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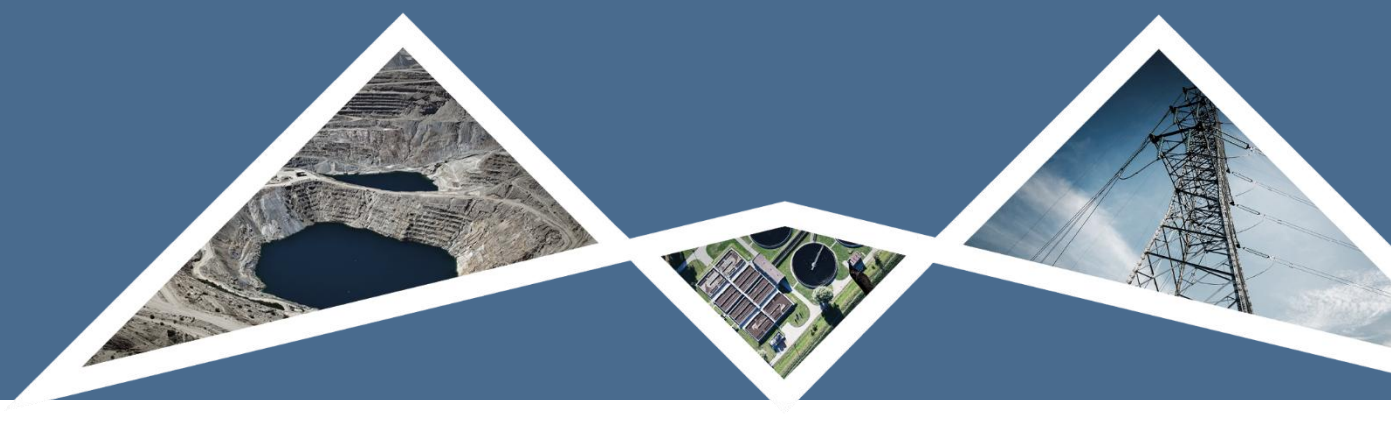
INTEGRATED WATER AND WASTE MANAGEMENT PLAN

HARMONY VALLEY TAILINGS STORAGE FACILITY



DOCUMENT DETAILS

EIMS REFERENCE: 1566

DOCUMENT TITLE: IWWMP: Harmony Valley Tailings Storage Facility

DOCUMENT CONTROL

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REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2026/01/21	ORIGINAL DOCUMENT	Harmony Valley TSF: Integrated Water and Waste Management Plan for Public Review

Table of Contents

List of Figures

List of Tables

Appendices

Abbreviations

CMA	Catchment Management Area
CMS	Catchment Management Strategy
DEA	Department of Environmental Affairs
DME	Department of Minerals and Energy
DMR	Department of Mineral Resources
DWS	Department of Water and Sanitation (formerly DWA / DHSWS)
EAP	Environmental Assessment Practitioner
ECO	Environmental Control Officer
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services (Pty) Ltd.
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
EMPR	Environmental Management Program
EMS	Environmental Management System
EO	Environmental Officer
ES	Ecological Sensitivity
ESMS	Environmental and Social Management System
I&AP	Interested and Affected Party
IEMPR	Integrated Environmental Management Programme
IHIA	Intermediate Habitat Integrity Assessment
IHAS	Invertebrate Habitat Assessment System (IHIA)
ISO	International Organisation for Standardisation
IWWMP	Integrated Water and Waste Management Plan
LED	Local Economic Development
LOM	Life of Mine
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MSDS	Material Safety Data Sheets
MPRDA	Mineral and Petroleum Resources Development Act (Act 28 of 2002)
NEMA	National Environmental Management Act, (Act 107 of 1998).
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMWA	National Environmental Management: Waste Act (Act 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas

NWA	National Water Act, Act 36 of 1998
NWRS	National Water Resource Strategy
PCD	Pollution Control Dam
PES	Present Ecological Status
PPE	Personal Protective Equipment
PPP	Public Participation Process
PTN	Portion
RE	Remaining Extent
RMF	Regional Maximum Flood
RQO	Resource Quality Objectives
ROR	Rate of Rise
RWD	Return Water Dam
SANS	South African National Standards
SASS	South African Scoring System
SAWQG	South African Water Quality Guidelines
SDF	Standard Design Flood
SHE	Safety, Health and Environmental
SHEQ	Safety, Health, Environment and Quality
SLP	Social and Labour Plan
SWMP	Storm Water Management Plan
WARMS	Water Authorisation Registration and Management System
WMA	Water Management Area
WML	Waste Management License
WMS	Waste Management Strategy
WUL	Water Use Licence
WULA	Water Use Licence Application
WRD	Waste Rock Dump

1 INTRODUCTION

Harmony Gold Mining Company Limited (hereafter referred to as Harmony / "the applicant") has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Environmental Assessment Practitioner (EAP) to undertake the necessary environmental authorisation and associated consultation processes for a proposed new Tailings Storage Facility (TSF) near Welkom in the Matjhabeng Local Municipality in the Free State province.

A new deposition site will be required for Harmony One Plant to replace the FSS2 and St. Helena 4 Tailings Storage Facilities by July 2024. The Valley TSF will cover an area of approximately 163 ha. The proposed TSF will be located on Farm portions Rietpan 14 (0) and Ouders Gift 48 (0/RE). EIMS is appointed to compile and submit the required documentation in support of applications for of applications for:

- Environmental Authorisation (EA) and Waste Management License (WML) in accordance with the National Environmental Management Act – NEMA (Act 107 of 1998)- Listed activity: Listing Notice 2, Activity 15 as well as various Listing Notice 1 and 3 activities as well as the National Environmental Management: Waste Act – NEMWA (Act 59 of 2008)- Activity A14, B7, B10 and B11; and
- Water Use Licence (WUL) in accordance with the National Water Act – NWA (Act 36 of 1998). Water uses: Section 21 (c), Section 21 (i) and Section 21 (g). A separate application for a Water Use Licence (WUL) has been lodged with the Department of Water and Sanitation (DWS) for the water use triggers.

1.1 ACTIVITY BACKGROUND

Harmony (the applicant) holds an approved Mining Right (MR) and Environmental Management Programme (EMPr), in terms of the Minerals and Petroleum Resources Development Act (Act 28 of 2002, as amended) (MPRDA), for the mining of gold at various operations in the Welkom area (Mining Right Ref: MR84).

A new deposition site will be required for Harmony One Plant to replace the FSS2 and St. Helena 4 Tailings Storage Facilities by July 2024. Of the alternative sites, apart from the Nooitgedacht site, which is the subject of a separate EIA, several were identified and assessed as possible suitable deposition sites for the tailings from Harmony One Plant but were found not feasible. Following a review of other possibilities for the One Plant's future tailings deposition, an option to utilise the space between the Free State North 1 (FSN1) and Free State North 2 (FSN2) TSFs and portion of the footprint of the FSN4 TSF as shown in Figure 1 has been identified as a possible deposition site. The TSF will cover an area of approximately 163 ha. The proposed TSF will be located on Farm portions Rietpan 14 (0) and Ouders Gift 48 (0/RE).

Table 1: Applicant Details.

Applicant Details	
Applicant Name:	Harmony Gold Mining Company Limited
Contact Person:	John van Wyk
Postal Address:	Randfontein Office Park
	Corner Main Reef Rd and Ward Ave
	Randfontein
	Gauteng
	1759

Senior Environmental Coordinator	John van Wyk
Tel:	+27 83 682 4089
E-mail:	jvwyk@harmony.co.za

1.2 REGIONAL SETTING AND LOCATION OF ACTIVITY

The Valley TSF is located approximately 8km north-west of Welkom Central in the Free State Province, South Africa. The northern boundary of the site is demarcated by the R34 roadway. The R30 and the R710 roadways delineate the eastern and southern limits respectively. The Valley TSF location is shown in Figure 1 below.

1.3 PROPERTY DESCRIPTION

Table 2 indicates the farm portions that fall within the proposed project including details on the project location as well as the distance from the proposed project area to the nearest towns.

Table 2: Locality details

Farm Name	Rietpan 14 (0) and Ouders Gift 48 (0/RE)		
Application Area (Ha)	Approximately 163 Hectares		
Magisterial District	Matjhabeng Local Municipality within the Lejweleputswa District Municipality (Free State Province).		
Distance and direction from nearest towns	Welkom is located 3,7km southeast and Odendaalsrus is located 3 km northeast of the proposed TSF site. The geographic coordinates at the centre of the site are 27°54'59.44"S, 26°40'22.09"E.		
21-digit Surveyor General Code for Property on which Project is Located	**Farm Name:**	**Portion:**	**21 Digit Surveyor General Code**
	Rietpan 14	0	F03900000000001400000
	Ouders Gift 48	0/RE	F03900000000004800000

The locality and extent of the proposed TSF is shown in Figure 1 with the layout map shown in Figure 2.

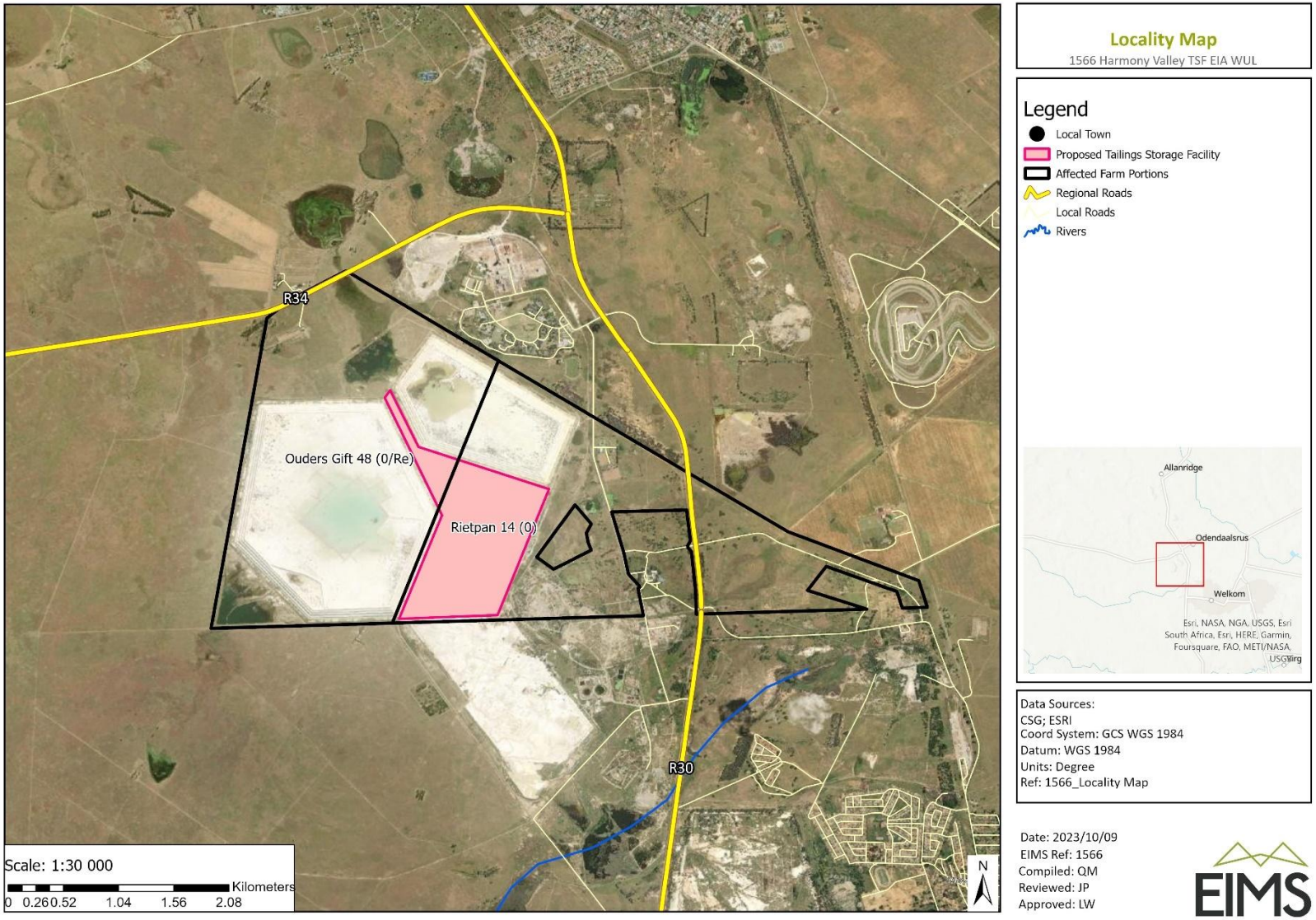


Figure 1: Aerial imagery locality map indicating the location of the proposed new tailings storage facility.

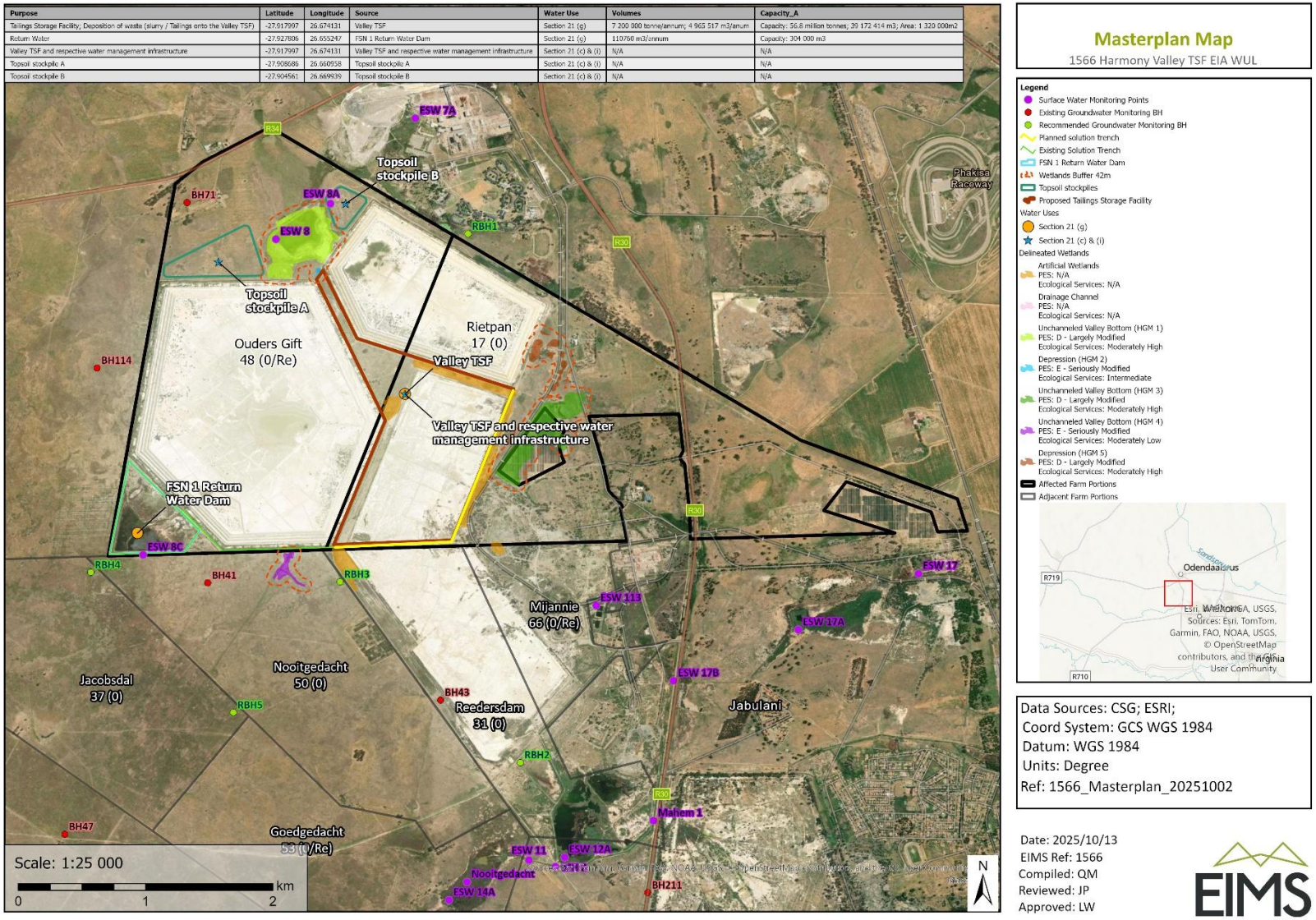


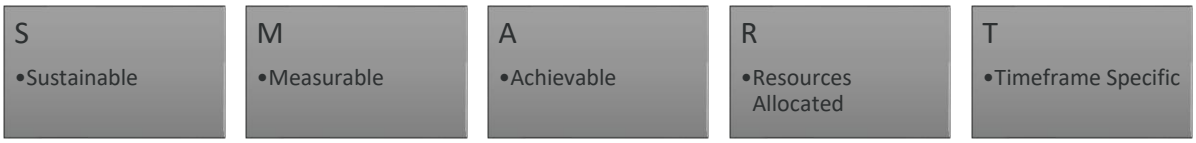
Figure 2: Masterplan map indicating the infrastructure of the proposed new tailings storage facility.

1.4 PURPOSE OF IWWMP

Although the requirement for the compilation of an Integrated Water and Waste Management Plan (IWWMP) was originally aimed at collating and rationalising the information submitted for Water Use Licence Applications (WULA) to the DWS, it has progressed beyond this purpose to:

- Provide the regulatory authorities with focused and structured information not only to meet their general information needs, but also to articulate the required management measures and actions to achieve the water and waste related performance on an on-going basis; and
- Provide direction and guidance to the water user on water and waste management of any activity.
- The IWWMP should be used in conjunction with other guidelines developed by DWS, such as the External Guideline on the Water Use Authorisation Process and the series of Best Practical Guidelines for water resource protection in the Industries and Mines. The Department and/or relevant Catchment Management Agencies (CMA) implement the integrated water resource management (IWRM) at source by means of an IWWMP.
- The Department requires an IWWMP as a simple feasible, implementable plan for water users based upon site specific programmes, also taking into account the National Water Resource Strategy (NWRS), Catchment Management Strategy (CMS), Resource Quality Objectives (RQO's) and sensitivity of the receiving water resource, upstream and downstream cumulative impacts of water use activities, external water use authorisation guidelines, as well as water use specific supplementary information requirements. The most important component of the IWWMP development process is the formulation of various strategies, goals and objectives for the water use or waste management of an activity, in accordance with the set philosophies and policies. The policies must address the four key areas related to IWWMP development, namely process water, storm water, groundwater and waste. The purpose of an IWWMP is as follows:
- Compilation of a site specific, implementable, management plan addressing all the identified water use and waste management related aspects (e.g., process water balances, storm water management, groundwater management, water re-use and reclamation, water conservation and demand management, waste minimization and recycling) of the specific activity, in order to meet set goals and objectives, in accordance with Integrated Water Resources Management principles;
- Provision of management plan to guide a water user regarding the water and waste related measures which must be implemented on site in a progressive, structured manner in the short, medium and long term;
- Documentation of all the relevant information, as specified in this guideline, to enable the Department to make the decision regarding the authorisation of a water use;
- Clarification of the content of the IWWMP from the DWS officials and the water users, as the various regional offices of DWS might have different interpretations regarding the content of an IWWMP;
- Standardisation of the format of the supporting documentation which the Department requires during submission of a WULA;
- Provision of guidance on the content of information required in an IWWMP as part of the water use authorisation process and level of detail that the Department requires to enable them to evaluate the supporting documentation to make a decision on authorisation water use; and
- Ensuring that a consistent approach is adopted by the Department and the various Regional Offices and CMA's with regards to IWWMPs.

It is the responsibility of the water user to demonstrate to the Department that the selected management measures in the IWWMP action plan adhere to the "SMART" concept i.e.:



It is a Departmental requirement that a water user needs to compile an IWWMP for any one of the following purposes:

- As the supporting technical documentation for any WULA (the main purpose of this document);
- When converting Existing Lawful Use (ELU) to licensed water use; and
- In order to comply with the conditions of an existing water use licence.

The implementation of the IWWMP is an interactive process whereas its performance is monitored on an annual basis. The assessment of the IWWMP document itself, as well as the submission of information relating to monitoring and auditing conducted in terms of it could lead to its shortcomings, which must be addressed in the annual update of the action plan of the IWWMP. This will ensure that the concept of continual improvement is applied throughout the life cycle of the activity (Operational Guideline: IWWMP dated February 2010 and GNR 267, the Water Use Licence Application and Appeals Regulations, dated March 2017).

In line with the guidelines of the DWS Operational Guideline: Integrated Waste and Water Management Plan (2010) and GNR 267, Water Use Licence Application and Appeals Regulations (2017), Figure 3 provides a guide to the structure of the IWWMP.

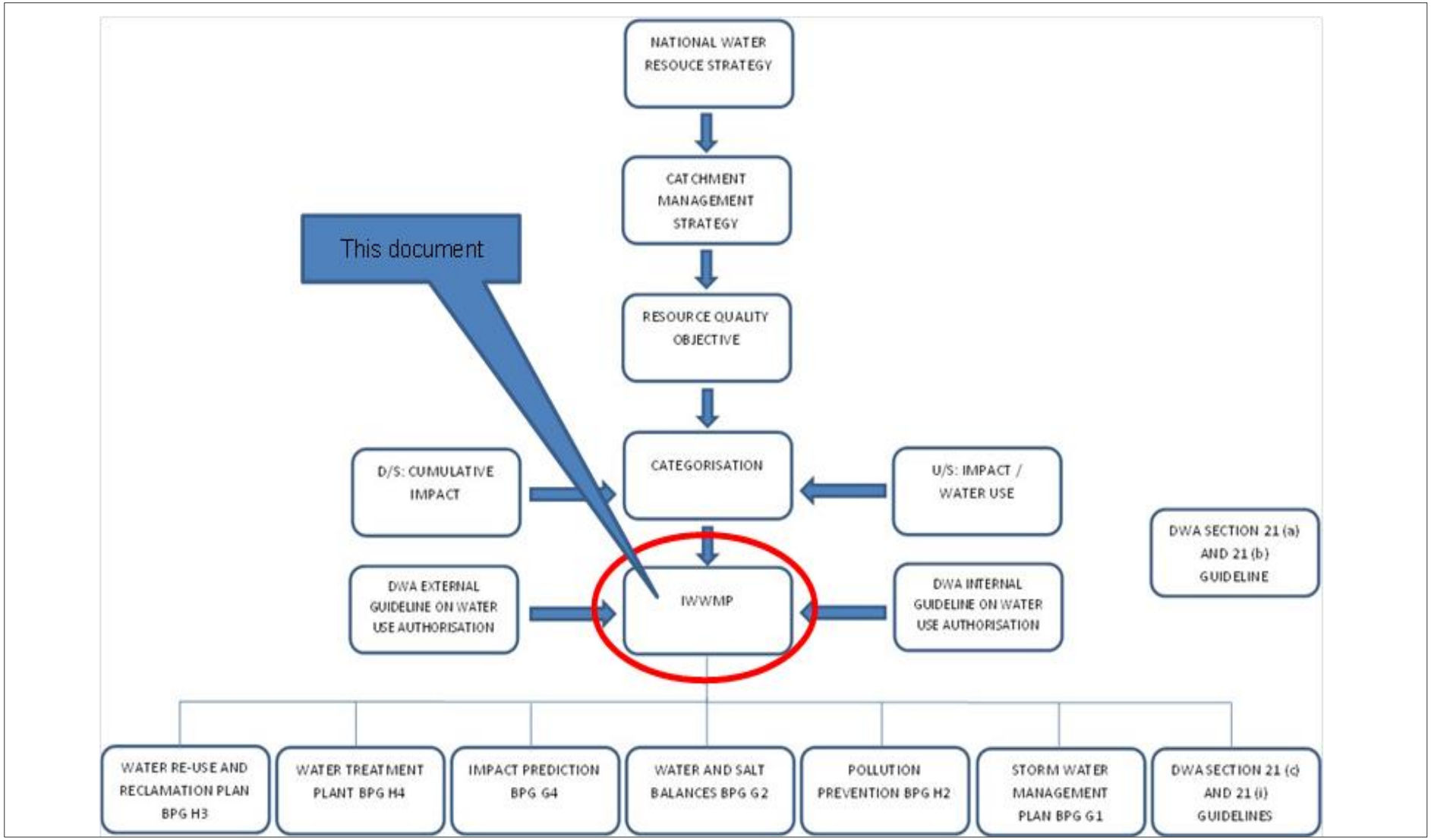


Figure 3: Schematic Layout of the IWWMP Approach

2 CONTEXTUALISATION OF THE ACTIVITY

The section below provides a detailed project description. The aim of the description is to indicate the activities that are performed at the mine. Furthermore, the detailed project description facilitates the understanding of the activities taking place that will result in impacts on the environment and for which mitigation measures are in place or plans are in place to implement these mitigation measures.

2.1 DESCRIPTION OF ACTIVITY

Tailings are the mineral waste remaining after ore processing to extract mineral concentrates and are typically stored within an engineered containment structure known as a tailing storage facility or TSF. Tailings is a common by-product of the metals and minerals recovery process. It usually takes the form of a liquid slurry made of fine metal or mineral particles and water – created when mined ore is crushed and finely ground in a milling process.

2.1.1 CONSTRUCTION PHASE

The construction phase of the project will require site establishment, site clearance, excavation, topsoil stripping and stockpiling, layering and compacting, prior to deposition of tailings at the site. No construction camps will be required and workers from surrounding towns will be bussed in.

The following operational activity details are relevant to the current application:

- Tailings material be delivered to the site through the use of existing slurry pipelines and deposition infrastructure.
- Infrastructure will include the TSF and associated infrastructure such as water management infrastructure including underdrainage pipeline infrastructure, solution trenches, and a return water dam.
- Tailings deposition method to be used: combination of spigot and cyclone deposition. Based on prior experience, the maximum rate of rise of 3.7m/year allows for safe upstream deposition. The stage capacity analysis indicates that the facility will provide a capacity of 56.8 million tons over 8.0 years at 600 000tpm.
- The Valley TSF will have a maximum height of 36m and a footprint area of approximately 163.5Ha.
- Stage capacities were developed for the Valley TSF based on a tailings in-situ dry density of 1.45 tons/m^3 at the design outer profile. The designed outer profile comprises an overall outer slope of 1V:4H with 3.0m high intermediate slopes of 1V:3H between each 3.0m wide bench.
- TSF barrier system as determined in consultation with the authorities and in compliance with relevant norms and standards for determination of liner requirements in terms of the NEM: WA (GN R. 636). The waste material solutes classify as a Type 3 waste. This requires a Class C liner system for the TSF and Return Water Dam (RWD).
- A TSF underdrainage system is provided above the liner system to intercept seepage through the facility. The underdrainage system lowers the phreatic surface, thereby improving the overall stability of the facility. The underdrainage system comprises of blanket drains and herringbone drainage pipes.
- A leakage detection system is to be installed beneath the liner system. The leakage detection system also alleviates any possible water pressure build-up beneath the liner from a potential rise of the groundwater table. In the event of a leak occurring, the drains serve to locate the area of the leak. Repairing the leak will then minimise the risk of possible contaminated seepage being released into the environment. The leakage detection outlet pipes discharge into the solution trench. All drain outlets will be clearly marked to distinguish between the underdrains, blanket drains and leakage detection drains. An underdrainage leak detection system will be monitored as part of the operations, maintenance, and surveillance plan to determine and quantify any leakage through the liner system.

The leakage detection drain comprises a 160mm slotted HDPE pipe surrounded in 19mm stone which is enclosed in a geofabric.

- The FSN1 RWD is an existing RWD. The FSN 1 RWD will be will be upgraded/ replaced with a new Lined RWD, to be known as the Valley RWD. The Valley RWD will have a total capacity of approximately 520 000 m^3.
- The Valley RWD barrier system comprises 200mm high geocells filled with 20Mpa concrete, underlain by a 1.5mm thick smooth HDPE liner and a 300mm base preparation layer compacted to 95% Proctor density at a moisture content between 0% and +2% of optimum moisture content. The RWD underdrainage comprise 160mm perforated HDPE pipes encased in 19mm washed stone. The stone will be wrapped in geofabric. The existing southern RWD will remain unlined.
- A silt trap is provided for at the Valley RWD. The silt trap ensures that solids are captured before entering the RWD, thereby minimising sedimentation in the RWD. The silt trap comprises a 2.25 m deep reinforced concrete water retaining structure and an access ramp is provided to allow for a TLB (or similar) equipment to clean out the silt trap when required. A sump has been included in each compartment of the silt trap to enable water to be pumped to the adjacent compartment prior to or after mechanical cleaning. Sluice gates (2 m x 1 m Gereg specification or similar approved) at the solution trench split will close off flow into one silt trap compartment while cleaning and maintenance is in progress.
- Warning signs will be installed around the perimeter of the TSF complex. A 5m wide all-weather access road is provided around the facility to all key infrastructure for operational and monitoring requirements.
- The main purpose of an anchor trench is to secure geomembranes at the top of slopes The Factor of Safety at the TSF anchor trench is 1.4. This indicates that the liner can withstand the shear stresses developed in the liner at the anchor trenches. The total tensile strain in the geomembrane is less than 1%. There will be no tensile strains due to the engineered base and 1.5mm double textured HDPE liner.

The proposed TSF barrier system is shown in Figure 4.

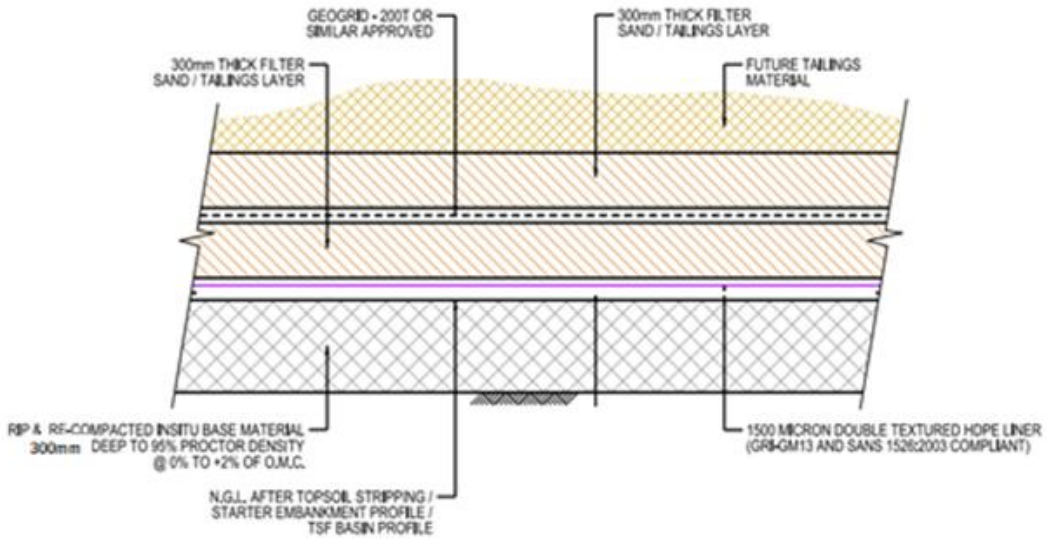


Figure 4: TSF Liner system proposed.

The barrier system comprises the following layers (from top down):

- 300mm thick layer of selected tailings material (only where geogrid is installed).
- A 200T geogrid is to be placed 100m from the outer walls only (only where geogrid is installed).
- 300mm thick layer of selected tailings material.

- Above liner drain comprising 160mm perforated HDPE pipes placed in a trapezoidal trench. The pipes will be encased in 19mm washed stone and wrapped in geofabric.
- 1.5mm thick double textured HDPE membrane (GRI-GM13 and SANS 1526:2003 compliant).
- A 300mm layer of in-situ clay.
- Ripping and recompacting of the in-situ base material to 95% Proctor density at a moisture content between 0% and +2% of optimum moisture content.
- Leakage detection system comprising 160mm perforated HDPE pipes placed in a 500mm-by-500mm trench. The pipes will be encased in 19mm washed stone and wrapped in geofabric.

The regulations allow the use of alternative materials such as geosynthetic composites for drainage, geotextiles for protection and geosynthetic clay liners for compacted clay liner proven to exhibit equivalent performance to the natural materials indicated in GN 636: National Norms and Standards for Disposal of Waste to Landfill.

2.1.2 OPERATIONAL PHASE

Tailings will be deposited using cyclones. During cyclone tailings deposition, the total tailings stream is split into a coarse fraction (underflow) and fine fraction (overflow) by centrifugal separation. The coarse underflow is usually discharged as a flare or spray in the shape of an inverted cone (spray discharge). A continuous discharge with the appearance of a rope (roping discharge) must be avoided. The optimum split of underflow is usually achieved when the underflow is spraying, but just at the point between spraying and roping.

The cyclones will be supported on customised steel stands placed in such a manner that an underflow cone of about 1.2m high will be deposited. The cyclone and stand will then be moved to an adjacent position to deposit another underflow cone the fine overflow will be discharged into the basin through an overflow pipe connected to the cyclone.. During commissioning the overflow pipes must be long enough to discharge overflow directly into the basin area beyond the blanket drains.

2.1.3 DECOMISSIONING PHASE

The closure of TSFs will involve their rehabilitation. Contour walls will be constructed, after which additives will be applied in order that favourable conditions for plant growth can occur. Once this has been achieved, vegetation will be planted on top and on the sides of the tailings to stabilise the tailings against wind and water erosion. When the vegetation has been established maintenance and monitoring of the tailings dam will take place. The maintenance will take place over a period of three years, while the monitoring will take place over a period of five years on a quarterly basis by analysing samples for pollutants.

2.2 EXTENT OF THE ACTIVITY

The final tailings facility will have a footprint of approximately 163 ha along with the drainage infrastructure which will function to convey process water to the Valley RWD.

2.3 KEY ACTIVITY PROCESSES AND PRODUCTS

The proposed TSF will consist of material being deposited on specialised drainage infrastructure, as such the only key product is the tailings being deposited from Harmony One Plant. As part of the tailings being deposited, wastewater will be produced which will follow the drainage infrastructure to the Valley RWD.

2.4 ACTIVITY LIFE DESCRIPTION

As stated in section 1 of this report, the proposed Valley TSF will replace the FSS2 and St. Helena 4 TSF facilities by 2024. The Valley TSF is estimated to be feasible for use for approximately 8 years.

2.5 ACTIVITY INFRASTRUCTURE DESCRIPTION

For a full description of the technical aspects of the infrastructure for the Valley TSF, please refer to Section 2 of this report.

2.6 KEY WATER USES AND WASTE STREAMS

The following details are relevant to the current application:

- Radioactive waste is handled and disposed of as per the requirements of the Certificate of Registration (COR - 58A 0192) issued in terms of the National Nuclear Regulator (NNR) Act, 1999 (Act No. 47 of 1999);
- TSF for storing of slimes-affected water;
- RWD for re-use of water from the TSF dam; and
- Domestic Waste is sorted on site and disposed to a registered landfill site.

2.7 ORGANISATIONAL STRUCTURE OF ACTIVITY

The reporting structure/procedure for Harmony is presented in Figure 5: Organogram of the Harmony Gold. below.

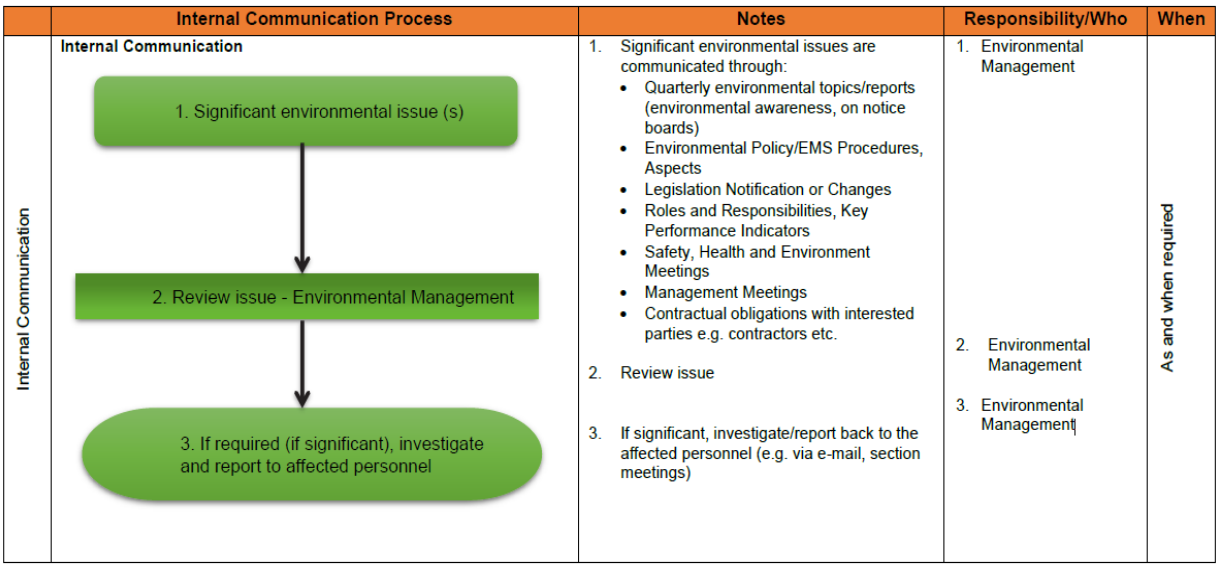


Figure 5: Organogram of the Harmony Gold.

2.8 BUSINESS AND CORPORATE POLICIES

The business corporate policy of Harmony is the Health Safety and Environment Policy. The policy emphasizes the company's commitment to:

- Conform to the Health, Safety and Environment Legislation;
- Manage and maintain an HSE and Quality System that is in line with internationally recognised quality management systems;
- Conduct business in a manner that safeguards its people and the environment from harm; and
- To communicate with employees, the community and authorities on issues that is relevant to the mine and the community.

3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

Harmony holds an approved Mining Right (Ref: MR84). The Department of Mineral and Petroleum Resources (DMPR) has granted an amendment to the Environmental Authorisation in terms of the NEMA (Act No. 107 of 1998) and the EIA Regulations, 2014 (as amended). Harmony is currently in the process of applying for a Water Use Licence (WUL) for the proposed Valley TSF Project. This Integrated Water and Waste Management Plan (IWWMP) forms part of the supporting documentation for the WULA.

3.1 SUMMARY OF WATER USES

A summary of the water uses applied for is indicated in Table 3.

Table 3: Water Uses for the Harmony Valley TSF.

Source	Purpose/Description	Properties	Volume (m^3/a)	Capacity (m^3)/ Area (m^2)	Co-ordinates	
					Latitude	Longitude
Section 21 (g)						
Valley TSF	Tailings Storage Facility Deposition of waste (slurry / Tailings onto the Valley TSF)	OUDERS GIFT 48, PTN 0 REITPAN 17, PTN 0 RE	7 200 000 tonne/annum 4 965 517 m3/Anum	Capacity: 56.8 million tonnes 39 172 414 m^3 Area: 1 320 000m^2	S 27°55'4.79"	E 26°40'26.87"
Valley RWD (currently FSN 1 RWD)	Return Water	OUDERS GIFT 48, PTN 0	110760 m3/annum	Capacity: 520 000 m^3	S 27°55'40.10"	E 26°39'18.89"
Section 21 (c) and (i)						
Valley TSF and respective water management infrastructure	Valley TSF located within 500m of wetlands (HGM 1, HGM 3, HGM 4, HGM 6 and HGM 6)	OUDERS GIFT 48, PTN 0 REITPAN 17, PTN 0 RE	-	-	S 27°55'4.79"	E 26°40'26.87"
Topsoil stockpile A	Topsoil stockpiles located within 500m of a wetland (HGM1)	OUDERS GIFT 48, PTN 0	-	-	S 27°54'31.27"	E 26°39'39.45"
Topsoil stockpile B					S 27°54'16.42"	E 26°40'11.78"

3.2 EXISTING LAWFUL USES

In terms of Section 32 of the NWA, an existing lawful water use is defined as follows:

"*Water use which has taken place at any time during a period of two years immediately before the date of commencement of the Act (1 October 1996 to 30 September 1998) and which was authorised by or under any law which was in force immediately before the date of commencement of this Act, or which has been declared an existing lawful water use in terms of Section 33 of the Act*".

Harmony Gold has various existing water uses for its operations in the greater Welkom region. These uses include but are not limited to plant activities, TSF facilities, pipelines, return water dams etc.

3.3 EXEMPTION TO THE REQUIREMENTS OF GN 704 OF 4 JUNE 1999

The Department of Water Affairs and Forestry (now the Department of Water and Sanitation) established General Notice (GN) 704 (dated 4 June 1999) to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The conditions of GN704 relevant to this project are as follows:

- Condition 4 – Restrictions on locality – No person in control of a mine or activity may:

    (a) locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100-year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked;

- Condition 5 – Restrictions on use of material

    - No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.

General Notice (GN) 704 (dated 4 June 1999) placed certain restrictions on mining and related activities for the protection of water resources. In terms of Regulation 3, the Minister may in writing authorise an exemption from the requirements of regulations 4, 5, 6 and 7 on his or her own initiative or on application, subject to such conditions as the Minister may determine. Certain of the proposed mining activities for the Harmony Valley TSF will require exemptions from GN 704 as listed above.

Harmony currently holds no exemptions to the regulations of GN 704 for their Free State operations. Motivation for the requested exemptions can be found in Section 3.8.

3.4 GENERAL AUTHORISATION WATER USES

No general authorisations are currently in place.

3.5 NEW WATER USES TO BE LICENCED

Since no existing WUL authorisations exist for this project, only the water uses being applied for in Table 3 are relevant and are shown in the Master plan map as shown in Figure 6. The following water uses are applied for as part of this WULA.

3.5.1 SECTION 21(C): IMPEDING OR DIVERTING THE FLOW OF WATER IN A WATERCOURSE AND SECTION 21(I): ALTERING THE BED, BANKS, COURSE OR CHARACTERISTICS OF A WATERCOURSE

The following activities will be undertaken that falls within the ambit of a Section 21(c) and (i) water use activity:

- Valley TSF and its associated infrastructure is located within 500m of wetlands (HGM 1, HGM2 , HGM 3, HGM 4, and HGM 5)
- Topsoil stockpiles (A and B) located within 500m of wetlands (HGM 1 and HGM 2)
- Valley RWD located within 500 m of HGM 4.

Registration and licensing requirements

According to the GN 509 general authorisations, dated 26 August 2016, subject to the provisions of this general authorisation, a person who uses water as contemplated in this general authorisation must submit the relevant registration forms to the responsible authority. Registration is, therefore, required.

According to the GN 509 general authorisations, the following exclusions from the general authorisation are applicable –

a) to the use of water in terms of section 21(c) or (i) of the Act for the rehabilitation of a wetland as contemplated in General Authorisation 1198 published in Government Gazette 32805 dated 18 December 2009,

b) to the use of water in terms of section 21(c) or (i) of the Act within the regulated area of a watercourse where the Risk Class is Medium or High as determined by the Risk Matrix (Appendix A). This Risk Matrix must be completed by a suitably qualified SACNASP professional member;

c) in instances where an application must be made for a water use licence for the authorisation of any other water use as defined in section 21 of the Act that may be associated with a new activity;

d) where storage of water results from the impeding or diverting of flow or altering the bed, banks, course or characteristics of a watercourse; and

e) to any water use in terms of section 21(c) or (i) of the Act associated with construction, installation or maintenance of any sewerage pipelines, pipelines carrying hazardous materials and to raw water and wastewater treatment works.

Section 21(g) water uses form part of this application, accordingly, a licence for the Section 21(c) and (i) water use activities is required.

3.5.2 SECTION 21(G): DISPOSING OF WASTE IN A MANNER WHICH MAY DETRIMENTALLY IMPACT ON A WATER RESOURCE

The following activities will be undertaken that falls within the ambit of a Section 21(g) water use activity:

- Valley TSF;
- Valley[1] RWD (currently known as FSN1 RWD)

Registration and licensing requirements

According to GN655 of 06 September 2013, a person who stores wastewater in terms of this authorisation must submit a registration form for registration of the water use before commencement of storage if more than 1 000 cubic metres are stored for disposal or if more than 500 cubic metres are stored for re-use. According to GN655 of 06 September 2013, a person may store up to 5 000 cubic metres of domestic and/or biodegradable industrial wastewater for the purpose of reuse if the storage of wastewater does not impact on a water resource or any other person's water use, property or land and it is not detrimental to the health and safety of the public in the vicinity of the activity. As the storage volumes for the RWDs are greater than 5 000 m^3, a water use licence is required.

[1] The FSN 1 RWD will be will be upgraded/ replaced with a new Lined RWD, to be known as the Valley RWD. The Valley RWD will have a total capacity of approximately 520 000 m^3.

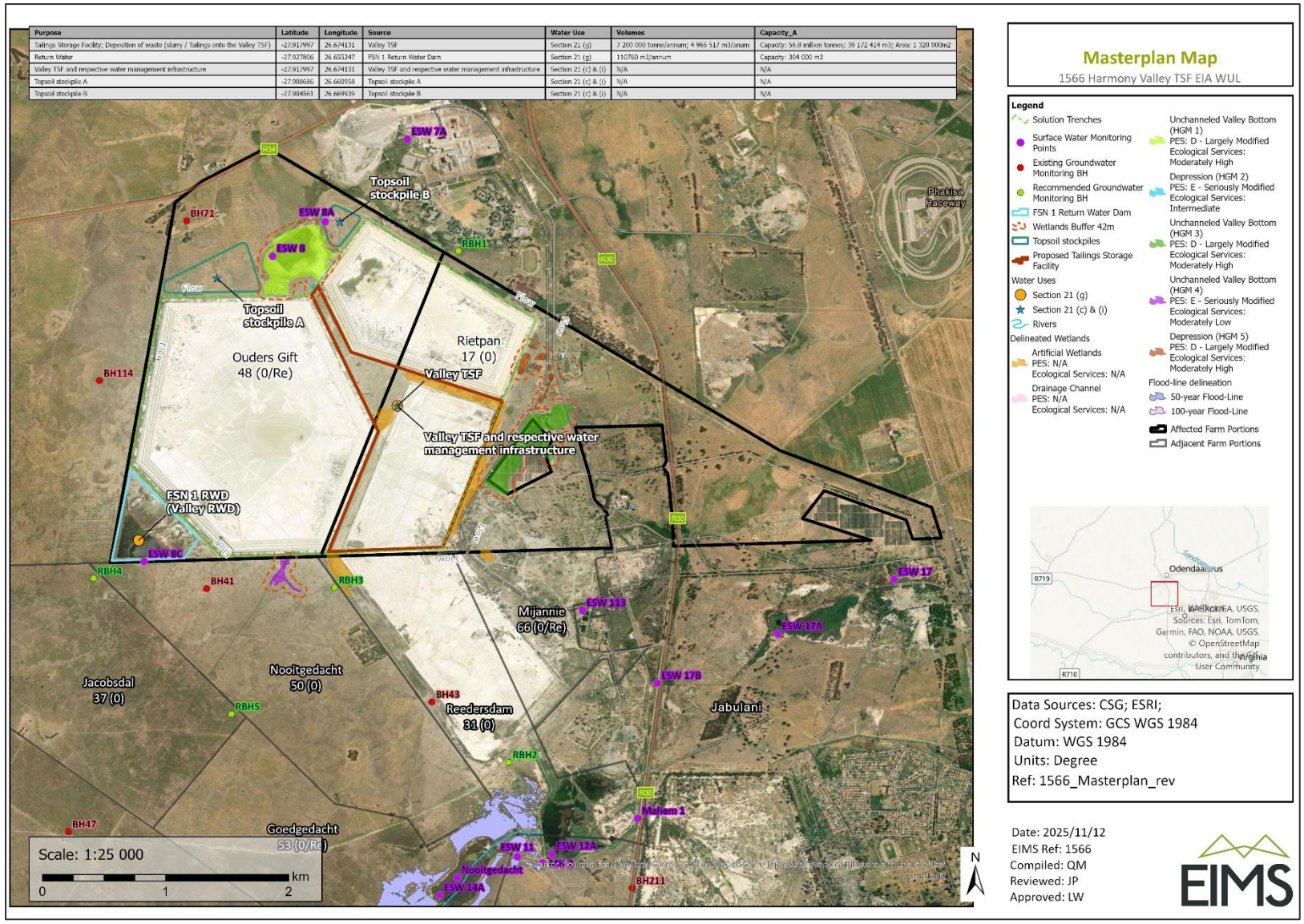


Figure 6: Master Layout Plan

3.6 WASTE RELATED AUTHORISATIONS

The Harmony Valley TSF is by its nature a waste storage facility and as such authorisations will be required in terms of the National Environmental Waste Act, 2008 (NEMWA).Waste is accordingly governed by the provisions of the National Environmental Management: Waste Act, 2008 (NEMWA).

Section 16 of the NEMWA must be considered which states as follows:

1. A holder of waste must, within the holder's power, take all reasonable measures to-
    a. "Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
    b. Reduce, re-use, recycle and recover waste;
    c. Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
    d. Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;
    e. Prevent any employee or any person under his or her supervision from contravening the Act; and
    f. Prevent the waste from being used for unauthorised purposes."

These general principles of responsible waste management will be incorporated into the requirements in the EMPR to be implemented for this project.

Waste can be defined as either hazardous or general in accordance with Schedule 3 of the NEMWA (2014) as amended. "Schedule 3: Defined Wastes" has been broken down into two categories – Category A being hazardous waste; and Category B being general waste. Under Category A (hazardous waste), the act makes allowance for, but not limited to, "wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal; oil wastes and wastes of liquid fuels; and construction wastes".

In order to attempt to understand the implications of these waste groups, it is important to ensure that the definitions of all the relevant terminologies are defined:

- Hazardous waste: means "any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles."
- Residue deposits: means "any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right."
- Residue stockpile: means "any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act."
- General waste: means "waste that does not pose an immediate hazard or threat to health or to the environment and includes – domestic waste; building and demolition waste; business waste; inert waste; or any waste classified as non-hazardous waste in terms of the regulations made under Section 69."

NEMWA Planning and Management of Residue Stockpiles and Residue Deposits Regulations, 2015 (GNR 632):

The purpose of these Regulations is to regulate the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation. The identification and assessment of environmental impacts arising from residue stockpiles and residue deposits must be done as part of the

environmental impact assessment conducted in terms of the NEMA. A risk analysis based on the characteristics and the classification set out in Regulation 4 and 5 must be used to determine the appropriate mitigation and management measures. The pollution control barrier system shall be defined by the-

- National Norms and Standards for the Assessment of Waste for Landfill Disposal, 2013; and
- National Norms and Standards for Disposal of Waste to Landfill, 2013.

Waste related authorizations included in the IWUL are:

- The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.;
- The disposal of any quantity of hazardous waste to land;
- The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity); and
- The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).

The wate activities being applied for as part of the EIA process for this project are listed in Table 4 below.

Table 4: Waste activities applied for in terms of NEMWA

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
Category A, Activity 14	The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.	TSF decommissioning once operational phase (deposition) has concluded.
Category B, Activity B7	The disposal of any quantity of hazardous waste to land.	TSF operation
Category B, Activity B10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	TSF construction
Category B, Activity B11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)	TSF construction / operation

3.7 OTHER AUTHORISATIONS

The MPRDA aims to “make provision for equitable access to, and sustainable development of, the nation’s mineral and petroleum resources”. The MPRDA outlines the procedural requirements that need to be met to acquire mineral and petroleum rights in South Africa. The MPRDA further governs the sustainable utilisation of South Africa’s mineral resources. In the event that the proposed activities require material (e.g., sand, gravel, aggregate) for the purposes of construction then the provisions of the MPRDA may apply.

In support of the EA application submitted for the Harmony Valley TSF Project area, the applicant conducted an EIA process comprising of the preparation of environmental Scoping and EIA Reports, an EMPR, as well as Interested and Affected Party (I&AP) consultations, all of which were submitted to the DMR for adjudication and was granted a positive authorisation. The listed activities in terms of NEMA are listed in Table 5 below.

Table 5: NEMA listed activities relevant to the Valley TSF

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
GN983, Activity 10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes- (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	Various pipelines over 1000m in length and 0.36m in diameter are proposed as part of the project which will trigger this activity including penstock pipelines and drainage collection pipelines.
GN983, Activity 12	The development of- (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs- (a) within a watercourse; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse;- excluding- (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.	Various wetlands were identified within and in close proximity to the proposed TSF site. The TSF has a footprint of over 100 square meters and will be located across various identified artificial wetlands.
GN983, Activity 19	"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand,	Various wetlands were identified within and in close proximity to the proposed TSF site.

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
	shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving- (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies."	Infilling and dredging of over 10 cubic meters of material in these identified wetlands within the TSF footprint will be required.
GN983, Activity 21D	Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment.	Amendment of the approved Mining Right EMPr through a MPRDA Section 102 application will be required.
GN984, Activity 6	The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding- (i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or (iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.	Although the TSF is included in the list of waste management activities, the WUL application includes 21(g) activities for which this activity will find applicability.
GN984, Activity 15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or	Clearance of over 20ha of indigenous vegetation will be required for the TSF footprint. The total area to be cleared is 163ha. The amount of indigenous vegetation to be cleared was calculated to be just over 20 ha.

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
	(ii) maintenance purposes undertaken in accordance with a maintenance management plan.	
GN985 Activity 4	The development of a road wider than 4 metres with a reserve less than 13,5 metres. b. Free State (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;	A 5m wide all-weather access road is provided around the facility to all key infrastructure for operational and monitoring requirements. The new roads will be 2km in length, Part of the site falls within an ESA 2 area.
GN985 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. b. Free State iv. Areas within a watercourse or wetland; or within 100 metres from the edge of a watercourse or wetland	Clearance of over 300 square meters of indigenous vegetation is required from within wetland areas. Part of the site also falls within an ESA 2 area.
GN985 Activity 14	"The development of- (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs- (a) within a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.". b. Free State (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans	Various artificial wetlands were identified within the identified TSF site. Part of the site falls within an ESA 2 area.

3.8 APPLICATION FOR EXEMPTION TO REGULATION GN 704 OF JUNE 1999

The following GNR 704 exemptions are applied for as part of this application. The table below includes an impact assessment, a management plan and a monitoring plan in support of the exemption application.

Table 6: Exemption motivations to the GNR 704.

No.	GN 704 Regulation	Activity requiring exemption	Motivation and reason for exemption
1.	4a. Restrictions on locality No person in control of a Mine or activity may – Regulation 4(a): locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within	Valley TSF FSN RWD	<u>Impact assessment:</u> The watercourses were delineated as part of the Wetland Baseline and Risk Assessment for the Proposed Harmony Valley Tailings Storage Facility (TSF) Project. The impacts on the watercourses were assessed and the risk was rated as High risk post mitigation for

No.	GN 704 Regulation	Activity requiring exemption	Motivation and reason for exemption
	the 1:100-year flood-line or within a horizontal distance of 100 metres from any watercourse.		HGM 1 and HGM 2, the current layout thus avoids the HGM 1 and HGM 2 with a post-mitigation buffer of 42 m being assigned to the systems. HGM 3 – 6 will not be impacted on by the proposed activities and will have low impacts as assessed in the Wetland Baseline and Risk Assessment Report included as Appendix B 1 of this IWWMP. <u>Management plan:</u> The Wetland Baseline and Risk Assessment for the Proposed Harmony Valley Tailings Storage Facility (TSF) Project study includes various mitigation measures to minimise the impact on the watercourses. The impacts on the watercourses were assessed and the risk was rated as High risk post mitigation for HGM 1 and HGM 2, the current layout thus avoids the HGM 1 and HGM 2 with a post-mitigation buffer of 42 m being assigned to the systems. HGM 3 – 6 will not be impacted on by the proposed activities. Furthermore the proposed TSF and associated RWD will be lined with an inverted barrier system Overall the level of significance of the impacts are considered low and therefore exemption to GN704 is being sought. Refer to Appendix B 1 for the Wetland Baseline and Risk Assessment. <u>Monitoring plan:</u> Refer to Section 4 for the monitoring plan applicable to the project.
2	5. Restrictions on use of material No person in control of a mine or activity may use any residue or substance which causes or is likely to cause pollution of a water resource for the construction of any dam or other impoundment or any embankment, road or railway, or for any other purpose which is likely to cause pollution of a water resource.	Utilising tailings material as part of the barrier system of the TSF.	Impact assessment: The geohydrological environment was assessed as part of the Geohydrological Impact Assessment for the Proposed Valley Tailings Facility, Free State Province. The report is attached as Appendix B 2 of this report. The impacts on the groundwater environment were assessed in the above-mentioned report wherein it was determined that the preferred alternative makes use of an ”ïnverted barrier system” comprising of underdrainage and a base preparation layer; a 1.5mm thick geomembrane ; and covered tailings the barrier system performance is improved by (a) seepage losses are reduced from about 140 l/ha/day to about 3 l/ha/day due to the

No.	GN 704 Regulation	Activity requiring exemption	Motivation and reason for exemption
			change from Bernoulli flow at discontinuities to D'Arcian flow controlled by the tailings permeability at these points. These leakage rates were included in the model and the impact simulated. The result from the 100-year simulation shows that any contamination from the site will be contained. The small volume of seepage that may flow through the liner system is diluted to the extent that contamination is not detected. As such the study concludes that the expected contribution of the impact from the Valley TSF is low and contained within the current impacted footprint. Management plan: The Wetland and Functional Impact Assessment for the Proposed Valley Tailings Facility (TSF) Project and Geohydrological Impact Assessment for the Proposed Valley Tailings Facility, Free State Province studies includes various mitigation measures to minimise the impact on the watercourses. The TSF will and its associated RWD will make use of an "ïnverted barrier system" comprising of underdrainage and a base preparation layer; a 1.5mm thick geomembrane ; and covered tailings the barrier system performance is improved by (a) seepage losses are reduced from about 140 l/ha/day to about 3 l/ha/day due to the change from Bernoulli flow at discontinuities to D'Arcian flow controlled by the tailings permeability at these points. Furthermore, the Wetland Baseline and Risk Assessment assessed the proposed development and rated the risk as High risk post mitigation for HGM 1 and HGM 2, the current layout thus avoids the HGM 1 and HGM 2 with a post-mitigation buffer of 42 m being assigned to the systems. HGM 3 – 6 will not be impacted on by the proposed activitieshas identified Refer to Appendix B 1 and Appendix B 2 for the Wetland Baseline and Risk Assessment, and Geohydrological assessment, respectively. The impacts are thus manageable and an exemption is being applied for.

No.	GN 704 Regulation	Activity requiring exemption	Motivation and reason for exemption
			Monitoring plan: Refer to Section 11 for the monitoring plan applicable to the project.

4 PRESENT ENVIRONMENTAL STATUS

The present environmental situation is consistent with the indications in the Environmental Management Plan (EMPr) Environmental Impact Assessment and Environmental Management Programme for Harmony Valley TSF which was compiled by EIMS.

4.1 TOPOGRAPHY

The topography of the location of the proposed TSF is fairly flat, comprising of undulating terrain. An analysis of topographical data indicated a slope of less than 1:10 over most of the project area.

4.2 CLIMATE

The average climate for the site is presented in Figure 7 using the outcome of the investigation into rainfall and evaporation for the site. The combination of rainfall (Pegram, 2016) and evaporation and temperature (Schulze and Lynch, 2006) result in a cold arid steppe climate according to the Köppen-Geiger climate classification 1.

4.2.1 TEMPERATURE

The lowest temperatures for the maximum temperatures are recorded over December and January whereas the minimum temperatures are recorded in June and July, this makes sense since these correspond with the summer and winter respectively as seen in Figure 7 below.

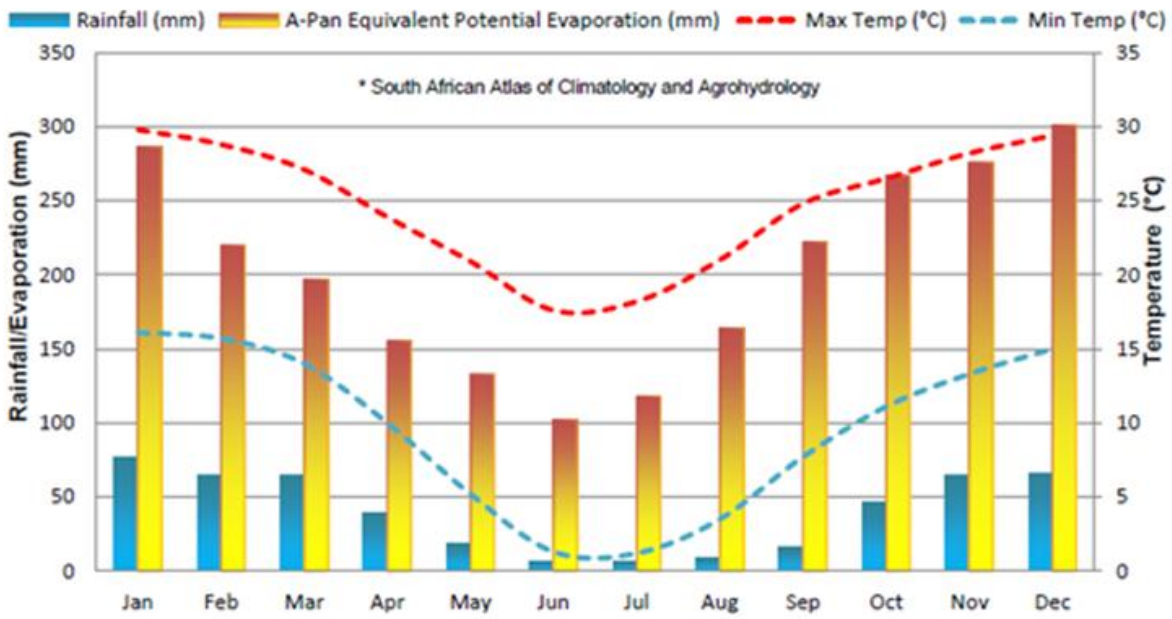


Figure 7: Climate summary

4.2.2 PRECIPITATION

The average monthly rainfall for the site was obtained from the Olivine Station (SAWS station No. 0328726 W) as shown in Table 7 below.

Table 7 Monthly rainfall and evaporation data

Month	Rainfall (mm)
January	83.9
February	71.4
March	71.9
April	43.2
May	18.9
June	7.4
July	7.5
August	8.5
September	16.9
October	47.8
November	67.5
December	69.4

4.2.3 EVAPORATION

Evaporation data was sourced from the South African Atlas of Climatology and Agrohydrology (Schulze and Lynch, 2006) in the form of A-Pan equivalent potential evaporation. The average monthly evaporation distribution is presented in Table 8 and shows the site has an annual potential evaporation of 2,441mm.

Table 8: Summary of Rainfall Data

Month	Lake evaporation (mm)
January	244.8
February	189.1
March	162.3
April	104.8
May	72.5
June	47.4
July	57.2
August	88.7
September	139.2
October	183.9
November	211.7
December	247.6

4.3 GEOLOGY

The Free State Goldfield which forms a triangle between Allanridge, Welkom and Virginia, produces gold from auriferous bearing reefs situated within sediments of the Central Rand Group of the Witwatersrand Supergroup. A detailed description of the geology of the Welkom Goldfields is provided by in Minter *et. al*; (1986). The mine geology, from shallow to deep, consist of the following:

- Karoo Supergroup;
- Ventersdorp Supergroup; and
- Witwatersrand Supergroup.

4.3.1 KAROO SUPERGROUP

The Karoo Supergroup in the Harmony Valley TSF study area is represented by the Vryheid Formation of the Ecca Group, comprising mudstone, siltstone, and fine- to coarse-grained sandstone. These sediments were deposited in a landlocked basin with deltaic and fluvial cycles, capped by coal beds formed in swampy environments. Dolerite intrusions are common and form impermeable layers that influence groundwater flow. The underlying Dwyka Formation, composed mainly of diamictite, acts as an aquiclude, separating the upper Karoo aquifer from deeper systems.

Hydrogeologically, the Karoo hosts two aquifers: a shallow weathered aquifer and a deeper fractured aquifer. The weathered aquifer occurs at depths of 10–20 m and has low vertical permeability, confining the underlying fractured aquifer. The fractured aquifer's water-bearing capacity is linked to secondary features like joints and dolerite contact zones. Groundwater yields vary, with dolerite intrusions playing a key role in flow dynamics. These aquifers are classified as minor systems with medium to low vulnerability, requiring medium to low levels of protection (MvB Consulting, 2025).

4.3.2 VENTERSDORP SUPERGROUP

The Ventersdorp Supergroup unconformably overlies the Witwatersrand Supergroup and consists of volcanic and sedimentary rocks, including andesitic lavas, tuffs, and agglomerates. It is subdivided into the Pniel sequence, Platberg Group, and Kliprivierberg Group. These formations reflect significant tectonic activity and

are associated with major fractures that were later filled with water, forming deep aquifers. The average thickness of the Ventersdorp Supergroup in the study area is approximately 1,319 m.

Hydrogeologically, the Ventersdorp rocks contribute to the deep aquifer system, often in conjunction with the Witwatersrand formations. These aquifers are typically brine-rich and situated at depths of 170–270 m. They are considered fossil or connate water systems, with minimal recharge due to the impermeable nature of the overlying Karoo sediments. Although post-Karoo tectonic events may have introduced limited connectivity, recharge remains negligible. These deep aquifers have been significantly dewatered due to mining, and recovery is unlikely (MvB Consulting, 2025).

4.3.3 WITWATERSRAND

The Witwatersrand Supergroup forms the economic backbone of the Free State Goldfield, hosting auriferous reefs within the Central Rand Group. This group comprises thick clastic sedimentary sequences dominated by quartzite, with minor shale and conglomerate. The reef horizons are found within paleoplacers formed during periods of erosion and deposition. The Central Rand Group is divided into the Turffontein Subgroup (Eldorado and Aandenk formations) and the Johannesburg Subgroup (Dagbreek, Harmony, Welkom, St Helena, and Virginia formations).

Hydrogeologically, the Witwatersrand aquifer is a deep, brine-rich system located approximately 300 m below surface. It is largely isolated from the overlying Karoo aquifers due to the Dwyka aquiclude. The aquifer has been extensively dewatered over the past four decades of mining, with water levels dropping significantly. Recharge is negligible, and the aquifer is unlikely to recover post-mining. Despite its historical significance, the Witwatersrand aquifer now plays a limited role in regional groundwater dynamics (MvB Consulting, 2025).

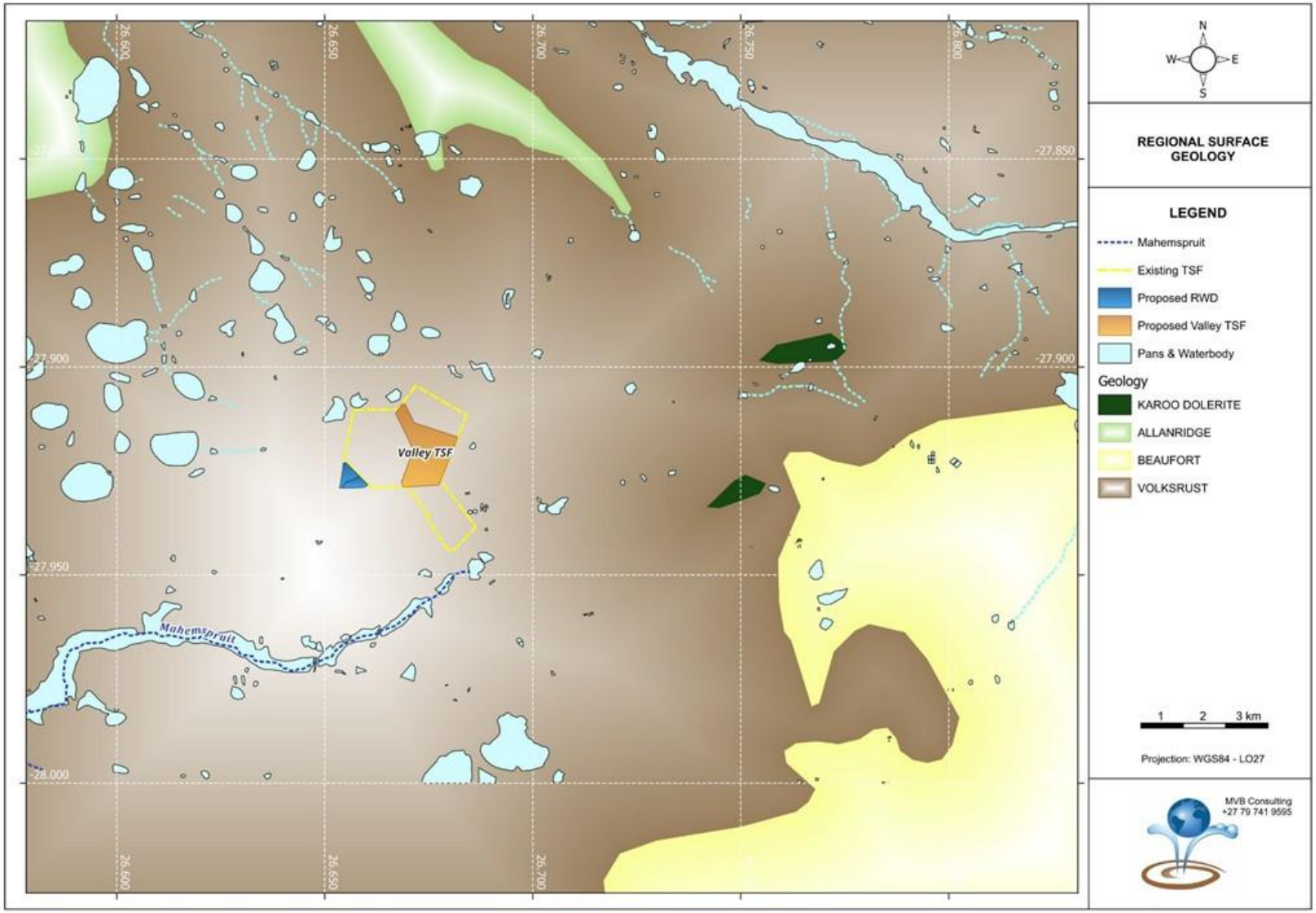


Figure 8: Regional geology

4.4 SOILS

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae 40, Bd 20, and Dc 9 land type. The Ae 40 land type is mainly characterised with Hutton, Mispah, Katspruit and Rensburg soil forms with occurrence of other soils within the landscape. The Bd 20 land type is mainly characterised with Clovelly, Hutton, and Valsrivier soil forms with occurrence of other soils within the landscape. The Dc 9 land type is mainly characterised with Hutton, Swartland, and Willowbrook soil forms according to the Soil classification working group, (1991), with the occurrence of other soils and rocky areas within the landscape. The Bd land type commonly has plinthic catena: upland duplex and margalitic soils rare; Eutrophic, red soils not widespread. The Dc land types commonly have prismacutanic and pedocutanic diagnostic horizons. Other horizons associated to the landscape includes vertic, melanic and red structure diagnostic horizons.

The following soil forms were identified on-site whilst surveying the relevant transects;

- Ermelo (Orthic topsoil on top of a thick yellow brown apedal horizon);
- Avalon (Orthic topsoil on top of a yellow brown apedal horizon with a soft plinthic horizon below);
- Pinedene (Orthic topsoil on top of a yellow brown apedal horizon with a gleyic horizon below);
- Molopo (Orthic topsoil on top of a yellow brown apedal horizon, with a soft carbonate horizon below);
- Etosha (Orthic topsoil on top of a neocutanic horizon, with a soft carbonate horizon below);
- Swartland (Orthic topsoil on top of a pedocutanic horizon, with a lithic horizon);
- Katspruit (Orthic topsoil on top of a gleyic horizon); and
- Witbank (Transported technosols or material from mining activities).

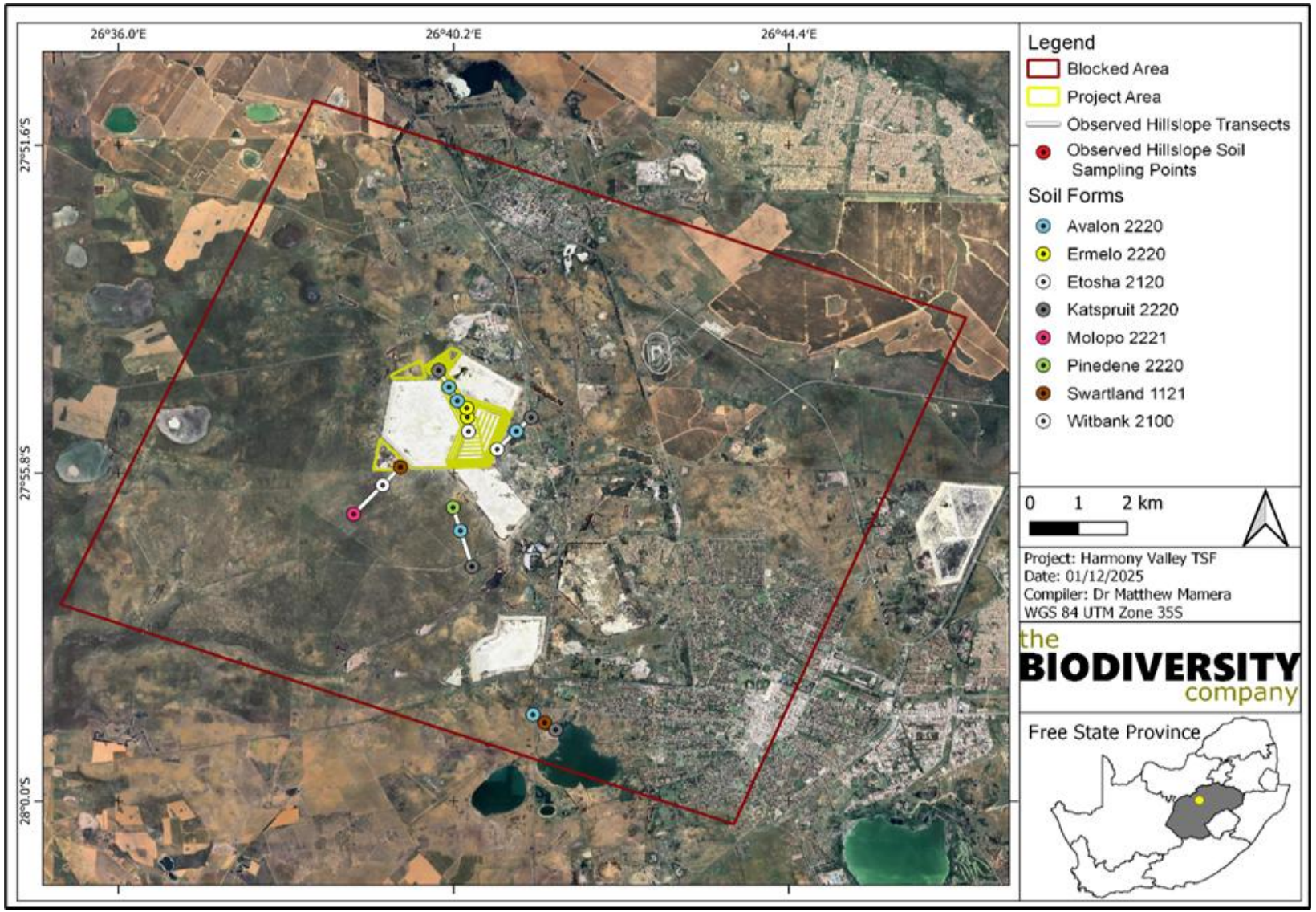


Figure 9 Soil forms within study area

4.5 SURFACE WATER

The site is positioned within quaternary catchment C43B which has an area of 723 km^2 and C25B which has an area of 1 895km^2 both of which are located within the Middle Vaal WMA. The Mahemspruit River is the only defined river relevant to this assessment (when considering the more detailed 1:50,000 topographical map data). Two additional (and significant) dams are within close proximity to the site and. This includes D-Dam Complex.

4.5.1 WATER MANAGEMENT AREA

A site visit was conducted by an aquatic specialist in April 2023. Several wetlands were identified and delineated however these are located outside the site or bordering the site for the TSF aside from the two artificial wetlands located within the proposed TSF footprint area. Apart from the wetlands indicated in Figure 10: Surrounding delineated the location of the proposed TSF site does not contain any surface water resources and is situated approximately 2 km at its closest from the nearest river/stream (the Mahemspruit River located southeast of the TSF site). A map of the above-mentioned wetlands is shown in Figure 10 below.

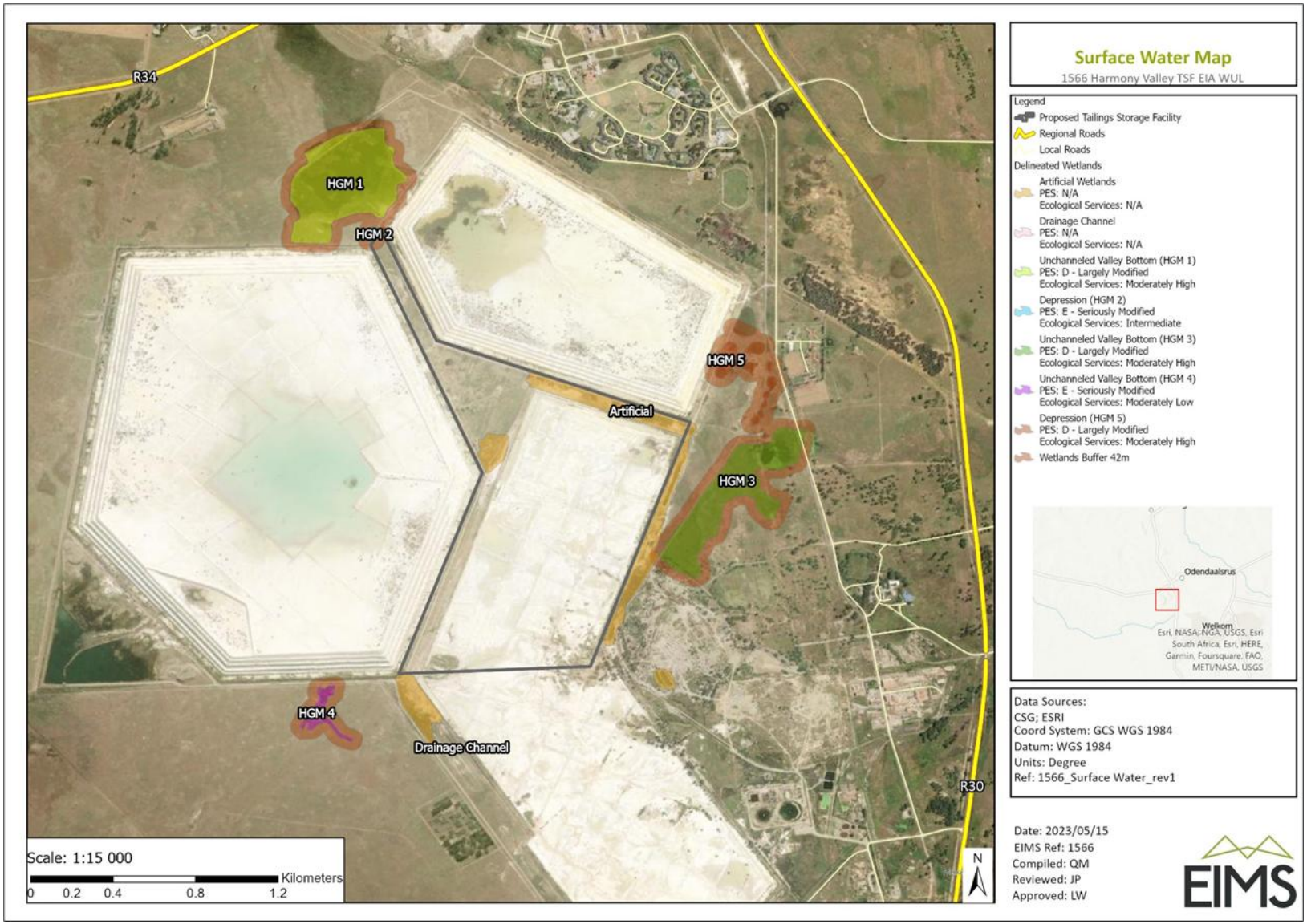


Figure 10: Surrounding delineated wetlands.

4.5.2 SURFACE WATER USES AND QUALITY

This section will establish the current status of surface water sites around the proposed Valley TSF. The data is available in Table 10 which is part of the Harmony surface water monitoring for its operations around Welkom. The data in the report was reported on as in August 2023. Table 9 below lists the standards used to select parameters as well as what the specific limit for each parameter is. The water quality results can be seen in Table 10: Surface water status.

Table 9: Standards and Limits for Surface Water Monitoring

Parameter	Limit	Unit	Source pH
pH	6.5-8.5	-	RQO 2016
Electrical Conductivity (EC)	65	ms/m	RQO 2016
Total Dissolved Solids (TDS)	1000	*mg/L*	SAWQG 1996 - V5 Livestock
Ammonia (NH_3)	1.5	*mg/L*	SANS 241: 2015
Chlorine (Cl)	1500	*mg/L*	SAWQG 1996 - V5 Livestock
Nitrogen Dioxide (NO_2)	100	*mg/L*	SAWQG 1996 - V5 Livestock
Phosphates (PO_4)	0.058	*mg/L*	-
Sulphates (SO_4)	1000	*mg/L*	SAWQG 1996 - V5 Livestock
Uranium (U)	0.01	*mg/L*	SAWQG 1996 – V4 Livestock

Table 10: Surface water status

Site		pH	EC (mS/m)	TDS (mg/L)	NH3 (mg/L)	Cl (mg/L)	NO2 (mg/L)	PO4 (mg/L)	SO4 (mg/L)	U (mg/L)	TON (mg/L)
Limit		**6.5-8.5**	**65**	**1000**	**1.5**	**1500**	**100**	**0.058**	**1000**	**0.01**	
ESW 14A	23-Mar	7.46	**277**	**2300**	0.059	531	0.242	0.005	601	**0.018**	0.242
	23-Apr	7.69	**451**	**3058**	0.113	986	0.194	0.043	709	**0.015**	0.194
	23-May	7.58	**292**	**2844**	1.2	344	0.213	**0.079**	**1015**	**0.205**	0.213
	23-Jun	7.79	**773**	**4982**	0.224	**2399**	2.36	0.005	504	**0.015**	2.36
	23-Jul	7.94	**859**	**5314**	0.145	**2683**	1.14	**0.633**	486	**0.015**	1.14
	23-Aug	8.04	**933**	**5730**	0.152	**2714**	0.323	0.005	518	**0.015**	0.323
ESW 11	23-Mar	7.86	**267**	**1762**	0.008	482	0.681	0.011	507	**0.086**	0.681
	23-Apr	8.01	**317**	**1954**	0.061	721	0.462	0.042	544	**0.015**	0.462
	23-May	8.18	**294**	**2192**	0.1	674	0.62	0.01	483	**0.015**	0.62
	23-Jun	7.65	**580**	**3900**	0.296	1285	3.18	0.005	**1163**	**0.015**	3.18
	23-Jul	8.17	**497**	**3554**	0.069	1143	2.44	0.005	820	**0.066**	2.44
	23-Aug	7.93	**529**	**3392**	0.379	1065	2.66	0.005	852	**0.153**	2.66

Site		pH	EC (mS/m)	TDS (mg/L)	NH3 (mg/L)	Cl (mg/L)	NO2 (mg/L)	PO4 (mg/L)	SO4 (mg/L)	U (mg/L)	TON (mg/L)
ESW 17B	23-Mar	8.14	**789**	**4544**	0.044	2323	0.399	0.031	194	**0.015**	0.399
	23-Apr	7.73	**1121**	**6726**	0.077	**3697**	0.194	**0.064**	260	**0.015**	0.194
	23-May	7.72	**1101**	**6900**	0.105	**3569**	0.34	**0.066**	303	**0.015**	0.34
	23-Jun	8	**1250**	**7818**	0.091	**4309**	2.29	0.005	345	**0.015**	2.29
	23-Jul	8.18	**1070**	**6374**	0.1	**3523**	1.43	**0.399**	265	**0.015**	1.43
	23-Aug	8.38	**937**	**5306**	0.112	**2822**	0.665	0.005	233	**0.015**	0.665
ESW 113	23-Mar	7.86	**267**	**1762**	0.008	482	0.681	0.011	507	**0.086**	0.681
	23-Apr	8.01	**317**	**1954**	0.061	721	0.462	0.042	544	**0.015**	0.462
	23-May	8.18	**294**	**2192**	0.1	674	0.62	0.01	483	**0.015**	0.62
	23-Jun	7.65	**580**	**3900**	0.296	1285	3.18	0.005	**1163**	**0.015**	3.18
	23-Jul	8.17	**497**	**3554**	0.069	1143	2.44	0.005	820	**0.066**	2.44
	23-Aug	7.93	**529**	**3392**	0.379	1065	2.66	0.005	852	**0.153**	2.66
ESW 8C	23-Mar	7.32	**577**	**4208**	0.009	1234	0.997	0.024	**1025**	**0.097**	0.997

Site		pH	EC (mS/m)	TDS (mg/L)	NH3 (mg/L)	Cl (mg/L)	NO2 (mg/L)	PO4 (mg/L)	SO4 (mg/L)	U (mg/L)	TON (mg/L)
	23-Apr	7.7	882	6606	0.473	2121	0.593	0.042	2093	0.015	0.593
	23-May	7.47	893	6808	0.723	1979	0.924	0.01	2224	0.015	0.924
	23-Jun	7.3	967	6906	0.962	2139	2.96	0.005	2297	0.015	2.96
	23-Jul	7.83	1429	11518	1.14	3400	1.21	0.005	3368	0.015	1.21
	23-Aug	7.66	946	6892	2.59	2062	2.71	0.005	1744	0.015	2.71
ESW 8	23-Mar	7.48	574	3852	0.021	1232	0.924	0.009	1008	0.102	0.924
ESW7A	23-Mar	8	303	1914	0.013	737	0.57				
	23-Apr	7.5	296	1704	0.252	753	5.31	0.084	167	0.015	5.31
	23-May	7.72	270	1670	0.114	749	14.8	0.057	171	0.015	14.8
	23-Jun	7.69	297	1862	0.405	789	8.77	0.097	208	0.107	8.77
	23-Jul	7.92	598	3786	0.906	1378	7.82	0.005	829	0.087	7.82
	23-Aug	8	303	1914	0.013	737	0.57	0.026	212	0.047	0.57
	23-Mar	3.54	529	4280	1.78	276	200	0.009	2370	5.88	200

Site		pH	EC (mS/m)	TDS (mg/L)	NH3 (mg/L)	Cl (mg/L)	NO2 (mg/L)	PO4 (mg/L)	SO4 (mg/L)	U (mg/L)	TON (mg/L)
ESW Nyala RWD	23-Apr	**3.04**	**300**	**2448**	3.6	112	42.9	**0.064**	**1468**	**2.88**	42.9
	23-May	**3.81**	**324**	**3576**	1.36	161	7.26	0.008	**1334**	**1.77**	7.26
	23-Jul	**3.6**	**770**	**8198**	**2.88**	479	68.6	**96.3**	**3161**	**4.07**	68.6
MH1	23-Mar	7.86	**275**	**1946**	0.08	601	0.293	0.019	604	**0.015**	0.293
	23-Apr	7.81	**947**	**5698**	0.155	**3655**	0.296	0.032	234	**0.015**	0.296
	23-May	8.05	**829**	**5068**	0.049	**2556**	0.194	0.005	228	**0.015**	0.194
	23-Jun	7.39	**989**	**6768**	0.128	**3602**	0.67	0.056	313	**0.015**	0.67
	23-Jul	7.8	**738**	**4566**	0.294	**2491**	0.961	0.005	313	**0.015**	0.961
	23-Aug	8.47	**765**	**4728**	0.289	**2385**	1.17	0.005	241	**0.015**	1.17
ESW 19	23-Mar	**4,15**	**443**	**3618**	**12,3**	682	0,432	0,005	**1496**	**1,03**	0,432
	23-Apr	6,86	**641**	**4904**	**13,7**	1019	1,82	0,041	**2242**	**0,015**	1,82
	23-May	**4,7**	**540**	**3792**	**14**	902	0,801	0,007	**1931**	**0,465**	0,801
	23-Jun	7,44	**79,7**	602	0,147	61,1	2,23	0,115	112	**0,015**	2,23

Site		pH	EC (mS/m)	TDS (mg/L)	NH3 (mg/L)	Cl (mg/L)	NO2 (mg/L)	PO4 (mg/L)	SO4 (mg/L)	U (mg/L)	TON (mg/L)
	23-Jul	**4,73**	**714**	**5474**	**18,1**	1182	3,55	**4,83**	**2243**	**0,434**	3,55
	23-Aug	8,24	**2150**	**18128**	0,421	**3893**	0,5	0,005	**5379**	**0,545**	0,5

4.6 WASTEWATER

Tailing materials will be deposited to the TSF where water will seep through to underground drainage channels which will return the dirty water to the Valley RWD. From the RWD water will be pumped back to the One plant for reuse in the mining activities.

4.7 GROUNDWATER

The geohydrological setting and conceptual model of the study area is described according to the following criteria:

- Borehole information;
- Aquifer type;
- Groundwater use;
- Aquifer parameters;
- Aquifer recharge;
- Groundwater gradients and flow;
- Groundwater quality; and
- Aquifer classification.

4.7.1 GEOLOGY AND AQUIFER TYPES

The mine infrastructure is situated on interbedded siltstone/sandstone and shale of the Vryheid Formation. Even though the shale and sandstone are not known to contain economic aquifers, groundwater contributes to stream flow and in some instances, high yielding boreholes have been recorded. The following three aquifers underlie the site:

- Weathered Aquifer (Karoo Formations): A shallow, weathered aquifer exists in the weathered shale and sandstone at an average depth of 10m – 20m below ground level. The most consistent water strike is located at the fresh bedrock / weathering interface. The hydraulic conductivity of the weathered aquifer is typically in the order of 0.1 m/day. The vertical permeability is in the order of 0.001 m/day to 0.00010 m/day, which is sufficiently low to confine the groundwater in the underlying fractured rock aquifer.
- Fractured Aquifer (Karoo Formations): The primary porosity of the Vryheid Formation is very low. Any water bearing capacity is therefore associated with secondary joints, bedding planes and faults. The contact zones of dolerite intrusions are characterised by cooling joints and fractures, which are considered the primary source of groundwater flow within the deeper formations. The hydraulic conductivity of the fractured rock aquifer is typically in the order of 0.001 m/day to 0.1 m/day. The depth to groundwater in this aquifer can be variable due to confining layers in parts of the study area.

The two aquifers may or may not be hydraulically connected, dependent on the local geology.

- Witwatersrand / Ventersdorp Aquifer: The deep brine Witwatersrand aquifer is situated approximately 300m below surface. Mining prospecting boreholes indicated this level to be between 170m to 270m (EMP, 2009). This aquifer is thought to be connate (i.e., original formation water) or extremely old (fossil) water and is usually concentrated on geological structures such as fault zones or igneous intrusions (e.g., dykes). The time gap between the end of the Central Rand Group and the start of the Karoo deposition was in the order of 2.3Ga. There is also a significant time gap between the Central Rand Group and the Ventersdorp Supergroup. During these intervening periods, the older rocks were uplifted and exposed to erosion and the near surface rocks to pressure release. This resulted in the forming of fractures in approximately the upper 150m of the rock succession. Subsequent land surface

changes and inundation by a shallow sea allowed marine water to percolate into the network of fractures in the Witwatersrand and Ventersdorp rocks (Young, 1990).

- The major fractures that that formed during the Ventersdorp tectonic events were filled with water to a depth of several kilometres. The impermeable nature of the overlying Karoo sediments, particularly the Dwyka Formation at the base of the Karoo, effectively sealed of the aquifer (Van Biljon, 1995). Post-Karoo movement and intrusions provided conduits for leakage from the Karoo aquifers to the deep Witwatersrand aquifer. However, the deep aquifer recharge from surface is regarded as negligible and at best localised (Van Biljon, 1995). The Witwatersrand aquifer has been largely dewatered during the past 40 years of mining and the water levels in the aquifer dropped significantly. In spite of the dewatering of the Witwatersrand aquifer, there is no evidence of dewatering of the Karoo aquifers.

It is therefore concluded that:

- There is no or very limited hydraulic connectivity between the Karoo aquifers and the deeper Witwatersrand aquifer.
- Recharge to the Witwatersrand aquifer is negligible.
- Once the Witwatersrand aquifer is dewatered (or the water level lowered) it will not recover. The estimated post-mining water level in the Witwatersrand aquifer will therefore be deeper than the pre-mining water level of ~200m below surface Groundwater Quality

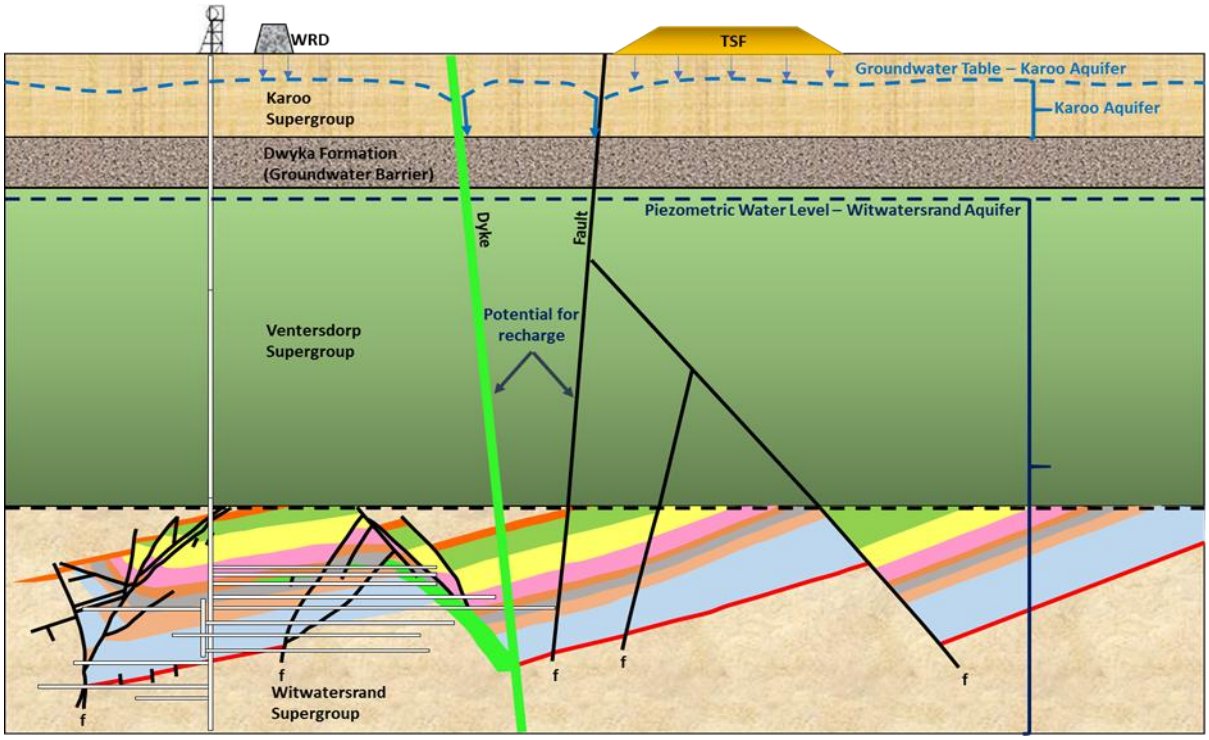


Figure 11 Graphical illustration of the aquifers in the study area

4.7.2 RECENT GROUNDWATER QUALITY STATUS

The chemical concentrations are compared to the Guidelines for Livestock Watering. Where these guidelines are exceeded, the values are highlighted in red. In the absence of limits for livestock watering the chemical concentrations are compared to the SANS 241 (2015) Guidelines for Drinking Water.

With reference to Table 12, the following is observed:

- The groundwater in the Free State is generally saline and most of the boreholes have Electrical Conductivity (EC) and Total Dissolved Solids (TDS) concentrations that exceed the guideline limits. Very high TDS concentrations are recorded in borehole BH46. This borehole is situated very close to a stream

indicating that spillage is occurring or has occurred into this stream. The high concentrations are not attributed to natural plume migration.

- The high salt concentrations are primarily attributed to chloride, sulphate and sodium.
- The existing tailings facilities have impacted on the surrounding groundwater environment. The extent of this impact is best illustrated through the sulphate (SO_4) concentrations in the monitoring boreholes (Figure 12). The most impacted areas appear to be associated with the return water dams, and / or spillage into a surface stream and not necessarily the TSF itself.

Table 11: Livestock watering – chemicals of concern (DWAF, 1996)

Category A			
Water quality constituents that are potentially hazardous, with a high incidence of occurrence			
Constituent	Target water quality (TWQR)	Constituent	Target water quality (TWQR)
Salinity (TDS)	1000 mg/l	Calcium	1000 mg/l
Chloride	3000 mg/l	Fluoride	2 mg/l
Sulphate	1000 mg/l	Molybdenum	0.01 mg/l
Arsenic	1 mg/l	Magnesium	500 mg/l
Copper	5 mg/l	Nitrate and Nitrite	100 mg/l NO_3
Sodium	2000 mg/l	Toxic algae	-
Category B			
Water quality constituents that are potentially hazardous, with a low incidence of occurrence			
Constituent	Target water quality (TWQR)	Constituent	Target water quality (TWQR)
Cadmium	0.01 mg/l	Cobalt	1 mg/l
Chromium	-	Iron	10 mg/l
Mercury	1 µg/l	Nickel	5 mg/l
Lead	0.5 mg/l	Vanadium	1 mg/l
Zinc	20 mg/l	Manganese	10 mg/l
Selenium	50 µg/l	Pesticides	-
Boron	5 mg/l	Pathogens	200 counts/100ml Faecal Coliform
Aluminium	5 mg/l		

Table 12: Groundwater chemistry

Parameter	SANS 241	DWAF	BH71	BH144	BH41	BH47	BH43	BH46	BH211	BH137	BH136	BH91	BH113
pH	<5 - >9.7	NG	8.29	7.61	7.89	8.63	2.63	7.80	8.19	8.87	7.66	7.83	8.06
EC mS/m	170	NG	615	1 641	906	146	1 355	4 980	142	141	2 234	302	74
TDS mg/L	1 200	1 000	3 860	11 124	6 110	1 029	8 997	39 137	852	863	14 881	2 381	472
Total Alk mg/L	NG	NG	244	513	501	190	6	551	238	518	472	405	194
Cl mg/L	300	1 500	1 373	4 466	2 229	246	5 106	16 284	171	105	6 854	562	94
SO_4 mg/L	500	1 000	939	2 660	1 583	107	1 121	8 622	233	115	2 723	834	84
NO_3-N mg/L	11	100	38.77	<0.46	0.50	51.43	1.63	<0.46	<0.46	0.59	1.55	<0.46	0.81
Ca mg/L	NG	1 000	284	478	182	31	823	738	90	13	528	241	13
Mg mg/L	NG	500	172	279	214	24	671	1 979	33	4	487	121	10
Na mg/L	200	2 000	746	2 902	1 576	268	1 254	11 146	171	306	3 975	348	138
K mg/L	NG	NG	26	24	18	8	15	29	8	2	19	26	11
Fe mg/L	2	10	0.009	<0.009	0.090	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	0.016	<0.009
Mn mg/L	0.4	10	0.001	<0.001	2.142	<0.001	12.288	<0.001	<0.001	<0.001	<0.001	<0.001	0.011

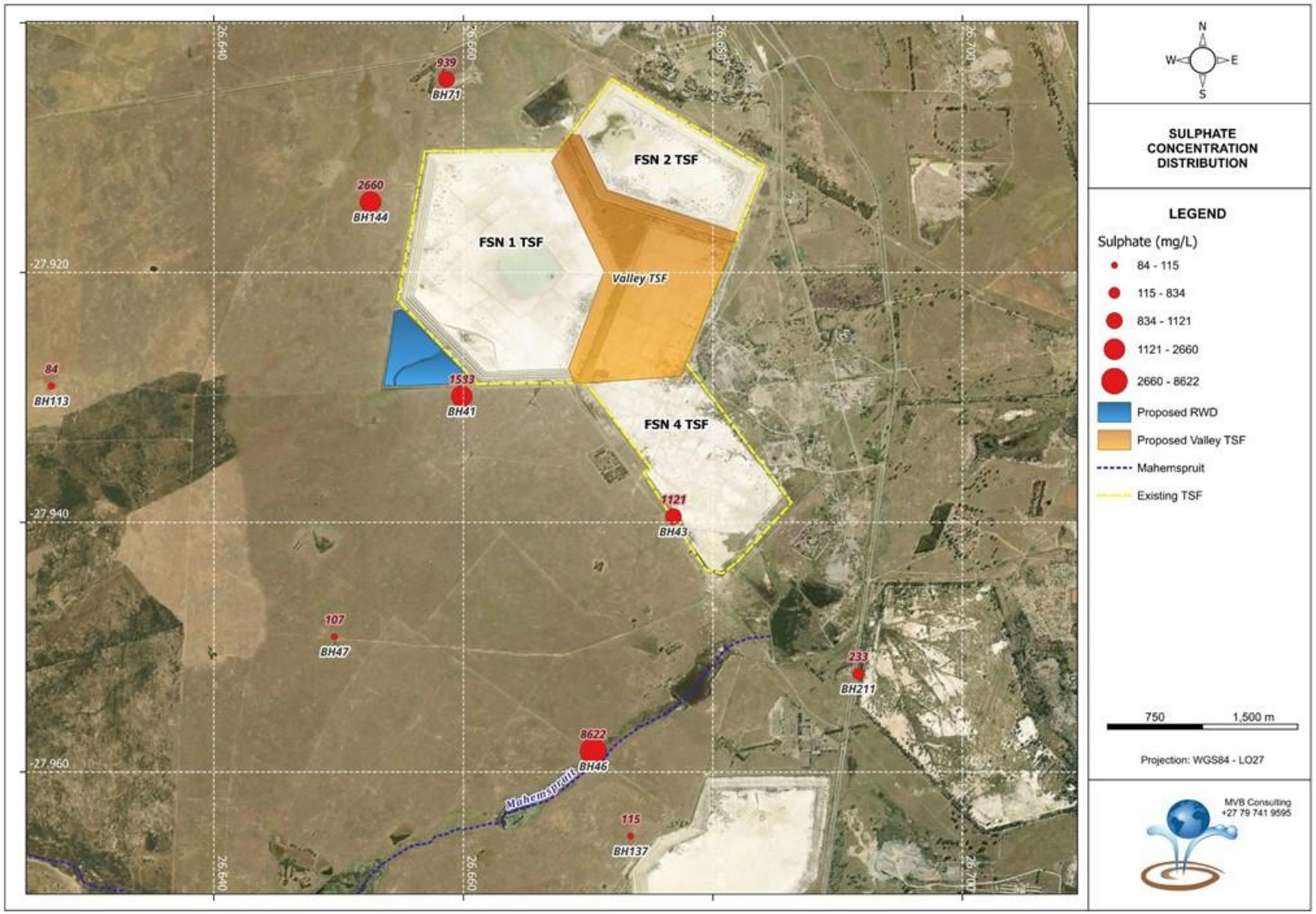


Figure 12: Sulphate concentration distribution in the groundwater monitoring boreholes

Table 13: Aquifer Parameters (Golder Associates (2009) in MvB Consulting (2025))

ID	X	Y	Z	Depth (m)	Water Level (m)	Abstraction Rate (lit/sec)	Drawdown (m)	Recovery (%)	Transmissivity (m^2/day)			Hydraulic Conductivity (m/day)
									Constant Rate Test	Recovery Test	Average	
BH1	26.65620	-27.92963	1335	90	5.50	0.55	60.22	92	0.10	0.10	0.10	0.001
BH2	26.65627	-27.92970	1331	36	6.41	0.45	20.63	94	0.40	0.50	0.45	0.015
BH3	26.65732	-27.94308	1334	73	54.03	0.44	8.88	87	0.70	2.50	1.60	0.084
BH4	26.65735	-27.94312	1336	24	0.00	0.51	19.66	100	0.40	0.40	0.40	0.017
BH5	26.64065	-27.93760	1327	73	Dry							
BH6	26.64062	-27.93755	1330	23	17.99	0.60	2.37	91	3.80	10.20	7.00	1.400
BH7	26.64061	-27.93019	1336	73	72.38	Not enough water						
BH8	26.64057	-27.93023	1336	26	20.87	5.00	1.93	100	2.60	15.60	9.10	1.800
BH9	26.67978	-27.94499	1330	73	4.12	0.73	19.07	92	2.30	1.50	1.90	0.028
BH10	26.67975	-27.94496	1329	23	6.47	0.14	19.37	70	0.10	0.20	0.15	0.009
BH11	26.67250	-27.90450	1350	68	0.00	2.02	29.30	100	0.50	0.70	0.60	0.009
BH12	26.67256	-27.90454	1348	27	0.00	0.51	25.42	100	0.20	0.30	0.25	0.009
BH13	26.68095	-27.90938	1354	73	52.48	0.43	22.97	41	0.20	1.90	1.05	0.051
BH14	26.68097	-27.90936	1349	29	2.02	0.50	24.93	92	0.30	0.90	0.60	0.022

ID	X	Y	Z	Depth (m)	Water Level (m)	Abstraction Rate (lit/sec)	Drawdown (m)	Recovery (%)	Transmissivity (m^2/day)			Hydraulic Conductivity (m/day)
									Constant Rate Test	Recovery Test	Average	
BH15	26.68849	-27.91220	1353	73	52.13	0.37	17.98	54	0.30	0.50	0.40	0.043
BH16	26.68845	-27.91220	1352	30	Dry							
BH17	26.67954	-27.92358	1345	73	40.06	0.45	46.82	47	0.10	0.30	0.20	0.006
BH18	26.67952	-27.92365	1345	29	4.03	0.49	23.26	94	0.30	0.40	0.35	0.014

4.7.3 GROUNDWATER MONITORING

A long-term monitoring programme should be developed based on the guideline documented in Best Practice Guideline G3 Water Monitoring Systems (2007) available from the Department of Water and Sanitation (DWS). These guidelines are summarised and implemented in the proposed monitoring plan.

A monitoring plan is necessary because(DWS, 2007):

- Accurate and reliable data forms a key component of many environmental management actions.
- Water monitoring is a legal requirement.
- The most common environmental management actions require data and thus the objectives of water monitoring include the following:
    - Development of environmental and water management plans based on impact and incident monitoring (facilitate in decision-making, serve as early warning to indicate remedial measures or that actions are required in certain areas) for the mine and region.
    - Generation of baseline/background data before project implementation.
    - Identification of sources of pollution and extent of pollution (legal implications or liabilities associated with the risks of contamination moving off site).
    - Monitoring of water usage by different users (control of cost and maximising of water reuse).
    - Calibration and verification of various prediction and assessment models (planning for decommissioning and closure).
    - Evaluation and auditing of the success of implemented management actions (ISO 14000, compliance monitoring).
    - Assessment of compliance with set standards and legislation (EMPs, water use licenses).
    - Assessment of impact on receiving water environment.

Monitoring within a project area consists of various components as illustrated by the overall monitoring process (Figure 13) It should be recognised and understood that the successful development and implementation of an appropriate, accurate and reliable monitoring programme requires that a defined structured procedure be followed. A monitoring programme should include the location of all monitoring points (indicated on a map), the type of data to be collected, as well as the data collection (protocol / procedure / methodology, frequency of monitoring and parameters determined, quality control and assurance), management (database and assessment) and reporting procedures. This programme should then be implemented. The results from the monitoring programme should be representative of the actual situation. To ensure that the monitoring programme functions properly, an operating and maintenance programme should be developed and implemented. A data management system is necessary to ensure that data is stored / used optimally and is accessible to all the relevant users. The monitoring programme should include quality control measures. It is important to note that this programme is dynamic and should change as the mine and water management needs change.

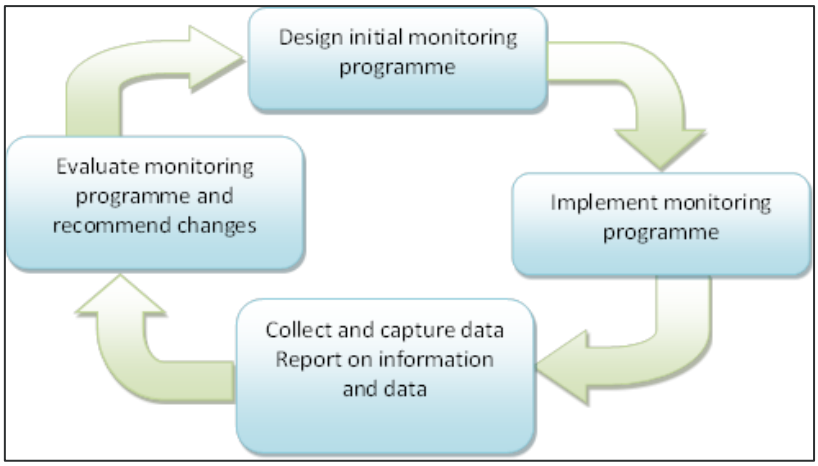


Figure 13: Monitoring process (DWA, 2007)

Effective groundwater monitoring systems consist of the following components:

- Groundwater quality monitoring system.
- Groundwater flow monitoring system.
- Data and information management system.

When designing the monitoring system, the following issues should also be taken into consideration:

- Potential or actual water use.
- Aquifer or catchment vulnerability.
- Toxicity of chemicals.
- Potential for seepage or releases.
- Quantities and frequency of release to the environment (point and non-point).
- Management measures in place to minimise risk.

Groundwater sampling should be done in accordance with industry standards. The sampling procedures are discussed in detail in:

- Weaver, J.M.C. 1992a. Groundwater sampling: A comprehensive guide for sampling methods (WRC Report No. TT 54/92). Pretoria: Water Research Commission.
- Weaver, J.M.C. 1992b. Groundwater sampling: An abbreviated field guide for sampling methods (WRC Report No. TT 56/92). Pretoria: Water Research Commission.

These sampling procedures should be adhered to.

4.7.3.1 GROUNDWATER MONITORING NETWORK

Three additional borehole pairs (one shallow and one deep) are recommended as shown in Figure 14**.** The impact from the lined Valley TSF will not extend beyond the dam itself, and the monitoring is therefore aimed at the entire footprint, not only the Valley TSF

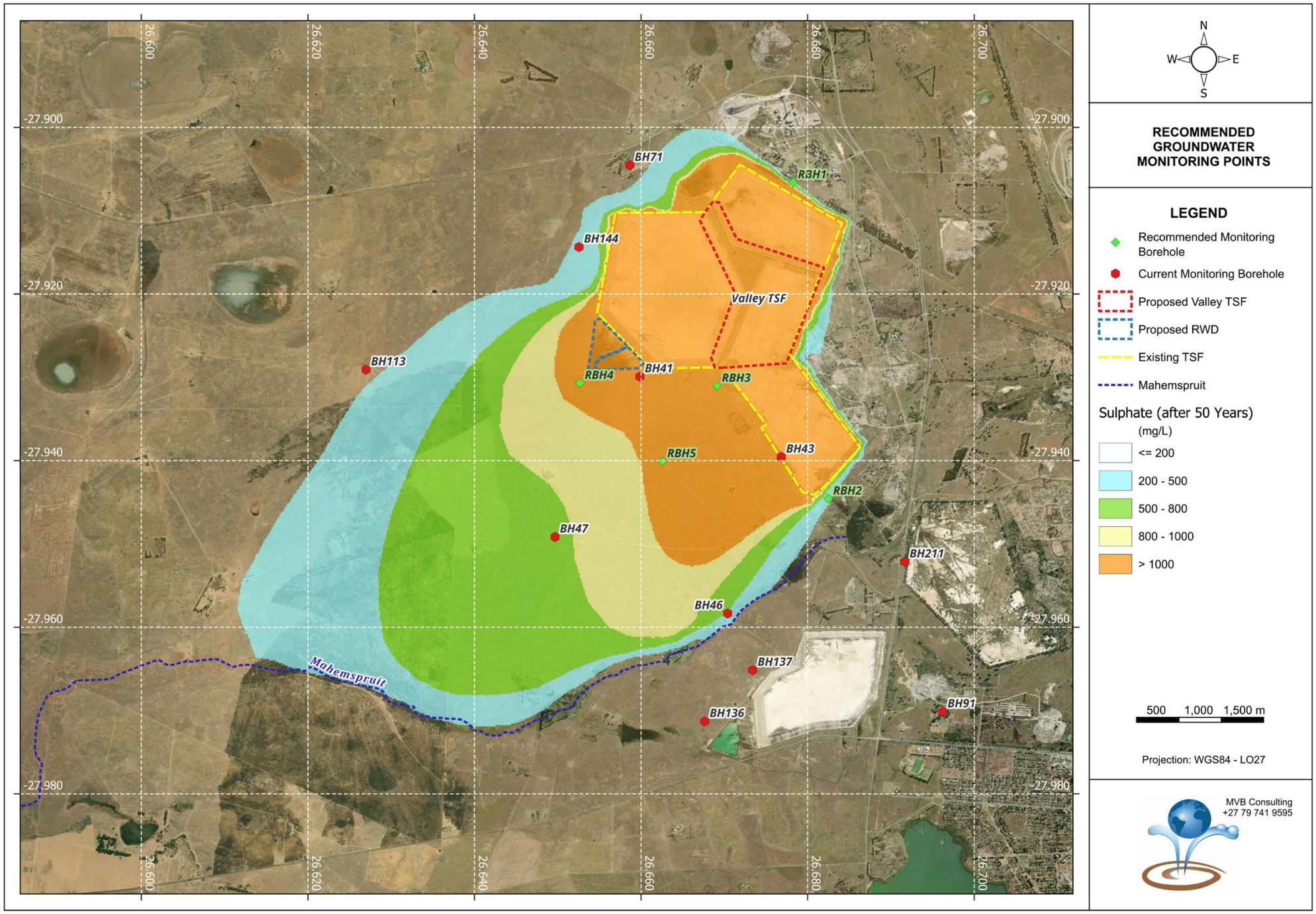


Figure 14:Recommended groundwater monitoring network

The following is recommended in terms of monitoring:

- Groundwater levels.
- Groundwater quality.
- Data should be stored electronically in an acceptable database.
- On the completion of every sampling run a monitoring report should be written. Any changes in the groundwater levels and quality should be flagged and explained in the report.
- A compliance report can be submitted to DWS once a year, if required.

4.7.3.2 MONITORING FREQUENCY

- A comprehensive quarterly analysis of the dedicated monitoring boreholes.
- Groundwater levels should be monitored monthly in the dedicated groundwater monitoring boreholes.
- Rainfall should be monitored daily.

4.7.3.3 MONITORING PARAMETERS

Samples should be submitted to a SANAS accredited laboratory. The following recommended parameters to be analysed for include:

- pH.
- Electrical Conductivity.
- Total Dissolved Solids.
- Total Alkalinity.
- Anions and Cations (Ca, Mg, Na, K, NO_3, NH_4, Cl, SO_4, F, Fe, Mn, Al, Cr).

4.8 AQUATIC BIO-MONITORING

There is no existing bio-monitoring program currently in place at the Harmony Valley TSF.

4.9 WATER BALANCE

A dynamic water balance is fundamental to optimise water management and minimising raw water usage on the mine. Dynamic water balances enable instantaneous examination of the changing situation of a mining operation. They also allow the investigation of different rainfall scenarios, such as drought conditions, process changes or new developments, which are critical to the planning process. The purpose of the water balance is to demonstrate that a TSF will be able to manage all water in its operational area, including rainfall, through the different phases of the operational period. Dynamic water balances are thus an important operational and regulatory tool for water and pollution control as well as an essential part of life-cycle analysis for all current and future activities at the mine.

The water balance is, therefore, utilised as a management tool, for example, in simulating the effect of additional water management measures or the effect of expansion projects on the water management system. Assessment of the water balance will reveal the areas of concern for water management at the mine as well as non-compliance with the requirements of Regulation GN 704, dated 1999. The water balance estimate is included in Figure 15.

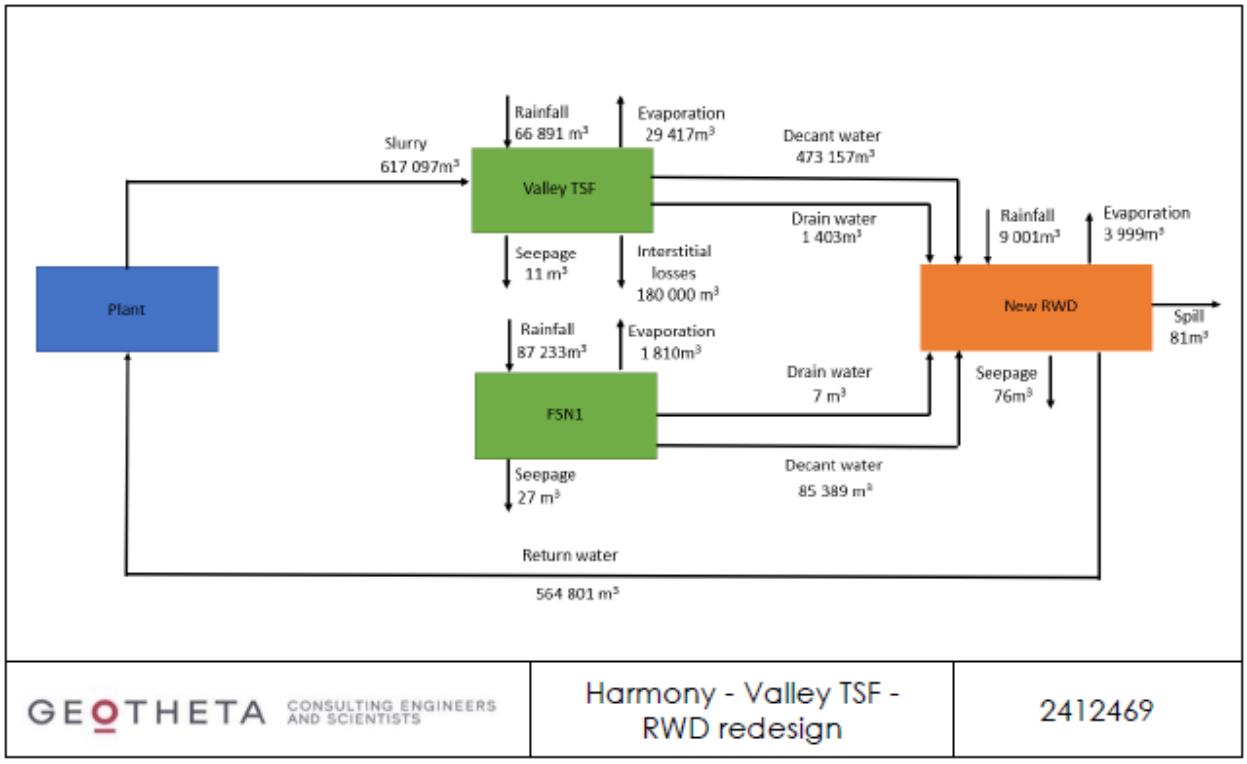


Figure 15: New Valley RWD Water balance model – monthly averages

4.10 SOCIO-ECONOMIC

The Lejweleputswa District Municipality is situated in the north western part of the Free State and borders the North West Province to the north; the Fezile Dabi and Thabo Mofutsanyane District Municipalities to the north-east and east respectively; the Xhariep District Municipality and Mangaung Metropolitan Municipality to the south; and the Northern Cape Province to the west. The LDM is accessible from Johannesburg, Cape Town, Klerksdorp and Kimberley through one of South Africa's main national roads, the N1. The district covers an area of 31 930 km2 and make up almost a third of the Free State province. It consists of the Masilonyana, Matjhabeng, Nala, Tokologo and Tswelopele Local Municipalities (www.lejweleputswa.co.za). The economy of the district relies heavily on the gold mining sector which is dominant in the Matjhabeng and Masilonyana Local Municipalities (Lejweleputswa DM IDP 2023/2024). The mining sector is on a downward trend and many businesses that have traditionally depended on the mining sector have either closed down are in the process of closing down. The other municipalities are dominated by agriculture.

The main towns in the Matjhabeng Local Municipality are Welkom, Odendaalsrus, Virginia, Hennenman, Allanridge and Ventersburg (www.matjhabeng.fs.gov.za). The economy of the municipality is centred on mining activities in and around Welkom, Allanridge, Odendaalsrus and Virginia. Manufacturing aimed at the mining sector exists to a limited extent in the above towns, with other activities being limited. Other main economic sectors include manufacturing, trading, agriculture, construction, transportation (logistics), and trade (Matjhabeng LM IDP 2024/2025).

The number of households in the study area has increased on all levels, although the rate of increase has varied. In Lejweleputswa District Municipality, the population grew modestly from 649,964 in 2016 to 634,462 in 2023, reflecting a 0.3% annual growth rate 1. Interestingly, the number of households decreased from 217,912 in 2016 to 194,315 in 2023, suggesting a shift in household composition and possibly migration patterns 1. This contrasts with national trends, where household numbers have generally increased. The average household size has likely decreased, consistent with broader demographic shifts toward smaller households.

The intensity of poverty—defined as the average proportion of indicators in which poor households are deprived—has increased slightly across the district. In Lejweleputswa, 45.9% of the population live below the lower poverty line, which is higher than the provincial average of 44% 1. However, the SAMPI headcount poverty

has improved to 3%, down from 6% in 20111, indicating progress in multidimensional poverty reduction. This suggests that while income poverty remains high, improvements in access to services and education may be contributing to better overall living conditions.

Ward 35 continues to show the highest proportion of economically active individuals who are employed, supported by the highest average household income in the area. However, employment in the gold mining industry, a major economic driver in the region, has declined significantly over the past decade. Nationally, employment in mining dropped from 157,019 in 2010 to 93,841 in 2022, and then slightly recovered to 479,111 in 2023, reflecting a 2.1% increase in mining jobs during 2023 2 3. Despite this modest recovery, the long-term trend remains downward, and unemployment in Lejweleputswa stands at 50.9%, one of the highest in the Free State.

Table 14: Summary of the socio-economic aspects of the proposed project (Lejwaleputswa DM IDP and CoGTA (2023)).

Aspect	Matjhabeng Local Municipality	Masilonyana Local Municipality
District Municipality	Lejweleputswa	Lejweleputswa
Province	Free State	Free State
Municipal Area Size	5,155.46 km²	6,796.08 km²
Number of Wards	36	10
Social		
Population Size (2023)	±428,843	±63,334
Number of Households (2023)	±123,195	±17,575
Population Growth (2011–2023)	+5.5%	Slight decline
Population Composition	89.5% Black African; 8.8% White; 1.4% Coloured; 0.3% Indian/Asian.	91.6% Black African; 6.7% White; 1.5% Coloured; 0.3% Indian/Asian.
Languages	Sesotho (64%); IsiXhosa (12.3%); Afrikaans (12.3%); English (3.6%).	Sesotho (66.9%); IsiXhosa (10.8%); Afrikaans (9.6%); Setswana (6.9%).
Gender Distribution	50.4% Female; 49.6% Male.	49.5% Female; 50.5% Male.
Land Use	Mixed urban: business, residential, industrial, parks.	Predominantly agricultural: 59% commercial farming, 10% residential.
Housing	78.5% formal dwellings; 58.5% owned/paying off.	Growing demand for housing; middle-income housing backlog.

Access to Water	Water infrastructure consists mostly of reservoirs (18) and 99 Km of bulk pipelines of Sedibeng Water, 29 pump stations, 1 water treatment plant and 12 waste water treatment plant. Sedibeng Water is the water service provider in terms of Water Service Act, and supply mainly the Goldfields region and the mines with water from the Vaal River, Bulkfontein near Bothaville and to a lesser extent from the Sand River. Main reservoirs are east of Allanridge, in Welkom, north and south of Virginia. Pump stations are east of Allanridge and at Virginia where purification plant exist. Other water infrastructure resources were constructed by the DWS including dams in Allemanskraal and canals serving the Sand – Vet irrigation scheme.	Decline in piped water access since 2001.
Sanitation	The second generation of democratic local government was mandated to among others to improve levels of sanitation and eradicate bucket system as form of sanitation. In this regard this mandates were fulfilled. However, challenges were identified, among others were poor project planning, execution and reporting. This has led to a particular number of households still not able to use proper sanitation thus reverting back to old system. The other challenge that came with expansion of service has been the capacity of waste water treatment plants and pump stations. As indicated above there are 12 treatment plants and all of them require major upgrade and refurbishment.	The Census results also indicate an increase of access to sanitation by 70.5% as compared to 23.4% in Census 2001.
Energy	The bulk electrical network is well established around the Matjhabeng area. Eskom serves all mines and all townships in the municipal area and thus there is sufficient bulk infrastructure	According to Census 2011, electricity provision has increased significantly by 93.2% compared to Census 2001 figures.

	available to serve the whole area. Main challenge however remains an aging electrical infrastructure in particular in towns where the municipality is provider. A change in cost recovery and their subsidisation policy has made it very expensive to electrify the rural areas, and these include farms and farming communities who need such basic power support. The municipality is overly dependent on electricity as a source of energy for lighting, cooking and heating. In fact, the statistics reflect an increase of electricity as energy source in that the use electricity for lighting has increased from 84.98 to 8702; for cooking from 60% to 80%; and heating from 54% to 57%.	
Economic		
Unemployment Rate	The number of unemployed residents in Matjhabeng has marginally decreased since 2001. However, Matjhabeng still has the worst unemployment rate within the District at 42.0%, which is also above the provincial rate.	General and youth unemployment trends in the municipality show a 3.3 % decline of overall unemployment rate between Census 2001 and 2011 respectively. Similarly, results show a minimal decline of 4.6 % of youth unemployment during the same period. However, unemployment remains a serious challenge in the municipality.
Main Economic Sector	The current statistics shows that the economies of Welkom 53%, Odendaalsrus 38%, and Virginia 78% are dominated by mining, whilst Hennenman is dominated by manufacturing 41%, agriculture 17%, trade 10%, and finance 10%. The total area percentages show a combined figure of 58% dominance by the mining sector. The biggest sectors in the district in 2012 were: Mining (42.9%); Community services (20.4%); and Trade (11.7%).	The agricultural sector of certain areas in the district is extremely prominent and contributes largely to the GDP of the Lejweleputswa District, which emphasize the agricultural significance of this district. The latter results to industrial development that is agricultural orientated. The Municipal area has a significant weekend related tourism potential that could, in future, contribute to the GDP of the district and should be further exploited. Brick Making projects in Masilo, Tshepong (Verkeerdevlei) and resuscitating the same project in Makeleketla (Winburg). Transportation modes

	Matjhabeng has a relatively large economy with a production value of almost R27 billion (current prices 2011). The mining sector is by far the largest sectoral contributor.	the residents use mostly consist of private vehicles buses, minibuses/ taxis, bicycles, motorcycles and non-motorized transport; walking is also common.
Tourism/Heritage	There is one formal land-based protected area in the municipality, being the Willem Pretorius Nature Reserve.	Brandfort is also known for its political history, including the Winnie Mandela House, where Mandela was sentenced to House Arrest during the State of Emergency in the 1980s. Winburg prides itself with the Voortrekker Monument as its Heritage Site, and Masilonyana boasts several game reserves across all its towns (e.g. Erfenis Dam Nature Reserve and Soetdoring Nature Reserve).

5 OPERATIONAL MANAGEMENT

Procedures are in place at the Harmony Valley TSF, to deal with potential polluting incidents (ISO 14001:4.1, 7.4.2 – 7.4.3/MHO/00/2018 and Harmony Risk Matrix – October 2019). The incident classification criteria are presented in Table 15 below.

Table 15: Harmony incident classification criteria (Harmony Risk Matrix – October 2019)

Severity Level	Mitigation Costs	Environmental Impact	Reputational Impact	Legal Impact
5	>R10 000 000	Irreversible damage on habitat or ecosystem	International condemnation	Potential director liability
4	<R10 000 000	Significant impact on habitat or ecosystem	National and international concern – NGO involvement	Very significant fines or prosecutions
3	<R5 000 000	Longer-term impacts & ecosystem compromised	Adverse media attention – locally/nationally	Breach of legislation and likely consequences from regulator
2	<R1 000 000	Moderate short-term effects but not affecting the eco-system function	Unresolved local complaints and possible local media attention	Minor breach of legislation
1	<R500 000	Localised affected area of low impact	Local complaints	No major breaches of legislation

Incidents classified as Level 3 and above are reported to DWS within 24 hours, initially via telephone, followed by a formal email or letter within five days of occurrence. The notifications sent to DWS contain the following information:

- Date and time of the incident.
- Description of the incident.
- Source of pollution.
- Risks/impact to safety, health, property or environment resulting from the incident.
- Remedial action taken or to be taken by the person in control, to remedy the effects of the incident and to prevent similar incidents in the future.

Formal incident investigations are undertaken by the relevant manager and the actions based on the investigations are uploaded to the business unit's Action Management System. A follow up action plan is submitted to DWS within 14 days of the incident occurring, which indicates the following:

- Measures taken to correct the impact of the incident.
- Measures taken to correct further impacts from the incident.
- Measures taken to prevent the reoccurrence of a similar incident.

An environmental incident that has been classified as Level 1 or 2 is reported internally. A formal incident investigation is not undertaken for these incidents, unless the same incident has repeatedly occurred three or more times within three months.

5.1 ORGANISATION STRUCTURE

The Harmony organisational structure for management of the Valley facility is presented in Figure 16 above. The below sections include a discussion of resources and competencies, as well as the internal and external communication processes that are implemented by the Applicant.

Figure 16: Organisational structure for the Harmony Free State Operations to implement the required measures for environmental protection

5.2 RESOURCES AND COMPETENCE

John van Wyk is currently the acting Environmental Manager for the Free State Operations which includes the Valley TSF to ensure implementation of all the required measures to protect the environment.

5.3 SKILLS DEVELOPMENT, EDUCATION AND TRAINING

The environmental management resources and systems in the Free State Operations which covers the Valley TSF include:

- Infrastructure and equipment e.g., liner system, pipelines etc.;
- An environmental management system (EMS);
- Personnel including environmental officers, site engineers, and appointed external contractors and consultants;
- The inclusion of environmental training for all new staff;
- The promotion of environmental awareness amongst employees and contractors;
- Annual environmental auditing and reporting;
- Registers including an incident register;
- Maintenance of a complaints register, clearly stating actions taken on specified dates.

The Environmental Officers will be supported by the site engineers in the implementation of the WUL once issued.

5.4 INTERNAL AND EXTERNAL COMMUNICATION

5.4.1 INTERNAL COMMUNICATION

Water targets are reported on a monthly basis by the Environmental Management Department of Harmony Gold Limited. The results from the monitoring and comparison of actual water use to the targets are included in monthly water reports, which are distributed to all the responsible environmental personnel.
Annual surface and groundwater monitoring reports are compiled for all business units to assess their impacts on the natural water resources. The monitoring reports are communicated to the business units by the Environmental Management Department.

Environmental improvements, monthly inspection findings and incidents are included in monthly environmental management reports, which are distributed to all responsible environmental personnel. The internal communication process for environmental issues is presented in Table 16 below.

5.4.2 EXTERNAL COMMUNICATION

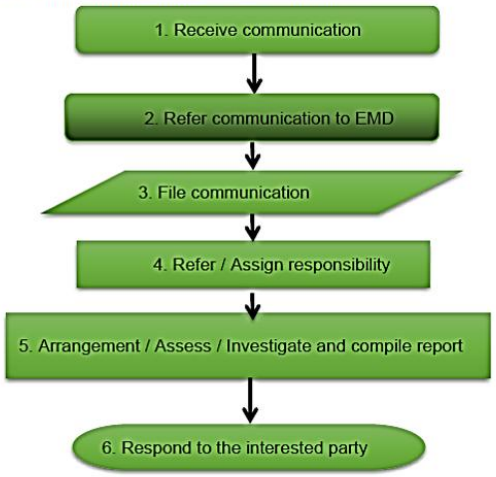
The reporting of incidents that have the potential to cause or have caused water pollution or pollution to the environment, health risks are undertaken. Records of all incidents and system malfunctions which may result in the pollution of the water resources are reported to DWS. The incidents are recorded by the individual business units and a summary report of all incidents is compiled and submitted to the Environmental Management Department on a monthly basis.

The external communication process for environmental issues is presented in Table 17 below.

Table 16: Internal communication procedure (ISO 14001:4.1, 7.4.2 – 7.4.3/MHO/00/2018)

	Internal Communication Process	Notes	Responsibility/Who	When
Internal Communication	**Internal Communication** 1. Significant environmental issue (s) ↓ 2. Review issue - Environmental Management ↓ 3. If required (if significant), investigate and report to affected personnel	1. Significant environmental issues are communicated through: • Quarterly environmental topics/reports (environmental awareness, on notice boards) • Environmental Policy/EMS Procedures, Aspects • Legislation Notification or Changes • Roles and Responsibilities, Key Performance Indicators • Safety, Health and Environment Meetings • Management Meetings • Contractual obligations with interested parties e.g. contractors etc. 2. Review issue 3. If significant, investigate/report back to the affected personnel (e.g. via e-mail, section meetings)	1. Environmental Management 2. Environmental Management 3. Environmental Management	As and when required

Table 17: External communication process (ISO 14001:4.1, 7.4.2 – 7.4.3/MHO/00/2018)

	External Communication Process	Notes	Responsibility/Who	When
External Communication	External Communication (excludes complaints) 	1. Received communication on e.g. needs, expectations, etc. from interested parties e.g. Government Departments, Non-Governmental Organisations, etc. at e.g. Meetings, Forums, Community Events, EIA/ EMPr Projects, etc. 2. Refer to Environmental Management 3. File communication 4. Refer/assign responsibility to relevant Environmental Manager in consultation with Senior Management 5. Investigate and determine opportunities for improvement, if required 6. Respond and/or report to Interested Party in one of the following methods: • Compile Letter or Report • Approve Letter or Report • Distribute letter/ report and or follow up in a forum to interested Party (where required).	1. Environmental Management 2. Environmental Management 3. Environmental Management 4. Environmental Management 5. Environmental Management/ Harmony Operations Mancom 6. Environmental Management	As and when required

5.5 AWARENESS RAISING

The environmental training and awareness process applicable to the EMS incorporates the following:

- The importance of complying with the Environmental Policy and Procedures.
- The requirements of the Environmental Management System (EMS);
- Significant environmental aspects and the associates actual or potential impacts, and the benefits of improved environmental performance;
- The roles and responsibilities in achieving compliance with the requirements of the EMS;
- The potential consequences from not following specific procedures.

Newly appointed employees receive job and business unit specific induction and training based on the Harmony human resources and training processes. Competence, training and awareness are addressed through the induction, awareness, capability and competency training and assessments.

6 ENVIRONMENTAL IMPACT ASSESSMENT

This section will discuss the methodology and detailed impacts identified during the EIA process. The methodology used in assigning and assessing risk factors is also shown below.

6.1 IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for impacts identified.

6.2 DETERMINATION OF SIGNIFICANCE

The final significance (FS) of an impact or risk is determined by applying a prioritisation factor (PF) to the post-mitigation environmental significance. The significance is dependent on the consequence (C) of the particular

impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in **Error! Reference source not found.** below.

Table 18: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. Highly localised, limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property or site boundary, or the area within a few hundred meters of the site)
	3	Local (i.e. beyond the site boundary within the Local administrative boundary (e.g. Local Municipality) or within consistent local geographical features, or the area within 5 km of the site)
	4	Regional (i.e. Far beyond the site boundary, beyond the Local administrative boundaries within the Regional administrative boundaries (e.g. District Municipality), or extends into different distinct geographical features, or extends between 5 and 50 km from the site).
	5	Provincial / National / International (i.e. extends into numerous distinct geographical features, or extends beyond 50 km from the site).
Duration	1	Immediate (<1 year, quickly reversible)
	2	Short term (1-5 years, less than project lifespan)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction/ operation/ decommissioning).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected)
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected, or affected environmental components are already degraded)
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; moderate improvement

Aspect	Score	Definition
		for +ve impacts; or where change affects area of potential conservation or other value, or use of resources).
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease; high improvement for +ve impacts; or where change affects high conservation value areas or species of conservation concern)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts; or disturbance to pristine areas of critical conservation value or critically endangered species)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring very high time and cost.
	5	Irreversible Impact.

Once the C has been determined, the significance is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per **Error! Reference source not found.**.

It is noted that both environmental risks as well as environmental impacts should be identified and assessed. Environmental Risk can be regarded as the potential for something harmful to happen to the environment, and in many instances is not regarded as something that is expected to occur during normal operations or events (e.g. unplanned fuel or oil spills at a construction site). Probability and likelihood are key determinants or variables of environmental risk. Environmental Impact can be regarded as the actual effect or change that happens to the environment because of an activity and is typically an effect that is expected from normal operations or events (e.g. vegetation clearance from site development results in loss of species of concern). Typically the probability of an unmitigated environmental impact is regarded as highly likely or certain (management and mitigation measures would ideally aim to reduce this likelihood where possible). In summary, environmental risk is about what could happen, while environmental impact is about what does happen.

Table 19: Probability/ Likelihood Scoring

		materialising
Probability	2	Low probability (Unlikely, impact could occur but not realistically expected; >5% and <20% chance).
	3	Medium probability (Possible, the impact may occur; >20% and <50% chance).
	4	High probability (Likely, it is most probable that the impact will occur- > 50 and <90% chance).
	5	Definite (Almost certain, the impact is expected to, or will, occur, >90% chance).

The result is a qualitative representation of relative significance associated with the impact. Significance is therefore calculated as follows:

$$S = C \, x \, P$$

Table 20: Determination of Significance

Consequence	5- Very High	5	10	15	20	25
	4- High	4	8	12	16	20
	3- Medium	3	6	9	12	15
	2- Low	2	4	6	8	10
	1- Very low	1	2	3	4	5
		1- Improbable	2- Low	3- Medium/ Possible	4- High/ Probable	5- Highly likely/ Definite
	Probability					

The outcome of the significance assessment will result in a range of scores, ranging from 1 through to 25. These significance scores are then grouped into respective classes as described in **Error! Reference source not found.**.

Table 21: Significance Scores

S Score	Description
≤4.25	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
>4,25, ≤8.5	Low-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>8.5, ≤13.75	High-Medium (i.e. where the impact could have a significant environmental risk/ reward).
>13.75	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact significance will be determined for each impact without relevant management and mitigation measures (pre-mitigation significance), as well as post implementation of relevant management and mitigation measures (post-mitigation significance). This allows for a prediction in the degree to which the impact can be managed/mitigated.

6.3 IMPACT PRIORITIZATION

Further to the assessment criteria presented in the section above, it is necessary to consider each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impacts' post-mitigation significance (post-mitigation). This prioritisation factor does not aim to detract from the significance ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the post-mitigation significance based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 22: Criteria for Determining Prioritisation

Cumulative Impact (CI)	**Low (1)**	**Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.**

	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in **Error! Reference source not found.**. The impact priority is therefore d etermined as follows:

$$\boldsymbol{Priority = CI + LR}$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to Table 23).

Table 23: Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance (FS), the PF is multiplied by the post-mitigation significance scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a higher significance).

Table 24: Final Environmental Significance Rating

Significance Rating	Description
<-25	**Very High (Impacts in this class are extremely significant and pose a very high environmental risk. In certain instances these may represent a fatal flaw. They are likely to have a major influence on the decision and may be difficult or impossible to mitigate. Offset's may be necessary.**

Significance Rating	Description
<-13.75 to -25	High negative (These impacts are significant and must be carefully considered in the decision-making process. They have a high environmental risk or impact and require extensive mitigation measures).
-8.5 to -13.75	Medium-High negative (i.e. Impacts in this class are more substantial and could have a significant environmental risk. They may influence the decision to develop in the area and require more robust mitigation measures).
<-4.25 to <-8.5	Medium- Low negative (i.e. These impacts are slightly more significant than low impacts but still do not pose a major environmental risk. They might require some mitigation measures but are generally manageable).
-1 to -4.25	Low negative (i.e. Impacts in this class are minor and unlikely to have a significant environmental risk. They do not influence the decision to develop in the area and are typically easily mitigated.
0	No impact
1 to 4.25	Low positive
>4.25 to <8.5	Medium-Low positive
8.5 to 13.75	Medium-High positive
>13.75	High positive

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

		Pre-Mitigation							Post Mitigation								Factor			
Impact	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	mitigation ER	Pre -	Nature	Extent	Duration	Magnitude	Reversibility	Probability	mitigation ER	Post-	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
Leaching and migration of radionuclides from the TSF during the post-closure phase	Rehab and closure	-1	3	5	1	3	2	-6	-1	3	5	1	3	2	-6	Medium	1	1	1.00	-6
Destruction, further loss and fragmentation of the of habitats, ecosystems and vegetation community;	Construction	-1	3	4	2	3	3	-9	-1	2	3	1	3	2	-4.5	Medium	1	1	1.00	-4.5
Introduction of alien and invasive species, especially plants;	Construction	-1	3	4	3	2	3	-9	-1	2	3	3	2	2	-5	Medium	1	1	1.00	-5
Displacement of the indigenous faunal community (incl bird and bats) due to habitat loss, direct mortalities, and disturbance (road collisions, noise, dust, light, vibration, and poaching).	Construction	-1	3	4	3	3	3	-9.75	-1	2	3	2	3	2	-5	Medium	1	1	1.00	-5
Continued fragmentation and degradation of habitats and ecosystems	Operation	-1	2	3	2	3	2	-5	-1	1	2	1	3	2	-3.5	Medium	1	1	1.00	-3.5
Spread of alien and/or invasive species	Operation	-1	3	3	3	2	2	-5.5	-1	2	2	2	1	1	-1.75	Medium	1	1	1.00	-1.75
Ongoing displacement and direct mortalities of the faunal community due to continued disturbance (road collisions, noise, light, dust, vibration, poaching, erosion, etc.).	Operation	-1	3	4	3	3	2	-6.5	-1	2	3	2	2	1	-2.25	Medium	1	1	1.00	-2.25
Loss of land capability	Planning	-1	1	1	1	2	1	-1.25	-1	1	1	1	1	1	-1	Low	1	1	1.00	-1
Soil compaction	Construction	-1	3	3	3	3	3	-9	-1	2	2	2	3	3	-6.75	Medium	2	3	1.38	-9.2813
Soil erosion (overland flows), Land degradation	Operation	-1	3	3	3	3	3	-9	-1	2	3	2	3	3	-7.5	Medium	2	3	1.38	-10.313
Soil erosion, Land degradation	Decommissioning	-1	2	2	2	3	3	-6.75	-1	2	2	1	3	2	-4	Low	2	2	1.25	-5
Soil erosion (overland flows), Land degradation	Rehab and closure	-1	2	2	2	2	2	-4	-1	2	2	1	2	1	-1.75	Low	1	2	1.13	-1.9688
Direct loss, disturbance and degradation of wetlands.	Construction	-1	2	1	5	3	4	-11	-1	2	1	4	3	3	-7.5	High	2	2	1.25	-9.375
Increased bare surfaces, runoff (overland flows) and potential for erosion	Construction	-1	2	3	3	3	3	-8.25	-1	1	2	2	3	3	-6	High	2	2	1.25	-7.5
introduction and spread of alien and invasive vegetation	Construction	-1	2	1	4	3	4	-10	-1	2	1	3	3	3	-6.75	High	2	2	1.25	-8.4375
Increased sediment loads to downstream reaches	Construction	-1	2	1	3	3	3	-6.75	-1	2	1	2	3	3	-6	High	2	2	1.25	-7.5
Contamination of wetlands with hydrocarbons due to machinery leaks and eutrophication of wetland systems with human sewerage and other waste.	Construction	-1	2	1	3	3	2	-4.5	-1	2	1	2	3	2	-4	High	2	2	1.25	-5
Disruption of wetland soil profile and alteration of hydrological regime	Construction	-1	2	1	3	3	3	-6.75	-1	2	1	2	3	3	-6	High	2	2	1.25	-7.5
Increased water inputs (clean) to downstream wetlands	Operation	-1	2	4	2	3	3	-8.25	-1	2	4	2	3	3	-8.25	High	2	2	1.25	-10.313
Degradation of wetland vegetation and proliferation of alien and invasive species	Decommissioning	-1	2	1	4	3	4	-10	-1	2	1	3	3	3	-6.75	High	2	2	1.25	-8.4375
Disruption of wetland soil profile, hydrological regime and increased sediment loads	Decommissioning	-1	2	1	3	3	3	-6.75	-1	2	1	2	3	3	-6	High	2	2	1.25	-7.5
Groundwater contamination - Valley TSF unlined (alternative 1)	Operation	-1	2	3	2	3	3	-7.5	-1	1	2	2	3	2	-4	Medium	2	2	1.25	-5
Cumulative groundwater contamination- Valley TSF unlined (alternative 1)	Operation	-1	3	4	3	3	4	-13	-1	2	3	3	3	4	-11	Medium	2	2	1.25	-13.75
Groundwater contamination - Valley TSF lined (alteranative 2)	Operation	-1	1	2	1	2	2	-3	-1	1	2	2	3	1	-2	Medium	2	2	1.25	-2.5
Cumulative groundwater contamination- Valley TSF lined (alternative 2)	Operation	-1	3	4	3	3	4	-13	-1	2	3	3	3	4	-11	Medium	2	2	1.25	-13.75
Groundwater contamination - Valley TSF unlined (alternative 1)	Decommissioning	-1	2	3	2	3	3	-7.5	-1	1	2	2	3	2	-4	Medium	2	2	1.25	-5
Cumulative groundwater contamination - - Valley TSF unlined (alternative 1)	Decommissioning	-1	3	4	3	3	4	-13	-1	2	3	3	3	4	-11	Medium	2	2	1.25	-13.75
Groundwater contamination - Valley TSF lined (alternative 2)	Decommissioning	-1	1	2	1	2	2	-3	-1	1	2	2	3	1	-2	Medium	2	2	1.25	-2.5
Cumulative groundwater contamination- Valley TSF lined (alternative 2)	Decommissioning	-1	3	4	3	3	4	-13	-1	2	3	3	3	4	-11	Medium	2	2	1.25	-13.75
Decrease in subsurface flows and return flows	Construction	-1	3	3	3	3	3	-9	-1	2	2	2	3	2	-4.5	Medium	2	1	1.13	-5.0625
Decrease in subsurface flows and return flows	Operation	-1	2	3	3	2.75	3	-8.0625	-1	1	1	1	1	2	-2	Medium	2	1	1.13	-2.25

Figure 17: Impact matrix for the Valley TSF based on water and soils.

6.4 CONSTRUCTION PHASE IMPACTS

This section describes the potential construction phase impacts.

6.4.1 GROUNDWATER (GEOHYDROLOGY) IMPACTS

The proposed Valley TSF will be built between existing tailings facilities. The date of construction of these facilities is unclear but it was assumed that the dams were established during the 1970's. The impact from the existing dams were therefore modelled, based on this assumption, and the current modelled impact from these dams are shown in Figure 18. The current impact is mainly towards the southwest and the Mahemspruit.

Assuming that the existing facility is 50 years old, the average plume migration can be estimated based on Darcy's law. Contaminants are transported in groundwater by advection, that is, the movement of a solute at the speed of the average linear velocity of groundwater (Anderson, et. al., 1992).

The hydraulic conductivity for the weathered aquifer is estimated as 0.289 m/day. The groundwater gradient averages 0.6% in the study area. The porosity of the aquifer material is estimated to be between 3 - 7% (AquiSim Consulting, 2012). Applying the above formula to the study area assuming a porosity of 5% it is calculated that the groundwater velocity averages a rate of 0.035 m/day or 12.66 m per annum. Over the 50-year period the plume migration is estimated at 633m, which is supported by the numerical modelling. The potential of impacted seepage from surface infrastructure (tailings dam) affecting downgradient receptors was evaluated. The first part of the assessment looks at the potential future impact from the proposed Valley tailings facility only and the second part of the assessment looks at the cumulative impact from the existing infrastructure and the proposed infrastructure.

The numerical model was used to simulate the following scenarios:

- Contaminant seepage from the Tailings Dam without any liner for periods 10-, 50- and 100-years; and
- Contaminant seepage from the Tailings Dam with an engineered liner for periods 50- and 100-years.

It is evident from this assessment that the area is already impacted by the historical activities. Plume migration is, however, slow and although the simulated current plume has reached the Mahemspruit, the concentrations are <500 mg/L. The Mahemspruit is, however, impacted not only by this tailings facility, but also by other contaminant sources in the region.

The expected contribution of the impact from the Valley TSF is low and contained within the current impacted footprint. The unmitigated impact shows that a contaminant plume will migrate from the proposed TSF towards the only down-gradient receptor, the Mahemspruit. This contaminant flow is very slow and small impacts (<500 mg/L SO4) will only reach the stream after approximately 100 years.

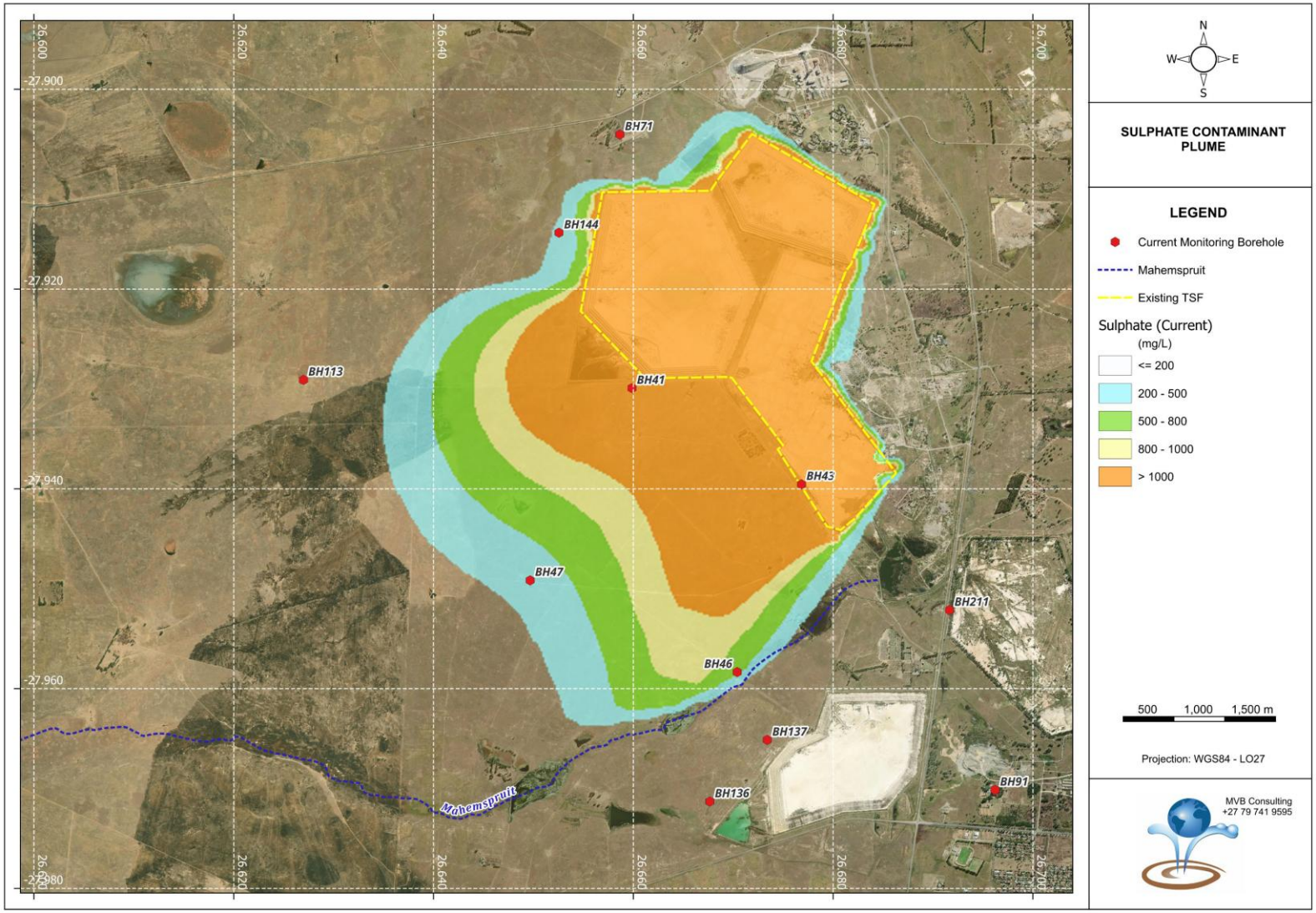


Figure 18: Simulated sulphate plume from existing facilities

The Tailings Dam was modelled as a constant source (worst-case scenario) as it is assumed that the facility will continue to release impacted seepage to the environment. The impacts after 10 years, 50 years and 100 years were simulated and the results presented in **Error! Reference source not found.** to **Error! Reference source not found.**

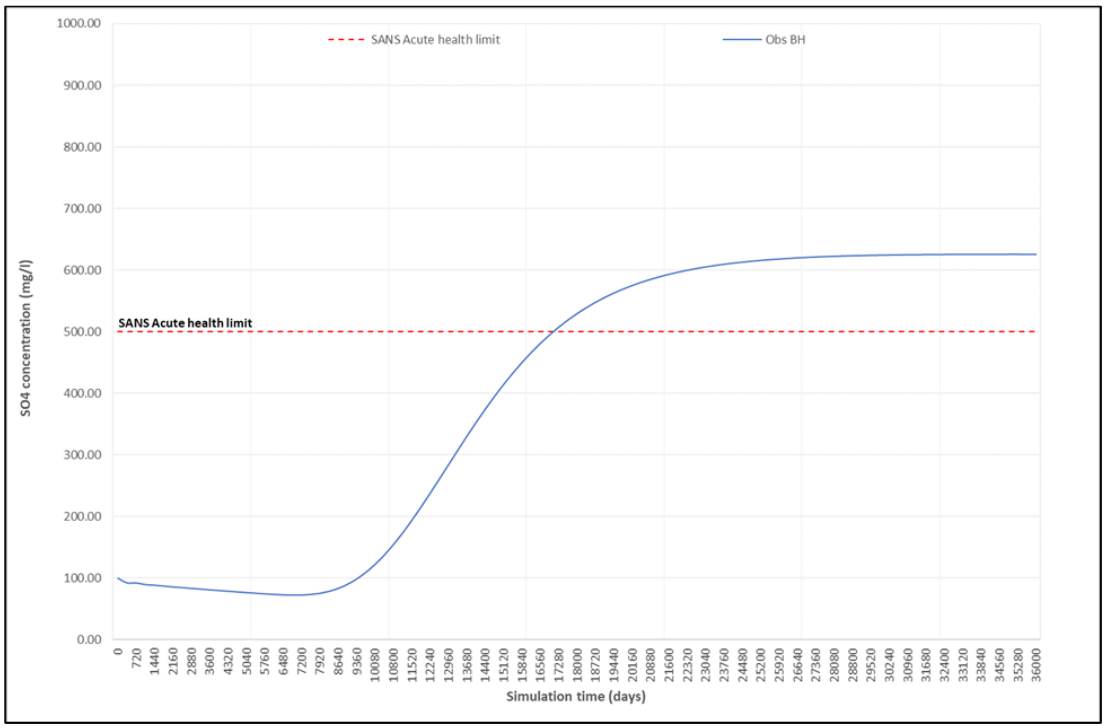


Figure 19: Simulated sulphate concentration in an observation borehole over time

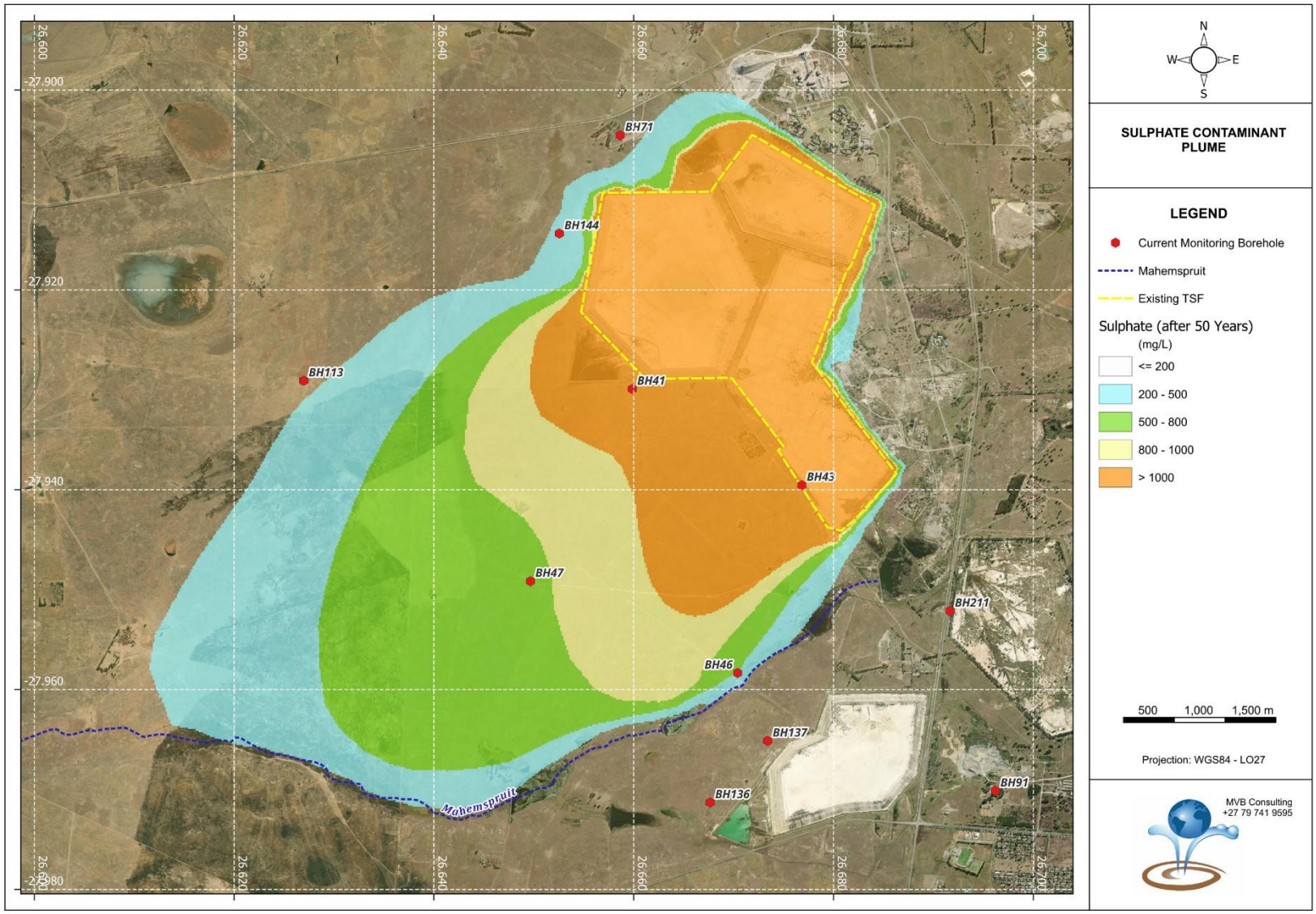


Figure 20: Simulated current plume after 50 years

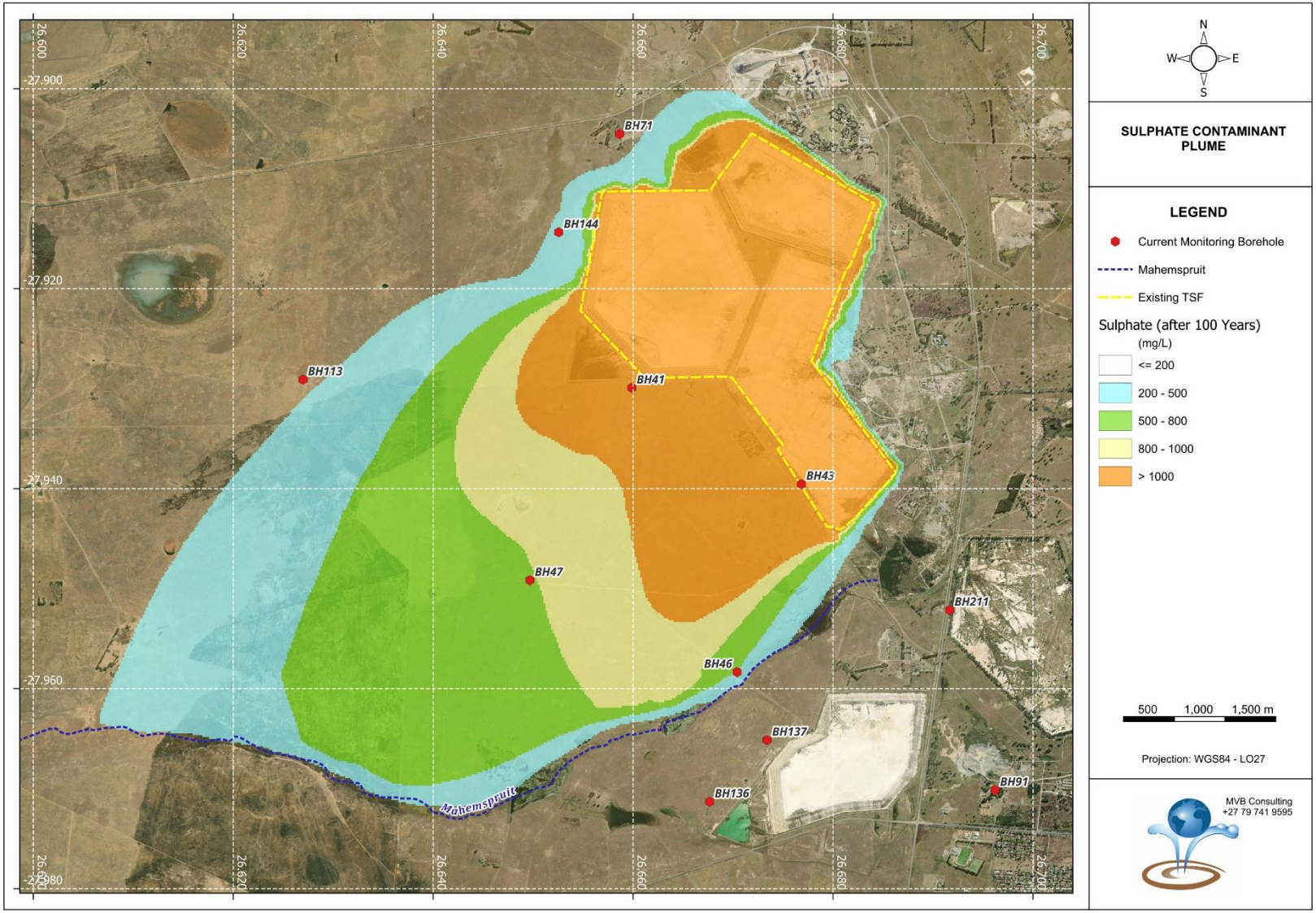


Figure 21: Simulated current plume after 100 years

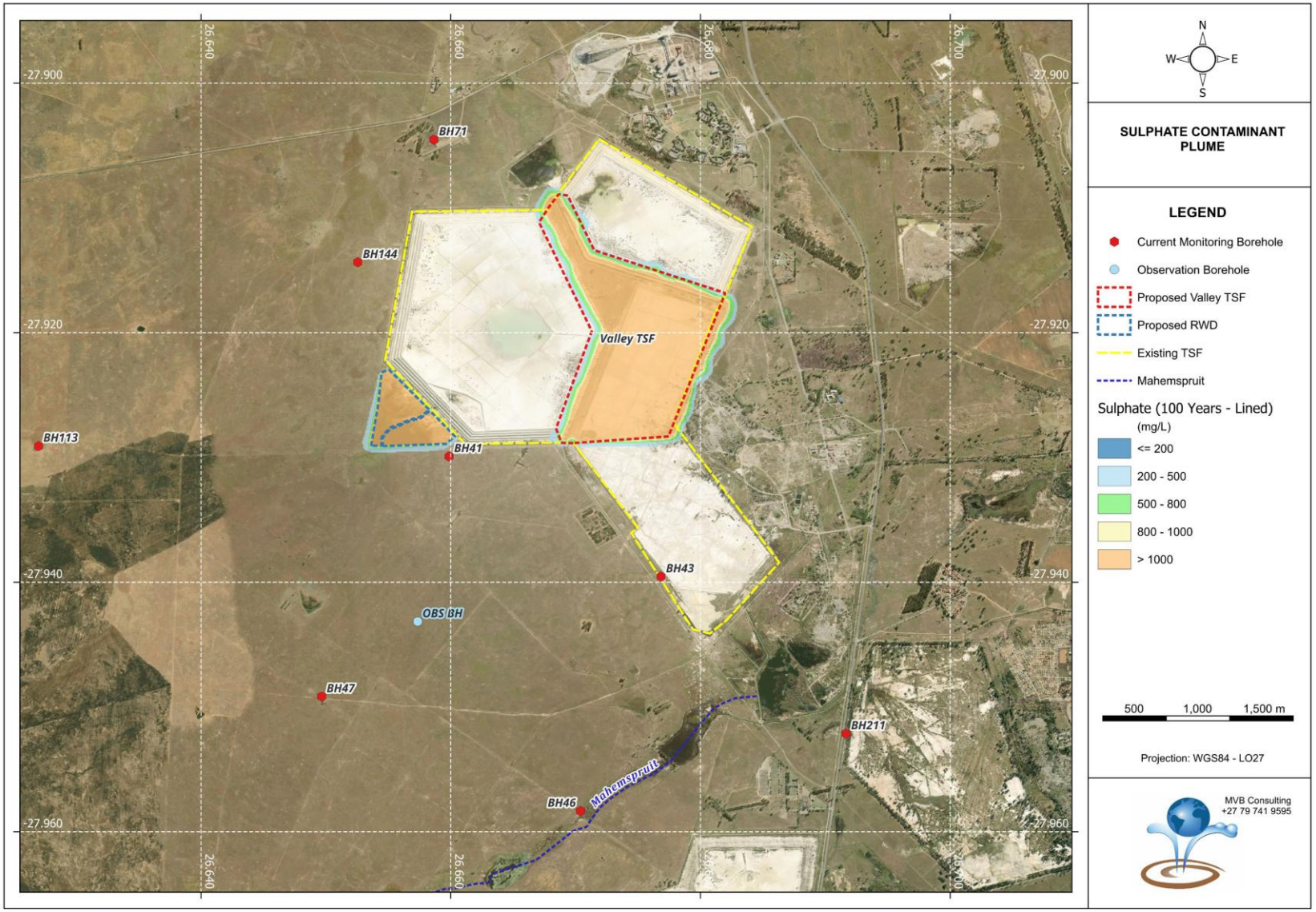


Figure 22: Simulated sulphate plume from proposed activities, with a liner, after 100 years

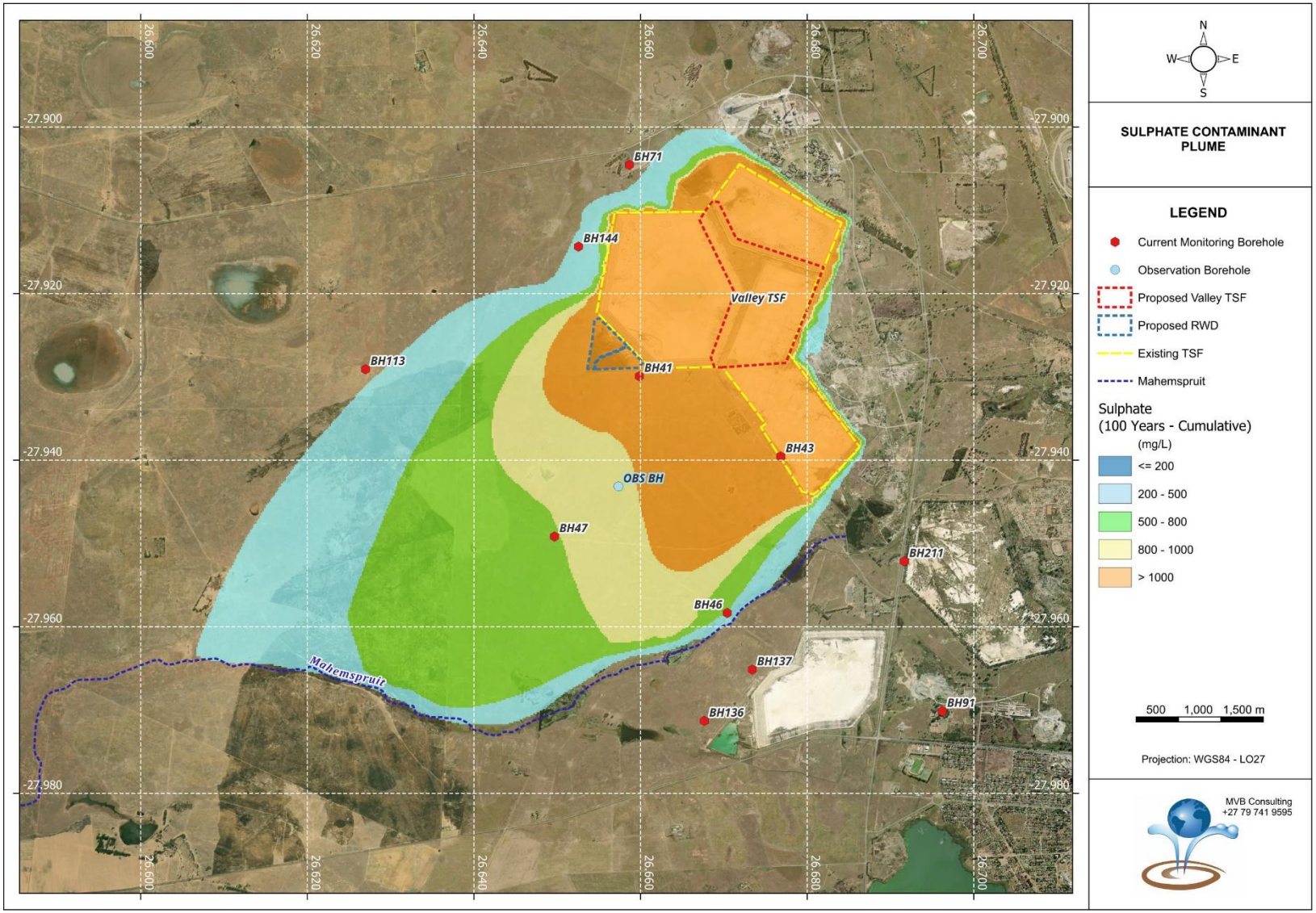


Figure 23: Cumulative Sulphate plume from the existing TSF and Valley TSF after 100 year

With reference to the above modelled plumes, it appears that the lining of the proposed Valley TSF will have net positive impact on the down-gradient groundwater quality. It is, however noted that although the positive impact is not visible on the extent of the plume, there is nevertheless a reduction in the contaminant concentration over time. The reduction in the sulphate concentration down-gradient from the facility, with a liner installed, is approximately 50mg/L after 30 years.

This is a small improvement and it is therefore recommended that a rehabilitation plan be developed to address the groundwater deterioration from the existing TSF, in conjunction with the lining of the Valley TSF. Figure 24 below shows the mitigating effect of the liner on the sulphate plumes.

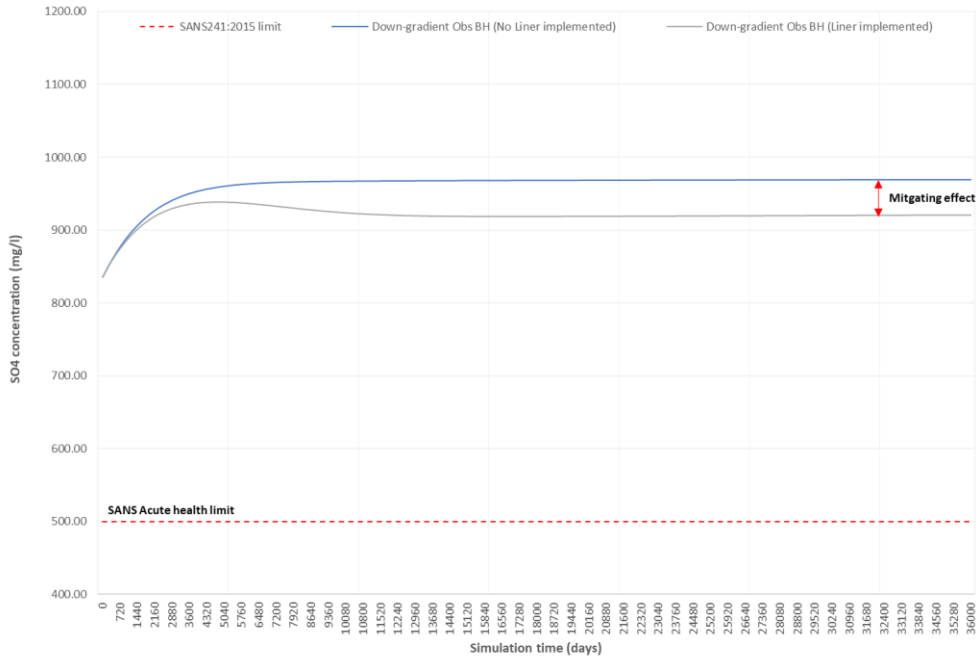


Figure 24: Simulated sulphate concentration in an observation borehole over time, with and without a liner

6.4.2 IMPACTS ON WETLANDS

The impact assessment considered the anticipated direct and indirect impacts to the wetland systems as a result of the proposed tailings facility. The mitigation hierarchy as discussed by the Department of Environmental Affairs (2013) was considered for this component of the assessment. In accordance with the mitigation hierarchy, the preferred mitigatory measure is to avoid impacts by considering options in project location, sitting, scale, layout, technology and project/activity phasing to avoid impacts.

Three levels of risk have been identified and considered for the overall risk assessment, these include high, medium, and low risks. Due to the destructive characteristics of a new tailing's facility on wetlands, High risks are expected for the project. Medium risk refers to wetland areas where the impacts will only occur inside the wetlands buffer and not on the wetlands themselves. Low risks are wetland systems where both the wetlands and their buffers are avoided by die proposed activities. The High risks were the priority for the risk assessment, focussing on the expected potential for these direct risks.

Due to the fact that direct impacts to the wetlands (and buffers) will not be avoided, the risk assessment considered all direct and indirect risks posed to these systems as a result of the project. A risk assessment was conducted in line with Section 21 (c) and (i) of the National Water Act, 1998, (Act 36 of 1998) to investigate the level of risk posed by proposed project.

During the site assessment, six HGM units were identified and assessed within the project area of influence. These comprise of three unchannelled valley bottoms, multiple depression wetlands and a seep wetland. The systems scored an overall PES score of E – "Seriously Modified", due to the modifications arising from anthropogenic influences and surrounding mining activities. The Importance and Sensitivity for both the valley

bottoms and the seep wetlands were calculated to be “High”, which combines the low protection status of the wet veg and the and the high threat status of the wetlands themselves. The depression wetlands scored “Moderate” sensitivities due to the low threat status of the wet veg and the low threat status of the wetlands themselves. The average ecosystem service score was determined to range between “Moderately Low” and “Moderately High”. A post-mitigation buffer of 42 m was assigned to the systems.

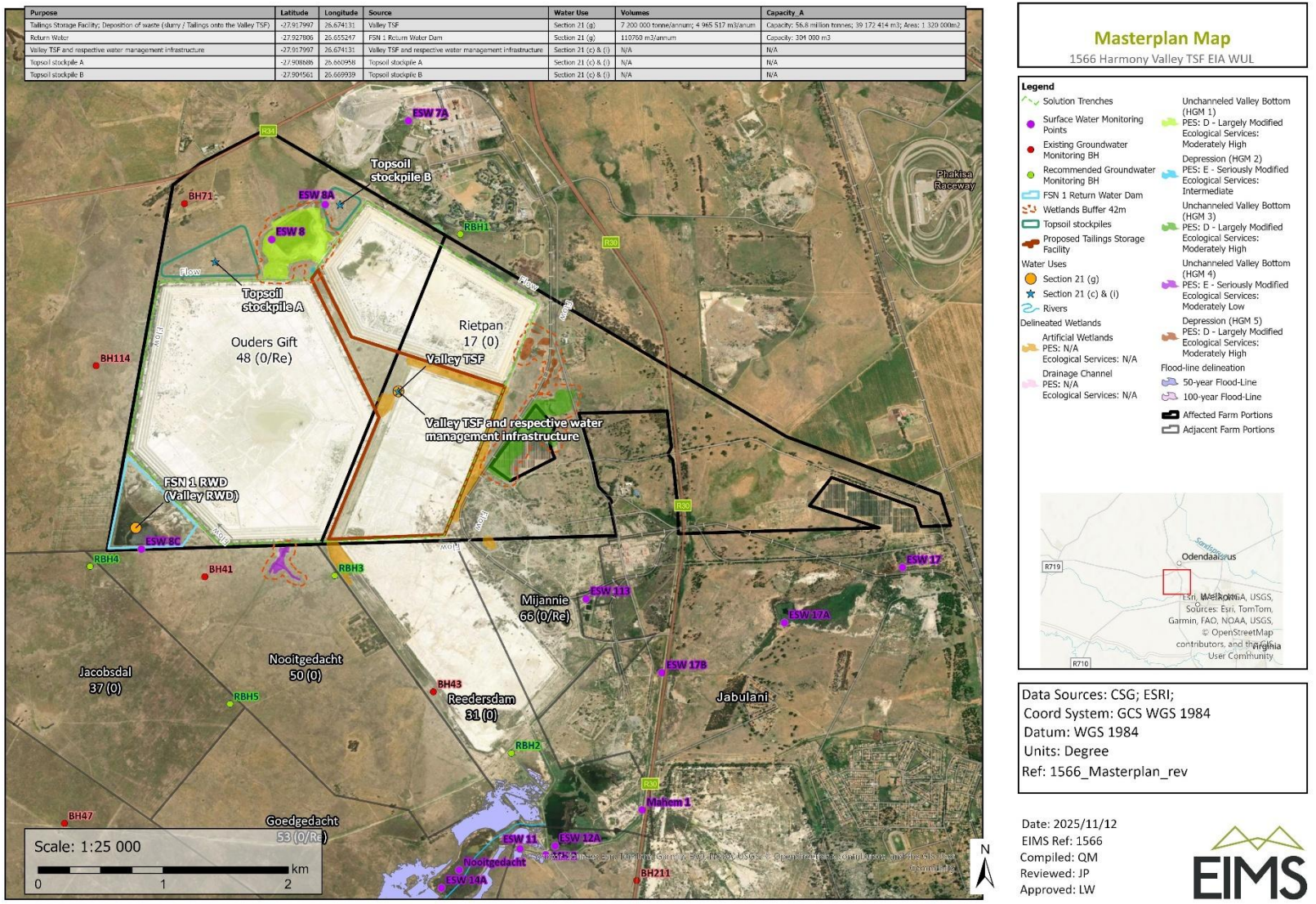


Figure 25: Masterplan showing the proposed infrastructure and wetlands identified.

6.4.2.1 PROPOSED WETLANDS MITIGATION

- Restrict all non-essential activities (e.g. cement mixing and equipment wetland machinery storage) to outside of wetlands and their prescribed buffers for wetlands around the edge of the facility that will not be destroyed by the TSF construction.
- Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.
- Minimize unnecessary clearing of vegetation.
- Contain wastewater in a RWD Contaminated water must not be discharged into watercourses untreated
- Conduct regular inspections along the TSF to ensure the integrity of the facility.
- Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the north-western seep.
- Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter.
- Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed.
- Try to reduce the disturbance footprint and the unnecessary clearing of vegetation on either side of the TSF facility when traversing wetlands.
- Construct as far as possible during winter when flow volumes are lowest, prioritise this for crossing sites. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time.
- Keep the TSF activities to the proposed site and only access the tailings facility from the the existing northern access road or from the South to prevent greater loss to the wetlands northern parts.
- Ensure that the TSF is lined to prevent seepage and sloped and vegetated to prevent runoff through rain.
- Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished.

6.4.3 IMPACTS ON SOILS

Infrastructure within the Valley TSF project and associated infrastructure project area assigned to the available land includes new infrastructure and pipelines, TSF expansion area and access roads. The proposed activities` buffer area often impede into designated “High” sensitivity crop fields. Even though these areas are historical crop field areas, these sensitivities are associated with some arable land potential and capability conditions (i.e., Soil status), therefore high land capability potential areas will be impacted on by the TSF expansion.

Impacts were assessed in terms of the proposed TSF expansion project and associated infrastructure, operational and decommissioning phases.

6.4.3.1 PLANNING PHASE IMPACTS

The planning phase activities are considered a low risk as they typically involve desktop assessments and initial site inspections. This would include preparations and desktop work in support of waste management plans, environmental and social screening assessments, finalising well sites and facilities and consultation with various contractors involved with a diversity of proposed project related activities going forward.

6.4.3.2 CONSTRUCTION PHASE IMPACTS

The project will result in the stripping of topsoil related to the construction of the TSF and alterations to the existing land uses. The changes in the land use will be from agricultural to mining activities development (or transformed). It will impact on areas expected to have high agricultural land capability potential (in some areas), with some aspects affecting "Moderate High" sensitivity areas. It is possible that suitable agricultural land could further be fragmented, resulting in these remaining portions no longer being deemed feasible to farm in the future.

During the construction phase, topsoil often will be cleared, stripped and stockpiled. Access roads will be created with trenches being dug for the installation of relevant cables. The erection of infrastructure where relevant to the current existing TSF structures will occur. Contractor and laydown yards will also be cleared with construction material being transported to laydown yards. Potential erosion is expected during the construction phase due to some erodible soils within the footprint assessment area, such as the Katspruit soil form. The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. Erosion of the area could result in further loss of soil forms suitable for agriculture and these soils will deposit in downslope areas such as the local watercourses, negatively affecting these ecologically sensitive ecosystems. Soil compaction can also result due to increased traffic on site along the proposed project area. The disturbed soil profiles will change from the original natural condition even through proper stockpiles will be stored. Disturbed soils can result in further water and nutrient losses from the soil matrix.

6.4.3.3 OPERATIONAL PHASE IMPACTS

During the operational phase, limited impacts are foreseen. Only the footprint area will be disturbed, and this will minimise soil and vegetation disturbance of the surrounding area. Revegetation will be carried out on exposed surrounding areas to avoid surface erosion. Maintenance of vegetation, infrastructure maintenance will have to be carried out throughout the life of the project. It is expected that these maintenance practices can be undertaken by means of manual labour.

6.4.3.4 DECOMMISSIONING PHASE IMPACTS

The cumulative decommissioning impacts post-mitigation have been scored "Low," indicating that the potential incremental, interactive, sequential, and synergistic impacts are limited. It is probable that the impact will result in spatial and temporal cumulative change.

6.4.3.5 SOILS MITIGATION MEASURES

Limited mitigation is required given the fact that the pre-mitigation significance rating has been scored as "Medium – Negative" and the post-mitigation significance rating being scored as Negligible "Low – Negative." Key mitigation measures include:

- Vegetate or cover all stockpiles after stripping/removing soils. Natural re-vegetation of these areas for the first growing season is allowed, with further action to be determined thereafter, if needed;
- Storage of potential contaminants should be undertaken in bunded areas;
- All contractors must have spill kits available and be trained in the correct use thereof;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Prevent flood damage or concentration of run-off;
- Preserve and enhance the quality of clean stormwater runoff into the receiving environment; and
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- No cleaning or servicing of vehicles, machines and equipment may be undertaken in water resources;

- Have action plans on site, and training for contractors and employees in the event of spills, leaks and other impacts to the aquatic systems;
- Continuously monitor erosion on site; and
- Monitor compaction on site.

7 PUBLIC PARTICIPATION

South Africa, being one of the countries with the most progressive constitutions, enshrined the public's right to be involved in decisions that may affect them in its Constitution. Section 57(1) of the new Constitution that provides: "*The National Assembly may (b) make rules and orders concerning its business, with due regard to representative and participatory democracy, accountability, transparency and public involvement".* This provision, along with several others gave rise to many new trends in South African legislation. In environmental legislation, the idea of public participation (or stakeholder engagement) features strongly and especially the National Environmental Management Act (Act 107 of 1998, NEMA) and the recent regulations passed under the auspices of this Act makes very strict provisions for public participation in environmental decision-making.

7.1 OBJECTIVES OF PUBLIC PARTICIPATION

Public participation can be defined as..."*a process leading to a joint effort by stakeholders, technical specialists, the authorities and the proponent who work together to produce better decisions than if they had acted independently*" From this definition, it can be seen that the input of the public is regarded as very important indeed.

The PPP is designed to provide sufficient and accessible information to Interested and Affected Parties (I&APs) in an objective manner to assist them to:

- During the Authorisation Process:
    - Verify that their issues have been recorded;
    - Comment on the findings of the environmental assessments; and
    - Provide relevant local information and knowledge to the environmental assessment.

The PPP is a requirement of several pieces of South African Legislation and aims to ensure that all relevant I&APs are consulted, involved and their opinions are taken into account and a record included in the reports submitted to Authorities. The process ensures that all stakeholders are provided this opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the necessary authorisation required for the project needs to be managed sensitively and according to best practises in order to ensure and promote:

- Compliance with international best practice options;
- Compliance with national legislation;
- Establishment and management of relationships with key stakeholder groups; and
- Encouragement of involvement and participation in the environmental study and authorisation/approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Introduce the proposed project and process for the authorisation project;
- Explain the environmental authorisation;
- Determine and record issues, concerns, suggestions, and objections to the project;
- Provide opportunity for input and gathering of local knowledge;

- Establish and formalise lines of communication between the I&APs and the project team;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximise and/or promote positive environmental impacts associated with the project.

This Public Participation Report (PPR) lists all verbal and written issues raised by I&APs during the call to register period from 15 March 2023 to date. A breakdown of the PPP is given within the remaining sections of this PPR.

7.2 STAKEHOLDER ENGAGEMENT METHODOLOGY

The methodology included:

- Identification of stakeholders (including regulatory authorities, interested and affected groups);
- Stakeholder notification (through dissemination of Background Information Documents, media and site notices); and
- Stakeholder engagement which included one on one meetings, public and authorities' meetings.

7.2.1 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES (I&APS)

An initial I&AP database has been compiled from historic projects in the area and Windeed searches to obtain the contact details of the surrounding landowners. The I&APs referred to in the PPR include:

- Pre-identified and registered landowners and surrounding landowners;
- Pre-identified and registered key stakeholders;
- Regulatory authorities;
- Specialist interest groups; and
- All I&APs who responded to the initial notifications and requested to be registered.

7.2.1.1 LIST OF ORGANS OF STATE IDENTIFIED AND NOTIFIED

The following key I&APs, but not limited to, were notified of the proposed project and invited to participate in the public participation process:

- Matjhabeng Local Municipality
- National Government of the Republic of South Africa
- South African National Biodiversity Institute
- Free State Provincial Heritage Resources Authority
- South African Civil Aviation Authority
- South African National Roads Agency Ltd
- South African Heritage Resources Agency
- Lejweleputswa District Municipality
- Free State Department of Agriculture& Rural Development
- Free State Department of Agriculture &Rural Development
- Free State Department of Cooperative Governance and Traditional Affairs
- Free State Department of Public Works and Infrastructure
- Free State Department of Police, Roads and Transport
- Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs
- Free State Development Corporation

- Free State Department of Mineral Resources and Energy
- Free State Department of Water and Sanitation
- National Department of Agriculture, Land Reform and Rural Development
- National Department of Forestry, Fisheries and Environment
- National Department of Water and Sanitation
- National Department of Transport
- National House of Traditional Leaders
- National Energy Regulator of South Africa (NERSA)
- Sedibeng Water
- Eskom SOC Ltd
- National Department of Agriculture Land Reform and Rural Development
- Free State Department of Small Business, Tourism, and Environmental Affairs
- Free State department of Health

7.2.1.2 LIST OF OTHER KEY I&APS IDENTIFIED AND NOTIFIED

- Directly Affected and Adjacent Landowners
- Freegold Harmony Pty Ltd/Harmony Gold Mining Co Ltd
- Armgold/Harmony Freegold Joint Venture co Pty Ltd
- Birdlife South Africa
- Transnet Properties
- Welkom Airport FAWM
- Phakisa Freeway
- Thusanong District Hospital
- Goldfields Equestrian centre
- Welkom Paintball
- Welkom Cemetery
- Griffons Rugby Union
- Fidelity Security Services - Welkom
- A & R Firearms and training
- Die Melkkan
- Western Holdings Primary School
- Working for Climate
- Endangered Wildlife Trust
- Ward councillors

7.3 STAKEHOLDER NOTIFICATION

This section provides details on the notifications that were distributed as part of the consultation process to date.

7.3.1.1 REGISTRATION OF I&APS

Efforts to pre-identify key I&APs involved various avenues such as consultation with the proponent and known landowners within the study area, review of related previously conducted studies, and identification of key interest groups and authorities within the vicinity of the study area and municipality. Refer to Appendix C1 for the Key Stakeholder/I&AP Database.

7.3.1.2 FAXES AND EMAILS

Notification letters in English, Afrikaans and Sesotho were distributed to pre-identified I&APS through either faxes, and/or emails.

The notification documents included the following information:

- List of anticipated activities to be authorised;

- Sufficient detail of the proposed development to enable I&APs to assess/surmise what impact the development will have on them or on the use of their land;
- The purpose of the proposed project;
- Details of the application processes associated with proposed activities;
- Details of the affected properties (including a locality map);
- Details of the South African environmental legislation that must be adhered to;
- Contact details of the EAP.

7.3.1.3 SITE NOTICE PLACEMENT

Ten (10) A2 Correx site notices (in English, Afrikaans, and SeSotho) as well as three (3) poster notices were placed at 13 locations along, within and surrounding the perimeter of the proposed project study area on the 4 April 2023. The on-site notices included the following information:

- Project name;
- Applicant name;
- Project location;
- Map of proposed project area;
- Project description;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

7.3.1.4 NEWSPAPER ADVERTISEMENTS

Advertisements describing the proposed project and EIA process were placed in the Welkom News Newspaper (in English, Afrikaans and Sesotho) with circulation in the vicinity of the study area on 6 April 2023.

- Project name;
- Applicant name;
- Project location;
- Nature of the activity;
- Legislative requirements; and
- Relevant EIMS contact person for the project.

7.4 STAKEHOLDER ENGAGEMENT

The table below provides a summary of the opportunities provided to I&APs for participation in the public participation process to date.

Table 25: Opportunities Provided for Public Participation

PHASE	DESCRIPTION	PUBLICATION/PLACE	DATE
Initial Call to Register	Notification of landowners, occupiers, and other key I&APs.	Affected landowners and key I&APs were notified via email, fax, and/or post.	**4 April 2023**
	Placement of site notices.	Ten (10) A2 site notices (English, Afrikaans and Sesotho) and three (3) A3 poster notices within and around the study area (13 placement locations).	**4 April 2023**
	Newspaper advertisement	Notices were placed in the Welkom News Newspaper	**6 April 2023**
SR Availability	Placement of SR for Public Review	SR placed in the Welkom Public Library	**10 June 2023**
	Public meeting	Public meeting was planned at Victoria Hall, Reibeeckstad	**28 June 2023**
EIAR Availability	Placement of EIAR for Public Review	EIAR placed in the Welkom Public Library	**22 March 2024**
	Public meeting	Public meeting held at Welkom Inn, Welkom	**11 April 2024**
IWWMP Availability	**Placement of IWWMP for Public Review**	**IWWMP placed at the Welkom Public Library**	**23 January 2026**

7.4.1 PROPOSED PUBLIC REVIEW TIMEFRAMES FOR THE IWWMP

The Integrated Waste and Water Management Plan is made available to all I&APs from 23 January 2026 for a 60 day comment period. The public will be notified regarding the availability of the Integrate Waste and Water Management Plan for review. Comments raised by I&APs will be used to update the issues table that accompanies the final Integrated Waste and Water Management Plan for submission to DWS.

7.5 RECOMMENDATIONS

Public consultation should be on-going throughout the operational and decommissioning phases of the operations.

8 MATTERS REQUIRING ATTENTION/PROBLEM STATEMENT

No audits for this project have yet occurred, as such this section is not applicable.

9 WATER AND WASTE MANAGEMENT

The following section describes water and waste aspects for the Valley TSF, as well as the related operational processes.

9.1 WATER AND WASTE MANAGEMENT PHILOSOPHY (PROCESS WATER, STORM WATER, GROUNDWATER, WASTE)

The water management in Harmony is in line with the best practice guidelines for water management on mines. The following principles will be implemented:

- The prevention of water contamination;
- The recycling and re-use of all water is implemented, and this has reduced the clean water requirement;
- Waste reduction, re-use and recycling is implemented; and
- Environmental monitoring is conducted regularly since operation started.

9.2 STRATEGIES (PROCESS WATER, STORM WATER, GROUNDWATER AND WASTE)

For the control of water flow in the facility, a management structure was included in the design plans for the TSF. These trenches will serve to capture all water originating from the tailings and guide them toward the RWD. This will include water from the slurry, direct rainwater falling on the site and any wastewater. This barrier consists of:

- A 150mm thick reinforced concrete lined solution trench is provided around the perimeter of the TSF. The trapezoidal solution trench is 1m deep with side slopes of 1V:1.5H and a base width of 1m.
- The solution trench conveys effluent from the drain outlets as well as other contaminated water from the facility to the silt trap of the RWD.
- A concrete lined solution trench prevents seepage of the drain effluent into the underlying soils and also provides a durable surface for cleaning and maintenance.
- The existing solution trenches along the perimeter of the facility will need to be assessed and rehabilitated.
- The underdrainage towards the south-eastern portion of Valley TSF will flow through the drainage outlet pipes and into the concrete lined solution trench located south of the TSF. This will then flow through the existing solution trench towards the existing RWD located southwest of the Valley TSF. The existing earth trench will comprise 160mm pipes surrounded by 19mm stone overlain by a layer of 150mm washed river sand which is enclosed in a geofabric.

In addition to the trenches, the existing northern RWD will be retroactively line in order to minimise the seepage originating from the site.

9.3 PERFORMANCE OBJECTIVE GOALS

The following key performance objectives have been identified for the Harmony Valley TSF as stated in Table 26.

Table 26: Performance Objectives

Theme	Objectives
Surface Water	Clean and dirty water separation.
	Containment of dirty water run-off.
	Prevent capacity constraints through regular maintenance of process water dams and through effective operation of the dams (i.e., demand and supply management).
	Protect watercourses against erosion, especially at watercourse crossings.
Groundwater	Minimise impact on groundwater quality.
	Prevent impact on groundwater availability to neighbouring users.
	To minimise the extent of disturbance of the aquifer.
Process Water	Maximise the re-use of process water.
	An up-to-date water balances.
	Manage process water dams with 0.8 m freeboard.
Sensitive landscapes	Minimise impact on sensitive areas (Wetland area) as part of future activities.
Waste	Minimise waste generation
	Re-use and recycle waste as far as possible.

9.4 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

Achievement of the objectives can be made certain by the following measures:

- Monitoring of water quality impacts within the catchment:
- The raw water intake (return water dam) is reduced by capturing of all contaminated water in the slimes and re-use the same water for the washing process, this includes groundwater seepage and direct rainfall into the TSF; and
- Environmental Management Plan Performance Assessment Audits to be undertaken to ensure the implementation of commitments made in the EMPr.

9.5 IMPACTS IDENTIFIED

This section will discuss the various impacts identified during the specialist studies relative to the IWWMP. These impacts will serve to provide context to the mitigation measures which will be in the following section.

9.5.1 CONSTRUCTION PHASE IMPACTS

Th construction of a TSF will have by its very nature will impact on the surrounding environment. During the specialist studies for the TSF, the following impacts have been identified:

- Direct loss, disturbance and degradation of wetlands.
- Increased bare surfaces, runoff and potential for erosion
- Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation
- Contamination of wetlands with hydrocarbons due to machinery leaks and eutrophication of wetland systems with human sewerage and other waste.
- Disruption of wetland soil profile and alteration of hydrological regime
- Groundwater contamination from Valley TSF
- Cumulative groundwater contamination

9.5.2 OPERATIONAL PHASE IMPACTS

During the operation of the facility, the design should serve to minimise the immediate impacts of the facility, that being said, some impacts will be present regardless:

- Increased sediment loads to downstream reaches
- Increased water inputs (clean) to downstream wetlands
- Groundwater contamination from Valley TSF
- Cumulative groundwater contamination

9.5.3 DECOMISSIONING/REHABILITATION PHASE IMPACTS

The decommissioning of the facility will have some impacts however these are limited due to the location of the TSF. Impacts identified for the dec missioning/rehabilitation phase are:

- Degradation of wetland vegetation and proliferation of alien and invasive species
- Disruption of wetland soil profile, hydrological regime and increased sediment loads
- Groundwater contamination from Valley TSF
- Cumulative groundwater contamination

9.6 PROJECT ALTERNATIVES

As this application relates only to a new TSF, there are limited feasible and/or reasonable alternatives that can be considered, and which are described and motivated below.

9.6.1 LOCATION ALTERNATIVES

The assessment of location alternatives is limited due to the available open space in close proximity to the mining activities (and especially the gold processing plant). Several alternative sites were identified and assessed as possible suitable deposition sites for the tailings from Harmony One Plant but apart from the Nooitgedacht site, which is the subject of a separate EIA, none were found feasible. Following a review of other possibilities for the One Plant's future tailings deposition, an option to utilise the space between the FSN1 and FSN2 TSFs and portion of the footprint of the FSN4 TSF as shown in Figure 26 has been identified as the preferred deposition site. The existing TSF is surrounded by existing or planned mining infrastructure and therefore expansion of the existing facility in other directions is not feasible as part of this application. The study area contains open space to the south of the TSF which is currently under consideration for the Nooitgedacht TSF EIA.

Several alternative sites were identified and assessed as part of a 2008 study completed by Golder Environmental. Various sites were identified as part of this 2008 study as indicated in Figure 26 below.

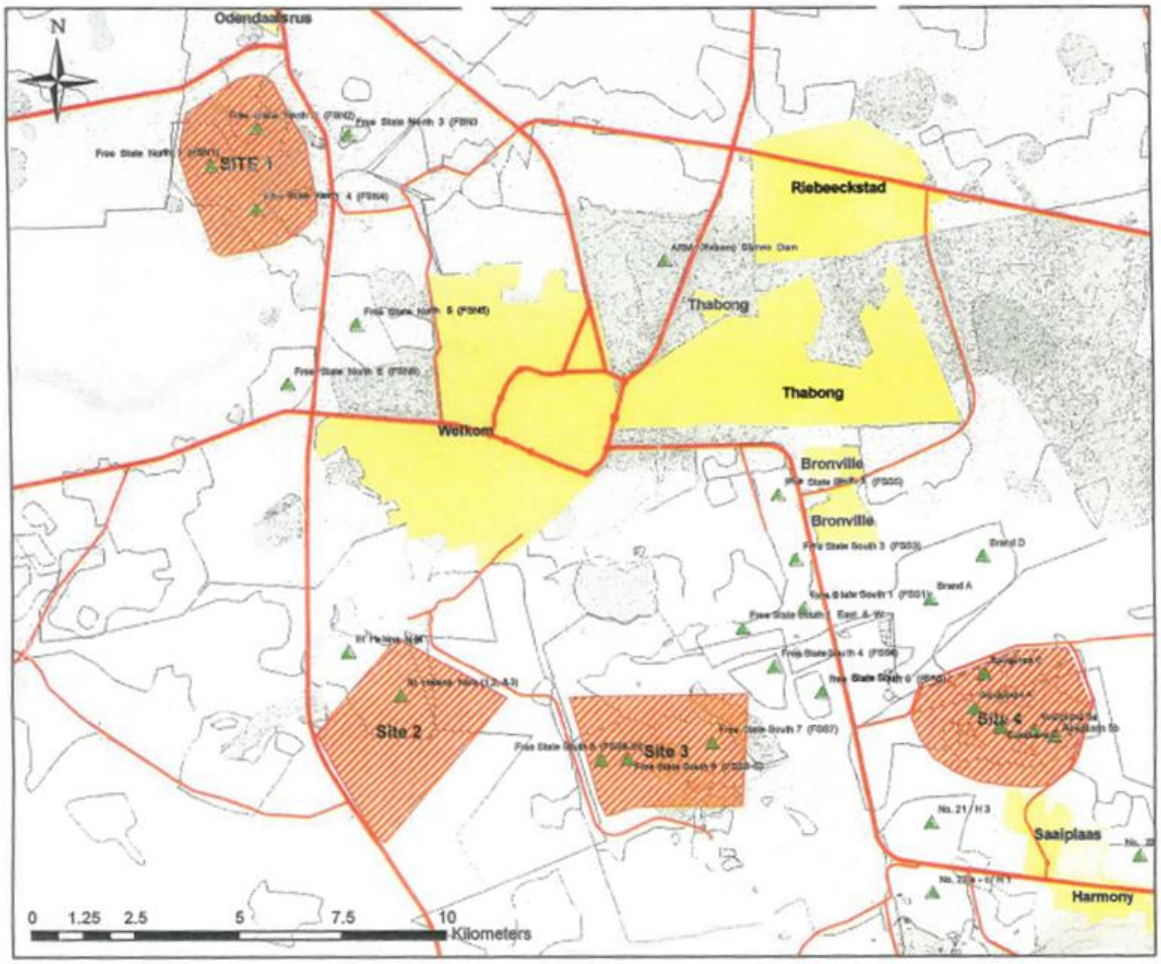


Figure 26: Sites assessed in the 2008 Golder Site Selection Study.

As part of the 2008 Golder Study various specialist input was obtained from ecological, surface water and groundwater specialists. During a Steering Committee meeting involving various stakeholders including DWS that was convened on the 25 October 2007 the site selection findings were discussed and an optimal site selected. Site 1 was agreed upon as the preferred site for the TSF (as agreed by the Steering Committee). This site overlaps with the Valley site currently being proposed for the TSF. The reason for this is that the proposed footprint is largely brownfields with a partial greenfields take. The resultant negative impacts on agriculture and ecosystems are considered to be negligible but outweighed by the positive attributes of the site. As such, no further location alternatives are considered in this assessment. The previous 2008 site selection study is considered suitable motivation for the current Valley TSF site.

The only feasible and reasonable location for the new TSF is the area proposed. This proposed area is vacant, disturbed land surrounded by existing TSF structures and is ideally situated to be used as additional deposition space. As such, no further location alternatives are considered in this assessment.

9.6.2 LAYOUT AND DESIGN ALTERNATIVES

The total volume of material to be deposited of on the TSF is based on the forecast gold reserves to be processed at the existing One Plant. As such, the total volume is a firm parameter which cannot be downscaled. The potential to reduce the footprint of the new TSF would require altering the dimensions of the facility by making it either higher with steeper side slopes or lower with a greater footprint area. Increasing the height would result in greater visual impacts and possibly increasing the secondary impacts such as fugitive dust generation and

erosion of the steeper side slopes. Alternatively, reducing the height of the facility would result in a larger footprint, however, there is insufficient available space to do so in the proposed location.

The EIA process that was undertaken included the assessment of potential impacts and the identification of environmental sensitivities within and in the vicinity of the proposed project area thereby allowing for the recommendation of mitigation measures towards the avoidance, minimisation and / or management of the anticipated impacts. The layout will be planned to avoid any no-go areas identified from the various specialist studies, if required, otherwise no additional layout or design alternatives are considered applicable to this application. The Environmental Authorisation was received in September 2025.

9.6.3 TECHNOLOGY ALTERNATIVES

The main available technology alternatives relate to the liner design for the TSF however the liner requirements are based on the waste classification of the material and geohydrological modelling and risk assessment. No additional technology alternatives are considered applicable.

Testing was done by Waterlab (Pty) Ltd (facilitated by Jones and Wagner) to determine the geochemical properties as well as the waste classification of the tailings material. The total concentration leachable concentration results were compared to the Total Concentration Threshold (TCT) and Leachable Concentration Threshold (LCT) values as prescribed in GN 635: National Norms and Standards for the Assessment of Waste for Landfill Disposal. The conclusions from the geochemical assessment indicate that the gold tailings material sampled classifies as a Type 3 waste according to the classification parameters set out by the National Environmental Management Waste Act (Act 59 of 2008).

GN 636: National Norms and Standards for Disposal of Waste to Landfill requires a Class C barrier system for a Type 3 waste. A typical Class C barrier system is illustrated in Figure 27. The Groundwater numerical model was used to simulate the following scenarios:

- **Contaminant seepage from the Tailings Dam without any liner for periods 10-, 50- and 100-years:** The TSF was modelled as a constant source (worst-case scenario) as it is assumed that the facility will continue to release impacted seepage to the environment. The impacts after 10 years, 50 years and 100 years were simulated. Seepage from the proposed TSF migrates to the southwest, towards the Mahemspruit. Slightly elevated concentrations, between 200 – 500 mg/L reaches the stream after approximately 100 years. The simulated sulphate concentration increase, at an observation point some 2 000m down-gradient from the TSF, shows that after 48 years the sulphate concentration will exceed the SANS 241 limits.
- **Contaminant seepage from the Tailings Dam with an engineered liner for periods 50- and 100-years:** The gold tailings that will be deposited on the Valley TSF are classified as a Type 3 waste in terms of the NEMWA Regulations 2013 requiring a Class C containment barrier performance. The Class C single composite barrier system has an expected seepage rate in the order of 140 litres / hectare / day (Legge, 2024). By making use of an ”inverted barrier system” comprising of underdrainage and a base preparation layer; a 1.5mm thick geomembrane ; and covered tailings the barrier system performance is improved by (a) seepage losses are reduced from about 140 l/ha/day to about 3 l/ha/day due to the change from Bernoulli flow at discontinuities to D’Arcian flow controlled by the tailings permeability at these points (Legge, 2024). These leakage rates were included in the model and the impact simulated. The result from the 100-year simulation shows that any contamination from the site will be contained. The small volume of seepage that may flow through the liner system is diluted to the extent that contamination is not detected.

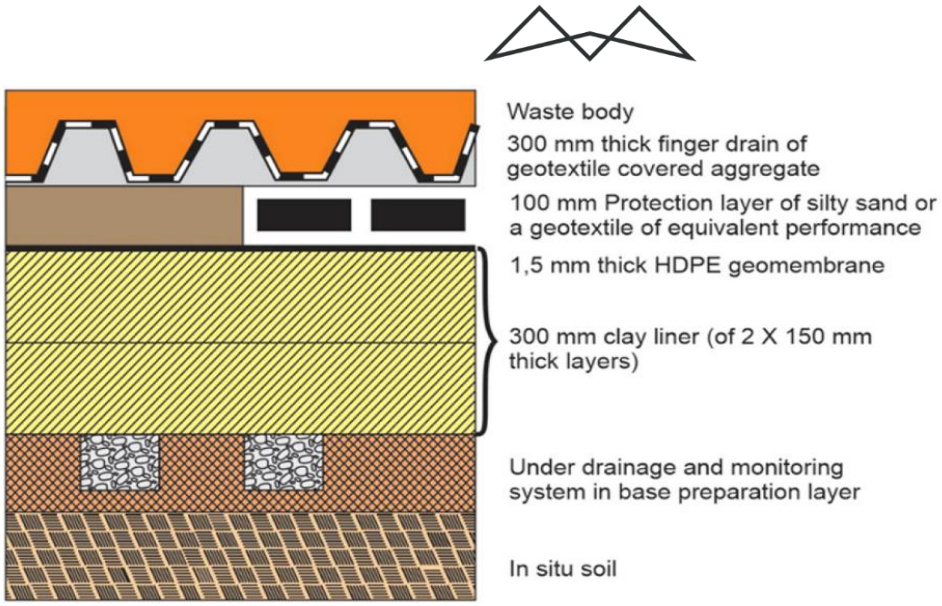


Figure 27: Typical Class C Liner

Two technology alternatives are being proposed:

- Technology alternative 1: Construction of the facility without a liner
- Technology alternative 2: Construction of the facility with a liner.

It is evident from this assessment that the area is already impacted by the historical activities. Plume migration is, however, slow and although the simulated current plume has reached the Mahemspruit, the concentrations are <500 mg/L. The Mahemspruit is, however, impacted not only by this tailings facility, but also by other contaminant sources in the region.

The expected contribution of the impact from the Valley TSF is low and contained within the current impacted footprint. The unmitigated impact shows that a contaminant plume will migrate from the proposed TSF towards the only down-gradient receptor, the Mahemspruit. This contaminant flow is very slow and small impacts (<500 mg/L SO_4) will only reach the stream after approximately 100 years.

With reference to the modelled plumes, it appears that the lining of the proposed Valley TSF will have net positive impact on the down-gradient groundwater quality. It is, however noted that although the positive impact is not visible on the extent of the plume, there is nevertheless a reduction in the contaminant concentration over time. The reduction in the sulphate concentration down-gradient from the facility, with a liner installed, is approximately 50mg/L after 30 years.

This is a small improvement, and it is therefore recommended that a rehabilitation plan be developed to address the groundwater deterioration from the existing TSF, in conjunction with the lining of the Valley TSF.

This modelling exercise did not include any remedial options. It is, however, expected that remediation, of which phyto-remediation is recommended, and the very slow contaminant migration rates will negate the need for a liner system.

There are also various **deposition techniques** which are applicable to tailings storage facilities. Once the tailings slurry (dilute or paste consistency) has arrived at the tailings storage area, there are several possible ways it can be deposited. These include the spigotting method, cyclone deposition and the paddocking method.

Spigots are multiple outlets along a delivery pipeline. This technology is only used when it is easily possible to cause a gravitational grading split between the coarse and the tailings' fine fractions.

Figure 28: Example of spigot deposition (source: www.researchgate.net)

Paddock deposition requires construction of small impoundments or containment berms with dried-out tailings borrowed from the previous layer deposited around the perimeter or edge of the paddock. These shallow paddocks are then filled with dilute slurry.

Figure 29: Example of paddock deposition

In **cyclone deposition** is a cyclone deposition device consisting of conical housing equipped with a feed pipe that enters the cone at its larger diameter closed end. A second pipe enters the cone and intrudes into the body of the cone. The slurry feed enters under pressure and is forced to swirl with a spiral motion towards the smaller end. In the process, centrifugal forces cause the larger particles in the slurry to move down and away from the axis, towards the narrow exit of the cone. The net effect is that the finer particles and most of the water leave the cyclone through the vortex finder and form the "overflow," while the partially dewatered larger particles leave at the opposite end as the coarser "underflow material. The purpose of using a cyclone is to create

underflow material that has good geotechnical characteristics, i.e., high permeability, fast consolidation and strength gain rate than the original tailings so that the underflow can be used to form an impoundment wall to the tailings storage facility. Effective operations of a cyclone TSF can also result in high water recoveries.

Figure 30: Example of cyclone deposition (source: international mining)

Currently cyclone deposition is the vastly preferred method of deposition for all of Harmony's current TSF operations due to the reasons described above. The environmental impacts associated with each deposition method are similar however cyclone deposition has higher water recovery rates and is also preferred from a geotechnical perspective. For the Valley TSF a combination of spigot and cyclone deposition is recommended. Based on prior experience, the maximum rate of rise of 3.7m/year allows for safe upstream deposition. The stage capacity analysis indicates that the facility will provide a capacity of 56.8 million tons over 8.0 years at 600 000tpm. As such no other deposition methods or technologies are considered in the EIA phase.

9.6.4 PROCESS AND ACTIVITY ALTERNATIVES

Process or activity alternatives imply the investigation of alternative processes, methods or activities to achieve the same goal for the proposed TSF. A new deposition site will be required for Harmony One Plant to replace the FSS2 and St. Helena 4 Tailings Storage Facilities by July 2024 and for this there are no feasible or applicable activity or process alternatives, additional deposition space will be required for the tailings material. No other process or activity alternatives have been identified that could be applicable to the TSF application.

9.6.5 NO GO ALTERNATIVE

The no go alternative would imply that no TSF is constructed for the safe deposition of new mine tailings from Harmony's Welkom operations. A new deposition site will be required for Harmony One Plant to replace the FSS2 and St. Helena 4 Tailings Storage Facilities by July 2024. The no go option would mean that the new TSF project would not proceed, and this would therefore negatively affect the future viability of Harmony's Welkom mining operations from July 2024 and beyond due to lack of deposition space. This would have a significant financial impact on not only Harmony but also have a direct negative impact on the workforce on the mine and surrounding businesses and communities that are directly or indirectly linked to the operations. As such, the no go alternative is not considered feasible or reasonable.

10 IWWMP ACTION PLAN

The IWWMP action plan for the Harmony Valley TSF is indicated in Table 27. This table outlines the impacts, objectives, performance indicators and mitigation measures that need to be implemented.

Table 27: IWWMP action plan

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
10.1 SITE ESTABLISHMENT						
Construction camp sewage management **Dust suppression** **Earthworks** **Fencing** **Hazardous substances management** **Site security** **Soil Management**	Construction	Erosion due to storm water runoff Impacts on wetlands Soil erosion, Land degradation Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation Increased sediment loads to downstream reaches Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts Long-term groundwater quality, and radiation impacts	The physical footprint of any construction or site camp shall be minimised and vegetation clearance should be kept to the minimum required area.	Avoid environmental pollution. Prevent unnecessary clearance of vegetation, loss in habitat and disturbance of species.	ECO report	Environmental Manager Site Manager
	Construction		Site and construction camps must be kept in a clean, neat and tidy condition at all times. The Mine shall maintain good housekeeping practices and shall comply with the relevant HSE regulations in terms of materials storage. Stockpiles of construction materials may only be placed within demarcated areas within the construction camp. Laydown areas must be kept neat and tidy and free of litter or waste at all times.	Avoid environmental pollution.	ECO report	Environmental Manager Site Manager
	Construction	Impacts on wetlands Land degradation	A waste storage area must be established within the site camp/construction camp that provides for appropriate and adequate waste	Avoid environmental Pollution	ECO report	Environmental Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Truck and heavy machinery operation **Utilization of portable toilets and generation of sewage** **Vegetation clearance**		Degradation of wetland vegetation Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts	storage and waste separation for recycling. All waste must be adequately contained to prevent ground and/or water pollution. The total volume of general waste stored shall not exceed 100m^3. In the case that a storage capacity exceeding this amount is required or planned for, the necessary waste permits must be obtained in accordance with the NEMWA beforehand .			Site Manager
	Construction		The site camp/construction camp shall have adequate provision for the storage of hazardous waste (e.g. old oil filters, soil from spills etc.) and the waste shall be contained within closed containers to prevent the possibility of spillages.	Protect watercourses and sources of water. Prevent soil contamination	ECO report Waste manifest	Environmental Manager Site Manager
	Construction		All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant safety regulations. Fuel storage areas may not be located within 100m of the watercourse and the total volume of fuel stored on site may not exceed 80 cubic metres (80 000l) without the necessary authorisation in terms of the NEMA. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during refuelling (e.g. a bunded, sealed concrete slab which drains to a sump/oil separator). No person smoke or take part in any activity that may results in sparks near fuels and other flammable substances to prevent ignition.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	ECO report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Construction		All hazardous substances shall be stored within designated areas that comply with the relevant HSE standards (e.g. ventilation, access control, HSE signage, firefighting equipment etc.) and that provide for spill prevention and containment. It is recommended that a dedicated, bunded and fenced Hazardous Storage Area is provided within the construction camp for this purpose.	Protect watercourses and sources of water. Prevent soil contamination	ECO report HSE Audit	Environmental Manager Site Manager
10.2 POLLUTION PREVENTION						
Site establishment **Water management Infrastructure construction** **General Construction**	Construction Operation Decommissioning Rehabilitation and Closure	Impacts on wetlands Land degradation Degradation of wetland vegetation Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts Long-term groundwater quality, and radiation impacts	Any equipment that may leak, and does not have to be transported regularly, shall be placed on watertight drips trays to catch any potential spillages of pollutants. The drip trays shall be of a size that the equipment can be placed inside it. Daily inspections shall be carried out to ensure such spill prevention measures are in place and remain effective. Drip trays shall be cleaned regularly and shall not be allowed to overflow. All spilled hazardous substances must be collected and adequately disposed of at a suitably licensed facility.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	ECO report Waste manifests	Environmental Manager
TSF operations **Maintenance and operation of site**	Construction Operation Decommissioning		Appropriate measures must be implemented to ensure that rainwater does not run into areas containing cement, oil, diesel etc. as this could result in a pollution threat. Storage areas for these substances should be placed on high-lying ground.	Protect watercourses and sources of water. Avoid and control through implementation of EMPr mitigation measures (e.g.	ECO report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
infrastructure and facilities **General decommissioning activities**				Spill prevention, Hydrocarbon Storage) Avoid and control through implementation of preventative measures (e.g. limit area of wetland disturbance for wetlands around the edges of the site, maintain stormwater infrastructure)		
	Construction Operation Decommissioning		Servicing and maintenance of vehicles may only take place in a workshop area (subject to suitable spill prevention and containment measures). The workshop area should be lined with concrete or alternatively plastic under gravel. If emergency repairs are required elsewhere on site, this shall be undertaken with the necessary spill prevention measures in place.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	ECO report	Environmental Manager Site Manager
	Construction Operation Decommissioning		Cement and liquid concrete are hazardous to the natural environment on account of the very high pH of the material, and the chemicals contained therein. As a result, the Mine shall ensure that: Concrete shall only be mixed on mortar boards or suitably lined areas, and not directly on the ground; The visible remains of concrete, either solid, or from washings, shall be physically removed immediately and disposed of as waste	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	ECO report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			(washing of visible signs into the ground is not acceptable); and All excess aggregate shall also be removed.			
	Construction Operation Decommissioning		All hazardous substances (e.g. fuel, grease, oil, brake fluid, hydraulic fluid) must be handled, stored and disposed of in a safe and responsible manner so as to prevent pollution of the environment or harm to people or animals. Appropriate measures must be implemented to prevent spillage, and appropriate steps must be taken to prevent pollution in the event of a spill.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	ECO report Waste manifest	Environmental Manager
	Construction Operation Decommissioning		Hazardous substances shall be confined to specific and secured areas, and in such a way that does not pose any danger of pollution even during times of high rainfall. Hazardous storage areas shall be bunded (impermeable) with adequate containment (at least 110% the total volume stored) for potential spills or leaks. Bunded storage areas shall be either provided with an oil separator or sump. Waste from spillages will then be removed and recycled or disposed of responsibly.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials	ECO report Incident report Waste Manifest	Environmental Manager Site manager
	Construction Operation Decommissioning		All fuel storage areas shall be bunded to contain at least 110 % of the volume stored and will comply with the relevant environmental and safety regulations. Fuel storage areas must be provided with an impervious surface with the provision to contain any potential fuel spillages during	Protect watercourses and sources of water. Prevent soil contamination	ECO report	Environmental Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			refuelling (e.g. a sealed concrete slab which drains to a sump/oil separator). The applicant must ensure that employees and labourers do not smoke or take part in any activity that may results in sparks in the vicinity of fuels and other flammable substances to prevent ignition.	Avoid pollution caused by fuel spillages and improper storage of materials		
	Construction Operation Decommissioning		Refuelling may only take place within a dedicated area inside the mine that is subject to appropriate spill prevention and containment measures Refuelling and transfer of hazardous chemicals and other potentially hazardous substances must be carried out so as to minimise the potential for leakage and to prevent spillage onto the soil. Drip trays should be utilised in relevant locations (inlets, outlets, points of leakage, etc.) during transfer to prevent such spillage or leakage. Any accidental spillages shall be contained and cleaned up promptly.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials	ECO Report	Environmental Manager Site Manager
	Construction Operation Decommissioning		Any excess or waste material or chemicals should be removed from the site and should preferably be recycled (e.g. oil and other hydrocarbon waste products). Any waste materials or chemicals that cannot be recycled shall be disposed of at a suitably licensed waste facility.	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials	ECO Report Waste Manifest	Environmental Manager Site Manager
	Construction Operation		Hazardous waste may only be disposed of at a licensed hazardous waste disposal facility. A specialist waste contractor shall dispose of	No contamination of the surrounding environment will occur.	ECO Report Waste Manifest	Environmental Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Decommissioning		such waste and shall be required to provide waste manifests and safe disposal certificates. The 'cradle-to-grave' principle must be complied with.			Site Manager
10.3 WASTE MANAGEMENT						
Maintenance and operation of site infrastructure and facilities **Site establishment** **Construction** **TSF operations** **Maintenance and operation of site infrastructure and facilities**	Construction Operation Decommissioning	Erosion due to storm water runoff Impacts on wetlands Soil erosion, Land degradation Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation Increased sediment loads to downstream reaches Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts Long-term groundwater quality, and radiation impacts	The mine shall develop and implement a waste management plan for the TSF which complies with the principles of the NEMWA and provides a mechanism for the effective management of waste throughout the LoM. This plan shall ensure the appropriate management of all solid waste, including construction debris (cement bags, wrapping material, timber, cans, wire, nails, etc.), waste and surplus food, food packaging, organic waste etc.	Avoid pollution caused by fuel spillages and improper storage of materials Limit the spread of pollution due to waste storage	ECO Reports	Environmental Manager Site Manager
	Construction Operation Decommissioning		The waste management system shall provide for adequate waste storage (in the form of waste skips and bins with lids), waste separation for recycling, and frequent removal of non-recyclable waste for permanent disposal at an appropriately licensed waste disposal facility. No waste material is to be disposed of on site.	Avoid pollution caused by fuel spillages and improper storage of materials Limit the spread of pollution due to waste storage	ECO Report Waste manifest	Environmental Manager Site Manager
	Construction Operation		Waste generated on site should be recycled as far as possible and sold/given to interested contractors. Recyclable waste should not be stored on site for excessive periods to reduce risk of environmental contamination Refuse	Avoid pollution caused by fuel spillages and improper storage of materials	Waste manifest ECO Report Audit report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
General decommissioning activities	Decommissioning		bins will be responsibly emptied and secured. Temporary storage of domestic waste shall be in appropriate receptacles.	Limit the spread of pollution due to waste storage		
	Construction Operation Decommissioning		The Mine shall implement a waste removal regime that ensures waste skips do not exceed their capacity before being removed from site for disposal.	Avoid pollution caused by fuel spillages and improper storage of materials Limit the spread of pollution due to waste storage	Waste Register Waste manifest ECO report	Environmental Manager Site Manager
	Construction Operation Decommissioning		Littering shall be strictly prohibited. The site shall remain in a neat and tidy condition at all times. If required, the mine shall make use of regular litter patrols to remove litter and ensure the site remains clean, neat and tidy.	Prevent environmental pollution	ECO Report	Environmental Manager Site Manager
	Construction Operation Decommissioning		The mine shall maintain a waste register which shall be used to track all waste removed from site. Proof of appropriate waste disposal shall be kept on file at the site for auditing purposes.	Ensure responsible waste management	ECO report Waste register Waste manifests Audit reports	Environmental Manager Site Manager
	Construction Operation Decommissioning		The mine will adopt a cradle-to-grave approach to ensure that the waste is removed and disposed of in the prescribed and correct manner.	Ensure responsible waste management	ECO report Waste register Waste manifests Audit reports	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
10.4 SEWAGE AND SANITATION						
Site establishment **General Construction** **General Mine Management** **TSF Operations** **Maintenance and operation of site infrastructure and facilities** **General decommissioning activities**	Construction Operation Decommissioning Rehabilitation and Closure	Erosion due to storm water runoff Impacts on wetlands Soil erosion, Land degradation Degradation of wetland vegetation and the introduction and spread of alien and invasive vegetation Increased sediment loads to downstream reaches Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts Long-term groundwater quality, and radiation impacts	There must be adequate provision for safe and effective sanitation (i.e. ablution facilities) at the mine and work sites and these shall conform to all relevant health and safety standards and codes. The Mine shall ensure compliance with the OHSA and MHSA in terms of sewage and sanitation (managed by safety department). Under no circumstances will pit latrines, french drain systems or soak away systems be allowed. Septic tanks are permitted on condition that they are closed units and are serviced regularly to prevent overflows. The Contractor should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate excretion and urinating be allowed other than in supplied facilities. A minimum of one toilet must be provided per 10 persons.	Prevent soil contamination Prevent pollution of water sources Prevent pollution of groundwater	ECO report Waste certificate	Environmental Manager Site Manager
	Construction Operation Decommissioning Rehabilitation and Closure		Portable toilets will be managed by reputable contractors and inspected daily for any potential leaks. The Contractor (or reputable toilet-servicing company) shall be responsible for the cleaning, maintenance and servicing of the toilets. Chemical toilets shall be emptied/serviced frequently to avoid offensive odours (at least weekly). Toilets must be kept in a clean, neat and hygienic condition.	Prevent soil contamination Prevent pollution of water sources Prevent pollution of groundwater	ECO report Waste certificate	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Construction Operation Decommissioning Rehabilitation and Closure		Toilets must be easily accessible. Toilets shall be placed outside areas susceptible to potential flooding and shall not be placed within 50m of any wetland or watercourse. Ablution facilities shall be located a sufficient distance from any offices or eating areas to prevent nuisance from offensive odours. Sanitary arrangements shall also be to the satisfaction of the ECO.	Prevent soil contamination Prevent pollution of water sources Prevent pollution of groundwater	ECO report Waste certificate	Environmental Manager Site Manager
	Construction Operation Decommissioning Rehabilitation and Closure		Disposal of sewage from chemical toilets shall be in a safe and responsible manner and at an approved facility specifically for that purpose. Proof of sewage removal and disposal shall be kept on file for auditing purposes.	Prevent soil contamination Prevent pollution of water sources Prevent pollution of groundwater	ECO report Waste certificate	Environmental Manager Site Manager
10.5 WETLANDS						
Site establishment **General Construction**	Construction	Erosion due to storm water runoff Impacts on wetlands Soil erosion, Land degradation Degradation of wetland vegetation and the introduction	Make sure that the function of HGM 1 will be the same after the upgrades to the northern RWD are done. The RWD facility replacing HGM 1 should have the same vegetation surrounding as currently present in HGM 1. Make sure that all the other HGM units and their buffers are avoided as far as possible to limit the impacts on them.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
TSF Operations **General decommissioning activities**		and spread of alien and invasive vegetation Increased sediment loads to downstream reaches		Prevent the pollution of water sources Prevent pollution of watercourses		
	Construction	Contamination of wetlands with hydrocarbons Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts Long-term groundwater quality, and radiation impacts Decrease in subsurface flows and return flows	Adhere to the prescribed wetland buffers. Restrict all non-essential activities (e.g. cement mixing and equipment wetland machinery storage) to outside of wetlands and their prescribed buffers. Request the wetland spatial data, load it onto a GPS and use it to mark out the positions where the proposed activities will take place and exits the prescribed m buffer on the boundary of a wetland. Request the wetland spatial data, load it onto a GPS and use it to mark out the positions where the proposed activities will take place and exits the prescribed m buffer on the boundary of a wetland. Demarcate the avoidance areas with wooden poles.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Construction and Operation		Adhering to the recommended footprint buffers and watercourse or wetland buffers should be sufficient to reduce the deductible water losses in the catchment. Also prevent any discharge of untreated potential slurry or effluent and wastewater into the catchment as responsive saturated soils (mostly associated with water channels) have a high tendency to promote contaminant (i.e., Bacteria and			

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			inorganic elements) migrations towards water resources.			
	Operation		Contain wastewater in an RWD. Contaminated water must not be discharged into watercourses .	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Planning and Design		Construct as far as possible during winter when flow volumes are lowest, prioritise this for crossing sites. This will reduce impacts to wetlands due to soil poaching and vegetation trampling under peak saturation levels. Additionally, the risk of vehicles getting stuck and further degrading the vegetation integrity is lowest during this time.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Planning and Design		Try to reduce the disturbance footprint and the unnecessary clearing of vegetation on either side of the TSF facility when traversing wetlands.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Construction Operation Rehabilitation Decommissioning		Keep the TSF activities to the proposed site and only access the tailings facility from the South to prevent greater loss to the wetlands northern parts.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater	ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Construction		Ensure that the TSF is lined and secured to prevent runoff through rain.		ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Construction Decommissioning		Mixing of concrete must under no circumstances take place in any wetland or their buffers. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished.		ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Construction		Do not situate any of the construction material laydown areas within any wetland. No machinery should be allowed to be parked in any wetlands.		ECO Reports Surface water quality monitoring Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Planning and Design Construction		Ensure topsoil is spread back over trench area. Flatten and lightly till (no deeper than 30 cm) excavated / cleared areas to encourage vegetation establishment as soon as possible. Ensure that topsoil is appropriately stored and re-applied during trench backfilling. Make sure that the soil is backfilled and compacted to accepted geotechnical standards to avoid conduit formation along the trench.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater	ECO Reports Biodiversity monitoring	Environmental Control officer Environmental manager Site manager
	Construction Operation Decommissioning		Promptly remove all alien and invasive plant species that may emerge during construction (i.e. weedy annuals and other alien forbs) must be removed. The use of herbicides is not recommended in or near wetlands (opt for mechanical removal).		ECO Reports Biodiversity monitoring	Environmental Control officer Environmental manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Rehab and closure					Site manager
	Construction Rehab and closure		Appropriately stockpile topsoil cleared from the project area for cover / rehabilitation of the TSF.		ECO Reports	Environmental Control officer Environmental manager Site manager
	Construction		Clearly demarcate construction footprint and limit all activities to within this area. Minimize unnecessary clearing of vegetation.		ECO Reports	Environmental Control officer Environmental manager Site manager
	Construction Rehab and closure		Landscape and re-vegetate all denuded areas as soon as possible.		ECO Reports	Environmental Control officer Environmental manager Site manager
	Construction		Install sandbags on downstream side of the footprint to trap sediment until the site has been constructed and vegetation has re-established.	Avoid contamination of wetlands Avoid loss of wetland habitats	ECO Reports	Environmental Control officer Environmental manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
				Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater		Site manager
	Construction		Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility.		ECO Reports	Environmental Control officer Environmental manager Site manager
	Construction		Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the north-western seep.	Avoid contamination of wetlands Avoid loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater Prevent hydrocarbon contamination	ECO Reports Biodiversity monitoring Water monitoring activities	Environmental Control officer Environmental manager Site manager
	Operation		Regularly maintain stormwater infrastructure, pipes, pumps and machinery to minimise the potential for leaks. Check for oil leaks, keep a tidy operation, install bins and promptly clean up any spills or litter.		ECO Reports	Environmental Control officer Environmental manager Site manager
	Operation		Conduct regular inspections along the TSF to ensure the integrity of the facility.		ECO Reports	Environmental Control officer Environmental manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
						Site manager
10.6 RADIATION						
Site establishment **TSF Operations** **General decommissioning activities** **Post Closure Monitoring and Maintenance**	Operation Rehabilitation and Closure	Erosion due to storm water runoff Impacts on wetlands Soil erosion, Land degradation Degradation of wetland vegetation Disruption of wetland soil profile and alteration of hydrological regime Groundwater quality impacts Long-term groundwater quality, and radiation impacts Loss of Biodiversity	Concurrent rehabilitation of the TSF side slopes must commence after the first step-in. Capping	Prevent/limit pollution of water resources Prevention of biodiversity Prevent loss of land capacity Prevent radiation entering groundwater(seepage)	ECO REPORTS Specialist studies	Environmental manager Site manager
	Construction Operation Decommissioning Rehabilitation and Closure		Vegetation of exposed areas of the TSF and wind barriers to reduce wind erosion and/or the application of dust suppressants		ECO REPORTS Specialist studies	Environmental manager Site manager
	Construction Operation Decommissioning Rehabilitation and Closure		Implementation of a passive groundwater remediation system downstream of the TSF to capture the contaminant plume.		ECO REPORTS Specialist studies	Environmental manager Site manager
			Implementation of radiation monitoring programme as described in the EMPr.		ECO REPORTS Specialist studies	Environmental manager Site manager
10.7 GROUNDWATER						
General decommissioning activities	Construction Operation	Disruption of wetland soil profile and alteration of hydrological regime	The mine must take all reasonable measures to avoid and limit pollution of ground water resources as a result of site activities. Pollution could result from the release, accidental or	Avoid contamination of groundwater resources	ECO Reports Groundwater monitoring	Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Maintenance and operation of site infrastructure and facilities **TSF Operations**	Decommissioning Rehabilitation and Closure	Groundwater quality impacts Long-term groundwater quality impacts	otherwise, of chemicals, oils, fuels, sewage, wastewater containing organic waste, detergents, solid waste etc. The Applicant shall comply with the requirements relating to hazardous materials and spill management presented in this EMPr. The site should be maintained to be free draining. Where relevant, areas should be compacted/shaped.	Avoid and control through implementation of preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)		
Post Closure Monitoring and Maintenance	Construction Operation Decommissioning		Rainfall runoff should be separated into clean and dirty water. Rainfall falling on the site should be allowed to drain quickly/freely.	Avoid contamination of groundwater resources Avoid and control through implementation of preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)	ECO Reports Groundwater monitoring	Environmental manager Site manager
	Construction Operation		In the event of pollution caused as a result of construction or operational activities, the responsible party, according to section 20 of the National Water Act (Act No. 36 of 1998) shall be responsible for all costs incurred by organisations called to assist in pollution control and/or to clean up polluted areas.	Avoid contamination of groundwater resources Avoid and control through implementation of preventative measures Control through implementation of mitigation measures (barrier system,	ECO Reports Groundwater monitoring	Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
				monitoring and phytoremediation)		
	Planning Operation Rehabilitation and Closure		For the Valley TSF application it is recommended that Phyto-accumulation and Hydraulic Control be further investigated. The main aim of such a study will be to find the most suitable tree species to absorb the chemicals of concern and to obtain the necessary permits from the authorities. It will take time for the tress to grow to a point where they are fully functional. It is therefore recommended that if this option is selected it be implemented as soon as possible.	Avoid contamination of groundwater resources Avoid and control through implementation of preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)	ECO Reports Groundwater monitoring	Environmental manager Site manager
	Planning Operation Rehabilitation and Closure		The following is recommended in terms of monitoring (refer to section 4.7.3): A comprehensive bi-annual analysis of the dedicated monitoring boreholes. Groundwater levels should be monitored monthly in the dedicated groundwater monitoring boreholes. Rainfall should be monitored daily. Samples should be submitted to a SANAS accredited laboratory. The following recommended parameters to be analysed for include pH, Electrical Conductivity, Total Dissolved Solids, Total Alkalinity, Anions and Cations (Ca, Mg, Na, K, NO3, NH4, Cl, SO4, F, Fe, Mn, Al, Cr).	Avoid contamination of groundwater resources Avoid and control through implementation of preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)	ECO Reports Groundwater monitoring	Environmental manager Site manager

11 CONTROL AND MONITORING

This section will discuss measures to be implemented for the monitoring and control where necessary to ensure that the project does not prove detrimental to the baseline environment.

11.1 MONITORING OF CHANGE IN BASELINE INFORMATION

Harmony has implemented a surface and groundwater monitoring programme across all of their Free State operations as described in Section 4. The indication in the geohydrology assessment (Appendix B 2), is that three additional borehole pairs (one shallow and one deep) are recommended in addition to the current monitoring network as shown in Figure 14. The bi-annual reports are to be submitted to the authorities at the stipulated time interval in the IWUL. Harmony currently has a monthly groundwater monitoring programme in which monitoring is conducted and a data record is kept, however the groundwater specialist recommends comprehensive bi-annual analysis of the dedicated monitoring boreholes.

11.2 AUDIT AND REPORT ON PERFORMANCE MEASURES

The mine is committed to continual improvement and prevention of pollution. The applicant undertakes annual EMPr audit performance assessments (NEMA Environmental Audits).

11.3 AUDIT AND REPORT ON RELEVANCE OF IWWMP ACTION PLAN

The WUL will require that the efficacy of the measures proposed as part of the action plan be reviewed and updated where required. As such, the IWWMP action plan will be reviewed and updated in line with the frequency required by the WUL (i.e., on an annual basis).

12 CONCLUSION

This section provides the concluding statements relating to the regulatory status of the activity, the motivation of the activity in terms of Section 27 of the NWA, attached as Appendix C and the proposed WULA.

12.1 REGULATORY STATUS OF ACTIVITY

Harmony Valley TSF is a new project requiring Environmental Authorisation under the MPRDA and the NEM:WA, and Water Use Authorisation, these processes were initiated concurrently. However, the project has since received a positive Integrated Environmental Authorisation in September 2025 (Ref: FS 30/5/1/2/3/2/1 (84) EM) As part of the EA process.

12.2 KEY COMMITMENTS

Harmony is committed to implementing and reviewing the IWWMP action plan included into this document based on any new information where required (Refer to Section 10 above).

13 REFERENCES

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14 APPENDICES

Appendix A: Valley Design Report

Appendix B: Specialist Reports

Appendix B 1: Wetland Assessment

Appendix B 2: Geohydrological Assessment

Appendix B 3: Soil Hydropedological Assessment

Appendix C: Section 27 Motivation Report

Appendix D: Impact Assessment Matrix

Appendix E: Public Participation Report