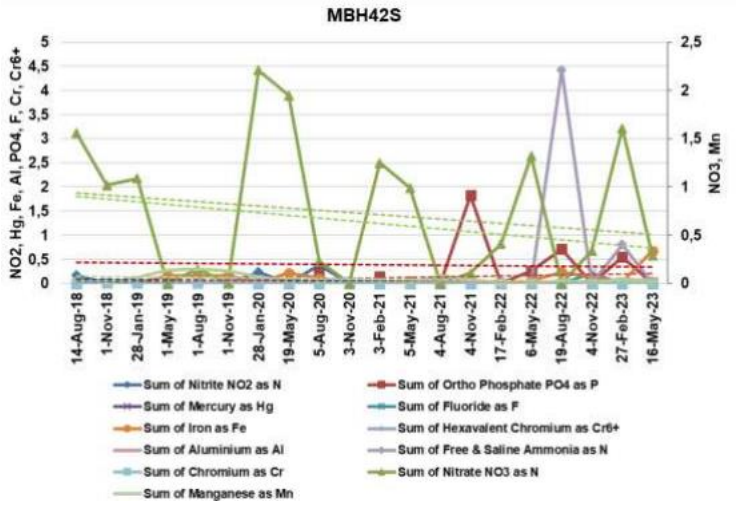
Graph 2: Borehole MBH42D Monitoring Graphs 2



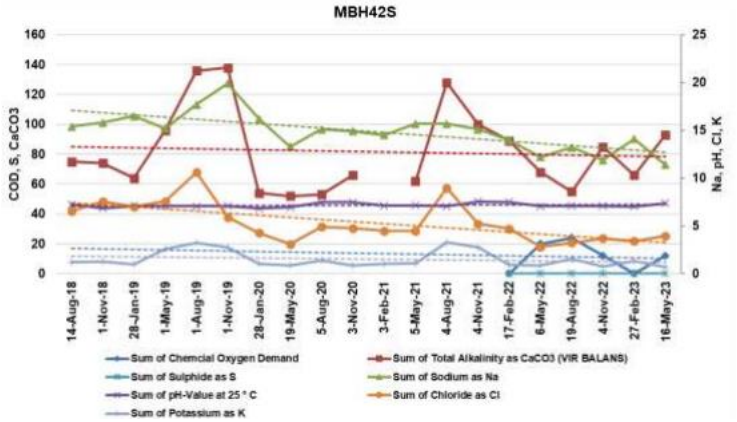
Graph 3: Borehole MBH42D Monitoring Graphs 3



Graph 4: Borehole MBH42S Monitoring Graphs 1



Graph 5: Borehole MBH42S Monitoring Graphs 2



Graph 6: Borehole MBH42S Monitoring Graphs 3

Figure 21: Groundwater Monitoring Points

5.8 Land Cover and Land Use

Land use and land cover have two main effects on meteorology. The first is the reflective properties, or albedo, of the land cover. This determines how much radiation is reflected which has implications for determining diurnal heating patterns and atmospheric mixing levels. Mixing heights will determine the volume of air available in which air pollutants can vertically disperse. Secondly, land use types have an associated surface roughness which influences relative turbulent or laminar flow of wind. This in turn affects pollutant dispersion.

The ARM MDW site is largely surrounded by grassland and cultivated areas (refer to Figure 22 and Figure 23), with the area immediately adjacent to the site consisting largely of open veld to the south and agricultural activities to the north, east and west. The nearest residential areas are eNtokozweni and Emthonjeni. The Leeuwspruit River lies to the east of the site. The nearest hospital is the Waterval Boven Hospital located within Emgwenya. The nearest medical centre is the Louw MST/a Zimzeni Medical Centre in eNtokozweni.

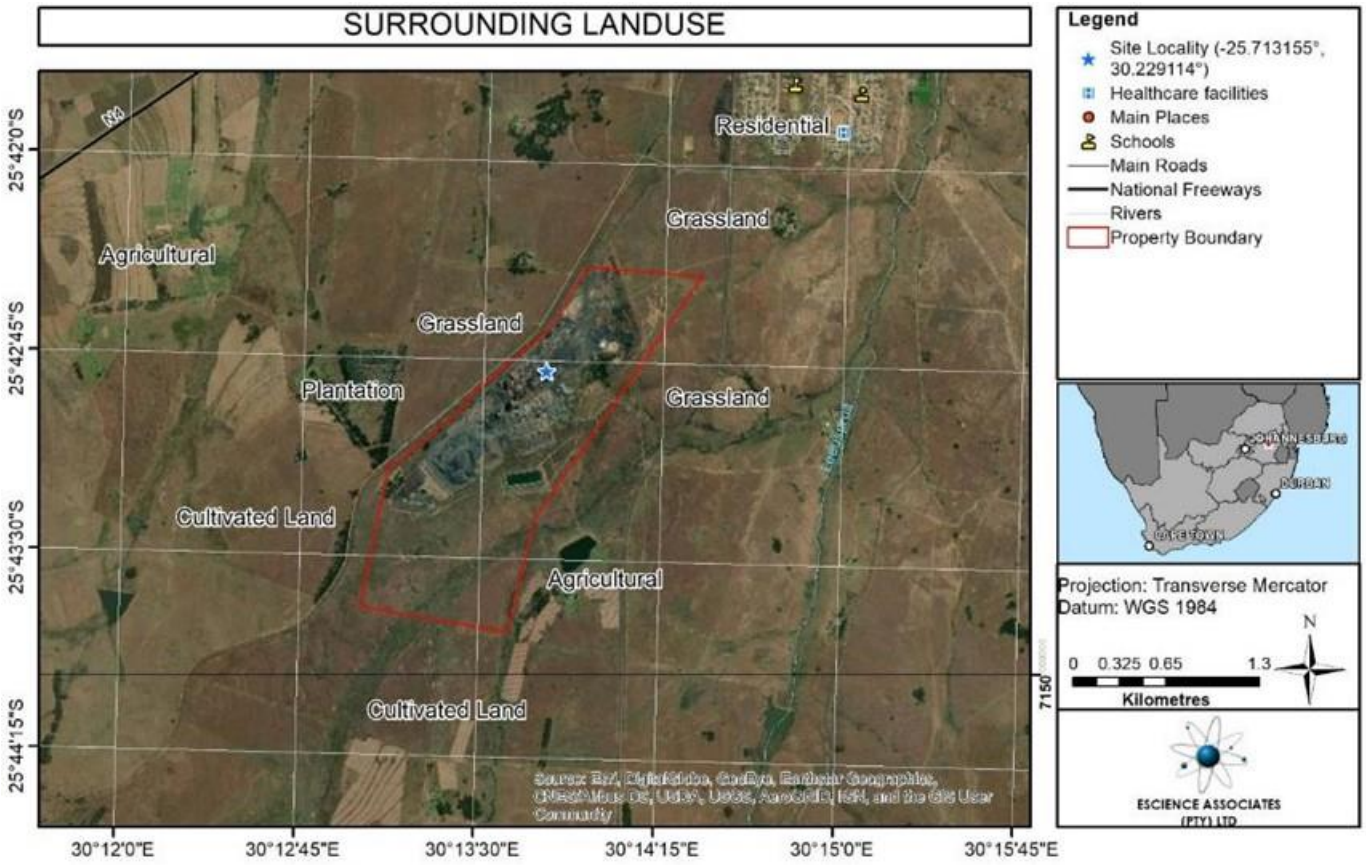


Figure 22: Satellite image –Surrounding land use

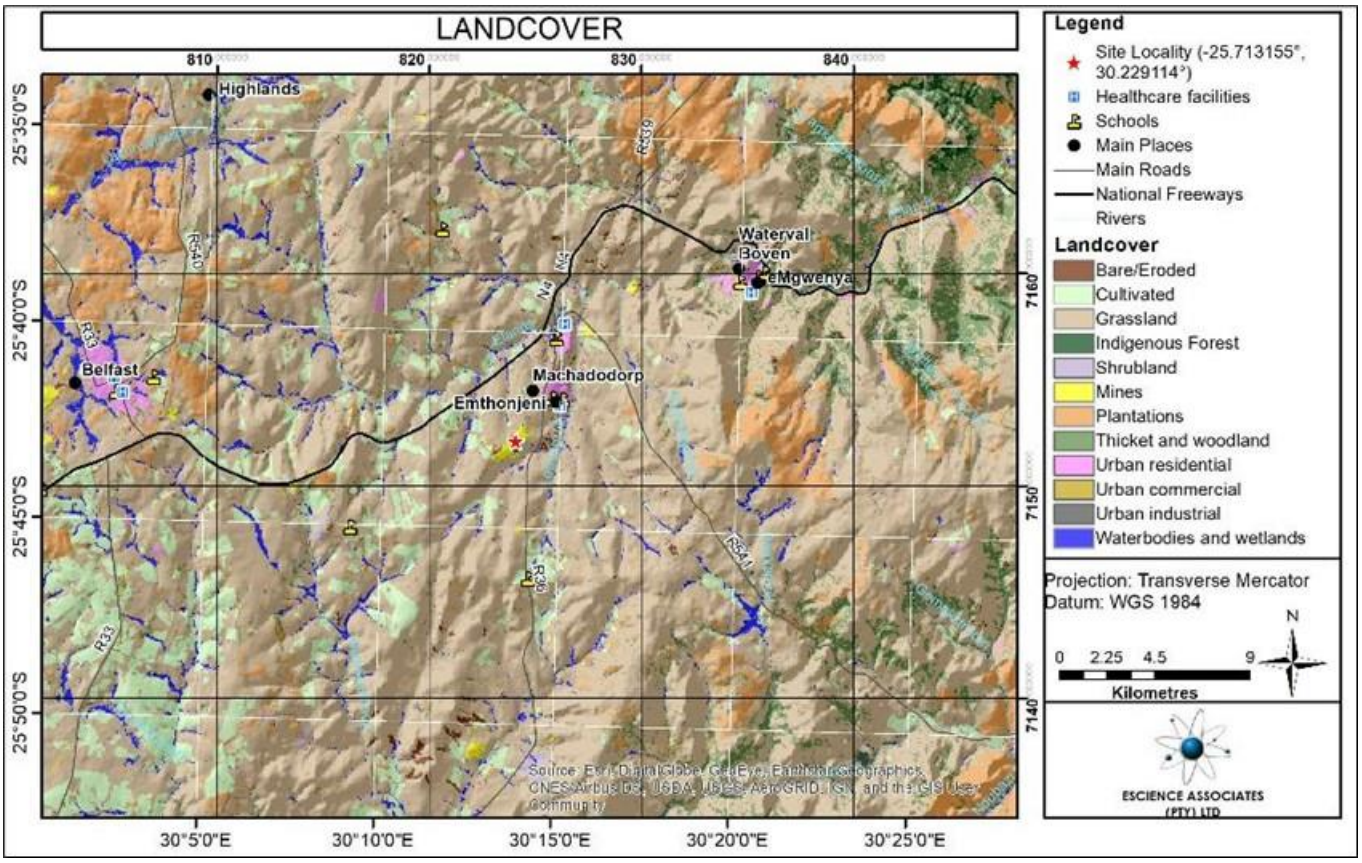


Figure 23: CALMET Land use types within the ARM modelling domain

5.9 Ecology

The proposed Project will be located within the development footprint of the Works. This area is regarded as completely transformed with no more ecological characterises remaining due to historical operation of the ARMMDW, with the exception of a small portion of grassland located to the farm western portion of the boundary where a portion of the proposed plant is planned. The site will be located to the north of an existing railway line, and where a current topsoil stockpile is placed.

The site is regionally located within the Moist Sandy Grassland area (Acocks, 1988) on the border between the Bankenveld and North Eastern Sandy Grassveld types. More recent vegetation classification indicates the site to be located within the Steenkampsberg Montane Grassland vegetation type, which is indicated as having a conservation status of Least Concern (Mucina & Rutherford, 2006). The Mpumalanga Biodiversity Sector Plan (2014) indicates the operational areas/ existing infrastructure within which the project is to be located to be heavily or moderately modified due to historical disturbances, however beyond the development footprint area, Other Natural Areas, Ecological Support Areas (ESAs) and Critical Biodiversity Areas (CBAs) occur.

Although the national screening tool indicates the south-western portion of the proposed plant site to be located in a CBA, the site-specific considerations indicate that this is not applicable, with the area being characterised by farm roads, a topsoil stockpile and a railway line in place prior to the 2014 Biodiversity Sector Plan. The proposed project will take place within the existing Works, where vegetation has mostly been disturbed historically.

	
Location of the Plant	Access road to the Plan, with the Manganese Slag Stockpile on the left and the plant area on the right.
	
Plant area on the right, with the Eskom Powerline, which will not be impacted at the back. The plant will remain outside of the servitude buffer.	Existing access gate towards the proposed Plant area, with the Eskom Powerline in the background.
	
The propsed Plant is planned in the area of the topsoil stockpile.	Topsoil Stockpile with the Manganese Stockpile on the left.

	
Are where the proposed Plant is planned in the background with the Slag Stockpiles visible on the right.	North of the proposed Plant area. The Transnet Railway line is located on the left.
	
Tyical site conditions where the Proposed Plant is planned.	Tyical site conditions where the Proposed Plant is planned. The Manganese Stockpile is visible in the background.
	
Transnet railline in the background.	North of the site, in the dirction of the Furnaces.

	
Looking towards the west wtht the proposed plant area in the foreground.	Typpical Stie Conditions
	
Manganese Stockpile on the right, and proposed Plant area on the left.	Manganese Stockpile in the foreground with the Plant area towards the right.

Photo 1: Illustration of vegetation setting

Further it is, however, important to note that although the general area is acknowledged as being a centre of floral and faunal biodiversity, the Works itself is a 'brownfields' site, subject to much existing disturbance as a result of the historic and on-going industrial operations. The Works, specifically the area where the project is planned, is by no means in a pristine condition and it is deemed to presently have little ecological value, due to the presence of powerlines, railway lines, edge effects and grazing practices. Please refer to the following two figures.

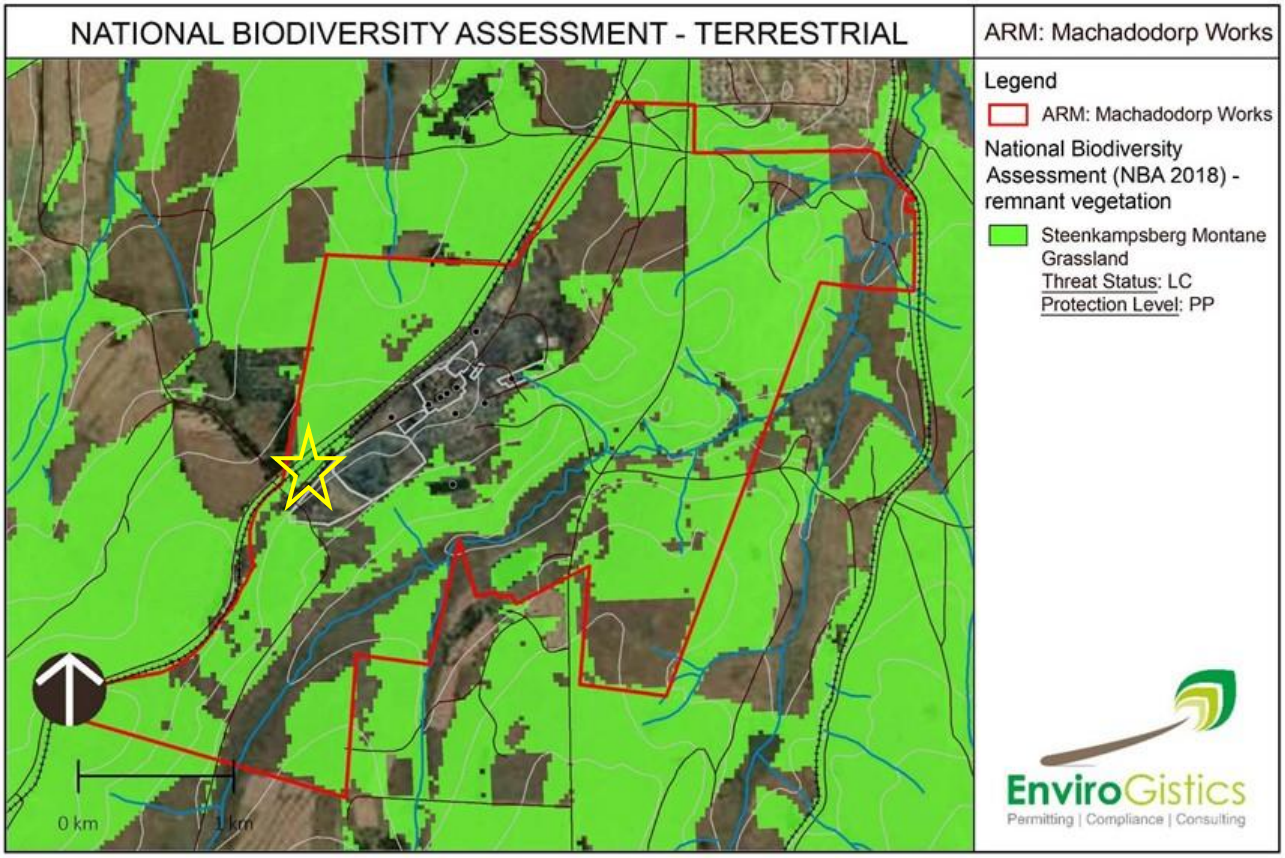


Figure 24: ARMMDW Ecological Setting – National Biodiversity Assessment (2018) (LC – Least Concern; PP – Poorly Protected)

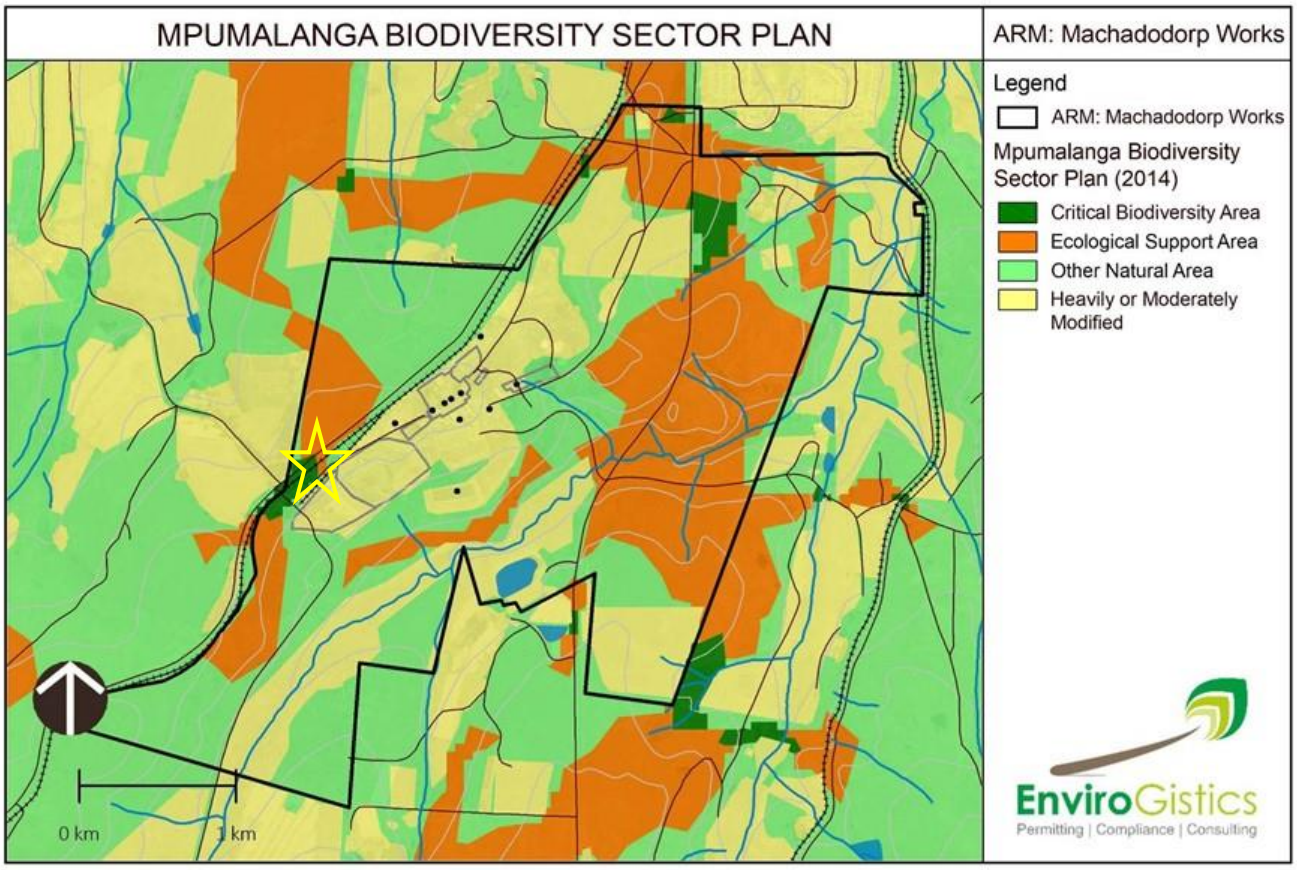


Figure 25: ARM MDW Ecological Setting – Mpumalanga Biodiversity Sector Plan (2014)

In general, animal life within the area is dependent on the soil, plant, and water resources of the area. It is these basic biophysical resources that afford suitable habitat and food to a range of fauna. The area proposed for the project is within the industrial footprintarea of the existing plant infrastructure. There will be no additional impact on the fauna of the area.

Again, as with the site's floral component, the proposed position at which the proposed project is to be established, is deemed by the EAP to have very little ecological value. This is again because of the 'brownfields'/ disturbed nature of the site resulting from historic and ongoing industrial activities by the ARMMDW.

5.10 Wetlands

Scientific Aquatic Services cc (SAS) undertook a Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) analysis of the wetland resources as part of the proposed water management projects at the ARMMDW. In addition, it was required that the various wetland zones be delineated in order to inform the design of a wetland recharge structure which is authorised under the Brine Evaporation Pond and associated RO Plant Integrated Waste Management Licence (IWML) Reference 12/9/11/L891/6, issued by the DEA, 11 April 2016.

The following general conclusions were drawn upon completion of the wetland field assessment:

- The wetland system (see Figure 21) within the ARMMDW property was categorised with the use of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. Four basic hydrogeomorphic (HGM) units were identified, namely unchanneled valley bottom, channelled valley bottom, hillslope seep and depression HGM units. These HGM units were then assessed to determine the importance of the wetland system in its entirety in terms of function and service provision as well as PES, and EIS of the systems (see the following figure).

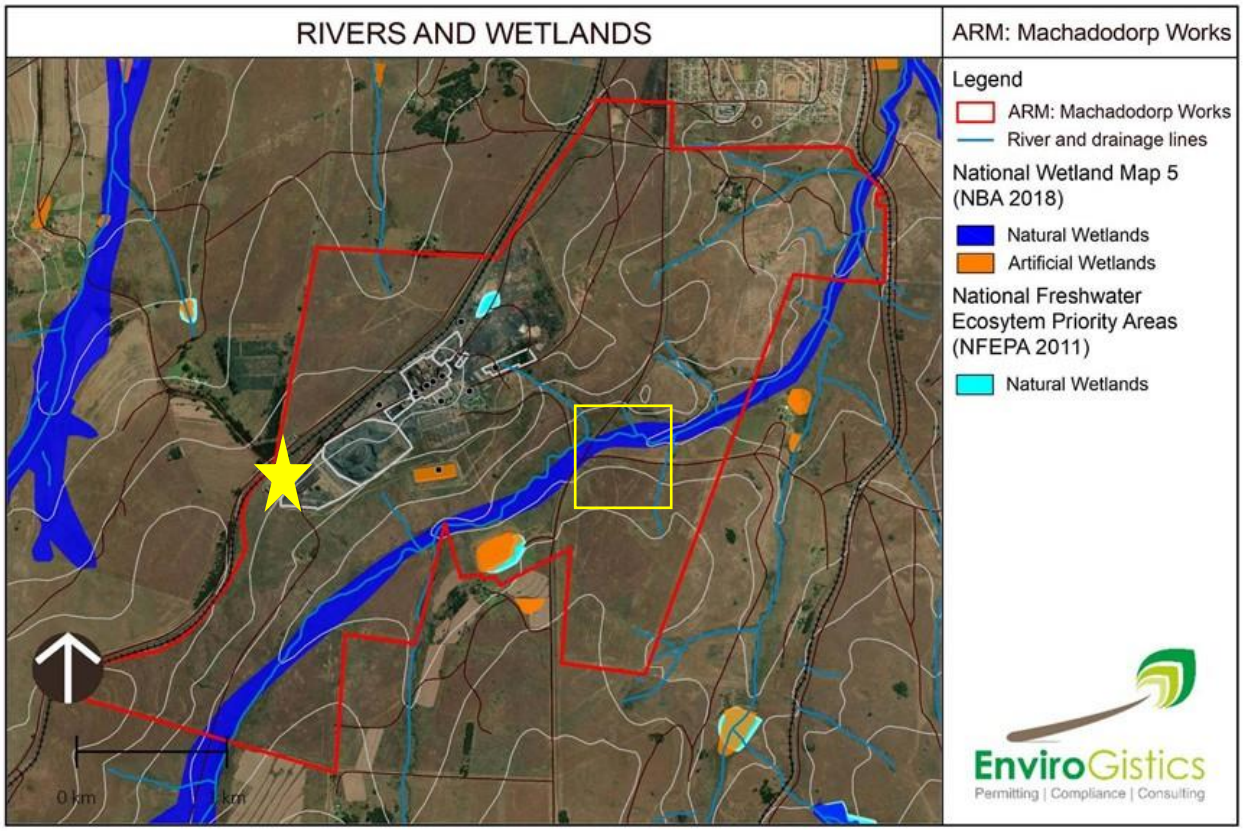


Figure 26: ARMMDW Ecological Setting – Wetlands (NFEPA, 2011; NBA, 2018) – Star indicating project area

5.11 Heritage and Cultural Significance

Please refer to Annexure 5 for the specialist studies completed.

5.11.1 Heritage

Most of the study area have been altered by the current Manganese Slag Dump that would have destroyed surface indicators of heritage resources if any ever occurred in this area and the development footprint is considered to be of low heritage potential.

The study area is in a rural setting characterised by cultivation and agricultural activities with a historical layering consisting of limited infrastructure like fences, a powerline, a railway line and structures (Figure 8.6 to 8.7). None of these are in the current project footprint.

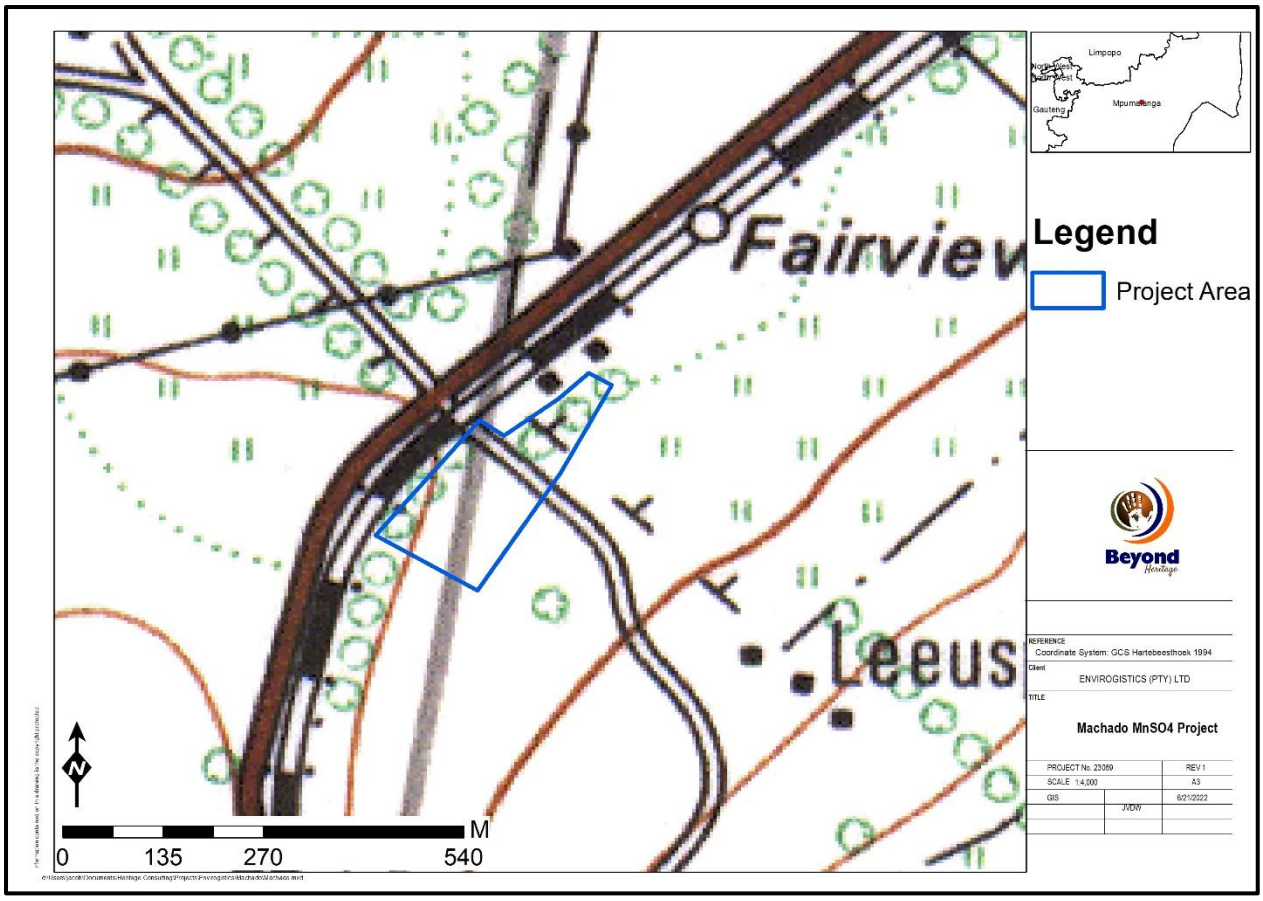


Figure 27: 1969 Topographic map of the area showing no developments in the study area. A railway line is visible outside of the study area as well as a powerline.

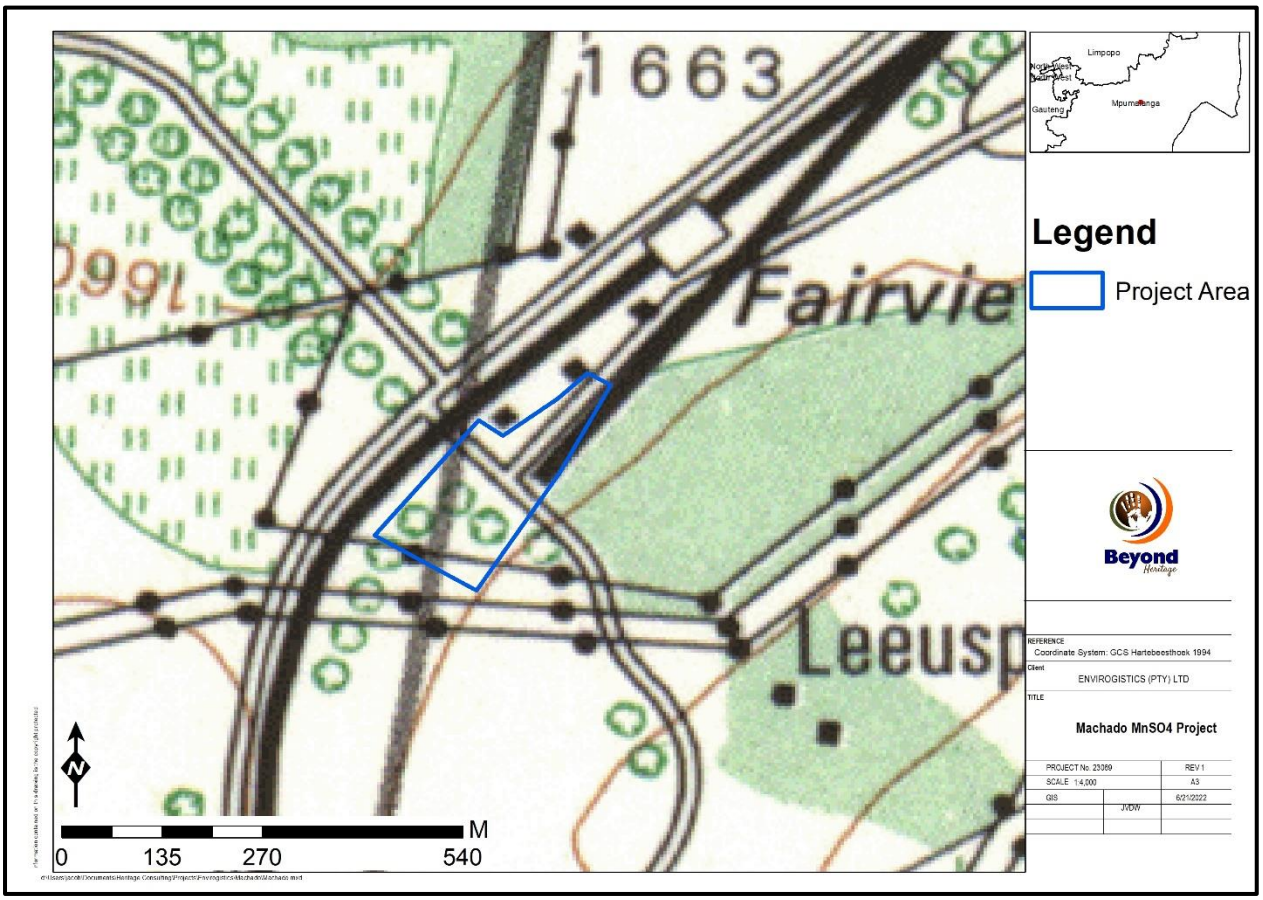


Figure 28: 1988 Topographic map indicating roads in the study area as well as visible powerline infrastructure.

No heritage finds were recorded.

Key findings of the assessment include:

- The area in which the project is located is extensively disturbed through the current Manganese Slag Dump that will be reworked and is considered to be of low heritage potential;
- The lack of significant heritage resources in the project footprint was confirmed during the site visit and no heritage features were recorded;
- According to the SAHRA Paleontological sensitivity map the study area is of high paleontological significance and an independent study was commissioned for this aspect.

5.11.2 Palaeontology

From the SAHRIS map below the area is indicated as highly sensitive (orange) for the Silverton Formation so a desktop study is required and is presented here.

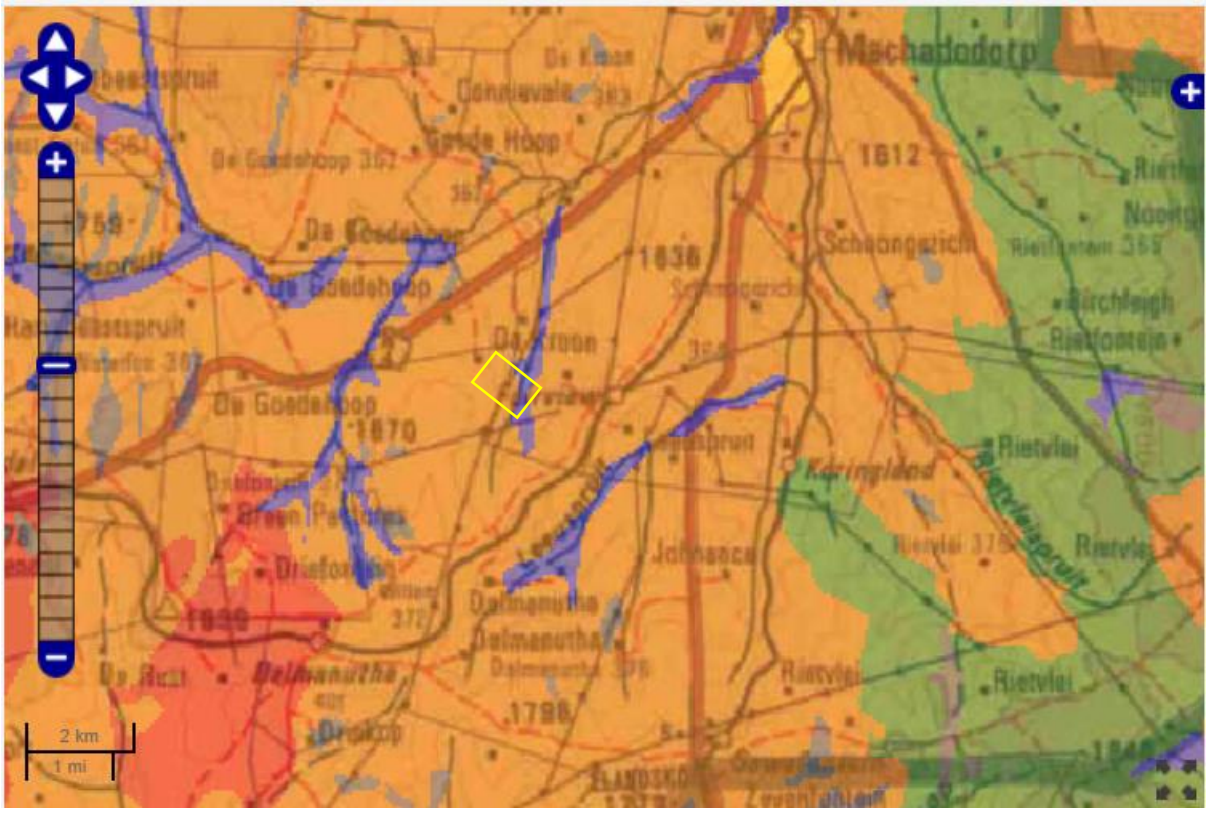


Figure 29: SAHRIS palaeosensitivity map for the site for the proposed new smelter for the Machadodorp Works shown within the yellow rectangle. Background colours indicate the following degrees of sensitivity: red = very highly sensitive; orange/yellow = high; green = moderate; blue = low; grey = insignificant/zero.

The site for development is in the Silverton Formation, most probably the basal Boven Shale Member. It has been interpreted as a high-stand facies tract that reflects the advance of an epeiric sea onto the Kaapvaal Craton from the east, and therefore the underlying Daspoort Formation would represent a low-stand facies tract or a transgressive systems tract (Eriksson et al., 2006). There is consensus in the geological literature that the Silverton Formation environment was a high energy one with shallow to deep water shales being deposited as sub-storm wave-base pelagic deposits, within an epeiric embayment on the Kaapvaal Craton (Eriksson et al., 2002, 2006, 2012; Frauenstein et al., 2009; Lenhardt et al., 2020). Several sub aqueous dykes and volcanic eruptions have also been recorded (Lenhardt et al., 2020). The formation is dated between 2202 and 2253 Ma (Zeh et al., 2020) and this is too old for any body fossils so the only fossils were microscopic algae and bacteria which if preserved, are in the form of the trace fossils such as stromatolites or microbial mats. There are no records of such trace fossils in the Silverton formation although they are present in the overlying Magaliesberg Formation.

Stromatolites are the trace fossils that were formed by colonies of green algae and blue-green algae (Cyanobacteria) that grew in warm, shallow marine settings. These algae were responsible for releasing oxygen via the photosynthetic process where atmospheric carbon dioxide and water, using energy from the sun, are converted into carbon chains and compounds that are the building blocks of all living organisms. The released carbon dioxide initially was taken up by the abundant reducing minerals to form oxides, e.g. iron oxide. Eventually free oxygen was released into the atmosphere and some was converted into ozone by the bombardment of cosmic rays. The ozone is critical for the filtering out of harmful ultraviolet rays.

Stromatolites are the layers upon layers of inorganic materials that were deposited during photosynthesis, namely calcium carbonate, magnesium carbonate, calcium sulphate and magnesium sulphate. These layers can be in the form of flat layers, domes or columns depending on the environment where they grew (Beukes, 1987). Some environments did not form stromatolites, just layers of limestone that later was converted to dolomite. The algae that formed the stromatolites are very rarely preserved, and they are microscopic so they can only be seen from thin sections studies under a petrographic microscope.

5.12 Air Quality

According to the Mpumalanga State of Environment Report (SoER; MDALA, 2003), air quality in the province is driven by human activities, such as urbanisation and population growth and natural phenomena, such as climate change, with associated impacts on both human health and ecosystems. In the Nkangala District Municipality, in winter months, the inversion layer phenomenon results in pollutants being trapped within the lower layers of the atmosphere (NDM, 2006).
Key sources of air pollution are veld fires, industry, mining, vehicles and domestic fuel use. Little is known about the ambient air quality in the Province, although there is an Eskom air quality monitoring station at Palmer, located between Dullstroom and Belfast, where Eskom measures ambient Sulphur Dioxide and particulate concentrations. Concentrations remained stable from 1996 to 2001. The SoER highlighted the need for a provincial monitoring network (MDALA, 2003).

The ARMMDW does not fall within the recently proclaimed Highveld Priority Air Quality Management Area (see figure below), but lies approximately 50km east and 60km north from the border of the Priority Area. Notwithstanding, air quality is an issue of concern in Mpumalanga, as it is in many other parts of South Africa. A wide variety of air pollution sources exist in the province including industrial processes, agriculture, mining activities, power generation, paper and pulp processing, vehicles and domestic coal burning. A variety of pollutants including heavy metal containing particulates, Oxides of Nitrogen, Sulphur Dioxide, and volatile organic compounds are emitted from these activities (adapted from Mpumalanga SoER, 2003).

Figure 30: Highveld Priority Area

An Air Quality Impact Opinion was conducted by EScience as part of this Environmental Authorisation process, in order to determine if the project would result in any changes to emissions (Annexure 5), and if so, what the significance of these changes would be. The primary objective of the Air Quality Impact Assessment was the prediction of impacts relating to both the existing and proposed development will have on ambient air quality in the project area. The main pollutants of concern which the study dealt with was particulate matter (PM10), Manganese (Mn fraction PM10) and Hexavalent Chromium (Cr(VI)). For this purpose, the study firstly concentrated on the baseline conditions. The baseline conditions consider the area under normal operational conditions in terms of the approved Environmental Authorisations and the approved AEL. The sections hereafter present the baseline conditions.

Measured air quality data for the site and surrounds is not available with the exception of ARM's ambient Cr(VI) and dust fallout sampling results.

Given the above, it is not possible to assess the background levels of ambient pollutants at the site using measured data, with the exception of monitoring results from ARM. There is potential for seasonal elevation of ambient particulate pollutant loads resulting from surrounding agricultural activities and biomass burning (i.e. veld fires). Long range sources such as coal fired power stations may contribute to background air quality, however the impact of these sources within the area of influence of the site's emissions is not anticipated to be significant due to the long distances from these sources.

The R36 regional road is approximately 500m away and is not expected to have a significant impact on ambient air quality at the site due to the relatively low density of traffic observed. The N4 national highway is approximately 3km away from the site and is also not expected and is not expected to have a significant contribution to ambient air quality at the site. In the absence of emissions data and measured ambient data. the impact cannot be definitively assessed.

In cognisance of the above, it has been deemed impractical and potentially unnecessary to undertake a cumulative impact assessment. This study focuses therefore on the ambient impact related to emissions from ARM's existing and proposed operations.

5.13 Socio Economics

The following information is obtained from the Nkangala District Municipality IDP Review Document 2020-2021, which presents the latest population statistics.

5.13.1 Population

All of the local municipalities included within the Nkangala District Municipality have seen growth from 2011 to 2016 however Steve Tshwete Local Municipality showed the highest population growth with an average annual growth rate of 3.9%, followed by Emalahleni Local Municipality with an average annual growth rate of 2.6%. The Emakhazeni Local Municipality, in which this project is located, had the lowest average annual growth rate of 0.04% relative to the other municipalities within Nkangala District Municipality. These figures show where people are moving to and settling which means that basic service provision needs to be intensified in these areas to accommodate their growth and prevent land invasions, service delivery strikes and the establishment of informal settlements.

Table 14: Population (IDP Review 2020/2021)

Municipality	2007	2011	2016	Average Annual Growth
Victor Khanye	64,900	74,100	82,300	2.41%
Emalahleni	340,000	389,000	440,000	2.60%

Steve Tshwete	179,000	224,000	262,000	3.88%
Emakhazeni	47,800	46,400	48,000	0.04%
Thembisile Hani	279,000	307,000	337,000	1.91%
Dr JS Moroka	237,000	246,000	253,000	0.64%
Nkangala	1,148,173	1,287,698	1,422,063	2.16%

5.13.2 Economy

With a Gross Domestic Product (GDP) of R 121 billion in 2016 (up from R 45.5 billion in 2006), the Nkangala District Municipality contributed 36.76% to the Mpumalanga Province GDP of R 328 billion in 2016 increasing in the share of the Mpumalanga from 37.06% in 2006. The Nkangala District Municipality contributes 2.78% to the GDP of South Africa which had a total GDP of R 4.34 trillion in 2016 (as measured in nominal or current prices). Its contribution to the national economy stayed similar in importance from 2006 when it contributed 2.47% to South Africa, but it is lower than the peak of 3.13% in 2012.

Steve Tshwete Local Municipality had the highest average annual economic growth, averaging 4.16% between 2006 and 2016, when compared to the rest of the regions within the Nkangala District Municipality. The Thembisile Hani Local Municipality had the second highest average annual growth rate of 2.75%. Emalahleni Local Municipality had the lowest average annual growth rate of - 1.35% between 2006 and 2016.

Table 15: GDP – Local Municipalities of Nkangala District Municipality, 2006 to 2016, share and growth (IDP Review 2020/2021)

Municipality	2016 (Current prices)	Share of district municipality (%)	2006 (Constant prices)	2016 (Constant prices)	Average Annual Growth
Victor Khanye	7.10	5.89	3.79	4.83	2.46%
Emalahleni	53.72	44.56	42.03	36.71	-1.35%
Steve Tshwete	42.87	35.56	19.77	29.72	4.16%
Emakhazeni	3.74	3.10	2.01	2.59	2.59%
Thembisile Hani	7.04	5.84	3.51	4.60	2.75%
Dr JS Moroka	6.09	5.05	3.70	3.99	0.75%
Nkangala	120.54	-	74.81	82.44	-

5.13.3 Industries

The Nkangala District Municipality's economy is made up of various industries. The GVA-R variable provides a sector breakdown, where each sector is measured in terms of its value added produced in the local economy. In 2016, the mining sector was the largest within Nkangala District Municipality accounting for R 41.1 billion or 37.3% of the total Gross Value Added in the district municipality's economy. The sector that contributes the second most to the GVA of the Nkangala District Municipality is the manufacturing sector at 12.0%, followed by the community services sector with 11.4%. The sector that contributes the least to the economy of Nkangala District Municipality is the agriculture sector with a contribution of R 2.18 billion or 1.98% of the total GVA.

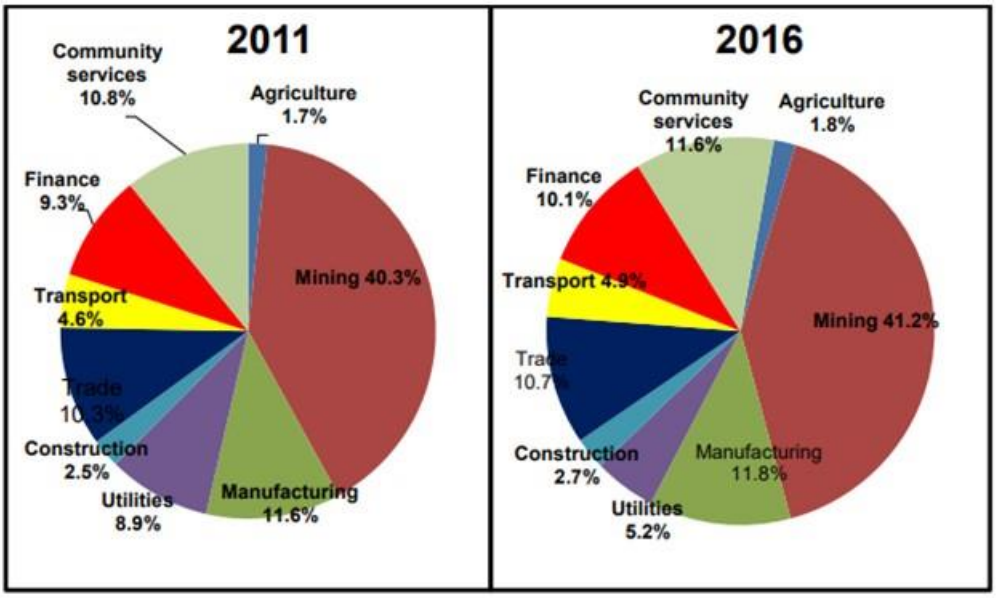


Diagram 4: Industry Contribution to GDP at basic prices (constant 2011 & 2016) (IDP Review 2020/2021)

5.13.4 Labour

The following figure summarises the participation rate per industry towards employment for 2011 and 2016. Although mining is the biggest industry in the district it is not the biggest employer in the district. Trade in both 2011 and 2016 was absorbing the largest number of labourers. According to the 2019-2020 IDP Review, in order to address unemployment in the district investing in trade (industry) is crucial.

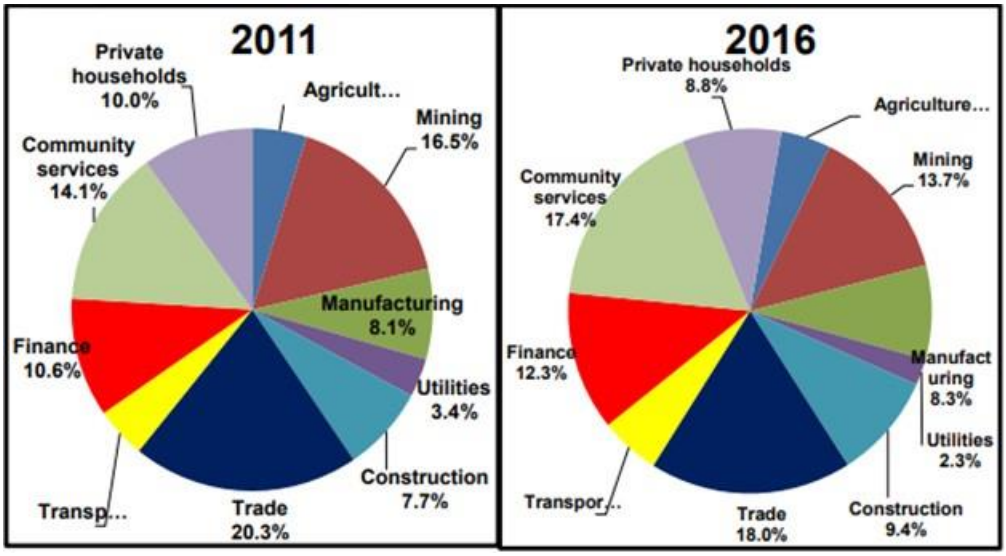


Diagram 5: Labour Force participation rate (IDP Review 2019-2020)

5.13.5 Total Employment

Emalahleni and Steve Tshwete Local Municipalities are the largest employers in the district, followed by Thembisile Hani Local Municipality (refer to Figure below).

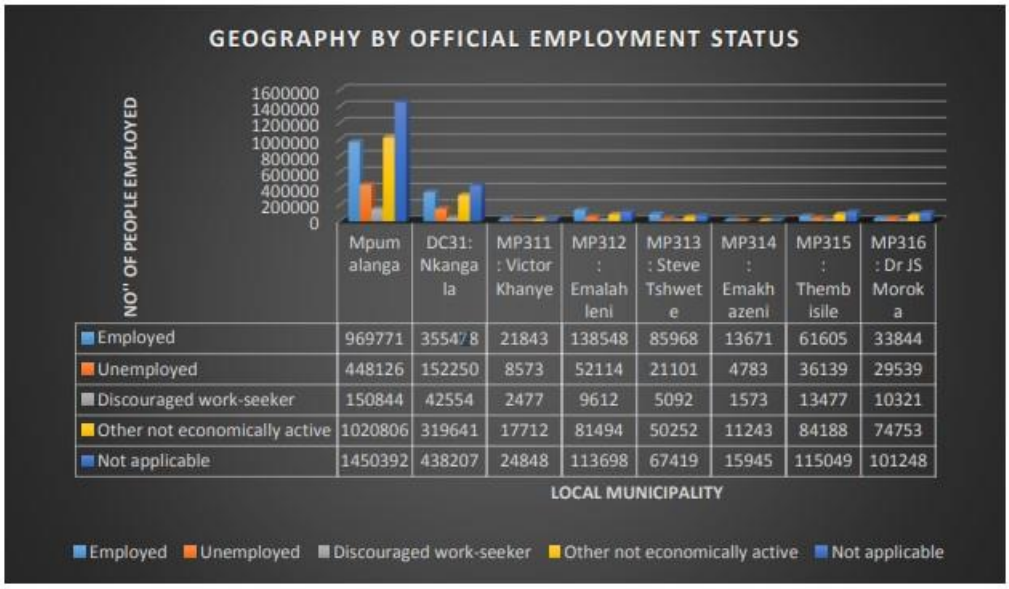


Diagram 6: Geography by Official Employment Status (source 2011 Statistics SA) (IDP Review 2019-2020)

Nkangala District Municipality's unemployment rate was the second highest amongst the districts of Mpumalanga. The unemployment rate for females was 34.3% and that of males 26.7%. The youth unemployment rate according to the Census figures was 39.6% with a challenge with especially very high youth unemployment rate of females. A concern exists about the high numbers of unemployed youth and especially females. The relatively low level of education and inadequate skills are likely to impact negatively on their employability.

Table 16: Unemployment rate per Municipality in the District (IDP Review 2019-2020)

Municipality	Unemployment rate 2014 (%)	Unemployment rate 2017 (%)	Share of Mpumalanga's unemployed (%)
Victor Khanye	24.8	25.9	1.9
Emalahleni	24.6	27.2	12.2
Steve Tshwete	16.8	17.6	4.6
Emakhazeni	22.5	22.5	0.9
Thembisile Hani	36.1	39.7	9.2
Dr JS Moroka	45.2	48.7	7.1

6 STAKEHOLDER CONSULATION

This section will include the comments received during the Public Participation Process (PPP) undertaken to date. The Comments and Responses Section has the following objectives:

1. To provide a formal and integrated record of all the issues raised by I&APs to date, and the responses provided by the Basic Assessment Report (BAR) study team.
2. To provide a mechanism that allows all parties participating in the process (including the Competent Authorities) to verify whether the issues raised have been considered and where appropriate, adequately addressed by the BAR study team.

Issues raised will be recorded through a variety of mechanisms. These include:

- Comments sheets received by fax, and/or e-mail;
- Comments sent to the public participation office via e-mails;
- Comments received telephonically; and
- Comments received during the announcement phase when interested Communities were met on site.

The PPP during the Basic Assessment Application of the project has to date consisted of the following activities:

- Communication with regulatory authorities and municipal authorities;
- Communication with surrounding landowners via the distribution of Background Information Documents (BIDs);
- The identification and engagement with the general public;
- Placement of notifications and advertisements in local newspapers;
- Placement of notifications on site and in close proximity to the site; and
- The PPP will be an ongoing activity and will only be concluded once the decision for the Environmental Authorisation has been issued. All I&APs will be informed as to the final decision taken by the Department.

6.1 Stakeholder Identification

The current Stakeholder Database of the AMRMDWs, developed for the 2019 and 2020 Environmental Authorisation Processes, was utilised as a basis for the development of the consultation register for this project. In addition, relevant government departments, municipalities and affected ward councillors were contacted during the week of 8 June 2023 to inform them of the proposed project and to obtain their issues and comments in this regard. The following stakeholders were consulted as part of the project:

- Inkomati Usuthu Catchment Management Agency (as part of the DWS) (IUCMA);
- DARDLEA (Environmental Authorisation Competent Authority);
- DFFE;
- Emakhazeni Local Municipality;
- Nkangala District Municipality (AEL Competent Authority);
- Surrounding Landowners; and
- Other Identified Stakeholders.

Please refer to Annexure 4 for the list of stakeholders consulted.

6.2 Stakeholder Identification and Notification

Notification of I&APs commenced on 8 June 2023. The notification process was undertaken by means of the following:

- Newspaper advertisements (the Lowvelder);
- Site Notices (Local Municipality, and the ARMMDW entrances); and
- Direct Notifications through a Background Information Document (BID).

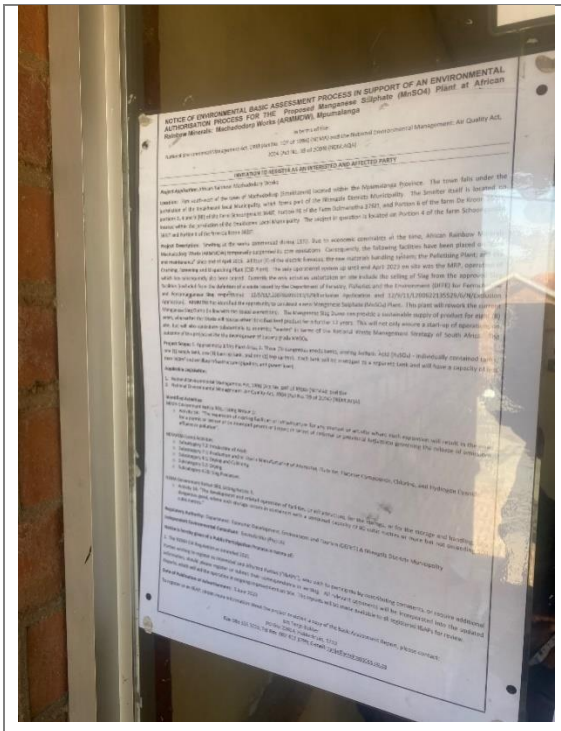
Please refer to Annexure 4 for copies of these notifications. Proof of email submissions can be requested from the EAP.

6.3 Site Notices

In order to inform surrounding communities and adjacent landowners of the proposed project, three site notices were erected on site (on 5 June 2023) and at visible locations close to the site.

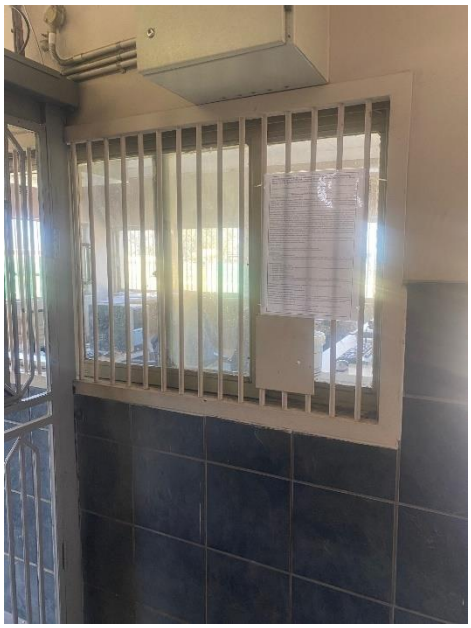
Site Notices were place at the following locations:

- ARMMDW Main Entrance;
- ARMMDW Security Entrance; and
- Emakhazeni Local Municipality.

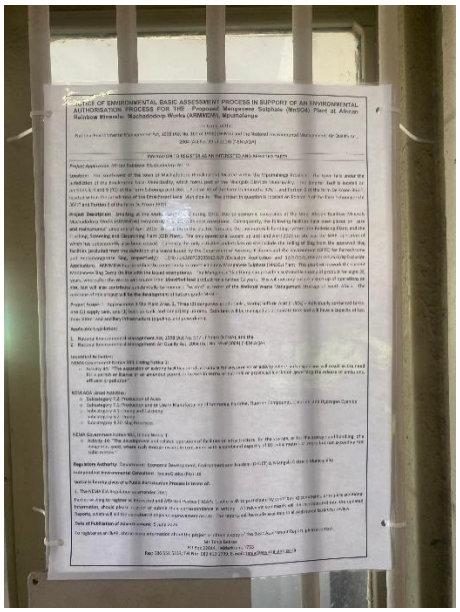


Local Municipality

Main Entrance



Security Entrance



Content of Notice

Figure 31: Proof of Site Notices

6.4 Background Information Documents

BIDs were distributed via email to all parties on the database on 12 June 2023 and again on 20 July 2023. Please refer to Annexure 4 a copy of this document.

6.5 Advertisements

The formal announcement of the proposed project was done by placing an advert in the Lowvelder (Local Newspaper) on 8 June 2023 to invite all I&APs to register on the project database. A second round of advert was placed on 27 July 2023 to include the identified Listing Notice 3 Activities. The objective of this newspaper advertisement was to:

- Inform I&APs of the proposed project;
- Inform I&APs of the EIA procedure and the way in which I&APs could lodge any objections to the proposed development and provide comments; and
- Invite I&APs to become involved in the proposed project by registering as I&APs.

Please refer to Annexure 4 for a copy of these adverts.

6.6 Document Review

All registered stakeholders were informed of the availability of the draft BAR on 25 July 2023 for the opportunity to review this document. The draft BAR was made available to stakeholders from 25 July 2023 to 23 August 2023 for review. All comments received have been captured and are presented in Section 6.8. It should be noted that a formal application will be lodged with the Nkangala District Municipality for the AEL, once the outcomes of this BAR Process have been finalised.

6.7 Stakeholder Meeting

No request for stakeholder meetings were raised by registered stakeholders. Due to the limited comments received no additional stakeholder meeting was scheduled.

6.8 Summary of Issues raised by the I&APs

To date the following comments have been received.

Table 17: Stakeholder Comments received

No.	Theme: General Comments / Issues			
	Issue Raised	**Date and How Issue Was Raised**	**Commentator**	**Response**
1	Sappi Ngodwana Mill conducts its own monitoring for ambient air and the Eland River and would need to understand contributing factors from surrounding industries.	12 June 2023 – BID submitted via email	Mrs van Wyk (Sappi	The proposed Processing Plant will not result in any emissions. The AEL is undertaken due to the processing of slag, as well as the storage of chemicals – please refer to Annexure xxx
2	I hereby requesting the Basic assessment Report form for the study you're conducting on the manganese. At Arm Machadodorp work. As an affected community member thanks	13 June 2023 – email	Mrs Zanele Mlangeni	Stakeholder has been included onto the database and will be provided with a copy of the draft reports for review and comment.

No.	Theme: General Comments / Issues			
	Issue Raised	**Date and How Issue Was Raised**	**Commentator**	**Response**
3	I hereby am requesting the Basic Assessment Report form for the Environmental Study you are currently conducting on the Manganese Sulphate at ARM Machado Works.	12 June 2023 - email	Mr. Solly T Malope	Stakeholder has been included onto the database and will be provided with a copy of the draft reports for review and comment.

7 SELECTION AND MOTIVATION FOR THE PREFERRED ALTERNATIVE

7.1 Technological Alternative

As mentioned in Section 3, manganese has elemental qualities that have the potential to improve density, capacity, rechargeability, safety and battery longevity. Other than being an ingredient in potential alternatives to lithium-ion batteries, manganese is an important component of the two most commonly produced types of batteries available today. Lithium-ion-manganese-oxide (LMO) batteries are the type of batteries currently used to power almost everything rechargeable.

Further considering an article published by Fastmarkets, 4 April 2022 (www.fastmarkets.com), an industry expert has warned that in the next ten years demand for high-purity manganese is likely to exceed supply unless more attention is paid to the battery-grade metal. The article states that manganese is widely used in steel production, accounting for more than 90% of global consumption.

Less than 2% of global consumption is converted into high-purity manganese for the battery sector. Many lithium-ion batteries, such as nickel-cobalt-manganese (NCM), use manganese sulphate as a raw material for the cathode precursor. The article stated that in the coming years, battery producers will be looking into reducing cobalt and nickel and increasing manganese consumption.

ARM mines and beneficiates iron ore, manganese ore, chrome ore, PGMs, nickel and coal and also has a strategic investment in gold through Harmony Gold Mining Company. One of the divisions within ARM is ARM Ferrous. ARM's ferrous metals interests are held through wholly owned ARM Ferrous which owns 50% of Assmang (Pty) Ltd, a long-established miner and processor of metals for the world's steel industries. The other 50% of Assmang (Pty) Ltd is held by Assore Ltd. Assmang's operating divisions are based on its two principal commodities: iron ore and manganese ore.

In addition to the mining of manganese, the ARMMDW itself has a Manganese Stockpile with a capacity to supply more than 12 years of manganese slag suitable for battery grade $MnSO_4$.

Considering the above, and the fact that the Works have an existing Manganese Slag Stockpile and feasibilities have indicated that the process will be successful in producing battery grade $MnSO_4$, the project is an economic opportunity for the Works and the socio-economic setting.

There are no other technological alternative options assessed as the process identified for this plant is site specific. The only alternative is to not undertake this project, which will result in:

- Loss of opportunity to operate the ARMMDW;
- Loss of employment opportunities;
- Lost opportunities to reduce waste currently on site; and

- Lost opportunities to reduce future slag waste which can be incorporated in this process.

7.2 Context of the Preferred Location

No alternatives have been investigated for the location of the Plant. The Plant will be placed within the ARMMDW operational boundary and next to the Manganese Slag Stockpile to optimise the process. The chemical tanks will be placed strategically to where chemicals will be supplied and where the chemicals will be utilised within the Processing Plant.

7.3 No Go Alternative

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.

Since the end of April 2015, various facilities have been placed on "care and maintenance". These included all four (4) of the electric furnaces at the Works; the raw materials handling system; the Pelletising Plant; and the CSD Plant. The only operational system since then has been the MRP and associated Slag Stockpile s (with the Historic Slag Dump being reworked, and new extensions available for future disposal). The current employment numbers have dwindled to about 60 full time personnel on site.

Should the project not be approved, the status quo will remain, and the opportunity to recommence operational activities on site will be lost, together with the potential for new employment opportunities. A further opportunity to reduce waste deposits, such as the Manganese Slag currently on site, will be lost.

The project will not result in the need for any additional services, waste storage requirements or water uses, as all existing facilities will be utilised within the approved design and licencing requirements.

The No Go option is therefore not desirable from a Socio-Economic and Environmental Management perspective.

8 IMPACT ANALYSIS

8.1 Risk Assessment Methodology

8.1.1 Criteria of assigning significance to potential impacts

The evaluation of impacts is conducted in terms of the criteria detailed in Table 18 to Table 23. The various environmental impacts and benefits of this project are discussed in terms of impact status, extent, duration, probability, and intensity. Impact significance is regarded as the sum of the impact extent, duration, probability and intensity and a numerical rating system has been applied to evaluate impact significance. Therefore, an impact magnitude and significance rating are applied to rate each identified impact in terms of its overall magnitude and significance (Table 23).

In order to adequately assess and evaluate the impacts and benefits associated with the project, it was necessary to develop a methodology that would scientifically achieve this and to reduce the subjectivity involved in making such evaluations. To enable informed decision-making, it is necessary to assess all legal requirements and clearly defined criteria in order to accurately determine the significance of the predicted impact or benefit on the surrounding natural and social environment.

8.1.2 Impact Status

The nature or status of the impact is determined by the conditions of the environment prior to construction and operation. A discussion on the nature of the impact will include a description of what causes the effect, what will be affected and how it will be affected. The nature of the impact can be described as negative, positive or neutral.

Table 18: Status of Impact

Rating	Description	Quantitative rating
Positive	A benefit to the receiving environment.	P
Neutral	No cost or benefit to the receiving environment.	-
Negative	A cost to the receiving environment.	N

8.1.3 Impact Extent

The extent of an impact is considered as to whether impacts are either limited in extent or if it affects a wide area or group of people. Impact extent can be site specific (within the boundaries of the development area), local, regional or national and/or international.

Table 19: Extent of Impact

Rating	Description	Quantitative rating
Low	Site Specific; Occurs within the site boundary.	1
Medium	Local; Extends beyond the site boundary; Affects the immediate surrounding environment (i.e. up to 5 km from the Project Site boundary).	2
High	Regional; Extends far beyond the site boundary; Widespread effect (i.e. 5 km and more from the Project Site boundary).	3
Very High	National and/or international; Extends far beyond the site boundary; Widespread effect.	4

8.1.4 Impact Duration

The duration of the impact refers to the time scale of the impact or benefit.

Table 20: Duration of Impact

Rating	Description	Quantitative rating
Low	Short term; Quickly reversible; Less than the project lifespan; 0 – 5 years.	1
Medium	Medium term; Reversible over time; Approximate lifespan of the project; 5 – 17 years.	2
High	Long term; Permanent; Extends beyond the decommissioning phase; >17 years.	3

8.1.5 Impact Probability

The probability of the impact describes the likelihood of the impact actually occurring.

Table 21: Probability of Impact

Rating	Description	Quantitative rating
Improbable	Possibility of the impact materialising is negligible; Chance of occurrence <10%.	1

Probable	Possibility that the impact will materialise is likely; Chance of occurrence 10 – 49.9%.	2
Highly Probable	It is expected that the impact will occur; Chance of occurrence 50 – 90%.	3
Definite	Impact will occur regardless of any prevention measures; Chance of occurrence >90%.	4
Definite and Cumulative	Impact will occur regardless of any prevention measures; Chance of occurrence >90% and is likely to result in in cumulative impacts	5

8.1.6 Impact Intensity

The intensity of the impact is determined to quantify the magnitude of the impacts and benefits associated with the proposed project.

Table 22: Intensity of Impact

Rating	Description	Quantitative rating
Maximum Benefit	Where natural, cultural and / or social functions or processes are positively affected resulting in the maximum possible and permanent benefit.	+ 5
Significant Benefit	Where natural, cultural and / or social functions or processes are altered to the extent that it will result in temporary but significant benefit.	+ 4
Beneficial	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified, beneficial way.	+ 3
Minor Benefit	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally benefited.	+ 2
Negligible Benefit	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly benefited.	+ 1
Neutral	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are not affected.	0
Negligible	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly affected	- 1
Minor	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally affected.	- 2
Average	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified way.	- 3
Severe	Where natural, cultural and / or social functions or processes are altered to the extent that it will temporarily cease.	- 4
Very Severe	Where natural, cultural and / or social functions or processes are altered to the extent that it will permanently cease.	- 5

8.1.7 Impact Significance

The impact magnitude and significance rating are utilised to rate each identified impact in terms of its overall magnitude and significance.

Table 23: Impact Magnitude and Significance Rating

Impact	Rating	Description	Quantitative rating
Positive	High	Of the highest positive order possible within the bounds of impacts that could occur.	+ 12 – 16
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other	+ 6 – 11

Impact	Rating	Description	Quantitative rating
		means of achieving this benefit are approximately equal in time, cost and effort.	
	Low	Impacts is of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	+ 1 – 5
No Impact	No Impact	Zero impact.	0
Negative	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged.	- 1 – 5
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action may be required.	- 6 – 11
	High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt.	- 12 - 16

8.2 Typical Activities Considered for the purposes of this Project

The following activities are considered for the purposes of this Project:

Construction Phase

- Vegetation Clearance;
- Footprint preparation;
- Increase of Storm Water Management System; and
- Construction of infrastructure.

Operational Phase

- Transportation of Slag to the Plant;
- Operation of the Plant;
- Distribution and handling of chemicals;
- Product dispatching;
- Storm water management by means of the approved Storm Water Management infrastructure (no new impacts to be assessed); and
- Management of water supply to the proposed plant as well as between the plant and RO Plant.

Closure Phase

- Removal of infrastructure;
- Shaping of footprint area; and
- Vegetation of footprint area.

8.2.1 Potential Impacts and Management Measures

The following sections present the potential impacts.

8.3 Construction Phase Impacts

8.3.1 Footprint Clearance

This phase of the project involves all those activities related to the preparation of the site and subsequent construction/establishment of the project infrastructure and associated surface infrastructure thereon, once prepared.

This phase will result in the following:

- Site preparation for the new Processing Plant, which will necessitate the relocation of the existing topsoil stockpile, some vegetation clearance and management of alien and invasive species.

Impacts to be managed in this activity will involve:

- Topsoil protection;
- Erosion control;
- Dust control due to earth movement;
- Clean and dirty water management; and
- Alien and invasive plant species management.

8.3.2 Construction of infrastructure

This phase will result in the following:

- Site preparation for the new Processing Plant, which will necessitate the relocation of the exiting topsoil stockpile and management of alien and invasive species;
- Establishment of pipelines where required to supply water between the facilities and the RO Plant;
- Construction of the new Processing Plant; and
- Construction of ancillary infrastructure such as tanks, offices, pipelines and stormwater management systems.

Impacts to be managed in this activity will involve:

- Clean and dirty water management;
- Noise management; and
- Dust control.

8.3.3 Construction Waste Generation and Disposal

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 steel, building rubble, packaging and fabrication waste/s. It is likely that most, if not all, of the waste generated would be non-hazardous/general waste. The generation of such waste could indirectly impact on the operational lifespan of the Municipal Waste Disposal Facility, through the permanent occupation of remaining available airspace at this facility. The same principle would apply to the applicable hazardous landfill facility/ies to which hazardous waste generated during construction will be taken for disposal.

Impacts to be managed in this activity will involve:

- Clean and dirty water management; and
- Unlawful waste disposal.

8.4 Operational Phase Activities

The operational phase will result in the movement of slag from suppliers or the Slag Stockpile to the plant, handling of chemicals and the general operation of the plant. Activities that must be managed include:

- Supply of chemicals;
- Storage of H_2SO_4 in tanks;
- Dirty water discharge to the RO Plant;
- Handling of Slag between the Slag Stockpile and processing plant;
- Operation of dirty water systems within the plant footprint; and
- Chemical management within the plant area.

Impacts to be managed in this activity will involve:

- Increase in water requirements;
- Release of Greenhouse Gasses;
- Alien Invasive Species Management;
- Chemical spills;
- Hydrocarbon spills during vehicle transport;
- Dust emissions due to the handling of slag;
- Slag Spills along conveyors; and
- Dirty water management.

8.5 Decommissioning Phase Activities

This phase will result in the following:

- Removal of infrastructure;
- Site preparation to achieve final land use;
- Shaping and vegetating of the footprint; and
- Clean and dirty water management.

Impacts to be managed in this activity will involve:

- Clean and dirty water management;
- Noise management;
- Dust control; and
- Alien and invasive plant species management.

8.5.1 Impact Ratings

Please refer to the following table for the detailed assessment of impacts and how the significance of these impacts has been identified.

Table 24: Impact Assessment Table

Activities	Impact Area	Potential Impacts	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Mitigation Measures	Rating Post Measures	Status	Extent	Duration	Probability	Intensity	SaM
Planning Phase																			
Legal Requirements (Environmental Permits)	Legal Compliance	Unlawful water and waste activities, which could lead to NWA Directives and Section 24G Rectification fines.	N	-4	-3	-2	-5	-14	CbA		A legal assessment of all activities and future planned activities must be undertaken annually to ensure that all activities are authorised.	P	4	3	5	5	17
											All legally appointed personnel responsible or involved in water use activities and activities associated with the Environmental Authorisations on site must receive training on the requirements of the Environmental Authorisations, Permits, AEL and relevant Environmental Legislation.						
											Ensure that the storage areas for hazardous chemicals are purchased in line with the requirements of the SDSs.						
											Ensure that the design of the plant and chemical storage areas fulfil the requirements of all SDSs in terms of transportation, storage, fire protection and storage requirements.						
											Quarterly internal audits on the lawful implementation of the Environmental Authorisation must be undertaken during the construction phase, where after biannual audits can be undertaken once construction has been completed.						
											Annual external inspections must be undertaken at the areas where waste is being removed to ensure the implementation of the cradle to grave principle.						
											The legal register must be updated as part of the implementation and regular update of an Environmental Management System (EMS).						
Planning towards Water and Energy Effectiveness	Water and Energy Demand and Conservation & Cleaner Environmental Practices	Increase in water consumption. The total water demand for the project is indicated as 268 000m^3/a, which constitutes a 75% use when converted from m^3/hr to m^3/a. It should be noted that with the consideration of vapour recycling, this volume may reduce substantially. This will form part of the Water Conservation and Demand	N	-3	-2	-5	-3	-12	CbA		Recycling of vapour within the plant should be considered to reduce water supply requirements.	P	3	2	5	3	12

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Rating Post Measures					SaM
										Mitigation Measures	Status	Extent	Duration	Probability	Intensity	
		Management Strategy which will be developed by the site to reduce water usage.														
		Release of Carbon Gases. Strategic placing of infrastructure and Equipment consideration may reduce energy consumption and reduce Carbon Gasses.	N	-4	-2	-4	-3	-13	CbA	Effective abatement equipment must be implemented as part of the Processing Plant design and development phase to limit emissions. The licence holder should undertake the necessary investigation to replace the diesel operated vehicles (two front end loaders and fork lifts) with battery operated equipment, solar charging systems. In addition to this investigations should be implemented to reduce Eskom supply with renewable sources. An AEL must be obtained for the purposes of this project prior to the operational phase.	P	4	2	4	3	13
Establishment of infrastructure along the boundary of the Works.	Landowner Relationships	Unlawful placement of activities	N	-3	-2	-3	-3	-11	CbA	All construction activities must be conducted outside of the approved servitudes of railway lines and powerlines. Where encroachment is required, the necessary approvals must be obtained from the approval bodies. Planning construction activities in consultation with nearby residences. Information regarding construction activities should be provided to all nearby residences or land users within a 100 m radius of the proposed site. Such information includes: - Contact details of a responsible person on site should complaints arise to reduce emissions in a timely manner. An open channel of consultation must be maintained throughout the process. The Standard Operating Practices (SOP) and/or Contactors SOP for the establishment of infrastructure around the railway line and power lines must be compiled.	N	-1	-1	-1	-1	-4
Construction Phase																

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Mitigation Measures	Rating Post Measures	Status	Extent	Duration	Probability	Intensity	SaM
Site Clearance and Infrastructure Establishment	Geology	Clearing and landscaping of terrain for the establishment of infrastructure may have impact on the pre-construction layout. This is not regarded a significant impact, due to the presence of activities as a result of mining activities.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Topography	Clearing and landscaping of terrain for the establishment of infrastructure may have impact on the pre-construction layout and the topographic function of the site. The change in topography could impact on and increase in surface runoff, resulting in erosion and siltation into surrounding properties.	N	-1	-3	-2	-2	-8	CbA	The footprint areas of all surface infrastructure must remain as small as possible within the parameters of operational and engineering requirements. Clean and dirty water management structures must be put in place at the start of the construction to ensure that dirty water runoff does not leave the site boundary. Footprint areas should be accessed through existing road network, where feasible to avoid unnecessary excavation. Excavation and long-term stockpiling of soil should be limited within the demarcated areas as far as practically possible Linear infrastructure must follow existing routes for as far as practically possible or the natural contours of the area. Construction areas must be clearly demarcated to control movement of personnel and vehicles, providing clear boundaries for construction sites in order to limit the spread of impacts. Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	N	-1	-2	-1	-1	-5
	Ecology	Loss of vegetation and habitat due to vegetation clearance.	N	-2	-3	-2	-3	-10	CbA	A weed eradication programme must be implemented prior to the removal of soil, due to the extensive presence of invader species (Wattles) on the current topsoil stockpile. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc. Prior to any vegetation clearance activities taking place a walkdown of the footprint must be undertaken and all floral and faunal SCC encountered must be GPS marked and the necessary permits applied for with the relevant national and provincial departments. The site walk down is to be conducted prior to clearance activities and ideally post good rains between November and February when the smaller bulbous plants are growing and visible.	N	-1	-1	-2	-1	-2

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place. Should any protected species be identified, the necessary permits must be obtained for the removal of these species. Construction areas must be clearly demarcated to control movement of personnel and vehicles, providing clear boundaries for construction sites in order to limit the spread of impacts. Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing. Fire management measures should be in place. No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas. All vehicles must stick to designated roads and no additional roads may be developed unless absolutely necessary. Removal of vegetation must be undertaken in a phased approach to limit surface exposure. Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established. Clean and dirty water separation must be implemented early in the construction phase, especially down-gradient of construction areas to ensure that the natural runoff patterns are impacted as little as possible.						
		The unmanaged disposal of waste, could result in the spread of invader species, as well as the influx of opportunistic species.	N	-2	-3	-3	-4	-12	CbA	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste. Develop dedicated waste handling areas, fit for purpose and prevent the spread of waste.	N	-1	-1	-2	-1	-5
		Spread of invader species	N	-2	-3	-4	-4	-13	CbA	A weed/ Alien and Invasive Plant (AIP) eradication programme must be implemented prior to the removal of soil, due to the extensive presence of invader species (Wattles) on the current topsoil stockpile. This programme must guide the Works on how to remove the weeds prior to soil clearance in order to avoid further spread of these species. Edge effects arising from the operational and maintenance activities of the proposed development, such as erosion and AIP proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020)). AIP monitoring and clearing/control should take place throughout the construction phase of the development, and a 30 m buffer surrounding the proposed project should be regularly checked for AIP proliferation and to prevent inward and or/outward spread of AIPs, notably into non infested areas outside of the proposed railway loop or into newly rehabilitated areas	N	-1	-1	-2	-1	-2

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.						
		Accidental death of animals on the roads and other causes of animal fatalities	N	-2	-3	-2	-4	-11	CbA	Clearly marked signs will be erected along the transportation routes around the inner boundary of the site to create awareness of animal crossings.	N	-2	-1	-1	-2	-6
										A clearly marked and enforced vehicle speed will be implemented on the internal transportation routes.						
										Weekly inspections must be done around the fences of the Works to inspect these for safety as well as the presence of risks to animals.						
										Records must be kept of all animal fatalities within the Works' boundaries.						
										Environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc						
										If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.						
										Vehicles may only travel on demarcated roads on site.						
										A fire management plan must be developed for the site.						
										Fire belts must be constructed around the boundaries of the site.						
										In terms of fencing: • no electrified strands should be placed within 30 cm of the ground as some species are susceptible to electrocution from electric fences • the electrified strands should be placed on the inside of the fence and not the outside • there should not be a large gap between the inner and outer fence if two are required • a single fence with mesh or plain wire strands on the outside and electrified strands on the inside is recommended.						
										The poaching and/or hunting of animals will be strictly forbidden.						
		Habitat degradation due to dust: Increased dust will occur in all areas where vegetation is cleared. Dust will be caused by excavation, and construction. Dust settling on plant material can	N	-2	-2	-2	-2	-8	CbA	Maintain the current air quality monitoring stations that determine fallout.	N	-1	-1	-2	-1	-5
										Dust suppression should be undertaken where and when dust is present.						

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Rating Post Measures					SaM
		Potential Impacts								Mitigation Measures	Status	Extent	Duration	Probability	Intensity	
		reduce plant productivity, growth and recruitment.														
	Soil and Land use	The removal and stockpiling of topsoil may lead to a loss of soil resource and land capability through erosion of the stockpiles and chemical and physical degradation.	N	-1	-2	-4	-4	-11	CbA	Excavation and long-term stockpiling of soil should be limited within the demarcated areas Excavated materials should not be contaminated and it should be ensured that the minimum surface area is taken up. The stockpiles may not exceed 2m in height. Topsoil should be stockpiled on designated topsoil stockpiles, unless around linear infrastructure, where the topsoil could be stockpiled next to the linear structure. The duration of stockpiling should be minimised where possible. Vegetation debris, logs and leaf litter should be retained where possible for reuse during rehabilitation. A topsoil stockpile should be treated with temporary soil stabilisation methods; such as the application of organic matter to promote soil aggregate formation, leading to increased infiltration rate, thereby reducing soil erosion. Also, the use of lime to stabilise soil pH levels. Thereafter a short-term topsoil amelioration program should be based on the soil chemical status after levelling and should consists of a pre-seeding lime and fertilizer application. Stockpiles should be managed to ensure that losses from the piles are minimised and that additional damage to the physical, chemical or biotic content is minimised. In addition, measures of soil fauna diversity should be used to monitor stockpile fertility. Soil eDNA techniques are well placed for this type of temporal monitoring and should be considered as part of the ongoing topsoil management and monitoring protocols. Restrict the amount of mechanical handling, as each handling event increases that compaction level and the changes to the soil structure. Wherever possible, the 'cut and cover' technique (where the stripped soils is immediately placed in an area already prepared for rehabilitation, thus avoiding stockpiling) should be used. Temporary stockpiles must be protected by means of suitable geotextiles such as hessian sheeting, silt curtains, sandbags etc. to prevent contamination of runoff and sedimentation of freshwater resources in the vicinity of the surface infrastructure and should remain outside of the buffer zones. Soil erosion should be controlled on stockpiles by having control measures to reduce erosion risk such as erosion control blankets, soil binders, revegetation, contours, diversion banks and spillways. Temporary berms can be installed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion Alternatively topsoil can be transported to the Eastern Portion, or the Historic Slag dump for rehabilitation.	N	-1	-2	-1	-1	-5
		Soil compaction - Heavy equipment traffic during	N	-2	-2	-2	-2	-8	CbA	The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area. All vehicular traffic should be restricted to the existing service roads and	N	-1	-1	-2	-1	-5

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Mitigation Measures	Rating Post Measures	Status	Extent	Duration	Probability	Intensity	SaM
		construction and exploration activities is anticipated to cause soil compaction.									the selected road servitude as far as practically possible; to avoid unnecessary compaction of the surrounding soils.							
											Laydown areas should be located within already disturbed areas.							
											Soil Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. If they have to be moved when wet, shovel and truck should be used as bowl scrapers create excessive compaction when moving wet soils.							
											Compaction should be minimised by use of appropriate equipment and replacing soils to the greatest possible thickness in single lifts.							
											Heavy equipment movement over replaced soils should be minimised							
											Minimise compaction during smoothing of replaced soils by using dozers rather than graders.							
											Following placement, compacted soils should be ripped to full rooting depth (at least 30 cm where feasible as the bare minimum seedbed) to allow penetration of plant root.							
											Compacted soils adjacent to the focus areas can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.							
											Compaction of soil can be mitigated by ripping the footprint and introducing both organic and inorganic fertilizers.							
											All contractors must receive induction. The induction should be updated on site, to make provision for the site plan and a detailed explanation on the purpose of the no-go zones, presence of protected species, presence of the Protected Areas and ESAs and the meeting thereof.							
		Clearing vegetation will result in the exposure of soil, which may in turn lead to soil erosion, in addition to this, stockpiling of topsoil material on sloping areas leading to increased runoff and erosion.	N	-2	-2	-4	-3	-11	CbA		Clean and dirty water systems must be established prior to construction.	N	-1	-1	-2	-1	-5
											Temporary erosion control measures such as berms should be used to protect the disturbed soils during the construction phase until adequate vegetation has established							
											Bare soils within the access roads should be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast							
											No construction or project related activities may be undertaken outside of the demarcated areas.							
											Ensure the required erosion protection measures are monitored and corrected where necessary.							
											Bare soils can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast							
											Natural vegetation establishment (self-succession) will be encouraged on cleared areas, and topsoil stockpiles. All disturbed areas adjacent to the project should be re-vegetated with an indigenous grass mix, where necessary, to re-establish a protective cover to minimise soil erosion and dust emission.							
											If natural succession of vegetation is not established within one rainy season, after rehabilitation, the disturbed areas and areas adjacent to the infrastructural areas must be re-vegetated with an indigenous grass mix, if							

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										necessary, to re-establish a protective cover, to minimise soil erosion and dust emission.						
										A fire management plan must be developed for the site.						
										Fire belts must be constructed around the boundaries of the site.						
										Water pipelines must preferably follow existing roads or other linear infrastructure.						
		Potential of Soil Contamination	N	-2	-3	-3	-3	-11	CbA	A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works.	N	-1	-1	-2	-1	-5
										Construction requirements specific for the Chemical Storage Areas: • Tanks will be individually contained facilities, without pipeline interlinkages; • All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid. • Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume. • The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4 as opposed to the metal of carbon steel tanks. • The back up chemical storage and top up tanks will be placed about 800-1000m from each other; • The back up chemical storage and supply chemical storage tanks will be placed about 800-1000m from each other; • All tanks will be ventilated in terms of the required Safety Datasheets (SDSs) standards; • Strict storage requirements will be implemented (e.g. dry areas, with ventilation at floor level, spill collection, with strict prohibitions on storage requirements); • The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials; • Reactivity hazards will be considered and managed; • Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented; • Secondary containment must be provided to ensure that off-loading of solution occur within the bund wall.						
										All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.						
										Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
										Refuelling must be undertaken over hard park bunded areas that are adequately sized to capture and contain spillages.						
										Machinery and vehicles should be parked on appropriately lined areas.						
										Drip trays must be employed under stationary machinery.						

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress.						
										Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site.						
		Contamination of soils as a result of a lack of sanitary services	N	-1	-2	-4	-4	-11	CbA	Chemical toilets must be readily available to employees where permanent infrastructure is not available.	N	-1	-2	-1	-1	-5
										Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.						
	Hydrology	There are no river system in close proximity to the project. In terms of hydrology it is important that clean and dirty water be separated that runoff from the dirty area does not enter the clean water setting.	N	-1	-2	-2	-3	-8	CbA	Clean and Dirty water separation systems should be implemented.	N	-1	-1	-2	-1	-5
										Vegetation clearance should be kept to an absolute minimum.						
										The plant and all chemical tanks must be constructed on surfaced areas. All dirty areas, or areas which could lead to contamination of groundwater, surface water or soil resources must be suitably bunded.						
										Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems.						
		Use of heavy machinery, trucks and vehicles for construction purposes - Potential hydrocarbon spillages washed into downslope drainage channels.								Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
										Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages.						
										Machinery and vehicles should be parked on appropriately lined areas.						
										Drip trays must be employed under stationary machinery.						
										The required Code of Practice for the operations of this facility should be develop.						
										Spillages should be reported immediately, and spill kits should be readily available at all times.						
	Groundwater	Spills of chemicals and hydrocarbons during the construction phase could lead to groundwater pollution if not managed.	N	-2	-1	-2	-2	-7	CbA	Clean and Dirty water separation systems should be implemented.	N	-1	-1	-1	-1	-4
										The plant and all chemical tanks must be constructed on surfaced areas. All dirty areas, or areas which could lead to contamination of groundwater, surface water or soil resources must be suitably bunded.						
										Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems.						
										Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
										Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages.						
										Machinery and vehicles should be parked on appropriately lined areas.						
										Drip trays must be employed under stationary machinery.						
										The required Code of Practice for the operations of this facility should be develop.						

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										Spillages should be reported immediately, and spill kits should be readily available at all times. Groundwater monitoring should be undertaken to include the assessment of the potential impacts of this facility.						
	Air Quality	Construction activities and material movement may temporarily result in dust dispersion.	N	-2	-1	-2	-1	-6	CbA	Maintain the current air quality monitoring stations. All construction vehicles should adhere to a low speed (30km/h for trucks and 40km/h for light vehicles) limit to avoid collisions with susceptible species such as snakes and tortoises. Implement dust suppression in and around the construction area where required.	N	-1	-1	-1	-1	-4
	Visual	No impact is foreseen. The activities are planned within the existing Works footprint, with the plant located next to the Mn Slag Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Noise	Minimal noise is expected during the construction activities.	N	-2	-1	-1	-1	-5	CbA	Equipment will be well maintained to reduce excessive noise creation. Construction activities may only be undertaken during the day period (6h00 to 18h00). A complaints register should be kept on site and surrounding landowners should be notified of its availability and the contact procedure.	N	-1	-1	-1	-1	-4
	Heritage and Palaeontology	No impacts are expected on heritage or paleontological sites.	N	-3	-3	-1	-3	-10	CbA	The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. A short summary of chance find procedures is discussed below. This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below. • If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. • It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area.	N	-1	-1	-1	-1	-4

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										• The senior on-site Manager will inform the Environmental Control Officer (ECO) of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA. The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence. 1. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted. 2. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures. 3. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment. 4. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible. 5. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.						

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										6. If no good fossil material is recovered, then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils. 7. If no fossils are found and the excavations have finished then no further monitoring is required.						
	Socio Economic	The proposed PV facility project could also lead to some indirect job creation within the informal sector, even if this is not necessarily authorised. This refers to the temporary development of food stalls by informal vendors near the site to cater for the needs of the construction team members.	N	-2	-2	-3	-2	-9	CbA	Prioritise local labour in the recruitment process as part of the company's own recruitment policy or as part of contractor management plan, especially with regards to unskilled or lower skilled opportunities If possible, a percentage of the workforce should be reserved for women and the disabled The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and Small, Medium Micro Enterprises (SMMEs) during the construction process Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMME's from the local sector	P	2	2	5	3	12
		Project-induced population influx	N	-2	-2	-3	-3	-10	CbA	Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations. Skills development and on-site training would be imperative to enhance capacity building and the possibility of workers being employed on similar construction related projects in future	P	2	2	5	3	12
Waste Management and Handling	Geology	No direct impact.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrocarbon spills within the Mining Area and	Topography	No direct impact.	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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the management of Domestic and Hazardous Waste	Soils	Contamination of soil resources due to hydrocarbon and chemical spills.	N	-1	-2	-4	-4	-11	CbA	Storage of fuels and oils, the refuelling of vehicles and equipment maintenance must be limited to designated, bunded (bunds to be 110% of volume of the materials stored) areas. All fuels and soils must be stored in appropriate containers. Chemicals and hazardous material must be stored in suitable containers, fit for purpose and in line with SDS requirements. Where drip trays are too small, specially prepared, non-pervious bunds with solution trenches must be used to capture spillages A spill kit must be provided to be used in the event of a spill. Oils and potentially hazardous materials must be disposed of at a licensed facility and waste certificates obtained. If a spill occurs, the contaminated soil must be removed immediately. Contaminated soil must be stored according to best practices until it can be disposed of at a suitably licensed facility. Safety signage must be used at designated storage areas. Any emulsion or other contaminants should be collected and the soils remediated immediately. All workers must undergo an induction which includes environmental awareness training to make them aware of the environmental incident management procedures as well as the importance of complying with management measures.	N	-1	-2	-1	-1	-5
		Contamination of soils as a result of a lack of sanitary services	N	-1	-2	-4	-4	-11	CbA	Chemical toilets must be readily available to employees where permanent infrastructure is not available. Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.	N	-1	-2	-1	-1	-5
		Handling of building Rubble	N	-2	-2	-1	-2	-7	CbA	Burying of any waste including rubble, domestic waste, empty containers on the site etc. should be strictly prohibited and all construction waste must be removed to an approved disposal site. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. All waste must be removed by licensed contractors and disposed of at a licensed landfill site or be disposed of at a licensed landfill site. As a duty of care and the cradle to grave principles, the Licence Holder should regularly inspect disposal site to ensure that best practices are implemented. Recycling practices must be investigated and implemented on site where practical.	N	-1	-1	-1	-2	-5
	Ecology	The unmanaged disposal of waste,	N	-2	-3	-3	-4	-12	CbA	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	N	-1	-1	-2	-1	-5

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		Potential Impacts								Mitigation Measures	Status	Extent	Duration	Probability	Intensity	
		could result in the spread of invader species, as well as the influx of opportunistic species.								Develop dedicated waste handling areas, fit for purpose and prevent the windblown litter.						
	Hydrology	Handling of Hazardous Waste within workshops, water containment facilities.	N	-3	-2	-2	-4	-11	CbA	Clean and Dirty water separation systems should be incorporated. A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste streams. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. All contaminated material must be contained in mobile sumps. The mobile sumps must maintain a suitable freeboard, to ensure when these are moved/transported, that no spillage will occur. Hazardous waste handling should only take place within bunded and/or lined areas. Hazardous waste should be removed by a licenced removal company and taken to a suitable and licenced landfill site. Clean spills, if occur within 24 hours. Documentation of removal and safe disposal must be available on site. The Licence Holder will adopt a cradle-to grave approach to ensure that the waste is removed and disposed of in a legally compliant manner. Notify the relevant regulatory authorities in the event of the occurrence of a reportable incident. Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance requirements must be documented and an action plan developed.	N	-1	-1	-2	-2	-6
	Groundwater	Large scale hydrocarbon or chemical spills could be present at the mining area	N	-3	-1	-4	-4	-12	CbA	Clean and Dirty water separation systems should be incorporated. No activities associated with hydrocarbons and/or chemicals may be undertaken outside of an effectively designed and contained area. All used oils must be removed from site by a licensed company and disposed of at a suitably licensed site. Any spills occurring during the collection process must be cleaned up immediately. Any significant spills must be captured in the incident reports and must be reported to the relevant department (DARDLEA, Catchment Management Agency/DWS). All equipment and machinery should be kept in good working order. A clean up procedure (i.e. Works Instruction) must be in place. Clean spills, if occur within 24 hours.	N	-2	-1	-2	-1	-6
		Handling or Hazardous Waste within workshops and general area.	N	-2	-2	-2	-4	-10	CbA	Clean and Dirty water separation systems should be incorporated. The workshop should be designed with the suitable waste containment measures (berms, sumps, oil separators). Waste management training must be implemented on site.	N	-1	-1	-2	-2	-6

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Mitigation Measures	Rating Post Measures					SaM
												Status	Extent	Duration	Probability	Intensity	
											Clear signs informing staff of waste management practices must be implemented on site.						
											Hazardous waste handling should only take place within bunded and/or lined areas, with a capacity of at least 110% of the volume stored.						
											Hazardous waste should be removed by a licenced removal company and taken to a suitable and licensed landfill site.						
											Documentation of removal and safe disposal must be available on site.						
		Handling and Storing of Domestic Waste	N	-2	-2	-1	-2	-7	CbA		Clean and Dirty water separation systems should be incorporated.	N	-1	-1	-1	-2	-5
											Waste management training must be implemented on site.						
											Clear signs informing staff of waste management practices must be implemented on site.						
											All waste must be removed by licensed contractors and disposed of at a licensed landfill site.						
											As a duty of care and the cradle to grave principles, the Licence Holder should regularly inspect disposal site to ensure that best practices are implemented.						
											Recycling practices must be investigated and implemented on site where practical.						
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Noise	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Visual	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Social	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operational Phase																	
Operation of the Plant and Chemical Storage	Topography	No further impacts foreseen.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Soil Management	Potential of Soil Contamination	N	-2	-3	-3	-3	-11	CbA		A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction Works'.	N	-1	-1	-2	-1	-5
											Construction requirements specific for the Chemical Storage Areas: • Tanks will be individually contained facilities, without pipeline interlinkages; • All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid. • Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume. • The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4 as opposed to the metal of carbon steel tanks. • The back up chemical storage and top up tanks will be placed about 800-1000m from each other; • The back up chemical storage and supply chemical storage tanks will be						

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										placed about 800-1000m from each other; • All tanks will be ventilated in terms of the required SDS standards; • Strict storage requirements will be implemented (e.g. dry areas, with ventilation at floor level, spill collection, with strict prohibitions on storage requirements); • The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials; • Reactivity hazards will be considered and managed; • Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented; • Secondary containment must be provided to ensure that off-loading of solution occur within the bund wall.						
										Only transportation companies equipped, trained and approved for the transportation of dangerous chemicals may be utilised.						
										All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.						
										Offloading of dangerous chemicals must be supervised by the supervisor.						
										Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
										Refuelling must be undertaken over hard park bunded areas that are adequately sized to capture and contain spillages.						
										A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works.						
										Machinery and vehicles should be parked on appropriately lined areas.						
										Drip trays must be employed under stationary machinery.						
										An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress.						
										Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site.						
		Spills along pipelines could contaminate or impact on the conditions of soils through soil erosion.	N	-2	-2	-4	-2	-10	CbA	Regular monitoring must be undertaken through walk-abouts to ensure that the Works is aware of any leaks along the pipelines.	N	-1	-1	-2	-2	-6
										Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points where water accumulation might occur. The system must effectively collect and safely disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion						
										Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against wind erosion						
										Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically						

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										record the occurrence of any erosion on site or downstream. This inspection should be done once per month during the construction phase and once every six months during the operation phase. Corrective action must be implemented to the run-off control system in the event of any erosion occurring						
										Chemical storage tanks and pipelines must be monitored regularly to ensure that the integrity is intact.						
										Where leaks are present measures must be implemented to contain and reduce the volumes of loss of water by either shutting down the pipeline or any other measure economically viable at that time of the operation.						
										Water Leaks must be rectified and fixed within 12 hours from occurrence.						
										Chemical leaks must be sealed off immediately.						
										Any leaks must be documented on the Isometrix system, no matter the quantity thereof. This will ensure that recurrences or areas where maintenance are required are identified proactively prior to a serious encounter.						
										A detailed water management and system maintenance procedure must be implemented on site, documenting the responsible persons, actions required on a daily, weekly, monthly or annual basis as well as recording requirements.						
		Incorrect storage of raw materials could lead to soil contamination	N	-2	-3	-3	-3	-11	CbA	Raw Materials must be stored in existing contained bunker areas.	N	-1	-1	-1	-1	-4
										Any spills of raw materials outside of the contained areas must be cleaned up as soon as possible.						
										The capacity of the bunkers must be adhered to at all times and for this reason all bunkers must be labelled in terms of allowable capacity.						
	Ecological Management	Spread of invader species	N	-2	-3	-3	-3	-11	CbA	AIP monitoring and clearing/control should take place throughout the construction phase of the development, and a 30 m buffer surrounding the plant area should be regularly checked for AIP proliferation and to prevent inward and or/outward spread of AIPs, notably into non infested areas outside of the proposed railway loop or into newly rehabilitated areas	N	-1	-1	-2	-1	-2
										Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.						
	Hydrology	There are no river system in close proximity to the project. In terms of hydrology it is important that clean and dirty water be separated that runoff from the dirty area does not enter the clean water setting.	N	-1	-2	-2	-3	-8	CbA	Clean and Dirty water separation systems should be implemented.	N	-1	-1	-2	-1	-5
										Where dirty water can be used, such as in the quenching systems, the first point of resource must be Dam 1, only thereafter may water from the Main Storage Dam (feed Leeuwspruit) be used. Flow meters must be installed on all pipelines to monitor water use from boreholes, Leeuwspruit, Main Storage Tank and Dam, these meters must be calibrated annually. Ongoing investigations must be conducted to improve water efficiency and use on site.						
										The bunded areas constructed for the management of chemicals, leach processes and water within the plant and at the tanks must be maintained to full integrity.						

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		The Works must also optimise water usage on site.									Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems.						
											Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
											Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages.						
											Machinery and vehicles should be parked on appropriately lined areas.						
											Drip trays must be employed under stationary machinery.						
											Spillages should be reported immediately, and spill kits should be readily available at all times.						
	Groundwater	Spills of chemicals and hydrocarbons during the operational phase could lead to groundwater pollution if not managed.	N	-2	-1	-2	-2	-7	CbA		Clean and Dirty water separation systems should be implemented.	N	-1	-1	-1	-1	-4
											The bunded areas constructed for the management of chemicals, leach processes and water within the plant and at the tanks must be maintained to full integrity.						
											Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems.						
											Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.						
											Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages.						
											Machinery and vehicles should be parked on appropriately lined areas.						
											Drip trays must be employed under stationary machinery.						
											Spillages should be reported immediately, and spill kits should be readily available at all times.						
											Groundwater monitoring should be undertaken to include the assessment of the potential impacts of this facility.						
	Visual Impacts	No further impacts foreseen.	-	-	-	-	-	-			Storm water management measures must be maintained	-	-	-	-	-	-
	Nois Impacts	No further impacts foreseen.	-	-	-	-	-	-			-	-	-	-	-	-	-
	Air Quality	All activities associated within the processing activities and movement of slag have the potential to release dust.	N	-2	-2	-3	-3	-10	CbA		The dust monitoring network and dust suppression programme must be implemented and maintained throughout the operational phase of the Works'.	N	-1	-1	-2	1	-3
											Dust monitoring should be undertaken in line with the recommendations of the air quality specialist.		-2	-1	-3	1	
											Water suppression or the use of a chemical bonding material on roads must be implemented to reduce fugitive dust emissions.		-2	-1	-3	1	
											Recommendations include reducing vehicle speed, reducing vehicle weights and limiting the amount of traffic.		-2	-1	-3	1	
		Release of Greenhouse Gasses	N	-2	-2	-3	-3	-10			Effective abatement equipment must be implemented as part of the Processing Plant design and development phase to limit emissions. Operate within the conditions of the AEL.	P	3	3	3	5	14

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										The licence holder should undertake the necessary investigation to replace the diesel operated vehicles (two front end loaders and fork lifts) with battery operated equipment, solar charging systems. In addition to this investigations should be implemented to reduce Eskom supply with renewable sources.						
	Socio Economic	The operational activities will result in additional employment of 190 people.	P	3	3	2	5	13		Local employment must be preferential when considering the appointment of staff and services.	P	3	3	3	5	14
	Waste Management and Handling Hydrocarbon spills within the Mining Area and the management of Domestic and Hazardous Waste (refer to Construction Phase)		-	-	-	-	-	-		-	-	-	-	-	-	-
Decommissioning Phase																
Legal Requirements (Environmental Permits)	Legal Compliance	Unlawful activities could lead to NWA Directives and Section 24G Rectification fines.	N	-4	-3	-2	-5	-14	CbA	A legal assessment of all activities must be undertaken annually to ensure that all are licensed. A detailed closure plan must be developed and submitted to the relevant departments for approval. All legally appointed personnel responsible or involved in activities on site must receive training on the requirements of the Environmental Authorisations and EMPs Quarterly decommissioning must be undertaken, on the lawful implementation of the Environmental Authorisation Environmental Authorisations must be available on site at all times. The legal register must be updated to indicate all updated activities.	P	4	3	5	5	17
Infrastructure Removal	Geology	No direct impact	-	-	-	-	-	-	-	-		-	-	-	-	-
	Topography	Removal of infrastructure may impact on the topography.	N	-2	-3	-4	-4	-13	R	Linear infrastructure constructed by the Works will be removed if it proves to inhibit land use at decommissioning. Where possible, infrastructure will remain for social investment opportunities, this will be decided in conjunction with the Integrated Development Plan of the area and the local authorities. Ensure the entire site remains fenced for the duration of rehabilitation. Retain security access control to the site for the duration of rehabilitation. All fixed assets that can be profitably removed will be removed for salvage or resale (the salvage and resale value have however not been incorporated into the closure cost estimate as per the legislative requirements) All surface structures, infrastructure and 'hard surfaces' (*inter alia* redundant pump equipment, etc.) are to be demolished and removed from the disturbed footprint, unless an alternative/ continued use for any such items is agreed upon and approved by the Competent Authority. All surface infrastructure would be demolished and removed to a depth of at least 1m. Any infrastructure below 1m will be sealed, made safe and left *in situ*.	P	3	3	4	4	14

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										All fences erected around the infrastructure be dismantled and either disposed of at a permitted disposal site or sold off as scrap (provided that these structures will no longer be required by the post mining land owner). Fences erected to cordon off dangerous excavations will remain in place and will be maintained as and when required.						
										Water pollution control structures will remain until the completion of all demolition and associated rehabilitation activities where after these will be rehabilitated.						
	Soil, Land Use and Land Capability	Spills around decommissioning areas (hydrocarbons and paste) may result in the contamination of soils.	N	-1	-2	-4	-4	-11	CbA	Draw up a plan clearly defining the area where the removal of infrastructure should take place. Implement the plan with sufficient measures in place not to compact new areas.	N	-1	-2	-1	-1	-5
										A chemical analysis must be undertaken of the footprint areas where chemicals where utilised to determine whether any contaminated soil are present (Phase 1 study).						
										Should contaminated soils be present, these must be remediated.						
										All hazardous waste should be disposed of at licensed and fit-for-purpose areas and safe disposal records should be kept on file.						
										Any hydrocarbon, effluent or other contaminants should be collected and the soils remediated immediately.						
		Contamination of soils as a result of a lack of sanitary services	N	-1	-2	-4	-4	-11	CbA	Chemical toilets must be readily available to contractors.	N	-1	-2	-1	-1	-5
										Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.						
		Loss of soils due to decommissioning activities present on site.	N	-1	-2	-4	-4	-11	CbA	Draw up a plan clearly defining the area where the removal of infrastructure should take place. Implement the plan with sufficient measures in place not to compact new areas.	N	-1	-2	-1	-1	-5
										Compacted soils adjacent to the infrastructure footprint can be lightly ripped to alleviate compaction where required.						
										Implement a strict penalty fine system for rule breaking with regard to vehicular movement.						
										Maintain Clean and Dirty water systems and undertake regular monitoring and maintenance thereof.						
	Ecology	The establishment of Weeds and Invader Species.	N	-2	-3	-4	-4	-13	CbA	Ongoing AIP and bush encroachment monitoring and control should take place throughout the rehabilitation phase of the project.	N	-1	-1	-2	-1	-2
										If natural succession of vegetation is not established within one rainy season, after commencement of rehabilitation, the disturbed areas and areas adjacent to the infrastructural areas must be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission.						

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										All temporary infrastructure and footprint areas associated with the borrow pit should be rehabilitated in accordance with the rehabilitation plan, and it must be ensured that an appropriate post-closure land use is achieved.						
										Where bare soils are left exposed as a result of construction activities, they should be immediately rehabilitated. Rehabilitated efforts should continue to be monitored throughout the operational phase, until natural processes will allow the ecological functioning and biodiversity of the area to be re-instated.						
										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.						
										Edge effects such as erosion and AIP proliferation, which may affect adjacent natural habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase.						
	Hydrology	Erosion control over rehabilitated areas and the prevention of erosion gullies.	N	-1	-1	-4	-2	-8	CbA	The topography of all disturbed areas must be shaped in such a manner that the surrounding natural area blends naturally with the rehabilitated areas well as to be free draining. This will reduce soil erosion and improve natural re-vegetation.	N	-1	-2	-1	-1	-5
										The topography should be returned to its former state (as far as practically possible).						
										Exposed areas should be vegetated as soon as possible.						
										The topsoil stockpiles should be used to fill in areas and to create a suitable substrate to re-vegetate areas.						
										Temporary erosion measures should be employed at exposed areas until vegetated.						
		Contamination of surface water as a result of removal of infrastructure.	N	-2	-2	-4	-3	-11	CbA	The detailed waste management strategy implemented during the construction and operation phases must be continuously implemented throughout the closure and decommissioning phase.	N	-1	-1	-2	-2	-6
										Contaminated water from the water containment facilities should be reused in the plant system as long as possible and left to evaporate. No unlawful discharge of water will be allowed.						
		Rubble and waste from site could pollute runoff.	N	-1	-1	-4	-2	-8	CbA	All wastes required should be removed to licensed waste disposal facilities and by licenced companies.	N	-1	-1	-2	-2	-6
	Groundwater	Decommissioning and removal of facilities could lead to the infiltration of dirty water to groundwater resources.	N	-2	-3	-2	-2	-9	CbA	No water may be discharged into watercourses, if this water has not been treated to the correct quality OR if approval from the DWS for such activity has not been obtained.	P	2	3	4	5	14
										Groundwater monitoring must continue up until closure is obtained.						
	Heritage	No direct impact	-	-	-	-	-	-	-	-		-	-	-	-	-
	Visual	Fugitive dust emissions as a result of infrastructure	N	-2	-2	-4	-3	-11	CbA	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the decommissioning/ closure phase of the site. With respect to road dust levels, it is recommended to limit vehicle	N	-2	-1	-3	1	-5

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
		removal and associated exposed/bare areas may have an impact in terms of air quality and visual characteristics.								speeds, especially during high risk periods of high winds, high temperature and low humidity. Vegetation clearance should be kept to an absolute minimum. Exposed areas should be vegetated as soon as possible. Establish and implement a dust suppression plan in consultation with the Environmental Control Officer and an air quality specialist as part of the contractor's responsibility. Dust suppression measures should be implemented to limit the generation of dust.						
	Air Quality	All activities associated with the removal of infrastructure and rehabilitation has the potential to release dust.	N	-2	-2	-4	1	-7	CbA	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the closure phase of the Works. With respect to haul road dust levels, it is recommended to limit vehicle speeds, especially during high risk periods of high winds, high temperature and low humidity.	N	-2	-1	-3	1	-5
	Noise	All activities associated with the removal of infrastructure and rehabilitation has the potential to generate noise.	N	-2	-2	-4	1	-7	CbA	The removal of all infrastructure is to take place during daytime periods only. Earthworks and planting of vegetation to be done during daytime Where noise becomes a nuisance, management measures will be investigated and implemented to address these.	n	-2	-1	-3	1	-5
	Social	No direct impact, however, communication is important.	N	-2	-2	-4	1	-7	-	Local residents, with the focus on the surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.	N	-2	-1	-3	1	-5
Earth Moving, shaping and ripping of ground	Geology	No direct impact	-	-	-	-	-	-	-	-		-	-	-	-	-
	Topography	The shaping of the site should be undertaken in such a manner that it improves the overall topography of the site.	P	1	3	4	5	13	R	Pre-construction topography should be reasonably restored through shaping and landscaping, such that the topography of rehabilitated areas will ultimately be commensurate with that of adjacent, non-disturbed areas. Where infrastructure have been removed, the surface areas must be ripped and ameliorated. Measures must be implemented to reduce erosion and to promote self-succession. If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification. The final shaping should be viable to allow for final land use. If possible, ensure a continuation of the premining surface drainage pattern.	P	1	3	5	5	14
	Soils	Soil erosion	N	-6	-3	-4	-3	-16	CbA	If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any	N	-2	-1	-3	1	-5

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
										deleterious effects must be corrected and the area be seeded with a seed mix to specification.						
		Ripping and topsoil replacement will restore the soil physical characteristics prior to re-vegetation.	P	1	3	4	5	13	CbA	Compacted soils will be ripped and topsoil will be replaced if the latter is deemed necessary for effective vegetation. Where sites have been alienated of vegetation or where soils have been compacted or covered with concretes, these sites will be ripped and ploughed. If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.	P	1	3	5	5	14
	Terrestrial Ecology (Fauna & Flora)	The rehabilitation of the site will allow reestablishment of natural vegetation.	P	1	2	3	4	10	CbA	Compacted soils will be ripped and topsoil will be replaced if the latter is deemed necessary for effective vegetation. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included. The soil fertility status should be determined by soil chemical analysis after levelling and before seeding/re-vegetation if deemed applicable. On-going alien and invasive floral species control is required through all phases of rehabilitation. If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.		3	3	3	4	13
	Surface Water	Runoff from rehabilitated areas will impact on watercourses especially during intensive rainstorms especially if the area are not free draining.	N	-2	-1	-3	1	-5	CbA	The areas will be shaped to be free draining in line with the approved storm water management plan.	P	3	3	3	4	13
	Groundwater	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-	-	-	-	-	-		-	-	-	-	-	-
	Visual	The rehabilitation (ripping, topsoil replacement and landscaping) will	P	2	4	4	1	11	CbA	The area should be shaped and vegetated to blend into the surrounding landscape.	P	2	4	4	3	13

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
		remove the visual incongruity.								An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been shaped and self-succession has occurred.						
										Demarcate the decommissioning area and limit the decommissioning activities as far as possible.						
										Final shaping will be implemented such that the final profile of the rehabilitated areas are formed to emulate natural contours of the area.						
										Foundations will be removed to a depth of 1 m below the surface and the area rehabilitated.						
										All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).						
										Linear infrastructure constructed by the Works' (i.e. pipelines) will be removed if it proves to inhibit land use at decommissioning.						
	Air Quality	All activities associated with the removal of infrastructure has the potential to release dust.	N	-2	-2	-3	1	-6	CbA	Dust sampling will be undertaken on a monthly basis.						
										Monthly monitoring reports will be generated by the Works' or through a suitably qualified air quality specialist.	N	-2	-1	-3	1	-5
	Noise	All activities associated with the removal of infrastructure and rehabilitation has the potential to generate noise.	N	-2	-1	-4	3	-4	CbA	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of action to ameliorate the situation.						
										The removal of all infrastructure is to take place during daytime periods only. Where noise becomes a nuisance, management measures will be investigated and implemented to address these.						
										Machinery with low noise levels and maintained in a good order to be used and to comply with the International Finance Corporation's (IFC) Health and Safety Regulations.	N	-2	-1	-3	1	-5
										Speed control measures will be implemented by the site through the placement of adequate signage.						
										Implement a penalty system for non-compliance to speed control measures and ensure that all workers are made aware of the penalty systems.						

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
	Social	No direct impact	-	-	-	-	-	-	-	Gravel roads to be maintained in as good and smooth a condition as possible.		-	-	-	-	-
Waste Management and decommissioning of hazardous (also fuels) substances	Geology	No direct impact	-	-	-	-	-	-	-	-		-	-	-	-	-
	Topography	No direct impact	-	-	-	-	-	-	-	-		-	-	-	-	-
	Soil, Land Use and Land Capability	Spills around the diesel storage areas and product stockpiles may result in the contamination of soils.	N	-1	-2	-4	-4	-11	CbA	A contaminated land assessment should be undertaken at all areas where dangerous goods was stored, as well as where fuel pipelines were placed. Any hydrocarbon, effluent or other contaminants should be collected and the soils remediated immediately.	N	-1	-2	-1	-1	-5
		Handling of Building Rubble	N	-2	-2	-2	-3	-9	CbA	Documentation of removal and safe disposal must be available on site. All infrastructure will be removed and rehabilitated, should no alternative use be found for the structures. Foundations will be removed to a depth of 0.5m below surface.	N	-1	-1	-2	-2	-6
	Terrestrial Ecology (Fauna & Flora)	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Groundwater	Handling or Hazardous Waste within workshops and general area.	N	-2	-2	-2	-4	-10	CbA	Clear signs informing staff of waste management practices must be implemented on site. Clean and Dirty water separation systems should be incorporated in the design. Waste management training must be implemented on site. Hazardous waste handling should only take place within bunded and/or lined areas. Hazardous waste should be removed by a licensed hazardous waste removal company and taken to a suitable and licensed landfill site.	N	-1	-1	-2	-2	-6
		Handling of Building Rubble	N	-2	-2	-2	-3	-9	CbA	Documentation of removal and safe disposal must be available on site. All infrastructure will be removed and rehabilitated, should no alternative use be found for the structures. Foundations will be removed to a depth of 0.5-1m below surface.	N	-1	-1	-2	-2	-6
		Handling and Storing of Domestic Waste	N	-3	-3	-3	-3	-12	CbA	All building rubble will follow the waste hierarchy and will therefore either be sold for reuse where possible and as a last option be disposed of at a licensed facility suitable for such waste in line with the NEMWA. Clean and Dirty water separation systems should be maintained. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. Groundwater monitoring must be undertaken in such a manner as to ensure that any potential impacts from the site can be detected. Recycling practices must be investigated and implemented on site.	N	-2	-3	-2	-2	-9

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	Rating Post Measures: Status	Extent	Duration	Probability	Intensity	SaM
	Surface Water	Handling of Hazardous Waste within workshops and general site area could contaminate the dirty water storage areas. The water is then reused in the system and could have impacts on the integrity of the storm water system and also the production.	N	-3	-2	-2	-4	-11	CbA	Clean and Dirty water separation systems should be maintained up until closure. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. Hazardous waste handling should only take place within bunded and/or lined areas. Hazardous waste and contaminated materials should be removed by a licensed hazardous waste removal company and taken to a suitable and licensed landfill site. Documentation of removal and safe disposal must be available on site.	N	-1	-1	-2	-2	-6
		Handling and Storing of Domestic Waste should have no impact on the surface water resources due to the location of the facility. However, incorrect disposal of waste could hamper the integrity of the storm water system.	N/A	-1	-2	-3	-3	-9	CbA	Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance requirements must be documented and an action plan developed. Clean and Dirty water separation systems should be maintained up until closure. Waste management training must be implemented on site. Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance requirements must be documented and an action plan developed. Clear signs informing staff of waste management practices must be implemented on site. Recycling practices must be investigated and implemented on site. Building rubble must be disposed of in line with the requirements of the NEMWA. Access control must be strictly enforced.	N	-1	-1	-2	-1	-5
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Visual	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Activities	Impact Area	Potential Impacts	Status	Extent	Duration	Probability	Intensity	SbM	CbA, R, Ir	Mitigation Type	Mitigation Measures	Rating Post Measures						SaM
												Status	Extent	Duration	Probability	Intensity		
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Noise	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Social	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

9 EMP AND ACTION PLAN

Please refer to Table 25 for the management measures and also to the EMP below – note that the EMP has been compiled to fulfil all requirements as stipulated in Appendix 4 of the NEMA EIA Regulations, 2014 (as amended).

This EMP has been compiled to provide recommendations and guidelines according to which compliance monitoring can be done during the construction and operational phases of the proposed project at the Works, as well as to ensure that all relevant factors are considered to ensure for environmentally responsible development.

This EMP informs all relevant parties, the Contractor, the Environmental Control Officer (ECO) and all other staff employed by the proponent at the site, as to their duties in the fulfilment of the legal requirements for the construction and operation of this proposed project, with particular reference to the prevention and mitigation of anticipated potential environmental impacts.

All parties should note that obligations imposed by the EMP are legally binding in terms of the Environmental Authorisation granted by the relevant environmental permitting authority.

9.1 Details of the EAP

Please refer to Section 1.7.2 of this report.

9.2 Aspects of the activity that are covered by this EMP

Please refer to Section 2 of this report for a detailed project description and Section 8.2 for the typical activities considered in the project. The latter is repeated below to put the EMP in context:

The following activities are considered for the purposes of this Project:

Construction Phase

- Footprint preparation;
- Increase of Storm Water Management System; and
- Construction of infrastructure.

Operational Phase

- Alien Invasive Plant Management;
- Transportation of Slag to the Plant;
- Operation of the Plant;
- Distribution and handling of chemicals;
- Product dispatching;
- Storm water management by means of the approved Storm Water Management infrastructure (no new impacts to be assessed); and
- Management of water supply to the Plant as well as between the plant and RO Plant.

Closure Phase

- Removal of infrastructure;
- Topographic reestablishment of footprint; and
- Vegetation of footprint.

Please refer to Figure 7 to Figure 11 for the full process flow and layout within the ARMMDW boundary.

9.3 Impact Management Outcomes/Objectives

Based on the outcomes of the impact assessment the objectives outlined below have been developed. It is key that all responsible parties on site are familiar with the objectives and why the recommended management measures (as stipulated in Table 25) must be adhered to.

9.3.1 EMP Objectives

The objectives of an EMP are to:

- Encourage good management practices through planning and commitment to environmental issues;
- Define how the management of the environment is reported and performance evaluated;
- Provide rational and practical environmental guidelines to:
    - Minimise disturbance of the natural environment;
    - Prevent or minimise all forms of pollution;
    - Protect indigenous flora and fauna;
    - Prevent soil erosion;
    - Prevent soil contamination;
    - Protect water resources, both surface and groundwater;
    - Comply with all applicable laws, regulations, standards and guidelines for the protection of the environment;
    - Adopt the best practicable means available to prevent or minimise adverse environmental impacts; and
    - Develop waste management practices based on prevention, minimisation, recycling, treatment or disposal of wastes.
- Enforce the National Waste Management Hierarchy by reducing waste on site, and utilising waste resources into economic resources;
- Describe all monitoring procedures required to identify impacts on the environment;
- Train employees and contractors with regard to environmental obligations;
- Verify environmental performance through information on impacts as they occur;
- Respond to unforeseen events;
- Provide feedback for continual improvement in environmental performance;
- Identify a range of mitigation measures which could reduce and mitigate the potential impacts to minimal or insignificant levels;
- Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project;
- Identify measures that could optimise beneficial impacts;
- Create management structures that addresses the concerns and complaints of I&APs with regards to the proposed project;
- Establish a method of monitoring and auditing environmental management practices during all phases of the activity; and
- Specify time periods within which the measures contemplated in the final EMP must be implemented, where appropriate.

9.3.2 Planning Phase Objectives

The following aspects with its associated objectives have been considered during the planning phase:

9.3.2.1 Legal Planning

The following objectives have been set for the identified aspect:

- Proactively consult with the Environmental Departments at the Works and ARM Head Office regarding the proposed project to timeously identify Environmental, Water, Waste, Biodiversity or Atmospheric Emission Licensing requirements;

- To operate within the enviro-legal ambits of South Africa; and
- To be aware of the latest environmental legal requirements.

9.3.2.2 Project Development and Implementation

The following objectives have been set for the identified aspect:

- Improve economic conditions within the Local Municipality by employing local labour where possible;
- Comply with the DWS Best Practice Guidelines;
- Comply with the issued WULs;
- Comply with the requirements of the approved EMP and Environmental Authorisations for the purposes of the furnaces, storm water management infrastructure, RO Plant, new Plant and Slag Management;
- Ensure that all relevant departments are aware of the conditions and requirements of the EMP and Environmental Authorisation, as well as the AEL, by undertaking regular training and refresher courses in this regard;
- Ensure that a communication forum and integrated meetings are in place between the above-mentioned departments, to ensure that environmental requirements are identified proactively to ensure optimal, timeous and lawful activities can be undertaken;
- Ensure that quenching is undertaken in such a manner to meet the SO_2 and NO_2 emission limits - if this is not possible, alternative abatement equipment must be implemented, and the necessary amendments to the AEL must be considered.

9.3.3 Construction Phase Objectives

- Improve economic conditions within the Local Municipality by employing local labour where possible;
- Comply with the DWS Best Practice Guidelines;
- Comply with the issued WULs;
- Comply with the issued AEL;
- Comply with the requirements of the approved EMP and Environmental Authorisations;
- Comply with the issued IWML;
- Manage the environment in which the site operations to avoid soil, air or water pollution;
- Ensure that all relevant departments are aware of the conditions and requirements of the AEL, EMP and Environmental Authorisation, by undertaking regular training and refresher courses in this regard; and
- Ensure that a communication forum and integrated meetings are in place between the relevant departments, to ensure that environmental requirements are identified proactively to ensure optimal, timeous and lawful activities can be undertaken.

9.3.4 Operational Phase Objectives

The following objectives have been set for the identified aspect:

- Comply with the DWS Best Practice Guidelines;
- Comply with the issued WULs;
- Comply with the issued AEL;
- Comply with the requirements of the approved EMP and Environmental Authorisations;
- Comply with the issued IWML;
- Remain within the approved footprints and parameters of the approved site;
- Ensure that all relevant departments are aware of the conditions and requirements of the AEL, EMP and Environmental Authorisation, by undertaking regular training and refresher courses in this regard;
- Ensure that a communication forum and integrated meetings are in place between the relevant departments, to ensure that environmental requirements are identified proactively to ensure optimal, timeous and lawful activities can be undertaken;

- Undertake investigation and implementation of ongoing optimisation of Water Demand and Conservation on site – optimising the use of dirty water and reducing the need for water treatment through the RO Plant;
- Reduce slag on site as far as practically possible and providing opportunities to rework other slag resources in the future;
- Maintain an open and transparent relationship with the regulatory authoritie;
- Prohibit unauthorised access to site and/or designated area without the necessary induction;
- Ensure an open channel of communication with the surrounding landowners/ land users to proactively determine any potential concerns; and
- Induction processes and content is to be updated and in line with all enviro-legal regulatory requirements.

9.3.5 General Objectives

9.3.5.1 Hydrocarbon Management

The following objectives have been set for the identified aspect:

- Ensure that vehicles are maintained and in good working conditions;
- Ensure that workshops are designed to accommodate the maintenance and servicing of vehicles within contained footprints;
- Ensure that the Works operates within a defined clean and dirty water system;
- Ensure that the necessary oil separation system and catchment areas are in place and maintained;
- To ensure that all hydrocarbons are stored in a manner which will prevent any harm to the environment;
- To prevent spillages of hydrocarbons;
- To capture, contain and manage any spillage;
- To ensure that any area which has been affected by a hydrocarbon spill is suitably rehabilitated and monitored until rehabilitation efforts have been successful; and
- Protect the groundwater resources to ensure that limited to no impact on groundwater resources occur as a result of the operations.

9.3.5.2 Chemical Management

The following objectives have been set for the identified aspect:

- Ensure that the supply, handling and management of chemicals are undertaken in terms of the Material Safety Datasheets (SDSs);
- Ensure that the Works operates within a defined clean and dirty water system;
- To ensure that all chemicals are stored in a manner which will prevent any harm to the environment;
- To prevent spillages of chemicals;
- To capture, contain and manage any spillage;
- To ensure that any area which has been affected by a chemical spill is suitably rehabilitated and monitored until rehabilitation efforts have been successful; and
- Protect the groundwater resources to ensure that limited to no impact on groundwater resources occur as a result of the operations.

9.3.5.3 Handing and Storing of Waste

The following objectives are associated with the identified aspect:

- The hierarchy of waste management should be implemented on site, in line with the National Waste Management Strategy;
- Ensure that storage takes place in such a manner as not to cause any pollution to the environment;

- All wastes (hazardous and domestic) to be disposed of at licensed facilities and removed by licenced/registered waste removal companies;
- The cradle to grave principle must be implemented;
- Ensure that temporary waste storage facilities comply with best practice guidelines;
- Prevent any pollution of water resources by ensuring that an effective surface runoff control system is in place in line with the approved Storm Water Management Plan (SWMP);
- Prevent, contain and clean up any spillages; and
- Ensure that all facilities are monitored and maintained on a regular basis.

9.4 Decommissioning and Closure Phase

No addition objectives are included in this EMP. All approved practices in terms of issued WULs, AELs; EMPs, Environmental Authorisations, and the IWML should be implemented during the decommissioning phase.

9.5 Legal Requirements

Please refer to Section 4 for the detailed legal discussion associated with this project. The key legislation currently applicable to the design, construction and implementation phases of the proposed project must be complied with. The list of applicable legislation is provided below:

- The Constitution of the Republic of South Africa Act, 1996 (Act No. 108 of 1996);
- National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA);
- National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- National Water Act, 1998 (Act No. 36 of 1998) (NWA);
- Hazardous Substances Act, 1973 (Act No. 15 of 1973);
- National Environmental Management: Waste Management Act, 2008 (Act No. 59 of 2008) (NEM:WA);
- Occupational Health and Safety Act, 1993 (Act No. 85 of 1993); and
- All relevant provincial legislation, Municipal by-laws and ordinances.

The following licence requirements would be relevant to the proposed project:

- Environmental Authorisation;
- Atmospheric Emission Licence (AEL); and
- Operate in terms of the issued Integrated Waste Management Licences (IWMLs) and Water Use Licences (WULs) (please refer to Section 1.2 of this report).

9.6 Management Actions

Please refer to the following table for the specific management actions.

Table 25: Management Actions (SbM: Significance before Management Measures; SaM: Significance after Management Measures, LoW: Live of Works; CbA: Can be Avoided; R: Reversible; Ir: Irreversible; ST: Short Term; MT: Medium Term; LT: Long Term)

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	**Impact Area**	**Potential Impacts**	SbM	**CbA, R, Ir**	**Mitigation Measures**	**SaM**	**Performance Objectives**	**Goals**	**ST (1-12 months)**	**MT (1-5 Yrs.)**	**LT (5 Yrs. +)**	**LoM**	**Compliance with Standard**	**Functional Requirements for Monitoring**	**Responsibilities**	**Monitoring and Reporting Frequency**
Planning Phase																
Legal Requirements (Environmental Permits)	Legal Compliance	Unlawful water and waste activities, which could lead to NWA Directives and Section 24G Rectification fines.	-14	CbA	A legal assessment of all activities and future planned activities must be undertaken annually to ensure that all activities are authorised.	17	To operate within the enviro-legal ambits of South Africa.	Ensure that all activities undertaken by the Works are lawful with the required environmental licences in place.	x				Compliance in terms of Regulatory Requirements and the implementation of the EMP.	Appointment of an Independent Environmental Control Officer (ECO) to assess compliance with the EMP.	Independent ECO	Monthly for the construction phase. Thereafter annual external audits can be undertaken. Monthly update of legal register.
					All legally appointed personnel responsible or involved in water use activities and activities associated with the Environmental Authorisations on site must receive training on the requirements of the Environmental Authorisations, Permits, AEL and relevant Environmental Legislation.		To be aware of the latest environmental legal requirements. Proactive knowledge of potential system errors and/or constraints will avoid potential non-compliance or process delays.	All Departments responsible for development of the projects, must understand the requirements of the environmental legislation and approved Environmental Authorisations and must include such into their planning processes. Operational Environmental Management System that addresses the needs and responsibilities of all departments.	x				Compliance in terms of Regulatory Requirements and the implementation of the EMP.	Monthly environmental meetings must be implemented to discuss the mining plan, implementation thereof, implication on current Environmental Regulations and potential constraints and liabilities. Minutes must be kept of these meetings and action plans with responsibilities must be drafted. The following must be placed at the site and is applicable to all activities: • Relevant Legislation; • Acts; • Regulations	SHEQ Department to Coordinate	Monthly Environmental Meetings. Monthly update of legal register. Regular updates of Code of Practices and Strategic Operating Plans. Annual induction which includes the relevant contents of Environmental Authorisations, approved Environmental Reports and applicable Environmental Legislation. No go zones map - immediately
					Ensure that the storage areas for hazardous chemicals are purchased in line with the requirements of the SDSs.		Compliance with the SDSs relating to the transport,	Zero incident reports regarding the transport,				x				

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Ensure that the design of the plant and chemical storage areas fulfil the requirements of all SDSs in terms of transportation, storage, fire protection and storage requirements. Quarterly internal audits on the lawful implementation of the Environmental Authorisation must be undertaken during the construction phase, where after biannual audits can be undertaken once construction has been completed. Annual external inspections must be undertaken at the areas where waste is being removed to ensure the implementation of the cradle to grave principle. The legal register must be updated as part of the implementation and regular update of an Environmental Management System (EMS).		handling and storage of chemicals.	handling and storage of chemicals.						• Codes of Practice (COPs) • Standard Operating Procedures (SOPs) Management and staff must be trained to understand the contents of these documents and to adhere thereto Environmental Awareness training must be provided to employees. A site layout with all the no-go zones should be compiled.		
Planning towards Water and Energy Effectiveness	Water and Energy Effectiveness	Increase in water consumption. The total water demand for the project is indicated as 268 000m³/a, which constitutes a 75% use when converted from m³/hr to m³/a. It should be noted that with the consideration of vapour recycling, this volume may reduce substantially. This will form part of the Water	-12		Recycling of vapour within the plant should be considered to reduce water supply requirements.	12	Reduce additional water consumption requirements.	Reduce additional water consumption requirements.				x	National Water Act.	Water Usage Monitoring	Engineering Department	Daily

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
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		Conservation and Demand Management Strategy which will be developed by the site to reduce water usage.														
		Release of Carbon Gases. Strategic placing of infrastructure and Equipment consideration may reduce energy consumption and reduce Carbon Gasses.	-13	CbA	Effective abatement equipment must be implemented as part of the Processing Plant design and development phase to limit emissions. The licence holder should undertake the necessary investigation to replace the diesel operated vehicles (two front end loaders and fork lifts) with battery operated equipment, solar charging systems. In addition to this investigations should be implemented to reduce Eskom supply with renewable sources. An AEL must be obtained for the purposes of this project prior to the operational phase.	13	Work towards a zero Scope 1 emission plant	Work towards a zero Scope 1 emission plant				x	National Environmental Management: Air Quality Act: Regulations: National Greenhouse Gas Emission Reporting and Company Targets	Greenhouse Gass Monitoring	Engineering Department	In terms of AEL
Establishment of infrastructure along the boundary of the Works.	Landowner Relationships	Unlawful placement of activities	-11	CbA	All construction activities must be conducted outside of the approved servitudes of railway lines and powerlines. Where encroachment is required, the necessary approvals must be obtained from the approval bodies. Planning construction activities in consultation with nearby residences. Information regarding construction activities should be provided to all nearby residences or land users within a 100 m radius of the proposed site. Such information includes: - Contact details of a responsible person on site	-4	Maintain good relationship with surrounding landowners. Operate within the restrictions set by the Transnet.	Approved operating procedures, safety files and communication structure and compliance thereto. Management of impacts on rail users during construction, operational and decommissioning phases.				x	Compliance with Health and Safety Requirements. Compliance with Environmental Authorisations. Compliance with the national Roads Regulations and specific SANRAL requirements. Compliance	Initiate discussions with Transnet regarding the procedures for the construction activities and placement of infrastructure.	Project Manager from the Development	Immediately

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					should complaints arise to reduce emissions in a timely manner.								with Transnet requirements.			
					An open channel of consultation must be maintained throughout the process.									Development of code of Practices and Health and Safety Requirements.	SHEQ Department to Coordinate	Immediately
					The Standard Operating Practices (SOP) and/or Contactors SOP for the establishment of infrastructure around the railway line and power lines must be compiled.									Maintain discussions and feedback meetings with the impacted parties and maintain records of such consultation.	Environmental Manager	Once off prior to the Construction Phase and annually thereafter (as required).
Construction Phase																
Site Clearance and Infrastructure Establishment	Geology	Clearing and landscaping of terrain for the establishment of infrastructure may have impact on the pre-construction layout. This is not regarded a significant impact, due to the presence of activities as a result of mining activities.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Topography	Clearing and landscaping of terrain for the establishment of infrastructure may have impact on the pre-construction layout and the topographic function of the	-8	CbA	The footprint areas of all surface infrastructure must remain as small as possible within the parameters of operational and engineering requirements.	-5	Remain within demarcated areas. Design facilities to blend into the existing site character as far as	No disturbed areas should remain beyond the demarcated areas. 100% compliance to remain with approved footprint areas.	x				Soil Integrity, Erosion and Loss protection. No impact on land not owned by the Works.	Appointment of an Independent Environmental Control Officer to assess compliance with the EMP. The SHERQ department should undertake ongoing site	Independent ECO and SHEQ Department	ECO: Monthly for the construction phase. Thereafter annual external audits can be undertaken. SHERQ: Weekly monitoring
					Clean and dirty water management structures must be put in place at the start of the construction to ensure that dirty water runoff does not leave the site boundary.											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		site. The change in topography could impact on and increase in surface runoff, resulting in erosion and siltation into surrounding properties.			Footprint areas should be accessed through existing road network, where feasible to avoid unnecessary excavation. Excavation and long-term stockpiling of soil should be limited within the demarcated areas as far as practically possible Linear infrastructure must follow existing routes for as far as practically possible or the natural contours of the area. Construction areas must be clearly demarcated to control movement of personnel and vehicles, providing clear boundaries for construction sites in order to limit the spread of impacts. Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.		practically possible.							monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements.		
	Ecology	Loss of vegetation and habitat due to vegetation clearance.	-10	CbA	A weed eradication programme must be implemented prior to the removal of soil, due to the extensive presence of invader species (Wattles) on the current topsoil stockpile. Preconstruction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.	-2	Limit the impact of the mining operation on the Ecological Setting of the area.	No unlawful removal of flora of conservation importance should take place. Initiate rehabilitation of disturbed areas once the construction phase has been completed. Successful self-succession to be achieved.	x			x	Limit the impact of the construction on the Ecological Setting of the area.	A weed eradication/ AIP control plan must be implemented on site. This must be undertaken prior to the growing season. Appointment of an Independent ECO to assess compliance with the EMP. The SHERQ department	SHEQ Department and a Specialised Ecologist.	ECO: Monthly for the construction phase. Thereafter annually external audits can be undertaken. SHERQ: Weekly monitoring Biodiversity Action Plan Development and update: Annually

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Prior to any vegetation clearance activities taking place a walkdown of the footprint must be undertaken and all floral and faunal SCC encountered must be GPS marked and the necessary permits applied for with the relevant national and provincial departments. The site walk down is to be conducted prior to clearance activities and ideally post good rains between November and February when the smaller bulbous plants are growing and visible.			Eradication of invasive species within the mining area footprint.						should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. Environmental Awareness training must be provided to employees.		Training; Annually Alien and Invasive Plant (AIP) Management: Quarterly implementation and weekly inspections.
					Draw up a procedure clearly reflecting the method and phases of clearance of vegetation only in areas where construction will take place.											
					Should any protected species be identified, the necessary permits must be obtained for the removal of these species.											
					Construction areas must be clearly demarcated to control movement of personnel and vehicles, providing clear boundaries for construction sites in order to limit the spread of impacts. Markers and pegs will be erected and maintained along the boundaries of the working areas, access roads, haul roads and paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.											
					Fire management measures should be in place.											
					No vehicles are allowed to indiscriminately drive through sensitive habitat and natural areas. All vehicles must stick to designated roads and no											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					additional roads may be developed unless absolutely necessary.											
					Removal of vegetation must be undertaken in a phased approach to limit surface exposure.											
					Temporary erosion control measures may be used to protect the disturbed soils during the construction phase until adequate vegetation has established.											
					Clean and dirty water separation must be implemented early in the construction phase, especially down-gradient of construction areas to ensure that the natural runoff patterns are impacted as little as possible.											
		The unmanaged disposal of waste, could result in the spread of invader species, as well as the influx of opportunistic species.	-12	CbA	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste.	-5	Proper waste management practices on site.	No unlawful disposal of waste. Registration of all waste handling and/or storage areas on site.	x			x	Ongoing Rehabilitation	Ongoing waste classification and management processes to be implemented. Updated waste inventory to be available on site. Waste Management and Handling Procedure to be available on site and updated regularly.	SHEQ Department	SHEQ: Weekly inspections. Regular update in terms of procedure requirements. Waste Classification of Waste Rock every five (5) years.
					Develop dedicated waste handling areas, fit for purpose and prevent the spread of waste.											
		Spread of invader species	-13	CbA	A weed eradication programme must be implemented prior to the removal of soil, due to the extensive presence of invader species (Wattles) on the current topsoil stockpile. This programme must guide the Works on how to remove the weeds prior to soil clearance in	-2	Limit the impact of the Works operation on the Ecological Setting of the area.	No unlawful removal of flora of conservation importance should take place. Initiate rehabilitation of	x			x	Limit the impact of the construction on the Ecological Setting of the area.	A weed eradication/ AIP control plan must be implemented on site. This must be undertaken prior to the growing season.	SHEQ Department and a Specialised Ecologist.	AIP Management: Quarterly implementation and weekly inspections.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					order to avoid further spread of these species.			disturbed areas once the construction phase has been completed. Successful self-succession to be achieved. Eradication of invasive species within the mining area footprint.								
					Edge effects arising from the operational and maintenance activities of the proposed development, such as erosion and AIP proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2020), in line with the NEMBA Alien and Invasive Species Regulations (2020).											
					AIP monitoring and clearing/control should take place throughout the construction phase of the development, and a 30 m buffer surrounding the proposed project loop should be regularly checked for AIP proliferation and to prevent inward and or/outward spread of AIPs, notably into non infested areas outside of the proposed railway loop or into newly rehabilitated areas											
					Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.											
		Accidental death of animals on the roads and other causes of animal fatalities	-11	CbA	Clearly marked signs will be erected along the transportation routes around the inner boundary of the site to create awareness of animal crossings.	-6	Limit the impact of the mining operation on the Ecological Setting of the area.	Zero animal fatality.	x			x	Creation of Awareness.	Induction with the view on creating environmental awareness.	SHEQ Department	Annual training for permanent staff. Induction at the start of each visit for new contractors.
					A clearly marked and enforced vehicle speed will be											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					implemented on the internal transportation routes.											Records must be kept of animal fatalities; this must be reviewed annually.
					Weekly inspections must be done around the fences of the Works to inspect these for safety as well as the presence of risks to animals.											
					Records must be kept of all animal fatalities within the Works' boundaries.											
					Environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc											
					If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.											
					Vehicles may only travel on demarcated roads on site.											
					A fire management plan must be developed for the site.											
					Fire belts must be constructed around the boundaries of the site.											
					In terms of fencing: • no electrified strands should be placed within 30 cm of the ground as some species are susceptible to electrocution from electric fences • the electrified strands should be placed on the inside of the fence and not the outside											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					• there should not be a large gap between the inner and outer fence if two are required • a single fence with mesh or plain wire strands on the outside and electrified strands on the inside is recommended. The poaching and/or hunting of animals will be strictly forbidden.											
		Habitat degradation due to dust: Increased dust will occur in all areas where vegetation is cleared. Dust will be caused by excavation, and construction. Dust settling on plant material can reduce plant productivity, growth and recruitment.	-8	CbA	Maintain the current air quality monitoring stations that determine fallout. Dust suppression should be undertaken where and when dust is present.	-5	Limit the impact of the Works operation on the Ecological Setting of the area.	Remain within the dust fallout limits in terms of the NEM:AQA.	x			x	Limit the impact of the construction on the Ecological Setting of the area.	Maintain a dust monitoring programme.	SHEQ Department	Monthly monitoring with annual reporting onto the NAEIS. Annual assessment of the ecological status of the area by undertaking an update and/or audit on the BAP.
	Soil and Land use	The removal and stockpiling of topsoil may lead to a loss of soil resource and land capability through erosion of the stockpiles and chemical and physical degradation.	-11	CbA	Excavation and long-term stockpiling of soil should be limited within the demarcated areas Excavated materials should not be contaminated and it should be ensured that the minimum surface area is taken up. The stockpiles may not exceed 2m in height Topsoil should be stockpiled on designated topsoil stockpiles, unless around linear infrastructure, where the topsoil could be stockpiled next to the linear structure. The duration of stockpiling should be minimised where possible. Vegetation debris, logs and leaf litter should be	-5	Limit the loss of soils as far as possible and ensure that the integrity remains during stockpiling for the purposes of successful rehabilitation. Protect the soil resources within the area in which the site operates.	The integrity of the soils stockpiled must remain suitable for the purposes of rehabilitation. No disturbed areas should remain beyond the demarcated areas. 100% compliance to remain with approved footprint areas.	x	-	-	-	Soil Integrity, Soil Erosion and incorrect stockpiling of topsoil.	Appointment of an Independent ECO to assess compliance with the EMP. The SHERQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. Erosion	Independent ECO and SHERQ Department.	ECO: Monthly for the construction phase. Thereafter annual external audits can be undertaken. SHERQ: Weekly monitoring. Induction Updates: Every 18 months

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					retained where possible for reuse during rehabilitation. A topsoil stockpile should be treated with temporary soil stabilisation methods; such as the application of organic matter to promote soil aggregate formation, leading to increased infiltration rate, thereby reducing soil erosion. Also, the use of lime to stabilise soil pH levels. Thereafter a short-term topsoil amelioration program should be based on the soil chemical status after levelling and should consists of a pre-seeding lime and fertilizer application. Stockpiles should be managed to ensure that losses from the piles are minimised and that additional damage to the physical, chemical or biotic content is minimised. In addition, measures of soil fauna diversity should be used to monitor stockpile fertility. Soil eDNA techniques are well placed for this type of temporal monitoring and should be considered as part of the ongoing topsoil management and monitoring protocols.									protection measures should be implemented and monitored on areas identified. Photographic records of assessments must be kept. Induction should be reviewed and updated biannually.		
					Restrict the amount of mechanical handling, as each handling event increases that compaction level and the changes to the soil structure. Wherever possible, the 'cut and cover' technique (where the stripped soils is immediately placed in an area already prepared for rehabilitation, thus avoiding stockpiling) should be used.											
					Temporary stockpiles must be protected by means of suitable geotextiles such as hessian sheeting, silt curtains, sandbags											

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					etc. to prevent contamination of runoff and sedimentation of freshwater resources in the vicinity of the surface infrastructure and should remain outside of the buffer zones.											
					Soil erosion should be controlled on stockpiles by having control measures to reduce erosion risk such as erosion control blankets, soil binders, revegetation, contours, diversion banks and spillways.											
					Temporary berms can be installed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion											
					Alternatively topsoil can be transported to the Eastern Portion, or the Historic Slag dump for rehabilitation.											
		Soil compaction - Heavy equipment traffic during construction and exploration activities is anticipated to cause soil compaction.	-8	CbA	The contractor will ensure that all activities, material and equipment storage and personnel movement take place within the designated area. All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible; to avoid unnecessary compaction of the surrounding soils	-5										
					Laydown areas should be located within already disturbed areas.											
					Soil Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. If they have to be moved when wet, shovel and truck should be used as bowl scrapers create excessive											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
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					compaction when moving wet soils.											
					Compaction should be minimised by use of appropriate equipment and replacing soils to the greatest possible thickness in single lifts.											
					Heavy equipment movement over replaced soils should be minimised											
					Minimise compaction during smoothing of replaced soils by using dozers rather than graders.											
					Following placement, compacted soils should be ripped to full rooting depth (at least 30 cm where feasible as the bare minimum seedbed) to allow penetration of plant root.											
					Compacted soils adjacent to the focus areas can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation.											
					Compaction of soil can be mitigated by ripping the footprint and introducing both organic and inorganic fertilizers.											
					All contractors must receive induction. The induction should be updated on site, to make provision for the site plan and a detailed explanation on the purpose of the no-go zones, presence of protected species, presence of the Protected Areas and ESAs and the meeting thereof.											
		Clearing vegetation will result in the exposure of soil, which may in turn lead to soil erosion, in	-11	CbA	Clean and dirty water systems must be established prior to construction.	-5										
					Temporary erosion control measures such as berms should be used to protect the disturbed soils during the construction											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		addition to this, stockpiling of topsoil material on sloping areas leading to increased runoff and erosion.			phase until adequate vegetation has established											
					Bare soils within the access roads should be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast											
					No construction or project related activities may be undertaken outside of the demarcated areas.											
					Ensure the required erosion protection measures are monitored and corrected where necessary.											
					Bare soils can be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast											
					Natural vegetation establishment (self-succession) will be encouraged on cleared areas, and topsoil stockpiles. All disturbed areas adjacent to the focus areas should be re-vegetated with an indigenous grass mix, where necessary, to re-establish a protective cover to minimise soil erosion and dust emission.											
					If natural succession of vegetation is not established within one rainy season, after rehabilitation, the disturbed areas and areas adjacent to the infrastructural areas must be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission.											

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					A fire management plan must be developed for the site.											
					Fire belts must be constructed around the boundaries of the site.											
					Water pipelines must preferably follow existing roads or other linear infrastructure.											
		Potential of Soil Contamination	-11	CbA	A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction works.	-5	Limit the loss of soils as far as possible and ensure that the integrity remains during stockpiling for the purposes of successful rehabilitation. Protect the soil resources within the area in which the site operates.	The integrity of the soils stockpiled must remain suitable for the purposes of rehabilitation.	x			x	Soil integrity	Appointment of an Independent Environmental Control Officer to assess compliance with the EMP. The SHERQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. Erosion protection measures should be implemented and monitored on areas identified. Photographic records of assessments must be kept.	Independent ECO and SHERQ Department.	ECO: Monthly for the construction phase. Thereafter biennial external audits can be undertaken. SHERQ: Weekly monitoring
					Construction requirements specific for the Chemical Storage Areas: • Tanks will be individually contained facilities, without pipeline interlinkages; • All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid. • Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume. • The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4 as opposed to the metal of carbon steel tanks. • The back up chemical storage and top up tanks will be placed about 800-1000m from each												

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					other; • The back up chemical storage and supply chemical storage tanks will be placed about 800-1000m from each other; • All tanks will be ventilated in terms of the required Safety Datasheets (SDSs) standards; • Strict storage requirements will be implemented (e.g. dry areas, with ventilation at floor level, spill collection, with strict prohibitions on storage requirements); • The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials; • Reactivity hazards will be considered and managed; • Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented; • Secondary containment must be provided to ensure that off-loading of solution occur within the bund wall.										
					All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.										
					Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.										
					Refuelling must be undertaken over hard park bunded areas that are adequately sized to capture and contain spillages.										

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Machinery and vehicles should be parked on appropriately lined areas.											
					Drip trays must be employed under stationary machinery.											
					An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress.											
					Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site.											
		Contamination of soils as a result of a lack of sanitary services	-11	CbA	Chemical toilets must be readily available to employees where permanent infrastructure is not available.	-5										Daily internal inspections Annual review of supply and removal companies contracts and permits.
					Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.											
	Hydrology	There are no river system in close proximity to the project. In terms of hydrology it is important that clean and dirty water be separated that runoff from the dirty area does not enter the clean water setting.	-8	CbA	Clean and Dirty water separation systems should be implemented.	-5	Operate the water management circuit on site to increase mining efficiency and reduce the need for maintenance of these facilities. Protect the surrounding	Implement the SWMP on site. Compliance in terms of the WUL and NWA.	x			x	Quality of water within the overall water catchment and internal water circuit. Compliance in terms of the WUL and the SWMP.	The water quality (constituents listed in the WUL) of the dam must be monitored monthly and records must be kept of these result in a centralised system. Analysis of results must be undertaken by an accredited laboratory.	SHEQ Department and Hydrologist	Surface Water Monitoring in line with the current monitoring programme. Monitoring of the conditions of the Wetland Systems biannually (winter and summary monitoring).
					Vegetation clearance should be kept to an absolute minimum.											
					The plant and all chemical tanks must be constructed on surfaced areas. All dirty areas, or areas which could lead to contamination of groundwater, surface water or soil resources must be suitably bunded.											
					Pumps must be available to pump contained dirty water spills from the area for either											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					reuse of legal disposal to maintain the capacity of the containment systems.		demarcated watercourses.									
		Use of heavy machinery, trucks and vehicles for construction purposes - Potential hydrocarbon spillages washed into downslope drainage channels.			Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide. Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages. Machinery and vehicles should be parked on appropriately lined areas. Drip trays must be employed under stationary machinery. The required Code of Practice for the operations of this facility should be develop. Spillages should be reported immediately, and spill kits should be readily available at all times.									Regular inspections must be undertaken to ensure that the facility is operated in line with the GN704 (1999) requirements. Annual compliance in terms of the designs of the facility and compliance in terms of the WUL must be undertaken. The integrity of the demarcated watercourses must be maintained.		Annual vegetation monitoring of rehabilitated areas. Annual GN704 Audit.
	Groundwater	Spills of chemicals and hydrocarbons during the construction phase could lead to groundwater pollution if not managed.	-7	CbA	Clean and Dirty water separation systems should be implemented. The plant and all chemical tanks must be constructed on surfaced areas. All dirty areas, or areas which could lead to contamination of groundwater, surface water or soil resources must be suitably bunded. Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems. Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.	-4	Limit the impact of the mining operation within the overall water catchment.	Achieve compliance to the water quality objectives as agreed to between the Licence Holder and the DWS.	x			x	Quality of water within the overall water catchment and internal water circuit.	The groundwater quality (constituents listed in the WUL) must be monitored quarterly and records must be kept of these result in a centralised system. Analysis of results must be undertaken by an accredited laboratory. Numerical groundwater models must be	SHEQ Department and Hydrogeologist	Quarterly groundwater monitoring or as stipulated in the WUL. Annual numerical models or as stipulated in the WUL.

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages.									used to determine the movement of any potential pollution plume.		
					Machinery and vehicles should be parked on appropriately lined areas.											
					Drip trays must be employed under stationary machinery.											
					The required Code of Practice for the operations of this facility should be develop.											
					Spillages should be reported immediately, and spill kits should be readily available at all times.											
					Groundwater monitoring should be undertaken to include the assessment of the potential impacts of this facility.											
	Air Quality	Construction activities and material movement may temporarily result in dust dispersion.	-6	CbA	Maintain the current air quality monitoring stations.	-4	Recording of dust fall out to determine trends.	Meeting ambient dust fall out limits in terms of applicable NEM:AQA Regulations.	x			x	National Dust Regulation Compliance.	Dust dispersion will be monitored in line with the current dust monitoring programme	SHEQ Department.	Monthly Monitoring with Annual Reporting.
					All construction vehicles should adhere to a low speed (30km/h for trucks and 40km/h for light vehicles) limit to avoid collisions with susceptible species such as snakes and tortoises.											
					Implement dust suppression in and around the construction area where required.											
	Visual	No impact is foreseen. The activities are planned within the existing Works footprint, with the plant located next to the Mn Slag Stockpile	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Noise	Minimal noise is expected during	-5	CbA	Equipment will be well maintained to reduce excessive noise creation.	-4	Remain with the required health and	Remain within the regulated guidelines and	x				Ambient noise monitoring.	Adjacent landowners will be informed of	SHERQ Department	Ongoing consultation with surrounding

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		the construction activities.			Construction activities may only be undertaken during the day period (6h00 to 18h00). A complaints register should be kept on site and surrounding landowners should be notified of its availability and the contact procedure.		safety standards.	limits as required by the OHSA.						the planned dates of the significant land clearance activities where applicable. Daily noise monitoring will be undertaken in the areas where high levels of noise take place.		landowners. Conduct annual noise monitoring on the boundaries of the site. Regulator noise monitoring in terms of OHSA.
	Heritage and Palaeontology	No impacts are expected on heritage or paleontological sites.	-10	CbA	The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. A short summary of chance find procedures is discussed below. This procedure applies to the developer's permanent employees, its subsidiaries, contractors and subcontractors, and service providers. The aim of this procedure is to establish monitoring and reporting procedures to ensure compliance with this policy and its associated procedures. Construction crews must be properly inducted to ensure they are fully aware of the procedures regarding chance finds as discussed below. • If during the pre-construction phase, construction, operations or closure phases of this project, any person employed by the developer, one of its subsidiaries, contractors and	-4	Protect heritage resources for future generations.	Ensure that there is no occurrence of impacts to heritage resources.	x			x	Presence of archaeological artefacts.	Development of a Heritage management plan. Implementation of a Chance find procedure during construction. Known graves should be indicated on development plans and avoided. Training of all contractors and responsible parties must be undertaken to ensure that all parties are aware of the need to protect these resources and what to observe for. Daily inspections must be undertaken during the site clearance and excavation phases.	Engineering Department	Daily internal inspections

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					subcontractors, or service provider, finds any artefact of cultural significance or heritage site, this person must cease work at the site of the find and report this find to their immediate supervisor, and through their supervisor to the senior on-site manager. • It is the responsibility of the senior on-site Manager to make an initial assessment of the extent of the find, and confirm the extent of the work stoppage in that area. • The senior on-site Manager will inform the ECO of the chance find and its immediate impact on operations. The ECO will then contact a professional archaeologist for an assessment of the finds who will notify the SAHRA The possibility of the occurrence of subsurface finds cannot be excluded. Therefore, if during construction any possible finds such as stone tool scatters, artefacts or bone and fossil remains are made, the operations must be stopped and a qualified archaeologist must be contacted for an assessment of the find and therefor chance find procedures should be put in place as part of the EMP. The following procedure is only required if fossils are seen on the surface and when drilling/excavations commence. 8. When excavations begin the rocks and must be given a cursory inspection by the environmental officer or											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					designated person. Any fossiliferous material (trace fossils, fossils of plants, insects, bone or coalified material) should be put aside in a suitably protected place. This way the project activities will not be interrupted. 9. Photographs of similar fossils must be provided to the developer to assist in recognizing the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones. This information will be built into the EMP's training and awareness plan and procedures. 10. Photographs of the putative fossils can be sent to the palaeontologist for a preliminary assessment. 11. If there is any possible fossil material found by the developer/environmental officer then the qualified palaeontologist sub-contracted for this project, should visit the site to inspect the selected material and check the dumps where feasible.											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					12. Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits. 13. If no good fossil material is recovered, then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils. 14. If no fossils are found and the excavations have finished then no further monitoring is required.											
	Socio Economic	The proposed PV facility project could also lead to some indirect job creation within the informal sector, even if	-9	CbA	Prioritise local labour in the recruitment process as part of the company's own recruitment policy or as part of contractor management plan, especially with regards to unskilled or lower skilled opportunities	12										

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		this is not necessarily authorised. This refers to the temporary development of food stalls by informal vendors near the site to cater for the needs of the construction team members.			If possible, a percentage of the workforce should be reserved for women and the disabled The project proponent and contractors should create conditions that are conducive for the involvement of entrepreneurs, small businesses, and SMME's during the construction process Tender documentation should contain guidelines for the involvement of labour, entrepreneurs, businesses and SMME's from the local sector											
		Project-induced population influx	-10	CbA	Communication efforts concerning job creation opportunities should refrain from creating unrealistic expectations. Skills development and on-site training would be imperative to enhance capacity building and the possibility of workers being employed on similar construction related projects in future	12										
	Geology	No direct impact.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Topography	No direct impact.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waste Management and Handling Hydrocarbon spills within the Mining Area and the management of Domestic and Hazardous Waste	Soils	Contamination of soil resources due to hydrocarbon and chemical spills.	-11	CbA	Storage of fuels and oils, the refuelling of vehicles and equipment maintenance must be limited to designated, bunded (bunds to be 110% of volume of the materials stored) areas. All fuels and soils must be stored in appropriate containers. Chemicals and hazardous material must be stored in suitable containers, fit for purpose and in line with SDS requirements. Where drip trays are too small, specially prepared, non-pervious bunds with solution	-5	Protecting of soil integrity.	Zero presence of contaminated land due to early detection and implementation of actions.	x			x	Soil Pollution Prevention	The SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. This should be undertaken by means of a thorough site visit, record keeping of	SHEQ Department	ECO: Annual external audits can be undertaken. SHEQ: Weekly monitoring.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					trenches must be used to capture spillages									findings in a checklist format, issuing of non-conformances to responsible parties, listing thereof on the Isometrics or similar reporting system and feedback to the management team.		
					A spill kit must be provided to be used in the event of a spill.									Ensure that a Hydrocarbon Management Procedure and Spill Prevention and Emergency Spill Response Plan is available on site and updated regularly.		Regular update in terms of procedure requirements.
					Oils and potentially hazardous materials must be disposed of at a licensed facility and waste certificates obtained.											
					If a spill occurs, the contaminated soil must be removed immediately. Contaminated soil must be stored according to best practices until it can be disposed of at a suitably licensed facility.		Awareness creation on site regarding duty of care and waste management.							Induction with the view on creating environmental awareness.		Annually for permanent staff. Start of each visit for contractors.
					Safety signage must be used at designated storage areas.											
					Any emulsion or other contaminants should be collected and the soils remediated immediately.											
					All workers must undergo an induction which includes environmental awareness training to make them aware of the environmental incident management procedures as well as the importance of complying with management measures.											
		Contamination of soils as a result of	-11	CbA	Chemical toilets must be readily available to employees where	-5	Protecting of soil integrity.	Zero presence of contaminated	x			x	Soil Integrity	Contracts must be in place for	SHEQ Department	Daily internal inspections

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		a lack of sanitary services			permanent infrastructure is not available. Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.			land due to early detection and implementation of actions.						the provision of chemical toilets where required. Removal companies must have the necessary contracts and permits in place.		Annual review of supply and removal companies contracts and permits.
		Handling of building Rubble	-7	CbA	Burying of any waste including rubble, domestic waste, empty containers on the site etc. should be strictly prohibited and all construction waste must be removed to an approved disposal site. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. All waste must be removed by licensed contractors and disposed of at a licensed landfill site or be disposed of at a licensed landfill site. As a duty of care and the cradle to grave principles, the Licence Holder should regularly inspect disposal site to ensure that best practices are implemented. Recycling practices must be investigated and implemented on site where practical.	-5		Maintain an accurate recording of waste and submission of such recording to the Department.	x			x				
								Maintain regular covering of the landfill site on site.	x			x				
	Ecology	The unmanaged disposal of waste, could result in the spread of invader species, as well as the influx of opportunistic species.	-12	CbA	Develop dedicated waste handling areas; prevent access to rodents and opportunistic species; prevent the spread of waste. Develop dedicated waste handling areas, fit for purpose and prevent the windblown litter.	-5	Proper waste management practices on site.	No unlawful disposal of waste. Registration of all waste handling and/or storage areas on site.	x			x	Ongoing Rehabilitation	Ongoing waste classification and management processes to be implemented. Updated waste inventory to be available on site.	SHEQ Department	SHEQ: Weekly inspections. Regular update in terms of procedure requirements. Waste Classification of

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
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														Waste Management and Handling Procedure to be available on site and updated regularly.		Waste Rock every five (5) years.
	Hydrology	Handling of Hazardous Waste within workshops, water containment facilities.	-11	CbA	Clean and Dirty water separation systems should be incorporated. A detailed waste management strategy will be established and implemented, which will clearly demarcate the containments for different waste streams. Waste management training must be implemented on site. Clear signs informing staff of waste management practices must be implemented on site. All contaminated material must be contained in mobile sumps. The mobile sumps must maintain a suitable freeboard, to ensure when these are moved/transported, that no spillage will occur. Hazardous waste handling should only take place within bunded and/or lined areas. Hazardous waste should be removed by a licenced removal company and taken to a suitable and licenced landfill site. Clean spills, if occur within 24 hours. Documentation of removal and safe disposal must be available on site. The Licence Holder will adopt a cradle-to grave approach to ensure that the waste is removed and disposed of in a legally compliant manner.	-6	Protect the integrity of the Storm Water Management System.	Aim to achieve a zero-spill record. Maintain a safe disposal record on the disposal of hazardous waste. Provide training to all staff on best practices regarding waste management every year.	x	x			Surface Water Pollution & Soil Assessments.	To ensure a proactive approach, the SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. The water quality (constituents listed in the WUL) must be monitored and records must be kept of these result in a centralised system. Analysis of results must be undertaken by an accredited laboratory. An incident reporting procedures should be available on site and definitions must be developed to determine when	SHEQ Department	Assessments: Weekly. Monitoring: As per approved WUL Reporting of incidents in terms of Environmental Authorisations, but generally within 24 hours of occurrence. Update of the Incident Reporting Procedure in terms of the procedure requirements.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Notify the relevant regulatory authorities in the event of the occurrence of a reportable incident.									an incident is reportable. Reportable incidents should be reported to the Regulatory Authority as per the regulatory requirements, as well as stipulations as part of the WUL and Environmental Authorisations.		
					Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance requirements must be documented and an action plan developed.											
	Groundwater	Large scale hydrocarbon or chemical spills could be present at the mining area	-12	CbA	Clean and Dirty water separation systems should be incorporated.	-6	Protect the groundwater resources to ensure that limited to no impact on groundwater resources occur as a result of the mining operations.	Achieve compliance to the water quality objectives.	x	x		x	Groundwater Pollution and potential trends & Soil Assessments.	To ensure a proactive approach, the SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. The groundwater quality (constituents listed in the WUL) must be monitored monthly and records must be kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory.	SHEQ Department	Assessments: Weekly. Monitoring: Asper approved WUL
					No activities associated with hydrocarbons and/or chemicals may be undertaken outside of an effectively designed and contained area.											
					All used oils must be removed from site by a licensed company and disposed of at a suitably licensed site.											
					Any spills occurring during the collection process must be cleaned up immediately.											
					Any significant spills must be captured in the incident reports and must be reported to the relevant department (DARDLEA, Catchment Management Agency/DWS).											
					All equipment and machinery should be kept in good working order.											
					A clean up procedure (i.e. Works Instruction) must be in place. Clean spills, if occur within 24 hours.											
		Handling or Hazardous Waste within	-10	CbA	Clean and Dirty water separation systems should be incorporated.	-6										

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		workshops and general area.			The workshop should be designed with the suitable waste containment measures (berms, sumps, oil separators).			Maintain safe disposal record on the disposal of hazardous waste.	x							
					Waste management training must be implemented on site.											
					Clear signs informing staff of waste management practices must be implemented on site.											
					Hazardous waste handling should only take place within bunded and/or lined areas, with a capacity of at least 110% of the volume stored.											
					Hazardous waste should be removed by a licenced removal company and taken to a suitable and licenced landfill site.											
					Documentation of removal and safe disposal must be available on site.											
		Handling and Storing of Domestic Waste	-7	CbA	Clean and Dirty water separation systems should be incorporated.	-5		Maintain a 100% accurate recording of waste and submission of such recording to the Department.	x	x		x				
					Waste management training must be implemented on site.											
					Clear signs informing staff of waste management practices must be implemented on site.											
					All waste must be removed by licensed contractors and disposed of at a licensed landfill site.											
					As a duty of care and the cradle to grave principles, the Licence Holder should regularly inspect disposal site to ensure that best practices are implemented.											
					Recycling practices must be investigated and implemented on site where practical.											
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Noise	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Visual	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	**Impact Area**	**Potential Impacts**	SbM	**CbA, R, Ir**	**Mitigation Measures**	**SaM**	**Performance Objectives**	**Goals**	**ST (1-12 months)**	**MT (1-5 Yrs.)**	**LT (5 Yrs. +)**	**LoM**	**Compliance with Standard**	**Functional Requirements for Monitoring**	**Responsibilities**	**Monitoring and Reporting Frequency**
	Social	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operational Phase																
Operation of the Plant and Chemical Storage	Topography	No further impacts foreseen.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Soil Management	Potential of Soil Contamination	-11	CbA	A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction Works'. Construction requirements specific for the Chemical Storage Areas: • Tanks will be individually contained facilities, without pipeline interlinkages; • All systems will maintain capable secondary containment measures. Secondary containment through concrete diking with an acid-resistant coating will be implemented, as concrete will react with the sulfuric acid. • Engineering safety protocols require that secondary containment be capable of retaining at least 110% of the tank system's total volume. • The use of thermoplastics such as poly tanks is currently considered for storage, as this material is not reactive with H_2SO_4 as opposed to the metal of carbon steel tanks. • The back up chemical storage and top up tanks will be placed about 800-1000m from each other; • The back up chemical storage and supply chemical storage tanks will be placed about 800-1000m from each other; • All tanks will be ventilated in terms of the required Safety Datasheets (SDSs) standards; • Strict storage requirements will be implemented (e.g. dry	-5	Protection of the integrity of soil resources and the avoidance of soil pollution.	Zero presence of contaminated land due to early detection and implementation of actions.				x	Soil Pollution Prevention	The SHEQ Department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. This should be undertaken by means of a thorough site visit, record keeping of findings in a checklist format, issuing of non-conformances to responsible parties, listing thereof on the Isometrics or similar reporting system and feedback to the management team.	SHEQ Department and Responsible Supervisor	ECO: Annual external audits can be undertaken. SHEQ: Weekly monitoring.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					areas, with ventilation at floor level, spill collection, with strict prohibitions on storage requirements); • The chemicals will be stored in a cool, dry area away from direct sunlight, heat, and ignition sources, separate from incompatible materials; • Reactivity hazards will be considered and managed; • Measures to seal off the areas in the event of a fire will be implemented and the required firefighting requirements in terms of the SDSs will be implemented; • Secondary containment must be provided to ensure that off-loading of solution occur within the bund wall.											
					Only transportation companies equipped, trained and approved for the transportation of dangerous chemicals may be utilised.											
					All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.											
					Offloading of dangerous chemicals must be supervised by the supervisor.											
					Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide.											
					Refuelling must be undertaken over hard park bunded areas that are adequately sized to capture and contain spillages.											

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Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					A spill prevention and emergency spill response plan, as well as dust suppression, and fire prevention plans should also be compiled to guide the construction Works'.											
					Machinery and vehicles should be parked on appropriately lined areas.											
					Drip trays must be employed under stationary machinery.									Ensure that a Hydrocarbon and Chemical Management Procedure and Spill Prevention and Emergency Spill Response Plan is available on site and updated regularly.		Regular update in terms of procedure requirements.
					An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent ingress.											
					Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited and all construction rubble waste must be removed to an approved disposal site.									Induction with the view on creating environmental awareness.		Annually for permanent staff. Start of each visit for contractors.
		Spills along pipelines could contaminate or impact on the conditions of soils through soil erosion.	-10	CbA	Regular monitoring must be undertaken through walk-abouts to ensure that the Works is aware of any leaks along the pipelines.	-6										
					Implement an effective system of storm water run-off control using bunds and ditches, where it is required - that is at points where water accumulation might occur. The system must effectively collect and safely											

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					disseminate any run-off water from all hardened surfaces and it must prevent any potential down slope erosion											
					Maintain where possible all vegetation cover and facilitate re-vegetation of denuded areas throughout the site, to stabilize the soil against wind erosion											
					Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. This inspection should be done once per month during the construction phase and once every six months during the operation phase. Corrective action must be implemented to the run-off control system in the event of any erosion occurring											
					Chemical storage tanks and pipelines must be monitored regularly to ensure that the integrity are intact.											
					Where leaks are present measures must be implemented to contain and reduce the volumes of loss of water by either shutting down the pipeline or any other measure economically viable at that time of the operation.											
					Water Leaks must be rectified and fixed within 12 hours from occurrence.											
					Chemical leaks must be sealed off immediately.											
					Any leaks must be documented on the Isometrix system, no matter the quantity thereof. This will ensure that recurrences or areas where maintenance are											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					required are identified proactively prior to a serious encounter. A detailed water management and system maintenance procedure must be implemented on site, documenting the responsible persons, actions required on a daily, weekly, monthly or annual basis as well as recording requirements.											
		Incorrect storage of raw materials could lead to soil contamination	-11	CbA	Raw Materials must be stored in existing contained bunker areas. Any spills of raw materials outside of the contained areas must be cleaned up as soon as possible. The capacity of the bunkers must be adhered to at all times and for this reason all bunkers must be labelled in terms of allowable capacity.	-4										
	Ecological Management	Spread of invader species	-11	CbA	AIP monitoring and clearing/control should take place throughout the construction phase of the development, and a 30 m buffer surrounding the plant area should be regularly checked for AIP proliferation and to prevent inward and or/outward spread of AIPs, notably into non infested areas outside of the proposed railway loop or into newly rehabilitated areas Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.	-2	Limit the impact of the mining operation on the Ecological Setting of the area.	No unlawful removal of flora of conservation importance should take place. Initiate rehabilitation of disturbed areas once the construction phase has been completed. Successful self-succession to be achieved. Eradication of invasive species within the mining area footprint.				x	Limit the impact of the activities on the Ecological Setting of the area.	An AIP control plan must be implemented on site. This must be undertaken prior to the growing season. An ecological study should be undertaken to determine the status of revegetation on the site especially around the rehabilitated areas.	SHERQ Department and a Specialised Ecologist.	Weed monitoring (monthly); Weed eradication (annually or as required); Ecological Study (annually)

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
	Hydrology	There are no river system in close proximity to the project. In terms of hydrology it is important that clean and dirty water be separated that runoff from the dirty area does not enter the clean water setting. The Works must also optimise water usage on site.	-8	CbA	Clean and Dirty water separation systems should be implemented. Where dirty water can be used, such as in the quenching systems, the first point of resource must be Dam 1, only thereafter may water from the Main Storage Dam (feed Leeuwspruit) be used. Flow meters must be installed on all pipelines to monitor water use from boreholes, Leeuwspruit, Main Storage Tank and Dam, these meters must be calibrated annually. Ongoing investigations must be conducted to improve water efficiency and use on site. The bunded areas constructed for the management of chemicals, leach processes and water within the plant and at the tanks must be maintained to full integrity. Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems. Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide. Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages. Machinery and vehicles should be parked on appropriately lined areas. Drip trays must be employed under stationary machinery. Spillages should be reported immediately, and spill kits	-5	Operate the water management circuit on site to increase mining efficiency and reduce the need for maintenance of these facilities. Protect the surrounding demarcated watercourses.	Implement the SWMP on site. Compliance in terms of the WUL and NWA.	x			x	Quality of water within the overall water catchment and internal water circuit. Compliance in terms of the WUL and the SWMP.	The water quality (constituents listed in the WUL) of the dam must be monitored monthly and records must be kept of these result in a centralised system. Analysis of results must be undertaken by an accredited laboratory. Regular inspections must be undertaken to ensure that the facility is operated in line with the GN704 (1999) requirements. Annual compliance in terms of the designs of the facility and compliance in terms of the WUL must be undertaken. The integrity of the demarcated watercourses must be maintained.	SHEQ Department and Hydrologist	Surface Water Monitoring in line with the current monitoring programme. Monitoring of the conditions of the Wetland Systems biannually (winter and summary monitoring). Annual vegetation monitoring of rehabilitated areas. Annual GN704 Audit.

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					should be readily available at all times.											
	Groundwater	Spills of chemicals and hydrocarbons during the operational phase could lead to groundwater pollution if not managed.	-7	CbA	Clean and Dirty water separation systems should be implemented. The bunded areas constructed for the management of chemicals, leach processes and water within the plant and at the tanks must be maintained to full integrity. Pumps must be available to pump contained dirty water spills from the area for either reuse of legal disposal to maintain the capacity of the containment systems. Machinery, trucks and vehicles must be well maintained and serviced regularly as per a recommended service guide. Refuelling must be undertaken over hard park bunded areas that adequately sized to capture and contain spillages. Machinery and vehicles should be parked on appropriately lined areas. Drip trays must be employed under stationary machinery. Spillages should be reported immediately, and spill kits should be readily available at all times. Groundwater monitoring should be undertaken to include the assessment of the potential impacts of this facility.	-4	Limit the impact of the mining operation within the overall water catchment.	Achieve compliance to the water quality objectives as agreed to between the Licence Holder and the DWS.	x			x	Quality of water within the overall water catchment and internal water circuit.	The groundwater quality (constituents listed in the WUL) must be monitored quarterly and records must be kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory. Numerical groundwater models must be used to determine the movement of any potential pollution plume.	SHEQ Department and Hydrogeologist	Quarterly groundwater monitoring or as stipulated in the WUL. Annual numerical models or as stipulated in the WUL.
	Visual Impacts	No further impacts foreseen.	-		Storm water management measures must be maintained	-	-	-	-	-	-	-	-	-	-	-
	Nois Impacts	No further impacts foreseen.	-		-	-	-	-	-	-	-	-	-	-	-	-
	Air Quality Impacts	All activities associated within the processing activities and	-10		The dust monitoring network and dust suppression programme must be implemented and maintained	-3	CbA	Remain within the regulated guidelines and limits.	Remain within the Dust Emission				x	Recording of dust fall out to determine trends.	Dust dispersion will be monitored as part of the	SHEQ Department.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		movement of slag have the potential to release dust.			throughout the operational phase of the Works'. Dust monitoring should be undertaken in line with the recommendations of the air quality specialist. Water suppression or the use of a chemical bonding material on roads must be implemented to reduce fugitive dust emissions. Recommendations include reducing vehicle speed, reducing vehicle weights and limiting the amount of traffic.				Regulation Limits. Remain within the minimum emission limits for points sources as per the NEM:AQA.					Meeting ambient dust fall out limits in terms of applicable NEM:AQA Regulations. Ensure optimal implementation and maintenance of the dust suppression programme.	overall Works dust monitoring programme. Isokinetic monitoring will be undertaken on the stacks. Regular inspection and audits will be undertaken to ensure compliance of the AEL and Environmental Autorisation.	
		Release of Greenhouse Gasses	-10	CbA	Effective abatement equipment must be implemented as part of the Processing Plant design and development phase to limit emissions. Operate within the conditions of the AEL. The licence holder should undertake the necessary investigation to replace the diesel operated vehicles (two front end loaders and fork lifts) with battery operated equipment, solar charging systems. In addition to this investigations should be implemented to reduce Eskom supply with renewable sources.	14	Reduce Greenhouse Gasses through proper planning.	Work towards a zero Scope 1 emission plant	Reduce Greenhouse Gasses				x	Ongoing planning towards the implementation of technologies to limit Greenhouse Gas releases	Compliance to Company Targets	Engineering Team
	Socio Economic	The operational activities will result in additional employment of 190 people.	13	-	Local employment must be preferential when considering the appointment of staff and services.	14	-	Local Procurement	Contribution to the economic baseline of the local municipality.	x	-	-	-	Local Economic Development and relevant Employment Equity Score Cards.	Compliance to Employment Equity Scorecards	HR Department
	Waste Management and Handling Hydrocarbon spills within the Mining Area and the management		-		-	-	-	-	-	-	-	-	-	-	-	-

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
	of Domestic and Hazardous Waste (refer to Construction Phase)															
Decommissioning Phase																
Legal Requirements (Environmental Permits)	Legal Compliance	Unlawful activities could lead to NWA Directives and Section 24G Rectification fines.	-14	CbA	A legal assessment of all activities must be undertaken annually to ensure that all are licensed.	17	To operate within the enviro-legal ambits of South Africa.	Ensure that all activities undertaken by the Works are lawful with the required environmental licences in place.			x		Compliance in terms of Regulatory Requirements and the implementation of the EMP.	Appointment of an Independent ECO to assess compliance with the EMP. Quarterly (construction); Biannually (after construction) internal audits must be undertaken during the construction phase, where after biannual internal audits can be undertaken, to ensure compliance with the Environmental Authorisation and EMP. This should be undertaken by means of a thorough site visit, record keeping of findings in a checklist format, issuing of non-conformances to responsible parties, listing thereof on the Isometrics or similar reporting system and feedback to the management team.	Independent ECO & SHEQ	ECO: Weekly; SHEQ: Daily
					A detailed closure plan must be developed and submitted to the relevant departments for approval.		To be aware of the latest environmental legal requirements.	Ensure that all environmental authorisations on site is implemented on site and ongoing monitoring of compliance are undertaken to reach 100% compliance.								
					All legally appointed personnel responsible or involved in activities on site must receive training on the requirements of the Environmental Authorisations and EMPs			All Departments responsible for development of the Works', must understand the requirements of the environmental legislation and must involve this into their planning processes.								
					Quarterly decommissioning must be undertaken, on the lawful implementation of the Environmental Authorisation											
					Environmental Authorisations must be available on site at all times.											
					The legal register must be updated to indicate all updated activities.											
	Geology	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	**Impact Area**	**Potential Impacts**	SbM	**CbA, R, Ir**	**Mitigation Measures**	**SaM**	**Performance Objectives**	**Goals**	**ST (1-12 months)**	**MT (1-5 Yrs.)**	**LT (5 Yrs. +)**	**LoM**	**Compliance with Standard**	**Functional Requirements for Monitoring**	**Responsibilities**	**Monitoring and Reporting Frequency**
Infrastructure Removal	Topography	Removal of infrastructure may impact on the topography.	-13	R	Linear infrastructure constructed by the Works will be removed if it proves to inhibit land use at decommissioning. Where possible, infrastructure will remain for social investment opportunities, this will be decided in conjunction with the Integrated Development Plan of the area and the local authorities.	14	Lawful removal of all infrastructure. Achieving final land use objectives.	Availability of safe disposal certificates. Free draining environment, with successful self-succession establishment.				**x**	Waste Disposal Ongoing Rehabilitation	Audits on safe disposal records and inspections at disposal sites. Inspections in terms of compliance with EMP commitments.	SHEQ Department	Monthly inspection of waste disposal records Biannual inspections of disposal sites Weekly inspections of rehabilitation progress.
					Ensure the entire site remains fenced for the duration of rehabilitation.											
					Retain security access control to the site for the duration of rehabilitation.											
					All fixed assets that can be profitably removed will be removed for salvage or resale (the salvage and resale value have however not been incorporated into the closure cost estimate as per the legislative requirements)											
					All surface structures, infrastructure and 'hard surfaces' (*inter alia* redundant pump equipment, etc.) are to be demolished and removed from the disturbed footprint, unless an alternative/ continued use for any such items is agreed upon and approved by the Competent Authority.											
					All surface infrastructure would be demolished and removed to a depth of at least 1m. Any infrastructure below 1m will be sealed, made safe and left *in situ*.											
					All fences erected around the infrastructure be dismantled and either disposed of at a permitted disposal site or sold off as scrap (provided that these											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					structures will no longer be required by the post mining land owner). Fences erected to cordon off dangerous excavations will remain in place and will be maintained as and when required. Water pollution control structures will remain until the completion of all demolition and associated rehabilitation activities where after these will be rehabilitated.											
	Soil, Land Use and Land Capability	Spills around decommissioning areas (hydrocarbons and paste) may result in the contamination of soils.	-11	CbA	Draw up a plan clearly defining the area where the removal of infrastructure should take place. Implement the plan with sufficient measures in place not to compact new areas. A chemical analysis must be undertaken of the footprint areas where chemicals where utilised to determine whether any contaminated soil are present (Phase 1 study). Should contaminated soils be present, these must be remediated. All hazardous waste should be disposed of at licensed and fit-for-purpose areas and safe disposal records should be kept on file. Any hydrocarbon, effluent or other contaminants should be collected and the soils remediated immediately.	-5	Protection of Soil Integrity.	Zero presence of contaminated land due to early detection and implementation of actions.				x	Soil Integrity	Appointment of an Independent ECO to assess compliance with the EMP. The SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. This should be undertaken by means of a thorough site visit, record keeping of findings in a checklist format, issuing of non-conformances to responsible parties, listing thereof on the Isometrics or similar reporting system and feedback to the management team.	SHEQ Department	Annual External Audit. Daily internal inspections. Recording of incidents when occurring.

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		Contamination of soils as a result of a lack of sanitary services	-11	CbA	Chemical toilets must be readily available to contractors. Licensed companies must be appointed to remove any contaminated material and or wastes to licensed landfill sites.	-5		Zero presence of contaminated land due to early detection and implementation of actions.				x	Soil Integrity	Contracts must be in place for the provision of chemical toilets where required. Removal companies must have the necessary contracts and permits in place.	SHEQ Department	Daily internal inspections Annual review of supply and removal companies contracts and permits.
		Loss of soils due to decommissioning activities present on site.	-11	CbA	Draw up a plan clearly defining the area where the removal of infrastructure should take place. Implement the plan with sufficient measures in place not to compact new areas. Compacted soils adjacent to the infrastructure footprint can be lightly ripped to alleviate compaction where required. Implement a strict penalty fine system for rule breaking with regard to vehicular movement. Maintain Clean and Dirty water systems and undertake regular monitoring and maintenance thereof.	-5		Maintaining soil integrity, with successful vegetation establishment.				x	Soil Erosion and incorrect stockpiling of topsoil. Soil integrity analysis	Appointment of an Independent ECO to assess compliance with the EMP. The SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. Assessment of the fertility of Soils	Independent ECO and SHEQ Department. Soil Scientist	ECO: Annual external audits can be undertaken. SHEQ: Weekly monitoring Prior to placement of soils.
	Ecology	The establishment of Weeds and Invader Species.	-13	CbA	Ongoing AIP and bush encroachment monitoring and control should take place throughout the rehabilitation phase of the project. If natural succession of vegetation is not established within one rainy season, after commencement of rehabilitation, the disturbed areas and areas adjacent to the infrastructural areas must be re-vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to	-2	Limit the impact of the mining operation on the Ecological Setting of the area.	Reduce the presence of invader species.	x			x	Invasion of Weeds and Alien Vegetation.	A weed (AIP) eradication plan must be implemented on site. This must be undertaken prior to the growing season. An ecological study should be undertaken to determine the status of revegetation on	SHEQ Department and a Specialised Ecologist.	Weed monitoring (monthly) Weed eradication (annually or as required) Ecological Study (annually)

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					minimise soil erosion and dust emission.									the site especially around the rehabilitated areas.		
					All temporary infrastructure and footprint areas associated with the borrow pit should be rehabilitated in accordance with the rehabilitation plan, and it must be ensured that an appropriate post-closure land use is achieved.											
					Where bare soils are left exposed as a result of construction activities, they should be immediately rehabilitated. Rehabilitated efforts should continue to be monitored throughout the operational phase, until natural processes will allow the ecological functioning and biodiversity of the area to be re-instated.											
					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.											
					Edge effects such as erosion and AIP proliferation, which may affect adjacent natural habitat, need to be strictly managed adjacent to the footprint areas and as part of the rehabilitation phase.											
	Hydrology	Erosion control over rehabilitated areas and the prevention of erosion gullies.	-8	CbA	The topography of all disturbed areas must be shaped in such a manner that the surrounding natural area blends naturally with the rehabilitated areas well as to be free draining. This will reduce soil erosion and improve natural re-vegetation.	-5	Protect the water resources within the area in which the site operates.	Maintenance of storm water management systems. Meeting the conditions in terms of Section 21c & i of the WUL.				x	Surface Water Pollution & Soil Assessments.	To ensure a proactive approach, the SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in	SHEQ Department	Assessments: Weekly. Surface Water Monitoring: Monthly Groundwater Monitoring: Quarterly
					The topography should be returned to its former state (as far as practically possible).											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Exposed areas should be vegetated as soon as possible.									accordance with the EMP Requirements. The water quality (constituents listed in the WUL) must be monitored monthly and records must be kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory. Monitoring of the effectiveness of the rehabilitation programme must be undertaken. This should be undertaken by means of weekly inspections and keeping a photographic record.		
					The topsoil stockpiles should be used to fill in areas and to create a suitable substrate to re-vegetate areas.											
					Temporary erosion measures should be employed at exposed areas until vegetated.											
		Contamination of surface water as a result of removal of infrastructure.	-11	CbA	The detailed waste management strategy implemented during the construction and operation phases must be continuously implemented throughout the closure and decommissioning phase.	-6										
					Contaminated water from the water containment facilities should be reused in the plant system as long as possible and left to evaporate. No unlawful discharge of water will be allowed.											
		Rubble and waste from site could pollute runoff.	-8	CbA	All wastes required should be removed to licensed waste disposal facilities and by licenced companies.	-6										
	Groundwater	Decommissioning and removal of facilities could lead to the infiltration of dirty water to groundwater resources.	-9	CbA	No water may be discharged into watercourses, if this water has not been treated to the correct quality OR if approval from the DWS for such activity has not been obtained.	14	Develop the area to its intended final land use.	Obtain buy in from stakeholders on the intended final land use.				x	Groundwater Pollution and potential trends & Soil Assessments.	To ensure a proactive approach, the SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. The groundwater quality (constituents listed in the WUL)		
					Groundwater monitoring must continue up until closure is obtained.											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
														must be monitored monthly and records must be kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory		
	Heritage	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Visual	Fugitive dust emissions as a result of infrastructure removal and associated exposed/bare areas may have an impact in terms of air quality and visual characteristics.	-11	CbA	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the decommissioning/ closure phase of the site. With respect to road dust levels, it is recommended to limit vehicle speeds, especially during high risk periods of high winds, high temperature and low humidity. Vegetation clearance should be kept to an absolute minimum. Exposed areas should be vegetated as soon as possible. Establish and implement a dust suppression plan in consultation with the Environmental Control Officer and an air quality specialist as part of the contractor's responsibility. Dust suppression measures should be implemented to limit the generation of dust.	-5	Remain within the regulated guidelines and limits.	Recording of dust fall out to determine trends.				x	Comply with the National Dust Regulations.	Dust dispersion will be monitored as part of the overall dust monitoring programme.	SHEQ Department	Monthly Monitoring with Annual Reporting.
	Air Quality	All activities associated with the removal of infrastructure and rehabilitation has	-7	CbA	The dust monitoring network and dust suppression programme established during the construction phase of the project will be maintained throughout the closure phase of the Works. With respect to haul	-5	Remain within the regulated guidelines and limits.	Recording of dust fall out to determine trends.				x	Comply with the National Dust Regulations.	Dust dispersion will be monitored as part of the overall dust monitoring programme.	SHEQ Department	Monthly Monitoring with Annual Reporting.
								Meeting ambient dust fall out				x				

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		the potential to release dust.			road dust levels, it is recommended to limit vehicle speeds, especially during high risk periods of high winds, high temperature and low humidity.			limits in terms of applicable NEM:AQA Regulations.								
	Noise	All activities associated with the removal of infrastructure and rehabilitation has the potential to generate noise.	-7	CbA	The removal of all infrastructure is to take place during daytime periods only.	-5	Remain within the regulated guidelines and limits.	Machinery with low noise levels and maintained in a good order to be used and to comply with the IFC's Health and Safety Regulations.				x	Noise Monitoring.	Adjacent landowners will be informed of the planned dates of the significant demolition activities where applicable. Daily noise monitoring will be undertaken in the areas where high levels of noise take place during decommissioning.	SHEQ Department	Ongoing consultation with surrounding landowners. Daily noise monitoring.
					Earthworks and planting of vegetation to be done during daytime			Health and Safety Regulations in terms of noise monitoring should be met.				x				
					Where noise becomes a nuisance, management measures will be investigated and implemented to address these.											
	Social	No direct impact, however, communication is important.	-7	-	Local residents, with the focus on the surrounding landowners, should receive accurate information with regards to the project status, timeframes for decommissioning and other relevant information about issues that could influence their daily living and movement patterns.	-5	Remain within the regulated guidelines and limits.	Ongoing consultation and interaction with the local community to build relationships.				x	Ongoing stakeholder consultation	Adjacent landowners will be informed of the planned dates of the significant demolition activities where applicable.	SHEQ Department	Ongoing consultation with surrounding landowners.
Earth Moving, shaping and ripping of ground	Geology	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Topography	The shaping of the site should be undertaken in such a manner that it improves the overall topography of the site.	13	R	Pre-construction topography should be reasonably restored through shaping and landscaping, such that the topography of rehabilitated areas will ultimately be commensurate with that of adjacent, non-disturbed areas.	14	Develop the area to its intended final land use.	Implement an action plan to systematically plan for closure.				x	Final Land use	An operational rehabilitation plan must be implemented and audited by the SHEQ department.	SHEQ Department	Monthly monitoring.
					Where infrastructure have been removed, the surface areas must be ripped and ameliorated. Measures must be											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					implemented to reduce erosion and to promote self-succession.											
					If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.											
					The final shaping should be viable to allow for final land use. If possible, ensure a continuation of the premining surface drainage pattern.											
	Soils	Soil erosion	-16	CbA	If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.	-5	Develop the area to its intended final land use.	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWS.			x	x	Soil Erosion and incorrect stockpiling of topsoil.	Erosion protection measures should be implemented and monitored on areas identified. Photographic records of assessments must be kept.	Independent ECO and SHEQ Department.	ECO: Weekly for the decommissioning phase. Thereafter annual external audits can be undertaken. SHEQ: Weekly monitoring Pedologist: Weekly assessment of soil rehabilitation.
		Ripping and topsoil replacement will restore the soil physical characteristics prior to re-vegetation.	13	CbA	Compacted soils will be ripped and topsoil will be replaced if the latter is deemed necessary for effective vegetation.	14										
					Where sites have been alienated of vegetation or where soils have been compacted or covered with concretes, these sites will be ripped and ploughed.											
					If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.											
	Terrestrial Ecology	The rehabilitation of the site will allow	10	CbA	Compacted soils will be ripped and topsoil will be replaced if the latter is deemed necessary	13	Protect the Ecology within	Free draining environment with successful			x		Invasion of Weeds and	A weed (AIP) eradication plan must be	SHEQ Department and a	Weed monitoring (monthly); Weed

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
	(Fauna & Flora)	reestablishment of natural vegetation.			for effective vegetation. After the topsoil has been replaced the area should be ameliorated and seeded, should self-succession of vegetation not take place. Only species indigenous to the area will be included. The soil fertility status should be determined by soil chemical analysis after levelling and before seeding/re-vegetation if deemed applicable. On-going alien and invasive floral species control is required through all phases of rehabilitation. If a reasonable assessment indicates that the re-establishment of vegetation is unacceptable slow, the soil need to be analysed and any deleterious effects must be corrected and the area be seeded with a seed mix to specification.		which the site operates	self-succession in place.					Alien Vegetation.	implemented on site. This must be undertaken prior to the growing season. A ecological study should be undertaken to determine the status of revegetation on the site especially around the rehabilitated areas.	Specialised Ecologist.	eradication (annually or as required); Ecological Study (annually)
	Surface Water	Runoff from rehabilitated areas will impact on watercourses especially during intensive rainstorms especially if the area are not free draining.	-5	CbA	The areas will be shaped to be free draining in line with the approved storm water management plan.	13	Protect the water resources within the area in which the site operates.	Continuous rehabilitation of the decommissioning area will be conducted in line with the Best Practice Guidelines released by the DWS.	x				Surface Water Pollution & Soil Assessments.	To ensure a proactive approach, the SHEQ department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. The water quality (constituents listed in the WUL) must be monitored monthly and records must be	SHEQ Department	Assessments: Weekly. Monitoring: Monthly

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
														kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory. Monitoring of the effectiveness of the rehabilitation programme must be undertaken. This should be undertaken by means of weekly inspections and keeping a photographic record.		
	Groundwater	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-		-	-	-	-	-	-	-	-	-	-	-
	Visual	The rehabilitation (ripping, topsoil replacement and landscaping) will remove the visual incongruity.	11	CbA	The area should be shaped and vegetated to blend into the surrounding landscape. An overall visual improvement will be noticed once all mining related infrastructure has been demolished and the area has been shaped and self-succession has occurred.	13	Successful establishment of vegetation.	Remain within the designated area demarcated for activities. Remain within the NEM:AQA Dust Regulation guidelines for rural communities.				x	Comply with the National Dust Regulations.	Dust dispersion will be monitored as part of the overall dust monitoring programme.	SHEQ Department	Monthly Monitoring with Annual Reporting.

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Demarcate the decommissioning area and limit the decommissioning activities as far as possible.											
					Final shaping will be implemented such that the final profile of the rehabilitated areas are formed to emulate natural contours of the area.								Vegetation Establishment.	An ecological study should be undertaken to determine the status of revegetation on the site especially around the rehabilitated areas.	SHEQ Department	Monthly
					Foundations will be removed to a depth of 1 m below the surface and the area rehabilitated.											
					All material recovered from the demolition of buildings and/or structures will either be transported to a permitted disposal site, or made available to the local community as building materials (provided they are in a satisfactory condition following demolition).											
					Linear infrastructure constructed by the Works' (i.e. pipelines) will be removed if it proves to inhibit land use at decommissioning.											
	Air Quality	All activities associated with the removal of infrastructure has the potential to release dust.	-6	CbA	Dust sampling will be undertaken on a monthly basis.	-5	No concerns raised by surrounding landowners regarding air quality.	Remain within the designated area demarcated for activities.	x			x	Dust dispersion.	Dust dispersion will be monitored as part of the overall dust monitoring programme.	SHEQ Department	Monthly Monitoring with Annual Reporting.
					Monthly monitoring reports will be generated by the Works' or through a suitably qualified air quality specialist.			Remain within the National Environmental Management: Air Quality Act, 2004 Dust Regulation guidelines for rural communities.								
	Noise	All activities associated with the removal of infrastructure and rehabilitation has	-4	CbA	In the event that air quality or dust issues are identified based on the monitoring programme, an independent specialist should be appointed to determine the best course of	-5	No concerns raised by surrounding landowners regarding air quality.	Remain within the designated area demarcated for activities.	x			x	Noise Monitoring.	Adjacent landowners will be informed of the planned dates of the significant	SHEQ Department.	Ongoing consultation with surrounding landowners. Daily noise monitoring.

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		the potential to generate noise.			action to ameliorate the situation.									demolition activities where applicable. Daily noise monitoring will be undertaken in the areas where high levels of noise take place during decommissioning.		
					The removal of all infrastructure is to take place during daytime periods only. Where noise becomes a nuisance, management measures will be investigated and implemented to address these.											
					Machinery with low noise levels and maintained in a good order to be used and to comply with the International Finance Corporation's (IFC) Health and Safety Regulations.			Remain within the NEM:AQA Quality Act, 2004 Dust Regulation guidelines for rural communities.								
					Speed control measures will be implemented by the site through the placement of adequate signage.											
					Implement a penalty system for non-compliance to speed control measures and ensure that all workers are made aware of the penalty systems.											
	Social	No direct impact	-	-	Gravel roads to be maintained in as good and smooth a condition as possible.	-	-	-	-	-	-	-	-	-	-	-
Waste Management and decommissioning of hazardous (also fuels) substances	Geology	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Topography	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Soil, Land Use and Land Capability	Spills around the diesel storage areas and product stockpiles may result in the contamination of soils.	-11	CbA	A contaminated land assessment should be undertaken at all areas where dangerous goods was stored, as well as where fuel pipelines were placed.	-5	Protection of Soil Integrity to achieve final land use objectives.	Zero presence of contaminated land due to early detection and implementation of actions.			x		Protection of Soil Resources.	Compliance with contaminated land objectives and limits.	SHEQ Department	Ongoing
					Any hydrocarbon, effluent or other contaminants should be collected and the soils remediated immediately.											
		Handling of Building Rubble	-9	CbA	Documentation of removal and safe disposal must be available on site.	-6										
					All infrastructure will be removed and rehabilitated,											

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type / Mitigation Measures	SaM	Performance Objectives	Goals	Time Period for Implementation: ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Action Plan: Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					should no alternative use be found for the structures.											
					Foundations will be removed to a depth of 0.5m below surface.											
	Terrestrial Ecology (Fauna & Flora)	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Groundwater	Handling or Hazardous Waste within workshops and general area.	-10	CbA	Clear signs informing staff of waste management practices must be implemented on site.	-6	Protect the groundwater resources to ensure that limited to no impact on groundwater resources occur as a result of the mining operations.	Achieve 100% compliance to the water quality objectives.		x		x	Groundwater Pollution and potential trends.	The groundwater quality (constituents listed in the WUL) must be monitored monthly and records must be kept of these results in a centralised system. Analysis of results must be undertaken by an accredited laboratory.	SHEQ Department	Quarterly (construction); Biannually (after construction)
					Clean and Dirty water separation systems should be incorporated into the design.											
					Waste management training must be implemented on site.			Maintain a 100% safe disposal record on the disposal of hazardous waste.				x				
					Hazardous waste handling should only take place within bunded and/or lined areas.											
					Hazardous waste should be removed by a licensed hazardous waste removal company and taken to a suitable and licensed landfill site.											
		Handling of Building Rubble	-9	CbA	Documentation of removal and safe disposal must be available on site.	-6										
					All infrastructure will be removed and rehabilitated, should no alternative use be found for the structures.											
					Foundations will be removed to a depth of 0.5-1m below surface.			Implement and operate a detailed waste manifest on site and maintain a 100% safe disposal record on the disposal of waste on site.			x	x				
		Handling and Storing of Domestic Waste	-12	CbA	All building rubble will follow the waste hierarchy and will therefore either be sold for reuse where possible and as a last option be disposed of at a licensed facility suitable for such waste in line with the NEM:WA.	-9		Achieve 100% compliance to the water quality objectives.		x		x				

Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Type	SaM	Performance Objectives	Goals	Time Period for Implementation				Action Plan			
		Potential Impacts			Mitigation Measures				ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
					Clean and Dirty water separation systems should be maintained.											
					Waste management training must be implemented on site.			Use licenced waste management companies.				x				
					Clear signs informing staff of waste management practices must be implemented on site.											
					Groundwater monitoring must be undertaken in such a manner as to ensure that any potential impacts from the site can be detected.			Maintain a 100% accurate recording of waste and submission of such recording to the Department.				x				
					Recycling practices must be investigated and implemented on site.			Maintain daily covering of the landfill site.	x			x				
	Surface Water	Handling of Hazardous Waste within workshops and general site area could contaminate the dirty water storage areas. The water is then reused in the system and could have impacts on the integrity of the storm water system and also the production.	-11	CbA	Clean and Dirty water separation systems should be maintained up until closure.	-6	Develop the area to its intended final land use.	Maintain the SWMP on site.				x	Surface Water Pollution & Soil Assessments.	To ensure a proactive approach, the SHEQ Department should undertake ongoing site monitoring to determine whether activities on site are undertaken in accordance with the EMP Requirements. The water quality (constituents listed in the WUL) of the dam must be monitored monthly and records must be kept of these result in a centralised system. Analysis of results must be undertaken by an	SHEQ Department	Assessments: Weekly. Monitoring: Monthly
								Maintain a 100% no-spill record.				x				
					Waste management training must be implemented on site.			Clean spills, if occur witan 24 hours.				x				
					Clear signs informing staff of waste management practices must be implemented on site.			Maintain a 100% safe disposal record on the disposal of hazardous waste.				x				
					Hazardous waste handling should only take place within bunded and/or lined areas.			Provide training to all staff on best practices regarding waste management every year.	x			x				
					Hazardous waste and contaminated materials should be removed by a licensed hazardous waste removal company and taken to a suitable and licensed landfill site.											
					Documentation of removal and safe disposal must be available on site.											
		Handling and Storing of Domestic Waste should have no	-9	CbA	Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance	-5		Maintain a 100% compliance with the conditions of the ECA permit	x			x				

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
		impact on the surface water resources due to the location of the facility. However, incorrect disposal of waste could hamper the integrity of the storm water system.			requirements must be documented and an action plan developed.			for the landfill site.						accredited laboratory.		
					Clean and Dirty water separation systems should be maintained up until closure.											
					Waste management training must be implemented on site.											
					Weekly inspections of Storm Water Management Systems must be undertaken. Any blockages or maintenance requirements must be documented and an action plan developed.											
					Clear signs informing staff of waste management practices must be implemented on site.											
					Recycling practices must be investigated and implemented on site.			Maintain daily covering of the landfill site up until final covering.	x			x				
					Building rubble must be disposed of in line with the requirements of the NEMWA.											
					Access control must be strictly enforced.			Self-succession of vegetation should establish within the first rainy season after construction has been completed.	x			x				
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Heritage	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Visual	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Air Quality	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		Potential Impacts			Mitigation Type				Time Period for Implementation				Action Plan			
Activities	Impact Area	Potential Impacts	SbM	CbA, R, Ir	Mitigation Measures	SaM	Performance Objectives	Goals	ST (1-12 months)	MT (1-5 Yrs.)	LT (5 Yrs. +)	LoM	Compliance with Standard	Functional Requirements for Monitoring	Responsibilities	Monitoring and Reporting Frequency
	Noise	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Social	No direct impact	-	-	-	-	-	-	-	-	-	-	-	-	-	-

9.7 Management Accountability and Environmental Control

9.7.1 Administration

Copies of this EMP, as well as the issued AEL shall be kept at the site office and will be distributed to all senior contract personnel. All senior personnel shall be required to familiarize themselves with the contents of this document.

9.7.2 Roles and Responsibilities

The implementation of this EMP requires the involvement of several stakeholders, each fulfilling a different but vital role to ensure sound environmental management during the construction phase.

9.7.2.1 Proponent and Project Coordinator

The Proponent remains ultimately responsible for ensuring that implementation of this EMP complies with the relevant legislation, and that the development is implemented according to the requirements of the EMP.

Although the Proponent has appointed the Contractor to undertake the contract on a design and construct basis, the responsibility still remains with the Applicant. The Applicant must ensure that sufficient resources (time, financial, labour, equipment, etc.) are available to the other role players [e.g. the Environmental Control Officer (ECO), and contractor, to efficiently perform their tasks in terms of the EMP. The Applicant will be held responsible for restoring the environment in the event of negligence leading to damage to the environment.

The Proponent must ensure that the EMP is included in tender documentation so that the contractor who is appointed is bound to the conditions of the EMP.

The Proponent must:

- Be familiar with the recommendations and mitigation measures of this EMP, and implement these measures.
- Monitor site activities on a daily basis for compliance.
- Conduct internal audits of the construction site against the EMP.
- Confine the construction site to the demarcated area.
- Rectify transgressions through the implementation of corrective action.

9.7.2.2 Contractor

The contractor acts as the Proponent's agent on site, and is bound to the EMP conditions through his/her contract with the developer. The contractor is responsible for ensuring that he/she adheres to all the conditions of the EMP. The contractor must thoroughly familiarise him/herself with the EMP requirements before coming onto site and must request clarification on any aspect of these documents, should they be unclear. The contractor must ensure that he/she has provided sufficient budget for complying with all EMP conditions at the tender stage.

The contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the EMP.

9.7.2.3 Environmental Site Officer

The Proponent shall ensure that an Environmental Site Officer (ESO) is appointed to oversee the project in terms of environmental compliance and enforcement. The ESO will be site-based and shall be the responsible person for implementing the environmental provisions of the construction contract.

There shall be an approved ESO on the site at all times. It may be necessary to have more than one ESO. The ESO's duties will include, *inter alia*, the following:

- Ensuring that all the environmental authorisations and permits required in terms of the applicable legislation have been obtained prior to construction commencing.
- Reviewing and approving construction method statements with input from the ECO and Engineer, where necessary, in order to ensure that the environmental specifications contained within the construction contract are adhered to.
- Assisting the Contractor in finding environmentally responsible solutions to problems.
- Keeping accurate and detailed records of all activities on site.
- Keeping a register of complaints on site and recording community comments and issues, and the actions taken in response to these complaints.
- Appointing specialists (air quality specialist, waste management companies, etc.)
- Ensuring that the required actions are undertaken to mitigate the impacts resulting from non-compliance.
- Taking appropriate action if the specifications are not followed.
- Reporting of environmental matters during quarterly Works Meetings.
- Reporting all incidences of non-compliance to General Manager.
- Report significant incidences to the Competent Authorities.
- Advising on the removal of person(s) and/or equipment not complying with the specifications.
- Recommending the issuing of fines for transgressions of site rules and penalties for contraventions of the EMP.

The ESO must have:

- The ability to manage public communication and complaints;
- The ability to think holistically about the structure, functioning and performance of environmental systems; and
- The ESO must be fully conversant with the BAR and EMP for the Project and all relevant environmental legislation.
- The ESO must have received professional training, including training in the skills necessary to be able to amicably and diplomatically deal with the public as outlined in bullet point one above.

9.7.2.4 The Environmental Control Officer (ECO)

The Environmental Control Officer (ECO) must be an independent environmental consultant appointed by the applicant or contractor to act as the applicant or contractor representative, to monitor and review the on-site environmental management and implementation of this EMP by the Contractor.

The ECO must form part of the project team and be involved in all aspects of project planning that can influence environmental conditions on the site. The ECO must attend relevant project meetings, conduct inspections to assess compliance with the EMP and be responsible for providing feedback on potential environmental problems associated with the development.

The ECO should be on site monthly during the construction contract, and thereafter on a needs basis, until project closure.

The ECO's duties will include the following:

- Assisting the ESO in ensuring that the necessary environmental authorisations and permits have been obtained.
- Maintaining open and direct lines of communication between the Applicant, Project Engineers, Contractor and ESO with regard to environmental matters.

- Reporting on environmental issues at construction site meetings.
- Reviewing and approving the Contractor's construction method statements.
- Regular site inspections of all construction areas with regard to compliance with the EMP.
- Monitoring and verifying adherence to the EMP, the Environmental Authorisation and AEL and approved method statements at all times, monitoring and verifying that environmental impacts are kept to a minimum.
- Assisting the Contractor in finding environmentally responsible solutions to problems.
- Monitoring the undertaking by the Contractor of environmental awareness training for all new personnel coming onto site.
- Auditing the implementation of the EMP and compliance with the Environmental Authorisation on a monthly basis.
- Undertaking a continual review of the EMP and recommending additions and/or changes to the document to the developer and contractor for discussion.
- Keeping a photographic record of progress on site from an environmental perspective. This can be conducted in conjunction with the ESO as the ESO will be the person that will be on site at all times and can therefore take photographic records. The ECO would need to check and ensure that the ESO understands the task at hand.
- Recommending additional environmental protection measures, should this be necessary.
- Providing report back on any environmental issues at site meetings.
- The ECO has the right to enter the site and carry out monitoring and auditing based on prior arrangement with the landowner/s and subject to compliance with health and safety requirements applicable to the site (e.g. wearing of safety boots and protective head gear).

9.8 Mechanisms for Monitoring and Reporting

9.8.1 Water Monitoring

Water Monitoring must be undertaken in terms of the approved 2008 and 2019 Water Use Licence (WUL).

9.8.2 Air Quality Monitoring

In terms of dust monitoring the following figure depicts the monitoring locations that take into account maximum distance of two (2) kilometres and sensitive receptors identified in the area surrounding ARMMDW. The table below shows latitudinal and longitudinal coordinates, as well directions and distances from the site fence line. Monitoring must be undertaken every 30 days.

Table 26: Proposed dustfall monitoring locations that include human residences and sensitive businesses, industrial or agricultural locations, within a maximum distance of 2 km from the source.

Receptor	Latitude (°S)	Longitude (°E)	Direction from Site Boundary	Distance from Site Boundary (km)
DFO 01 Stoltz	25.7062	30.2282	N	0.33
DFO 02 Bella Vista	25.7026	30.24609	NE	1.25
DFO 03 Glenshee	25.7165	30.24836	E	1.29
DFO 04 Koringland	25.7248	30.25025	SE	2.00
DFO 05 Dalmanutha	25.7392	30.22176	S	1.75
DFO 06 Southwest	25.7286	30.21261	SW	0.95
DFO 07 De Kroon	25.7145	30.2121	W	0.94
DFO 08 De Goedehoop	25.7068	30.20609	NW	1.95

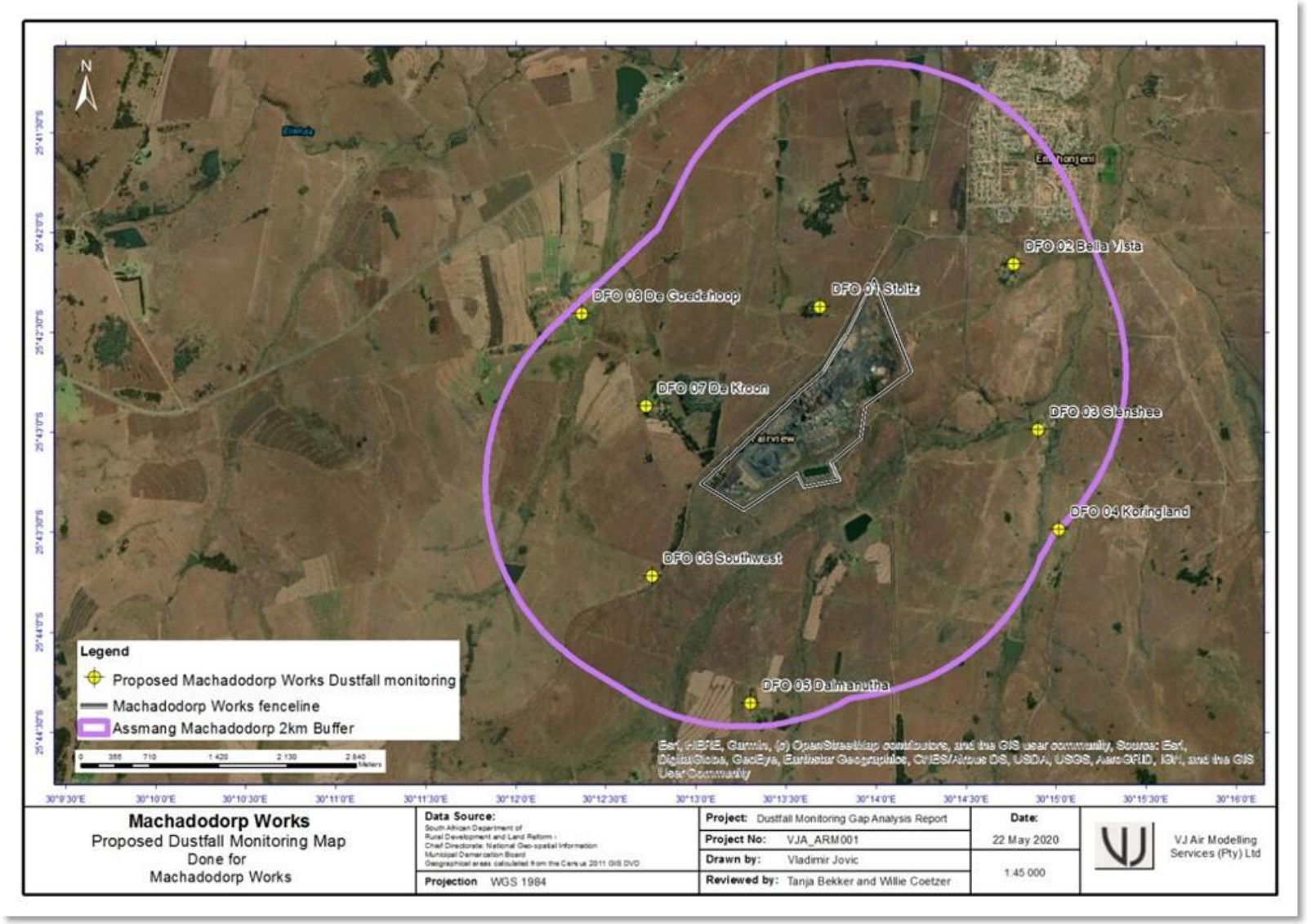

Figure 32: Proposed dust fallout monitoring locations at ARM Machadodorp Works.

9.8.3 Auditing on Compliance

9.8.4 External Auditing

An Environmental Performance assessment must be conducted annually on the EMP and its associated Environmental Authorisation (approval) and AEL. The Environmental Performance Assessment must be undertaken by an external Environmental Assessment Practitioner and submitted 30 days from the finalisation of such assessment.

9.8.5 Internal ECO Auditing

A monitoring programme will be implemented for the duration of the construction phase of the development. The ECO will be responsible for liaising with the construction team and the approving authorities if so required.

The ECO must submit monthly environmental audit reports to the applicant and contractor.

Monthly monitoring will be conducted by the ECO for the remainder of the construction phase to ensure compliance to the EMP conditions, and were necessary make recommendations for corrective action. These audits can be conducted randomly and do not require prior arrangement with the Project Coordinator.

Compilation of an audit report with a rating of compliance with the EMP. The ECO shall keep a photographic record of any damage to areas outside the demarcated site and construction area.

A register shall be kept of all complaints from the Landowner or community. All complaints/ claims shall be handled immediately to ensure timeous rectification/ payment by the responsible party.

9.8.6 Internal Audits

An Internal Environmental Performance assessment must be conducted bi-annually on the EMP and its associated Environmental Authorisation (approval). The audit reports must be kept on file and be available to the External Auditor or Competent Authorities upon request.

9.8.7 National Atmospheric Emissions Inventory System (NAIES) Reporting

Annual NAIES reporting must be conducted in terms of the NEM:AQA. It is recommended that this be undertaken by an external Air Quality Specialists. In addition to this it is recommended that an annual External Audit be undertaken on the issued AEL by an external Air Quality Specialists. The reports must be submitted to the Competent Authority within 30 days of finalisation.

9.9 Environmental Awareness Plan

ARM will implement an Environmental Awareness Plan at the ARMMDW. The material/source of information for the Environmental Awareness Plan will be the approved EMP, as well as other relevant specialist reports. The environmental awareness plan is detailed in the sections below.

This environmental awareness plan sets out the Works training procedures and objectives regarding environmental awareness. It is a stand-alone procedure, which serves to improve awareness, training and competency in the environmental field. It contains

no detail on the actual training initiatives but rather serves to ensure that a responsible person is appointed to deal with and increase environmental awareness on the Works.

It should be the responsibility of the Environmental Manager to implement the Environmental Awareness Plan.

The objectives of the Environmental Awareness Plan as defined by ISO14001 are as follows, for specific Competence, Training and Awareness:

- The organisation shall ensure that any person(s) performing tasks for it or on its behalf that have the potential to cause a significant environmental impact(s) identified by the organisation is (are) competent on the basis of appropriate education, training or experience, and shall retain associated records.
- The organisation shall identify training needs associated with its environmental aspects and its environmental management system. It shall provide training or take other action to meet these needs, and shall retain associated records.
- The organisation shall establish, implement and maintain a procedure(s) to make persons working for it or on its behalf aware of:
    - The importance of conformity with the environmental policy and procedures and with the requirements of the environmental management system.
    - The significant environmental aspects and related actual or potential impacts associated with their work, and the environmental benefits of improved personal performance.
    - Their roles and responsibilities in achieving conformity with the requirements of the environmental management system.
    - The potential consequences of departure from specified procedures.

The responsible person will revise the environmental awareness procedures from time to time. The date of commencement of the revised procedure will always be indicated on the relevant Work Instructions or Policies.
Please refer to the following table for the Environmental Awareness Plan:

Table 27: Environmental Awareness Plan

Aspects	Objectives	Description	Time Period	Responsible Party/Person
1. Environmental policy	Demonstrate management commitment to responsible environmental management	Top management has a role to play in building awareness and motivating employees by explaining the company's environmental values and communicating its commitment to environmental policy. All workers of the company should understand and be encouraged to accept the importance of implementing the EMP. Motivation to continually improve can be enhanced when employees are recognized for achieving environmental objectives and targets and encouraged to make suggestions that can lead to improved environmental performance.	In place	Environmental Manager
2.Environmental Management System (EMS)	Systematic implementation of Roles and Responsibilities to achieve environmental compliance.	Identify, assess and manage risks to employees, non-employees, the environment and the communities within which the activity is carried out. Set environmental targets, allocate appropriate resources to achieve those targets, and undertake periodic reporting of Environmental Performance.	Ongoing	Environmental Manager
3.Communication	Describe the manner in which the Works will inform employees of any environmental risks which may result from their work; and The manner in which the risks must be dealt with in order to avoid pollution or the degradation of the environment	Internal: How do the employees receive the information? • At safety training sessions (Weekly talk topics); • Induction programmes; • Regular publications and information leaflets; • Bulletin boards (posters), • Electronic mail messages, • Forum meetings, which involves the local I&AP's and the DARDLEA. • Communicate and consult with employees and contractors in developing EMS and improvements. External: A clear communication point should be established that will be responsible for liaison with the I&APs should any concerns rise. A complete procedure for I&AP liaison must be made available to all on site. Communication from I&APs may be received by e-mail, fax, telephonically or by mail. Where required, a written response will be sent, on receiving such communication, by the appropriately appointed individual under signature of the Project Manager, to the respective I&AP. All events or concerns will be captured and actioned on an existing and/or future database.	Ongoing	Management & Environmental Manager
4. Information	Availability of Environmental Report in a format to allow compliance and implementation on all levels.	Information from internal (EMP, etc.) and external sources would be put in a language understandable to workers. Environmental information will be communicated via the methods spelled out above.	Ongoing	Environmental Manager
5. Training	Knowledge on all levels to ensure compliance and implementation on all levels, as well as to ensure responsibility.	All employees should receive basic environmental awareness training, either as induction training or later at special training sessions. Different levels of responsibility in relation to individual's potential impact on the environment must be addressed in the training session. Induction: All full-time staff and contractors are required to attend an induction session. Contractors and staff during the construction phase will be inducted prior to the commencement of their work for the construction. These workshops will be conducted in English, as well as one of the local languages.	Ongoing	Environmental Manager and Supervisors

Aspects	Objectives	Description	Time Period	Responsible Party/Person
		This induction will form part of the health and safety induction. Environmental issues and aspects related to the operation phase and other relevant phases will be addressed in the induction sessions. All environmental impacts and aspects and their mitigatory measures will be discussed, explained and communicated to all. The induction sessions will be modified according to the level of contractor and staff attending the induction session, so that all employees gain a suitable understanding of environmental issues and pollution. Annual revision of induction will be required for all employees and contractors. <u>On the Job Training:</u> On the job training is an essential tool in environmental awareness. Unskilled employees will be given details of the expected environmental issues and concerns specifically related to their occupation. Unskilled employees will be trained on how to respond if an environmental problem or source of environmental pollution arises during construction. <u>Further Training:</u> Further motivation of the workforce will be achieved through in-house training and attending short courses with regard to environmental management, etc. Appropriate training relevant to the achievement of the environmental policy, implementation of the environmental management program will be provided to all personnel. Employees shall have an appropriate knowledge base. The Works will also ensure that the contractors working on site provide evidence that they have the requisite knowledge and skills to perform the work in an "environmentally responsible manner". Education and training are needed to ensure that the employees' knowledge of regulatory requirements, internal standards and policies and objectives is current.		
6. Reporting	Record keeping allowing for the implementation of action plans and trends to work towards ongoing improvement.	<u>Specialist Reports:</u> Copies of relevant specialist study reports and EMPs will be available on request from an external party. Queries from I&APs: Response to queries about environmental impacts and aspects will be addressed by the relevant department and approved by the project manager. <u>Incidents:</u> Every environmental incident that might happen and which the workers become aware off should be reported to the manager. The worker can only report on incidents if he is made aware off the possible environmental risks through the communications methods indicated in section 1. A written reporting format should be put in place. Communication includes establishing processes to report internally and, where desired, externally, on environmental activities in order to: • Demonstrate management commitment to responsible environmental management; • Deal with concerns and questions about environmental issues; • Raise awareness of the organisation's environmental policies, EMP; and • Inform internal or external interested parties about the Works' management system;	Ongoing	All

Aspects	Objectives	Description	Time Period	Responsible Party/Person
		A formal complaints/concerns reporting system to address I&AP will be put in place (complaints register); Significant incidents will be reported in line with the required reporting requirements in terms of the NEMA and NWA.		
Risk Management	The following requirements of ISO14001 have bearing: 1. The organisation shall establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them. 2. The organisation shall respond to actual emergency situations and accidents and prevent or mitigate associated adverse environmental impacts. 3. The organisation shall periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or emergency situations. 4. The organisation shall also periodically test such procedures where practicable.	Environmental risks must be identified and procedures must be set in place to deal with risks, which could include: • Fires; • Spills of hazardous substances, including explosions; • Leaks or breaks of pipes or vessels, including dam overflows; • Accidents, especially during adverse weather; • Slow environmental degradation related to continuous poor housekeeping; and • Social issues, either complaints about poor environmental management, or direct employment type issues. Many of these environmental risks have been identified in the EMP and therefore the risk assessment exercise will not be repeated here. Once the mitigation measures have been read in the EMP chapter, it will be clear what training will assist with the prevention or reduction of each environmental risk.	Ongoing	Supervisor and Environmental Manager

9.10 Specific Conditions

The following specific conditions are recommended for inclusion into the Environmental Authorisation:

- The project may only commence with the approval of the Environmental Authorisation, as well as the AEL.
- All chemicals must have a Material SDSs in place and must be managed accordingly.
- No interlinkages may be present between the three (3) H_2SO_4 Storage Tanks.
- The plant area must be in a fully bunded area with no opportunity for spills beyond the footprint of the plant.
- Dirty water must report directly to the RO Plant.
- RO Plant water must be the first supply of water to the plant whereafter natural resources, as approved of in the WUL should be considered.
- A Phase 1 Contaminated Land study must be conducted at the commencement of the Decommissioning Phase.

10 DESCRIPTION OF ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

The Basic Assessment Report (BAR) was undertaken successfully, with consideration on the following limitations and assumptions:

- The project description is based on the project and process information provided by the applicant and was assumed to the accurate and true;
- Independent specialists have been consulted regarding the key environmental considerations, however past studies were also considered in the environmental understanding and assessment of the project;
- No alternative site was assessed as part of this project and only the optimal generation capacity within the identified areas was determined; and
- A preliminary site layout has been developed. Some features may change when final designs are drawn up by the Engineer contractor prior to construction.

11 CONCLUDING STATEMENT

Since the end of April 2015, various facilities at ARMMDW have been placed on “care and maintenance”. These included all four (4) of the electric furnaces at the Works; the raw materials handling system; the Pelletising Plant; and the CSD Plant. The current employment numbers have dwindled to about 20 full time personnel on site.

Currently the only activities undertaken on site include the selling of Slag from the approved Slag facilities [excluded from the definition of a waste issued by the Department of Forestry, Fisheries and the Environment (DFFE) for Ferrochrome and Ferromanganese Slag, respectively): 12/9/11/L200702095913/6/N/Exclusion Application and 12/9/11/L200622135529/6/N/Exclusion Application] The Historic Slag Dump is being reworked, and new extensions are available for future disposal. In addition to this, ARMMDW is currently in the process of constructing a RO Plant (approved in terms of the NWA under reference 05/X21F/ACFGI/8736, dated 5 February 2019 and the NEMWA under reference 12/9/11/L891/6, dated 11 April 2016).

ARM is highly committed to ensure that the ARMMDW is operating in terms of all Environmental Authorisations requirements and specifically to have a facility which could once again contribute to improved Social and Economic Conditions within eNtokozweni and the greater Emakhazeni Local Municipality and Nkangala District Municipality within the Mpumalanga Province. The ARMMDW has invested significant capital to investigate alternative options to recommence operations.

Manganese has elemental qualities that have the potential to improve density, capacity, rechargeability, safety and battery longevity. Other than being an ingredient in potential alternatives to lithium-ion batteries, manganese is an important component of the two most commonly produced types of batteries available today. Lithium-ion-manganese-oxide (LMO) batteries are the type of batteries currently used to power almost everything rechargeable.

Further considering an article published by Fastmarkets, 4 April 2022 (www.fastmarkets.com), an industry expert has warned that in the next ten years demand for high-purity manganese is likely to exceed supply unless more attention is paid to the battery-grade metal. The article states that manganese is widely used in steel production, accounting for more than 90% of global consumption.

Less than 2% of global consumption is converted into high-purity manganese for the battery sector. Many lithium-ion batteries, such as nickel-cobalt-manganese (NCM), use manganese sulphate as a raw material for the cathode precursor. The article stated that in the coming years, battery producers will be looking into reducing cobalt and nickel and increasing manganese consumption. ARM mines and beneficiates iron ore, manganese ore, chrome ore, PGMs, nickel and coal and also has a strategic investment in gold through Harmony Gold Mining Company (Harmony). One of the divisions within ARM is ARM Ferrous. ARM's ferrous metals interests are held through wholly owned ARM Ferrous which owns 50% of Assmang (Pty) Ltd, a long-established miner and processor of metals for the world's steel industries. The other 50% of Assmang is held by Assore Ltd. Assmang's operating divisions are based on its two principal commodities: iron ore and manganese ore.

ARMMDW has a Manganese Stockpile with a capacity to supply more than 12 years of manganese slag suitable for battery grade $MnSO_4$.

Considering the above, and the fact that the Works has an existing Manganese Slag Stockpile and feasibilities have indicated that the process will be successful in producing battery grade $MnSO_4$, the project is an economic opportunity for the Works and the socio-economic setting.

In cognisance of the findings of the assessment, and that the project will contribute to the economic setting of the area without fatal flaws or significant impacts, with the required management measures, it is recommended that the proposed activities be authorised.

12 OATH OF AFFIRMATION BY THE EAP

The EAP herewith confirms:

12.1 The correctness of the Information provided in the Reports
12.2 The inclusion of Comments and Inputs from Stakeholders and I&APs
12.3 The inclusion of Inputs and Recommendations from the Specialist Reports where relevant
12.4 That the Information provided by the EAP to I&APs and any Responses by the EAP to Comments and Inputs made by I&AP are correctly reflected herein

Signature of the Environmental Assessment Practitioner

EnviroGistics (Pty) Ltd

Name of company

Date

13 CLIENT COMMITMENT

Herewith I, *the person whose name and identity number is stated below*, confirm that I am the person authorised to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises EIA and EMP compiled in accordance with the guideline on the Departments official website and the directive in terms of sections 29 and 39 (5) in that regard, and the applicant undertakes to execute the Environmental management plan as proposed.

_____
Full Names and Surname

_____
Identity Number

_____
Designation

_____
Signature

_____
Date

14 ANNEXURES

Annexure 1: Environmental Authorisations (AEL)

Annexure 2: NEMA Application and Acknowledgement

Annexure 3: EAP CV

Annexure 4: Stakeholder Consultation

Annexure 5: Specialist Studies

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Notification Proof

Stakeholder Database

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BID

Comments Received

Notification Proof

Stakeholder Database

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BID

Comments Received

Annexure 5: Specialist Studies

Air Quality

Water Balance

Heritage and Paleontology