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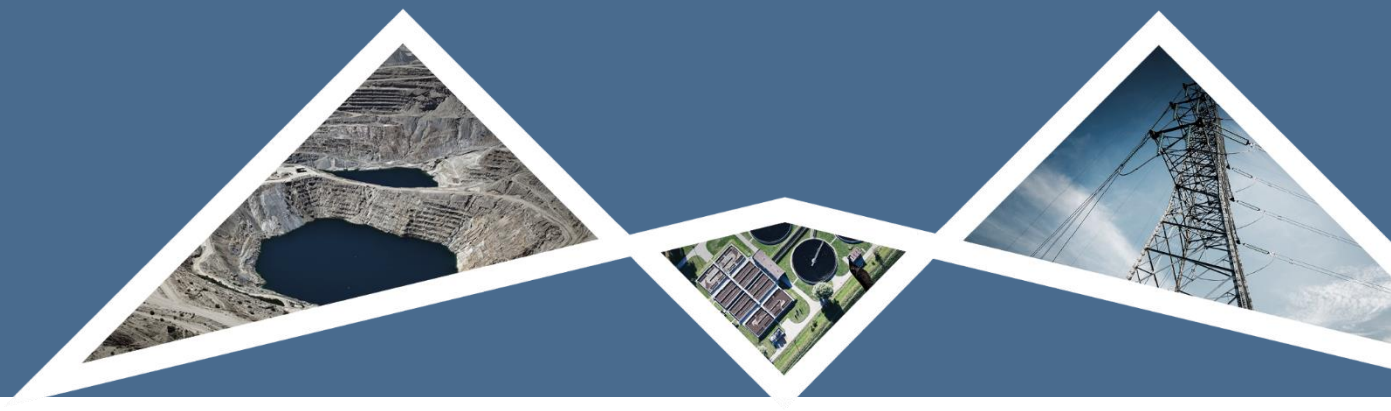
INTEGRATED WATER AND WASTE MANAGEMENT PLAN

HARMONY GOLD MINING COMPANY LIMITED



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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) project and associated pipelines near Welkom in the Matjhabeng Local Municipality in the Free State province.

The applicant owns and operates a number of Gold Mines and plants in the Welkom region in the Free State and currently deposits tailings onto the Free State South 2 Tailings Storage Facility (TSF), St. Helena 4 TSF, St. Helena 123 TSF, Dam 23 TSF, Brand D TSF and Target 1&2 TSF. The current planned Life of Mine (LOM) of the Free State operations exceed the available deposition capacity of these TSFs and the applicant is therefore proposing to construct the proposed Nooitgedacht TSF to cater for this additional capacity.

The TSF will cover an area of approximately 805 Ha as shown in Figure 1. The proposed TSF will be located on Farm portions Mijannie 66 portion 0/RE, Goedgedacht 53 portion 0, Nooitgedacht 50 portion 0, Jacobsdal 37 portion 0 and Rheedersdam 31 portion 0.

Three new pipelines are required to be constructed:

- Two 10km long slurry lines from Harmony One Plant to the St Helena Booster Pump Station;
- One 16km long slurry line from Brand A TSF to the St Helena Booster Pump Station; and
- One 17km slurry line from the St Helena Booster Pump Station to FSN 1 TSF.

The pipelines will be flanged steel pipelines of over 0,36m in diameter and installed above-ground on pre-cast concrete plinths and a 3.5m wide access road, adjacent to the pipelines, will be cleared/graded to provide access for construction, maintenance and inspections.

The proposed pipelines traverse the following farm portions: Vlakplaats 125 Portion 3, 4 and 5; Mijannie RE/66 Portion 0; Toronto RE/115 Portion 7 and 0; Rietpan 17 Portion 0; Rietkuil 28 Portion 0; Rheeders Dam 31 Portion 0; Farm 41 Portion 20; Ouders Gift 48 Portion 0; Nooitgedacht 50 Portion 0; Goedgedacht 53 Portion 0; Theronia 71 Portion 1 and 7; Jacobsrust 118 Portion 0; St Helena 42 Portion 2 and 3, Farm 80 Portion 0, Stuirmanship 92 Portion 1, 7 and 0, Saaiplaas 690 Portion 1, 11, 15 and 0; Klippan 14 Portion 1, 2 and 15, Marmageli 20 Portion 0 and 157 Portion 0.

In addition, a new low pressure water facility is required to be constructed on farm Klippan 14 portion 2 which will cover an area of up to 2 ha. Return water will be fed to this facility where the water will then be taken to the plants and the active reclamation sites.

EIMS is compiling and submitting 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 License (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 License (WUL) has been lodged with the Department of Water and Sanitation (DWS) for the water use triggers.

The following details are relevant to the current application:

- Infrastructure will include the TSF and associated infrastructure including possible access roads and water management infrastructure including pipelines and a new low pressure water system.
- The infrastructure will cover a total area of up to 897 hectares in addition to the pipelines as described above.

- Tailing deposition method to be used: cyclone deposition.
- The current design scope of the Nooitgedacht TSF is based on a height of 93m.
- The TSF barrier system will be determined in consultation with the authorities and will be in compliance with relevant norms and standards for determination of liner requirements.

The primary sources of tailings for deposition at the Nooitgedacht TSF will come from the Harmony Saaiplaas Plant and the Harmony Central Plant. The locations of these plants are shown in Figure 1.

The TSF will also serve to create additional future deposition space for an application which has not yet been lodged but which should be considered (Harmony Free state Reclamation project). The planned Free state Reclamation project will aim to reclaim various TSF facilities around the Welkom area and redeposit the tailing on the Nooitgedacht TSF footprint. This future application will include the reclamation of various TSFs around the Welkom area as well as various new pipelines and a potential new plant for the processing of the reclaimed material. As previously stated, the applications for the Free State Reclamation project will occur at a future date and as such does not form part of the application for the Nooitgedacht TSF project.

As part of the WUL application for the Nooitgedacht TSF project an Integrated Water and Waste Management Plan (IWWMP) is required to be compiled. This IWWMP has therefore been drafted in support of the WUL application.

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).

The applicant owns and operates a number of Gold Mines and plants in the Welkom region in the Free State and currently deposits tailings onto the Free State South 2 Tailings Storage Facility (TSF), St. Helena 4 TSF, St. Helena 123 TSF, Dam 23 TSF, Brand D TSF and Target 1&2 TSF. The current planned Life of Mine (LOM) of the Free State operations exceed the available deposition capacity of these TSFs and the applicant is therefore proposing to construct the proposed Nooitgedacht TSF to cater for this additional capacity. The TSF will cover an area of approximately 805 ha as shown in Figure 1. The proposed TSF will be located on Farm portions Mijannie 66 Portion 0/RE, Goedgedacht 53 Portion 0, Nooitgedacht 50 Portion 0, Jacobsdal 37 Portion 0 and Rheedersdam 31 Portion 0.

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 Officer	John van Wyk
Tel:	+27 83 682 4089

Applicant Details	
E-mail:	JVWyk@Harmony.co.za

1.2 REGIONAL SETTING AND LOCATION OF ACTIVITY

The study area falls within a landscape that contains existing pipelines and TSFs, thus the area can be described as largely disturbed. The landscape has historically been used for informal cattle grazing. Other elements of disturbance identified within the study area include farm and provincial roads and other infrastructure associated with the existing pipelines and other mining activities such as the existing TSFs to the northeast and southeast of the proposed TSF site. The TSF will cover an area of approximately 805 Ha . The proposed TSF will be located on Farm portions Mijannie 66 Portion 0/RE, Goedgedacht 53 Portion 0, Nooitgedacht 50 Portion 0, Jacobsdal 37 Portion 0 and Rheedersdam 31 Portion 0. The locality map is included in Figure 1. The study area is serviced by the R34, R30, provincial gravel roads and farm roads. Existing infrastructure includes mine infrastructure such as existing TSFs, electricity transmission lines, telephone lines, fences and other recent structures.

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	The Tailings Storage Facility is located on the following farm portions: Mijannie 66 Portion 0/RE, Goedgedacht 53 Portion 0, Nooitgedacht 50 Portion 0, Jacobsdal 37 Portion 0 and Rheedersdam 31 Portion 0. The proposed pipelines traverse the following farm portions: Vlakplaats 125 Portion 3, 4 and 5; Mijannie RE/66 Portion 0; Toronto RE/115 Portion 7 and 0; Rietpan 17 Portion 0; Rietkuil 28 Portion 0; Rheeders Dam 31 Portion 0; Farm 41 Portion 20; Ouders Gift 48 Portion 0; Nooitgedacht 50 Portion 0; Goedgedacht 53 Portion 0; Theronia 71 Portion 1 and 7; Jacobsrust 118 Portion 0; St Helena 42 Portion 2 and 3, Farm 80 Portion 0, Stuirmanship 92 Portion 1, 7 and 0, Saaiplaas 690 Portion 1, 11, 15 and 0; Klippan 14 Portion 1, 2 and 15, Marmageli 20 Portion 0 and 157 Portion 0. The proposed new low pressure water system is located on: Klippan 14 Portion 2		
Application Area (Ha)	• Approximately 895 Hectares / 8.95 km^2 (TSF footprint). • 43 km x approximately 4m wide servitude (pipelines). • Approximately 21248m^2 (low pressure water system facility footprint)		
Magisterial District	Matjhabeng Local Municipality within the Lejweleputswa District Municipality (Free State Province).		
Distance and direction from nearest towns	Welkom is located 3km southeast and Odendaalsrus is located 5.2 km north of the proposed TSF site. The geographic coordinates at the centre of the TSF site are 27°56'30.11"S and 26°39'43.96"E.		
21-digit Surveyor General Code for Property on	**Farm Name:**	**Portion:**	**21 Digit Surveyor General Code**
	TSF Centre point: 27°56'30.11"S and 26°39'43.96"E.		

which Project is Located	Mijannie 66	Portion 0/RE	F03900000000006600000
	Goedgedacht 53	Portion 0	F03900000000005300000
	Nooitgedacht 50	Portion 0	F03900000000005000000
	Jacobsdal 37	Portion 0	F03900000000003700000
	Rheedersdam 31	Portion 0	F03900000000003100000
	Central to St Helena Pipeline Start: 28° 0'51.51"S, 26°51'2.16"E Middle: 28° 1'33.64"S, 26°47'32.92"E End: 28° 1'26.99"S, 26°43'0.25"E One Plant to St Helena Booster Pump Station Pipeline Start: 28° 1'3.66"S, 26°45'2.74"E Middle: 28° 2'26.72"S, 26°45'28.08"E End: 28° 1'25.72"S, 26°42'59.89"E St Helena Booster Pump Station to FSN1 Pipeline Start: 28° 1'27.41"S, 26°43'3.54"E Middle: 28° 0'13.31"S, 26°41'12.30"E End: 27°55'43.84"S, 26°40'6.11"E		
	Vlakplaats 125	Portion 3	F03900000000012500003
	Vlakplaats 125	Portion 4	F03900000000012500004
	Vlakplaats 125	Portion 5	F03900000000012500005
	Mijannie RE/66	Portion 0;	F03900000000006600000
	Toronto RE/115	Portion 7	F03900000000011500007
	Toronto RE/115	Portion 0	F03900000000011500000
	Rietpan 17	Portion 0;	F03900000000001700000
	Rietkuil 28	Portion 0;	F03900000000002800000
	Rheeders Dam 31	Portion 0;	F03900000000003100000
	Welkom Farm 41	Portion 20;	F03900000000004100020
	Ouders Gift 48	Portion 0;	F03900000000004800000
	Nooitgedacht 50	Portion 0	F03900000000005000000
	Goedgedacht 53	Portion 0	F03900000000005300000

	Theronia 71	Portion 1	F03900000000007100001
	Theronia 71	Portion 7	F03900000000007100007
	Jacobsrust 118	Portion 0;	F03900000000011800000
	St Helena 42	Portion 2	F03900000000004200002
	St Helena 42	Portion 3	F03900000000004200003
	Welkom Farm 80	Portion 0	F03900000000008000000
	Stuirmanship 92	Portion 1	F03900000000009200001
	Stuirmanship 92	Portion 7	F03900000000009200007
	Stuirmanship 92	Portion 0	F03900000000009200000
	Saaiplaas 690	Portion 1	F03500000000069000001
	Saaiplaas 690	Portion 11	F03500000000069000011
	Saaiplaas 690	Portion 15	F03500000000069000015
	Saaiplaas 690	Portion 0	F03500000000069000000
	Klippan 14	Portion 1	F03900000000001400001
	Klippan 14	Portion 2	F03900000000001400002
	Klippan 14	Portion 15	F03900000000001400015
	Marmageli 20	Portion 0	F03900000000002000000
	Marmageli 20	Portion 157	F03900000000002000157
Low Pressure Water System Centre point: 28° 2'5.43"S, 26°47'39.11"E			
	Klippan 14	Portion 2	F03900000000001400002

The locality and extent of the proposed Nooitgedacht tailings storage facility and associated pipelines in relation to the existing mining right area is shown in Figure 1.

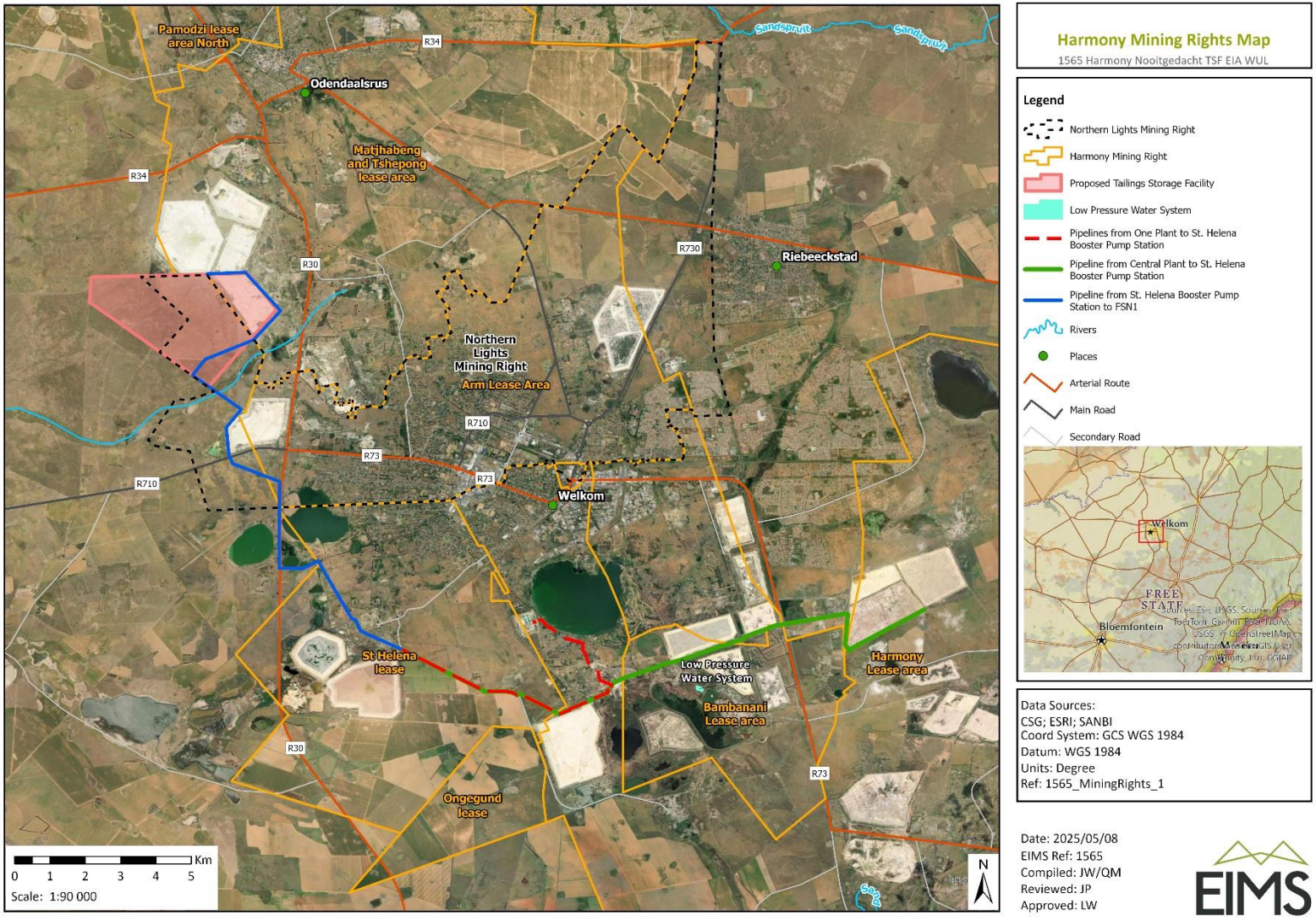


Figure 1: Locality map indicating the location of the proposed new tailings storage facility and pipelines in relation to Harmony's mining right areas.

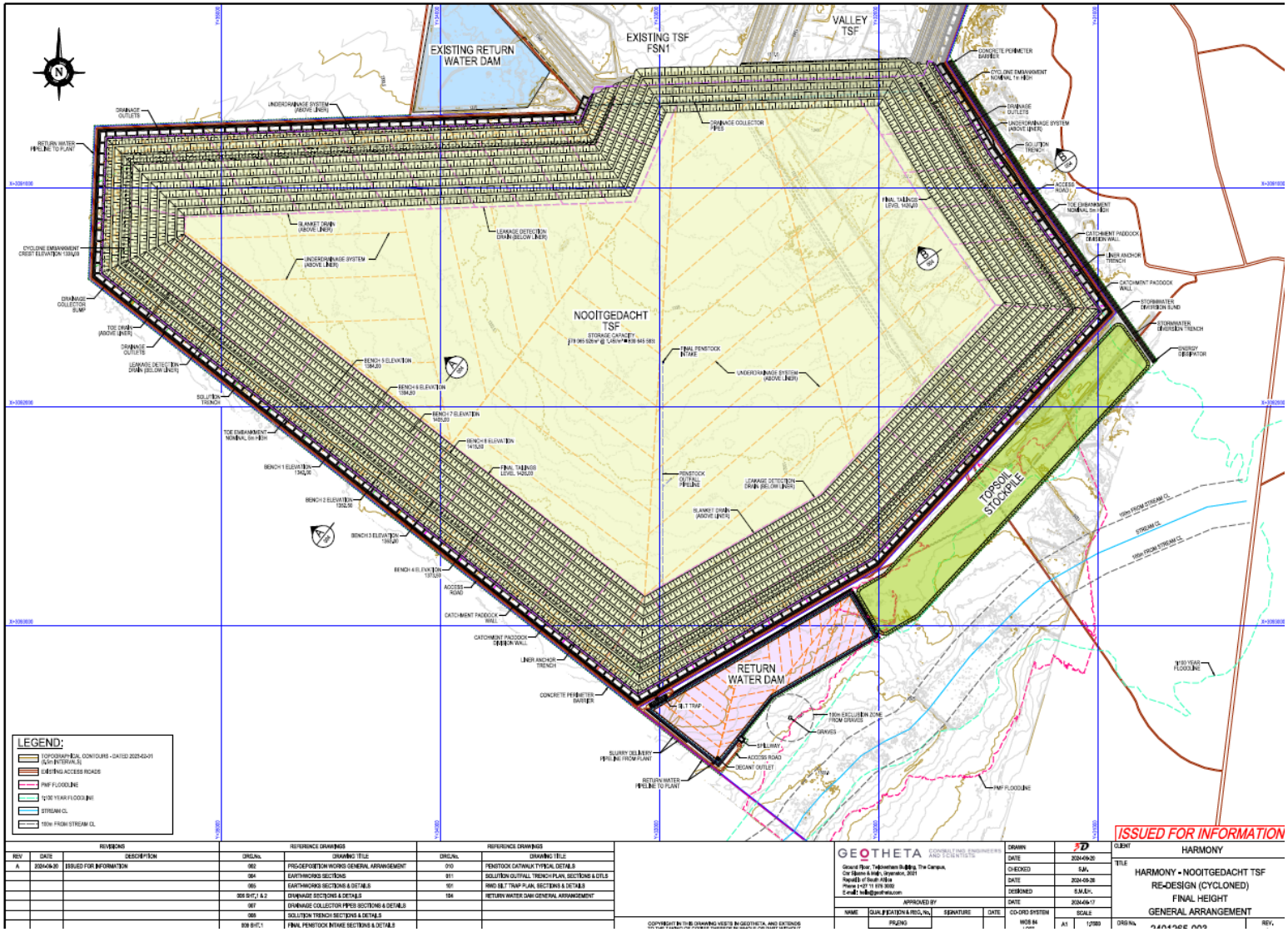


Figure 2: Preliminary general arrangement of the proposed Nooitgedacht TSF

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.:

S	M	A	R	T
•Sustainable	•Measurable	•Achievable	•Resources Allocated	•Timeframe Specific

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.

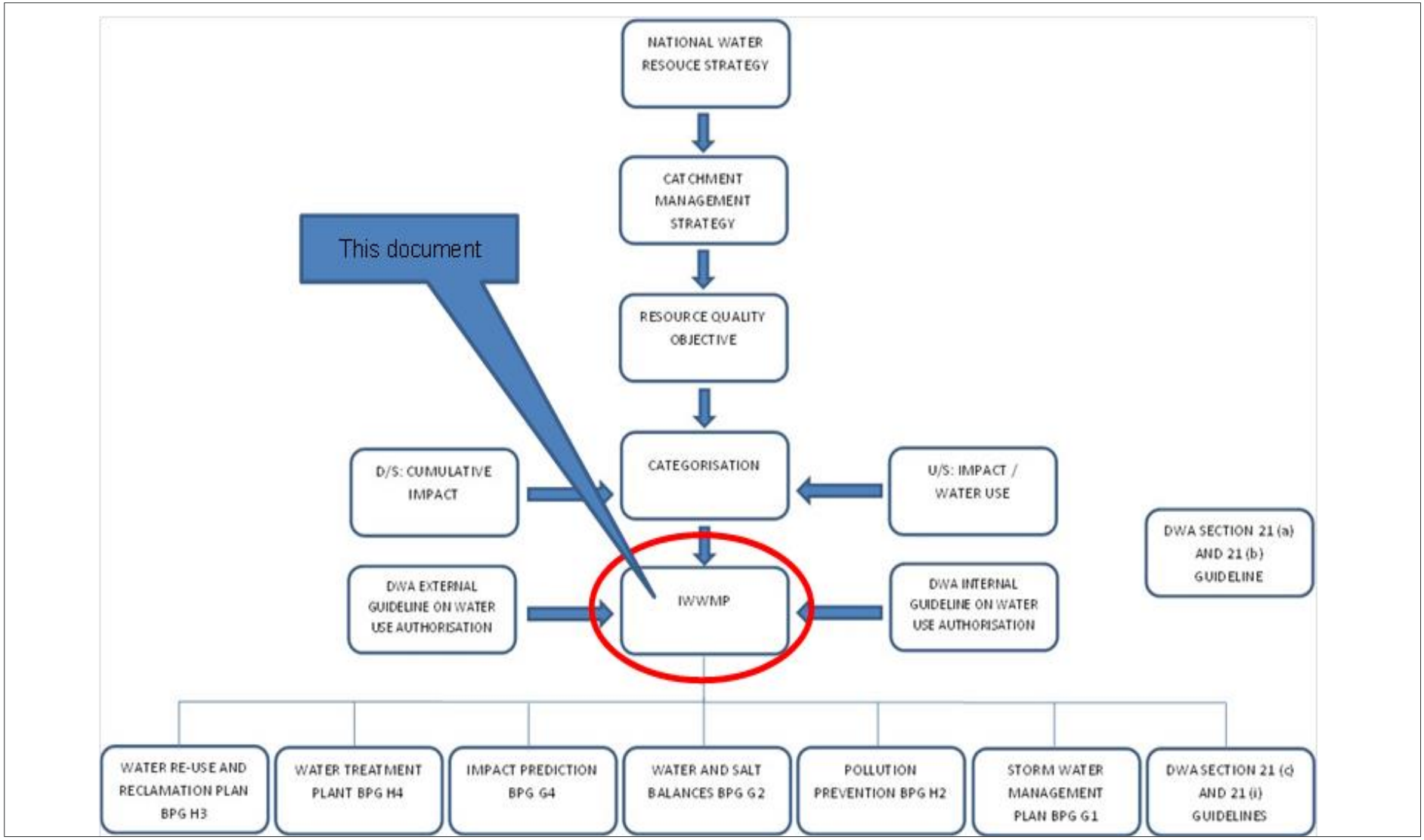


Figure 3: Schematic Layout of the IWWMP Approach

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

The following section will describe the technical aspects during the various phrases of the project.

2.1.1 CONSTRUCTION PHASE

The construction phase of the project will consist of site establishment, site clearance, excavation, topsoil 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.

Key parameters of the Nooitgedacht TSF design are as follows:

- Maximum final height: 93m
- Footprint area: 805 Ha
- Total capacity: 804 million tonnes
- Total deposition period at 2 000 000 tons per month: 34 years
- Maximum rate of rise (Basin): 3.77m/year
- Maximum rate of rise (Embankment): 2.89m/year
- Deposition method: Cyclone

The following operational activity details are relevant to the current application (refer to preliminary design report include in Appendix 2for further technical detail):

- 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 pipelines and a return water dam.
- The Nooitgedacht TSF will have a maximum height of 93m and a footprint area of approximately 805Ha.
- The Nooitgedacht TSF will be developed with an intermediate outer slope of 1V:3H between benches. The overall slope of the facility is 1V:4H. The inter-bench height is 10.5m and the benches are 10.5m wide. The engineered toe wall embankment is maximum 5m high with a 3m wide crest and an outer slope of 1V:1.5H and inner slope of 1V:2H. The toe wall embankment will be constructed in 150mm layers to 95% Proctor density at optimum moisture content. The minimum Factor of Safety against failure is 1.9 under drained conditions, 1.9 under undrained conditions, 1.3 under post seismic, post liquefaction or residual conditions and 1.3 under pseudo-static conditions.
- 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.

Further design detail is provided in the sections that follow.

2.1.1.1 TSF LINER SYSTEM

The Nooitgedacht TSF will make use of a two-liner system as described below.

- Liner system 1 - Over the existing FSN4 TSF footprint and the outer edge wall, where high liner stresses are present, the liner system comprises (from top down), a 300mm thick layer of tailings, 600kN/m geogrid (or similar approved), a 300mm thick layer of tailings, 1.5mm thick double textured HDPE liner underlain by a 300mm ripped and recompacted layer of in-situ base preparation material.
- Liner system 2 - The liner system in the inner basin area comprises (from top down), 1.5mm thick double textured HDPE liner underlain by a 300mm ripped and recompacted layer of in-situ base material.

The proposed TSF barrier system is shown in detail in Figure 4, Figure 5 and Figure 6.

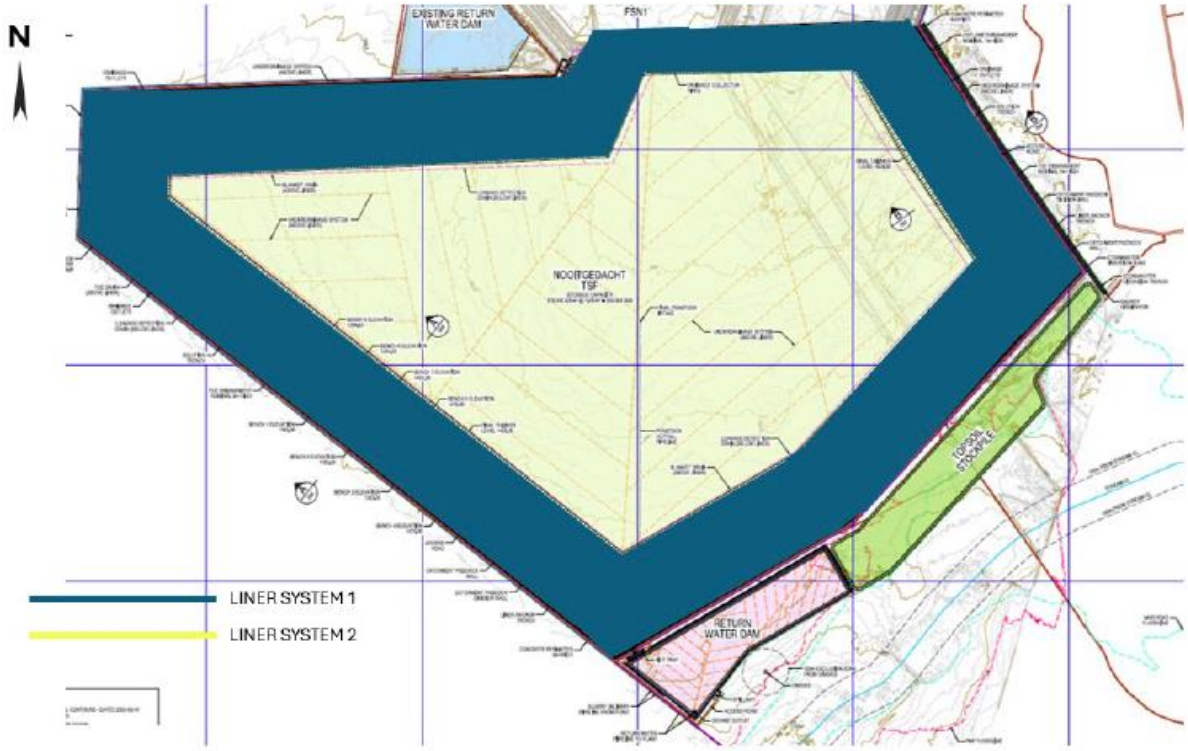


Figure 4: Liner systems proposed (preliminary design)

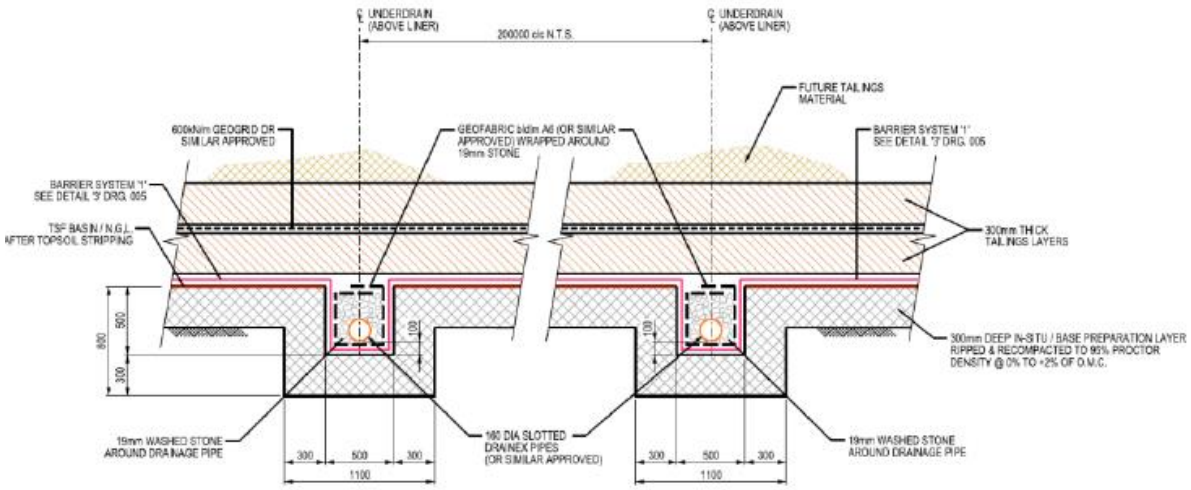


Figure 5: Liner system 1 (outer wall area)

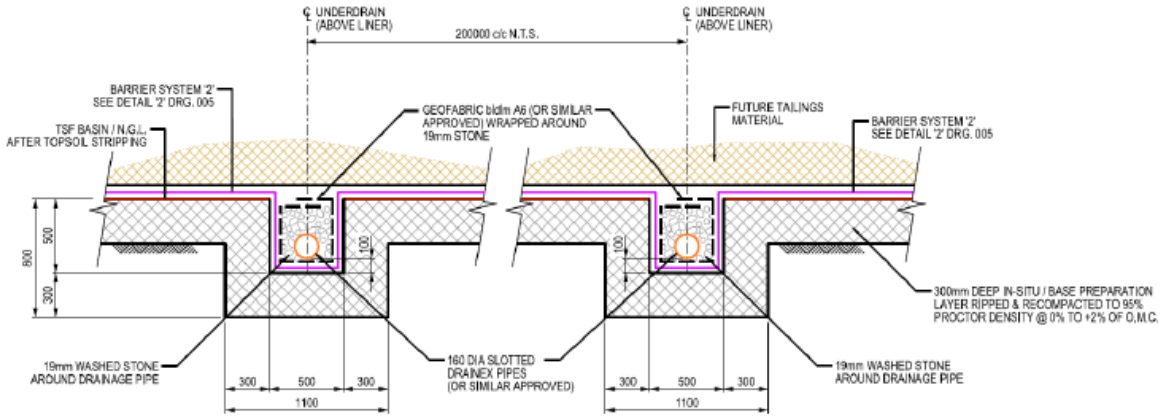


Figure 6: Liner system 2 (basin area)

2.1.1.2 UNDERDRAINAGE SYSTEM

The TSF drainage system is provided above the liner system to intercept seepage through the facility and to reduce static water head on the liner. The underdrainage system lowers the phreatic surface, improving the overall stability of the facility. The underdrainage system consists of toe drains, blanket drains and herringbone drains. Herringbone drainage is provided between the cyclone wall and the toe wall to ensure that the outer cyclone underflow wall remains drained.

The above liner toe drains comprise 160mm slotted HDPE pipe surrounded in 19mm stone overlain by a layer of 6mm stone all enclosed in a geofabric. The toe drain outlet pipes also discharge into the solution trench. The blanket drains comprise 160mm slotted Drainex HDPE pipes surrounded in 19mm stone overlain by a layer of 6mm stone and graded filter sand all enclosed in a geofabric. These drains intersect the starter wall with an HDPE pipe boot at the point of intersection with the liner.

The herringbone drainage pipes comprise 160mm slotted Drainex HDPE pipes surrounded in 19mm stone enclosed in a geofabric. The above-liner drains are spaced 200m apart. 13.3.7 The herringbone drainage east of the TSF will flow towards the main collector pipe which then discharges into the RWD situated south-east of the TSF. The herringbone drainage system west of the TSF will flow towards the collector pipe which flows into the 6.5m x 6.5m x 2.6m deep sump situated south-west of the TSF. The sump has been designed to accommodate a volume of 110 m^3. Water collected in the sump will then be pumped into the solution trench for discharge into the RWD south-east of the TSF. A 250 TV Multotec vertical spindle pump with a flow rate of 115l/s and a head of 3m is proposed. Electricity must be provided to the vertical spindle pump from the RWD electrical supply.

At the 36m height of the adjacent Valley TSF elevated drains will be installed on the Nooitgedacht TSF. The elevated drains will be designed just prior to installation based on actual measured tailings permeabilities at that time. Nooitgedacht TSF will be constructed against the existing FSN 1 TSF and the Valley TSF. Underdrainage collecting seepage from the existing FSN1 and Valley TSF along the toe of the TSF comprises a 160mm slotted Drainex HDPE pipe and a 160mm unslotted Drainex HDPE collector pipe, joined by a 160mm double socket Y junction (45 degree). The 160mm pipes will be surrounded by 19mm stone overlain by a layer of 150mm washed river sand which is enclosed in a geofabric. These drainage collector pipes discharge into the solution trench.

2.1.1.3 BELOW LINER LEAKAGE DETECTION SYSTEM

The below liner leak detection drains will be monitored as part of the operations, maintenance, and surveillance plan to determine and quantify any leakage through the liner system. The below liner leakage detection was sized and spaced using the seepage rate through the liner. The below liner leak detection system also alleviates any possible water pressure buildup beneath the liner from a potential rise of the groundwater table.

In the event of a leak, the drains serve to locate the area of the leak. Once the area of the leak is located, monitoring of the area and maintenance of the phreatic level is required or further action will need to be taken.

The below liner leakage detection drain comprises a 160mm slotted HDPE pipe surrounded in 19mm stone which is enclosed in a geofabric. 13.4.5 The below liner 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.

2.1.1.4 LINER TENSION FORCES

Due to the foundation and height of the facility there are high tensile forces induced on the liner. Liner stresses induced by the slopes of the facility exceed the liner tensile strengths. To alleviate these stresses, geogrid has been designed. The maximum shear stresses in the 600kN/m geogrid were determined. The maximum shear stresses (and forces) have been analysed against the yield strength of the 600kN/m geogrid to determine the Factor of Safety against yield (failure) under drained, undrained, post seismic conditions and pseudo-static conditions.

Other remedial measures were considered to reduce the liner stresses. These included adjusting the intermediate slopes and foundation saw tooths equally spaced along the failure surface. These did not reduce the induced liner stresses, and the geogrid was designed. The total tensile strain in the geomembrane is less than 1%. This is due to minimal movement expected because of the engineered base, reinforcing geogrid, and cushion tailings protection layer of the inverted barrier system. A 600kN/m geogrid (or similar approved) has been specified.

2.1.1.5 LINER SERVICE LIFE ASSESSMENT

The service life of a geomembrane is affected by various factors including UV exposure, temperature conditions and applied loading. The deposition life of the Nooitgedacht TSF is 34 years, after which, pending future reclamation, it may exist as a dormant TSF for a very long time. The main factors affecting the service life of a geomembrane is UV exposure and temperature. The geomembrane on the TSF will be covered during construction by tailings, therefore UV exposure will not have a detrimental effect on the service life of the geomembrane. The geomembrane can alternatively be covered using tailings underflow, but installation timing and tailings beach advancement will need to be considered during liner installation and construction. Due to risk to the membrane, the placed tailings layer is recommended.

The average minimum and maximum ambient temperature of the site is 10°C and 25°C respectively. Based on research conducted by the Geosynthetics Institute in USA “Geomembrane Lifetime Prediction: Unexposed and Exposed Conditions” originally published in 2005 and later updated in 2011, it is reported that an unexposed geomembrane at 25°C will have a design life of more than 250 years. It is noted that this time is for the geomembrane to reach the so called “half-life”, meaning the antioxidant in the geomembrane have reached 50% of their original value.

The projected service life of a geomembrane at Nooitgedacht TSF is 2 775 years at 10°C and decreases to 608 years at a temperature of 25°C. The geomembrane service life is therefore considered acceptable.

2.1.1.6 DAM BREAK ANALYSIS

A feasibility dam break analysis was done by Geotheta in September 2023 using FLO- 2D Overland Flood Modelling. Contours of the inundation area were used to develop a digital terrain model. These are accurate at 5m intervals which is considered sufficiently accurate for the purposes of establishing an indicative inundation zone. Given the range of possible failure scenarios, failure volumes and surface flow resistances that can occur, the contour intervals are therefore adequate for the purpose of this feasibility level study.

The proposed Nooitgedacht TSF is an Extreme Consequence Classification facility according to the Global Industry Standard on Tailings Management (GISTM) criteria. This is determined by analysing the impact a failure would have on life, the environment and infrastructure in the modelled inundation zone. The corresponding SANS 10286 hazard classification is High. Note that this is the facility’s “Consequence Classification”, and it is not at all linked to the likelihood of failure. The dam break analyses merely address the consequence should the facility fail. The consequence classification leads to the design criteria to be used to ensure that the facility is adequately designed, operated, managed and closed so that the risk of failure is reduced to as low as reasonably practicable.

The analyses concluded that there would be extensive damage to both the natural environment and infrastructure within the inundation area. Tailings flowing into the river south of the facility, will result in the loss of aquatic wildlife and decrease in water quality. It is likely that the pollution of the river and loss of aquatic wildlife would have adverse impacts on the ecosystem of the area and adversely affect users of the water. The inundated area must be environmentally surveyed to identify the affected population, environment and infrastructure within the Zone of Influence. The flood event would inundate households and associated infrastructure located near the facility and the populated area to the north-east of the Nooitgedacht TSF. The potential population at risk falls between 100 – 1 000, with the potential loss of life not exceeding 100.

The rainy day tailings flow of a breach on the north eastern flank will affect the residential area of Odendaalsrus to the north of the facility. This flow could be diverted away from the nearby residential area by constructing a (dump rock) bund approximately 1m high at the edge of the residential area. This can reduce the probability of loss of life to ranges of 1:10 000 or better. The bund must be designed to withstand flow erosion.

2.1.1.7 RETURN WATER DAM DESIGN

The layout of the Return Water Dam (RWD) is shown below:

Figure 7: RWD design

The lined RWD is situated south-east of the TSF. The basin of the RWD is formed by excavation into the ground materials. The RWD has a total storage capacity of 606 500m^3. This provides adequate capacity to contain runoff from the TSF catchment area. The stochastic water balance analysis indicates that the required RWD storage capacity is 606 500 m^3. This ensures that the RWD does not spill more than once every 50 years as required by Government Notice 704 of the National Water Act (Act No 36 of 1998). The RWD mean operating volume is 136 464m^3 at average 600mm deep. The mean operating volume was calculated by taking the volume of the fifth highest spill that is most likely to happen (470 036m^3), subtracted from the total storage capacity of the RWD (606 500m^3). The operating depth of 600mm is calculated by dividing the operating volume by the total area of the RWD. The depth of 600mm is recommended during the heavy rainfall seasons. This can be raised during the drier months.

The RWD is not classified as a dam with a safety risk in terms of Regulation 139 of the of the National Water Act. The requirements for a dam with a safety risk as indicated in Regulation 139 of the of the National Water Act do not apply.

The RWD spillway is designed to accommodate the expected probable maximum flood (PMF), i.e. the 1:10 000 year 24-hour storm event, without overtopping of the RWD embankment. The RWD spillway was sized to have

adequate capacity to safely discharge the PMF. The 1:10 000 year 24-hour storm event was calculated at 240mm. A concrete lined spillway is provided to safely discharge excess water without overtopping of the RWD embankment walls. The RWD spillway has a freeboard of 800mm and has been designed to discharge the 1:10 000 24-hour Probable Maximum Flood rate of 39.3m^3/sec over a 12-hour period.

A silt trap is provided upstream of the RWD. The silt trap includes cleaning infrastructure. The silt trap ensures that solids are captured before entering the RWD, thereby minimising sedimentation in the RWD. A sump has been included in each compartment of the silt trap to enable water and slurry to be pumped out to the TSF during operation, and prior to or after mechanical cleaning.

The settling velocity calculation used in the design of the silt trap is 0.00207m/s. The discharge from the penstock calculation assuming flow from penstock inlets with 400mm pool depth is 1.436m^3/sec. The entrainment velocity and tangential velocity is 0.13m/s and 0.12m/s respectively. The design of silt trap is therefore 89m in length and 18.5m wide.

The RWD liner system (from top down) comprises the following (Figure 8):

- 200mm high perforated HDPE Geocells (SW-356/200HD or similar approved) filled with 20Mpa concrete.
- 1.5mm thick smooth HDPE membrane (GRI-GM13 and SANS 1526:2003 compliant).
- Ripping and recompacting 300mm of the in-situ base preparation material to 95% Proctor density at a moisture content between 0% and +2% of optimum moisture content.
- Underdrainage/leakage detection system comprising 160mm perforated HDPE pipes placed in a 300mm by 300mm trench. The pipes will be encased in 19mm washed stone and wrapped in geofabric.

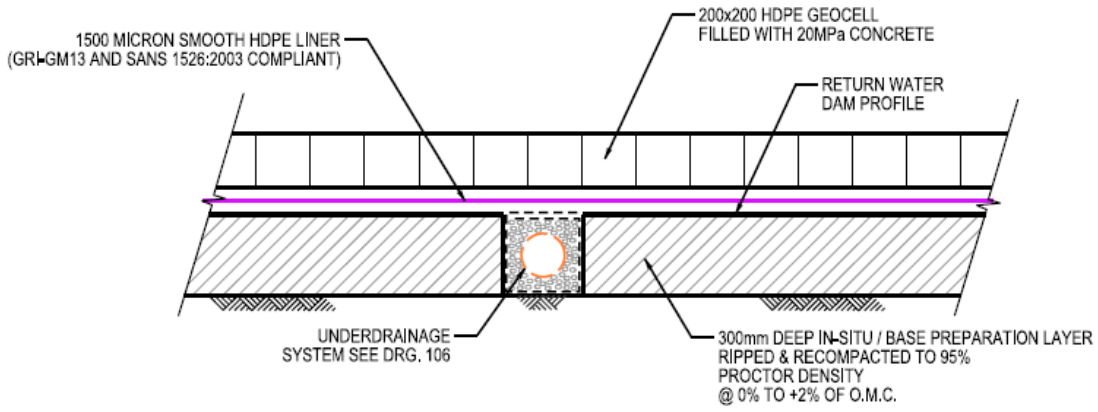


Figure 8: RWD liner system

The use of a geomembrane requires a protection layer to achieve intimate contact between the liner and the underlying clay to ensure overall liner functionality. The protection layer also provides durable protection to the liner against UV degradation and (possible) equipment and machine damage. The protection layer will be 200mm high concrete filled perforated geocells. These will provide superior and long life protection compared to other options evaluated. The calculated RWD seepage is 1.4 x 10-4 L/ha/day.

An underdrainage system is provided beneath the RWD basin area. The underdrainage system acts as a leakage detection. The underdrainage system also alleviates any possible water pressure build-up beneath the liner caused by a potential rise of the groundwater table.

The underdrains comprise 160mm slotted HDPE pipes encased in 19mm washed stone. The stone will be wrapped in geofabric to prevent fines from entering the drains. The underdrains from the RWD basin lead to collection manholes located on the perimeter of the RWD. The manholes provide access to monitor under-liner seepage. The underdrainage system will be monitored as part of the operations, maintenance, and surveillance

plan to determine and quantify any leakage through the liner system. Water extraction from the RWD will be by means of a decant outlet sump and pump chamber. The pump specification should be sized as a 400L centrifugal pump. The maximum operating flow rate in the pumping system is 155 000m^3/day. The pumping system can run for an average of 14 hours per day.

2.1.1.8 WATER MANAGEMENT STRUCTURES

A 150mm thick reinforced concrete lined solution trench is provided at the perimeter of the Nooitgedacht TSF except the northern flank which is butt up against existing FSN1 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. The solution trench of the Nooitgedacht TSF will accommodate the maximum peak discharge from the penstock of 2.87m^3/sec.

A concrete lined solution trench will be installed since the effluent is contaminated dirty water. This will prevent seepage of the drain effluent into the underlying soils. It also provides a durable surface for cleaning and maintenance. An HDPE liner can be considered; however the liner is exposed and therefore deteriorates over time. Cleaning and maintenance will need to be done by hand and any damage caused to the liner will need to be repaired immediately. The drainage collector sump is situated to the south-west of the TSF. The sump has been designed to accommodate a volume of 110 m^3. Water collected in the sump will be pumped by a vertical spindle pump into the solution trench to the east of the sump and flow to the RWD.

The stormwater runoff water quality is to be monitored by the Mine's environmental consultants as and when required. Drain water discharging from the Nooitgedacht TSF and RWD underdrainage outlet pipes are to be monitored by the Mine's environmental staff/consultants, at most annually.

Stormwater around the facility will be gravity-drained away from the Nooitgedacht TSF. Vehicle and equipment access ramps will double as water run-off increases. The run-off from the side slopes of the TSF wall will be attenuated by the vegetation cover established at closure. A trapezoidal stormwater diversion trench and bund are provided along the upstream flank of the TSF to divert clean stormwater away from the TSF site. This ensures that clean and dirty water systems are kept separate. A bund wall will be constructed on the outer edge of the access road to prevent flow of water on the access road. The compacted diversion bund embankment is 2.5m high and has a 2.5m wide crest with outer slopes of 1V:1.5H. The diversion trench is 2.5m deep with side slopes of 1V:1.5H and a base width of 2.5m. Dirty runoff water within the Nooitgedacht TSF catchment area is routed to the RWD via the concrete lined solution trench.

2.1.1.9 ACCESS CONTROL

A perimeter fence will not be installed around the TSF complex as the fence is prone to theft. Perimeter barrier warning signs will be installed around the perimeter of the TSF complex as an alternative. The signs will be installed during construction. All signs are to comply with the Harmony Gold Mine standards. A 5m wide all weather access road is provided around the facility to all key infrastructure for operational and monitoring requirements.

2.1.1.10 TAILINGS SLURRY DELIVERY SYSTEM

Slurry will be delivered from the One Plant to the TSF site via an overland Cement Mortar Lined (CML) flanged steel pipe up to the perimeter of the TSF. Slurry will be distributed to cyclones via a 900NB steel delivery pipeline around the TSF perimeter. The flange specification is SABS 1123:2500/3. A 900NB pinch valve (or similar approved) will be used at every cyclone.

Tailings delivery stations are provided every 30m along the starter wall crests to convey tailings slurry from the ring main pipeline to the cyclones. As the facility is raised with tailings, the cyclones will be raised to the new crest elevation. The ring main will be lifted onto new berms as required.

2.1.1.11 DECANT SYSTEM

The initial decant system comprises a gravity decant and a 900mm HDPE outfall pipe. Intermediate penstock intake structures are each a reinforced concrete base with one 510mm precast concrete penstock ring intake.

The final penstock intake structure is a reinforced concrete base with four 510mm precast concrete penstock ring intakes.

As the facility rises the penstock intakes will be raised by stacking standard precast concrete penstock rings. The penstock intake structure is located centrally within the TSF basin. The intermediate and final penstock concrete bases will be located on concrete piles driven to refusal.

Based on previous experience on similar projects, the 900mm HDPE pipe will provide sufficient usage for approximately 10 years, thereafter the pipe may be susceptible to long term creep failure. Due to the pipes being susceptible to creep failure, the 900mm HDPE pipes will be concrete encased.

The final penstock outfall pipe comprises two 900mm OD PN10 PE100 HDPE pipes encased in concrete. In an event of one of the HDPE pipes being defective, the second HDPE pipe will be functional. The main outfall pipe will flow towards the RWD. Once sufficient head is obtained between 20-25m high, the decant system will change to a syphon system.

A syphon system consists of a syphon head and floating catwalk. The syphon head consists of a fibreglass structure that is airtight and watertight to create buoyancy. A fibreglass outfall pipe which is cut out to accommodate the pan is placed below. Due to the buoyant force, the pan floats on top of the pool of water below the outfall pipe. Water then collects into the pan which then flows into the outfall pipe. To overcome the difference in height between the basin and the wall, a vacuum pump is needed to overcome the head. Once the head is overcome a natural syphon occurs. The detailed syphon system and floating catwalk will be designed just prior to being required based on the operating conditions at that time. The system will be required 9 years after deposition begins. Once the syphon is in operation, the existing 900mm HDPE outfall pipes will become redundant and will be sealed off.

2.1.1.12 MAINTENANCE PLAN AND EMERGENCY MANAGEMENT PLAN

An operating, maintenance and surveillance manual has been prepared for the Nooitgedacht TSF. The objective of the manual is to provide a methodology for the safe, efficient and environmentally responsible management of the TSF and associated infrastructure. Adherence to the guidelines provided in the operating, maintenance and surveillance manual will result in continued safe operations of the TSF for the design life. A Trigger Action Response Plan (TARP) and Emergency Response Plan (ERP) will also be developed by Harmony.

2.1.1.13 OPERATION AND DEVELOPMENT

Tailings will be cyclone deposited on the eastern, western and southern flanks of the Nooitgedacht TSF. No cyclone deposition will take place on the outer wall of FSN1 TSF which butts up against the Nooitgedacht TSF. Spigot deposition will be done from FSN1 for pool control only when required. Delivery piping will be placed on the dormant facilities as required. Upstream cyclone deposition will commence when the TSF is at the FSN 1 height of 36m.

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. An underflow : overflow mass split of 17 : 83 was used in the stage capacity calculations.

The cyclones are 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 are then moved to an adjacent position to deposit another underflow cone. The cyclone should also be moved to fill in low spots between underflow cones to ensure an even horizontal surface along the top of the outer wall.

The fine overflow will be discharged into the basin through an overflow pipe connected to the cyclone. The end of the overflow pipe discharging into the basin should always be at a lower elevation than the cyclone vortex finder. During commissioning the overflow pipes must be long enough to discharge overflow directly into the basin area beyond the toe drains. Overflow must be discharged well beyond the coarse underflow zone and

must not be discharged directly over the exposed toe or blanket drains during commissioning. Deposition of the tailings material must be done according to the deposition plan. The deposition plan must ensure that the rate of rise of the cyclone underflow is greater than the rate of rise of the basin. The deposition position into the basin is to be selected based upon managing the height of solids around the TSF perimeter and the shape of the pool. The deposition locations are to be rotated around the facility to ensure adequate beach formation and favourable pool location and size. Vegetation on the surface and outer slopes of the facility will reduce erosion and dust generation. Vegetation on all the outer side slopes is to be established at closure.

An initial layout map / design drawing of the TSF facility is included as Figure 2. This represents the latest design completed for the TSF which has already undergone several iterations. Certain details regarding the design are still to be updated and amended however a preliminary design report with further technical design information is included in Appendix 2.

2.1.1.14 LOW PRESSURE WATER SYSTEM

For the low pressure water system a trade off study was conducted considering three options for the 40 megalitre Low Pressure (LP) water storage system and considered. This area is currently a very disturbed area and was in the past used as the thickener station for the Dam 13 dredging operations which occurred many years ago. The location of the low pressure water system is shown in Figure 13of this report. The following options are being considered by Harmony.

- Two HDPE lined earth dams – footprint 190m X 125m

Figure 9: Earth dam option

- Two concrete tanks – footprint 95m X 45m

Figure 10: Concrete tank option

- Twelve Steel tanks. – footprint 210m X 65M

Figure 11: Steel tank option

All of the water for the project will be pumped to the LP water system. The water source for the reclamation operation will include:

- Return water from the Nooitgedacht TSF;
- Treated effluent from Waste Water Treatment works;
- Ground water from boreholes; and
- Overflow water from the Metallurgical Plants,

The option with the smallest footprint, at ground level, that provides a simple suction manifold layout and positive suction head for the pumps at all times is the installation of the two 40m diameter concrete tanks however the final preferred option will be presented in the EIA report.

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 805ha along with the drainage infrastructure which will function to convey process water to the return water dam to be constructed adjacent to the site as well as the low pressure water system.

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, Saaiplaas Plant and Central Plant. As part of the tailings being deposited, wastewater will be produced which will follow the drainage infrastructure to return water dams.

2.4 ACTVITY LIFE DESCRIPTION

As stated in section 0 of this report, the proposed Nooitgedacht TSF will replace Free State South 2 Tailings Storage Facility (TSF), St. Helena 4 TSF, St. Helena 123 TSF, Dam 23 TSF, Brand D TSF and Target 1&2 TSF for approximately34 years at a deposition rate of approximately 2 000 000 tons per month.

2.5 ACTIVITY INFRASTRUCTURE DESCRIPTION

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

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;
- LP Water system 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 12: Organogram of the Harmony Gold. below.

	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

Figure 12: 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 has an approved MR (Ref: MR84). Harmony is in the process of applying for an integrated EA and WML for the proposed Nooitgedacht TSF as well as a WUL. This IWWMP forms part of the WULA for the Nooitgedacht TSF.

3.1 SUMMARY OF WATER USES

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

Table 3: Water Uses for the Harmony Nooitgedacht TSF.

Section 21 Water use	Source	Purpose/Description	Properties	Volume (m^3/a)	Capacity (m^3)/ Area (m^2)	Co-ordinates Latitude	Longitude
Section 21(g)	Nooitgedacht TSF	Tailings Storage Facility Deposition of waste (slurry / Tailings onto the Nooitgedacht TSF)	Nooitgedacht 50, Ptn 0 Goedgedacht 53, Ptn 0 Jacobsdal 37, Ptn 0	24 000 000 tonne/annum 17 021 276 m3/anum	Capacity: 804 million tonnes Area: 8 050 000 m2 570 212 766 m3	27°56'22.04"S	26°39'59.06"E
Section 21(g)	Nooitgedacht Return Water Dam	Return Water	Goedgedacht 53, Ptn 0	15 672 384 m3 / annum	OLD Capacity: 603 000 m3 NOW 606 500 m3	27°57'13.45"S	26°40'7.29"E
Section 21(g)	Low Pressure Water Supply System	Low pressure water system	Klippan 14 Ptn 2.		40000 m3	28°2'5.43"S	26°47'39.11"E
Section 21 (c&i)	Nooitgedacht TSF	Nooitgedacht TSF will be constructed over HGM 1 (unchannelled Valley Bottom Wetland), HGM 2 (unchannelled Valley Bottom Wetland) and HGM 4 (Depression Wetlands)	Nooitgedacht 50, Ptn 0 goedgedacht 53, Ptn 0 Jacobsdal 37, Ptn 0	-	-	27°56'22.04"S	26°39'59.06"E

Section 21 Water use	Source	Purpose/Description	Properties	Volume (m^3/a)	Capacity (m^3)/ Area (m^2)	Co-ordinates Latitude	Longitude
		Nooitgedacht TSF within 500m of HGM3 (Channelled Valley Bottom Wetland - Mahemspruit), HGM 4 (Depression Wetlands)	Nooitgedacht 50, Ptn 0	-	-	27°56'22.04"S	26°39'59.06"E
			goedgedacht 53, Ptn 0				
			Jacobsdal 37, Ptn 0				
Section 21 (c&i)	Nooitgedacht Return Water Dam	Nooitgedacht RWD within 500m of HGM3 (Channelled Valley Bottom Wetland - Mahemspruit)	Goedgedacht 53, Ptn 0	-	-	27°57'13.45"S	26°40'7.29"E
Section 21 (c&i)	Topsoil stockpiles	Topsoil Stockpile within 500m of HGM3 (Channelled Valley Bottom Wetland Mahemspruit) and HGM 4 (Depression Wetlands)	Nooitgedacht 50, Ptn 0	-	-	27°56'53.61"S	26°40'37.72"W
			Goedgedacht 53, Ptn 0				
Section 21 (c&i)	Harmony One Plant slurry pipeline (x1) One slurry pipeline from St Helena Booster pump	Pipeline within 500 m of regulated area of a depression wetland (HGM 4)	Farm Nooitgedacht 50 (0)	-	-	Start	
						27°56'50.77"S	26°40'31.01"E
			Farm Goedgedacht 53(0)RE			End:	
						27°56'56.14"S	26°40'18.37"E
		Pipeline crossing a river and an associated CVB wetland (HGM 3)	Farm Goedgedacht 53(0)RE	-	-	Start:	
						27°57'29.43"S	26°40'10.97"E
						End:	

Section 21 Water use	Source	Purpose/Description	Properties	Volume (m^3/a)	Capacity (m^3)/ Area (m^2)	Co-ordinates Latitude	Longitude
	station to Nooitgedacht TSF.					27°57'33.51"S	26°40'16.79"E
		Pipeline within 500 m of a regulated area of depression wetlands (HGM 7)	Farm Jacobusrust 118(0)	-	-	Start:	
						27°58'42.06"S	26°40'41.28"E
			Farm Welkom 41 (20)RE			End:	
						27°58'54.16"S	26°41'11.95"E
		Pipeline within 500 m of a regulated area of depression wetlands/ pans (HGM 5 and HGM 6)	Farm Welkom 41 (20)RE	-	-	Start:	
						27°59'0.25"S	26°41'11.79"E
			Farm Theronia 71 (7)			Middle:	
						27°59'36.87"S	26°41'10.85"E
			Farm Theronia 71(1)			End:	
						28°0'13.20"S	26°41'11.53"E
		Pipeline within 500 m of a regulated area of depression (HGM 5), and CVB (HGM 8 and HGM 9) wetlands	Farm Theronia 71(1)	-	-	Start:	
						28°0'13.20"S	26°41'11.53"E
						End:	
						28°0’7.60"S	26°41’47.92”E
		Pipeline within 500 m of a regulated area of CVB wetlands (HGM 8 and HGM 9)	Farm Theronia 71(1)	-	-	Start:	
						28°0'6.79"S	26°41'46.79"E
			Farm Vlakplats 125(5)			End:	
						28°0'53.13"S	26°42'14.89"E
		Pipeline crossing a CVB (HGM 8) and associated UVB (HGM 9) wetlands	Farm Vlakplaats 125(3)	-	-	Start:	
						28°0'11.93"S	26°41'50.53"E
						End:	
						28°0'32.55"S	26°42'2.58"E
			Farm St Helena 42(2)	-	-	Start:	

Section 21 Water use	Source	Purpose/Description	Properties	Volume (m^3/a)	Capacity (m^3)/ Area (m^2)	Co-ordinates Latitude	Longitude
		Pipeline within 500 m of a regulated area of depression wetlands (HGM 7)				28°1'36.92"S	26°43'23.04"E
						End:	
						28°2'5.53"S	26°44'38.71"E
		Pipeline within 500m of wetland (HGM2)	Farm Ouders Gift 48 ((0)RE)	-	-	Start:	
						27°55'44.13"S	26°39'55.95"E
						End:	
						27°55'44.03"S	26°39'58.86"E
Section 21 (c&i)	Harmony One Plant slurry pipelines (x2) Two slurry pipeline from Harmony One Plant to St Helena Booster pump station.	Pipeline with 500m of the Wit Pan, Pan wetland	Farm Welkom 80 (0(RE))	-	-	Start	
						28°1'3.07"S	26°45'3.78"E
			Farm Marmageli 20 (0(RE))			Middle:	
						28°1'16.27"S	26°45'29.96"E
			Farm Stuurmanspan 92 (0(RE))			End:	
						28°1'32.19"S	26°45'52.31"E
		Pipeline within 500 m of a regulated area of depression wetlands (HGM 7)	Farm St Helena 42(2)	-	-	Start:	
						28°1'36.92"S	26°43'23.04"E
						End:	
						28°2'5.53"S	26°44'38.71"E
	Central Plant slurry pipeline (x1) One slurry pipeline from Brand D TSF to St. Helena TSF booster pump station.	Pipeline within 500 m of a regulated area of depression wetlands (HGM 7)	Farm St Helena 42(2)	-	-	Start:	
						28°1'36.92"S	26°43'23.04"E
						End:	
						28°2'5.53"S	26°44'38.71"E

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 7on 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 Brand A TSF will require exemptions from GN704 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 maps as shown in Figure 13 to Figure 17. 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:

- Nooitgedacht TSF

- Nooitgedacht TSF will be constructed over HGM 1 (unchannelled Valley Bottom Wetland), HGM 2 (unchannelled Valley Bottom Wetland) and HGM 4 (Depression Wetlands)
- Nooitgedacht TSF within 500m of HGM3 (Channelled Valley Bottom Wetland - Mahemspruit), HGM 4 (Depression Wetlands)

- Nooitgedacht RWD within 500m of HGM3 (Channelled Valley Bottom Wetland - Mahemspruit)
- Topsoil stockpiles Nooitgedacht topsoil stockpiles within 500m of a Wetland
- Harmony One Plant slurry pipeline (x1) and One slurry pipeline from St Helena Booster pump station to Nooitgedacht TSF.
    - Pipeline within 500 m of regulated area of a depression wetland (HGM 4);
    - Pipeline crossing a river and an associated CVB wetland (HGM 3);
    - Pipeline within 500 m of a regulated area of depression wetlands (HGM 7);
    - Pipeline within 500 m of a regulated area of depression wetlands/ pans (HGM 5 and HGM 6);
    - Pipeline within 500 m of a regulated area of depression (HGM 5), and CVB (HGM 8 and HGM9) wetlands;
    - Pipeline within 500 m of a regulated area of CVB wetlands (HGM 8 and HGM 9);
    - Pipeline crossing a CVB (HGM 8) and associated UVB (HGM 9) wetlands;
    - Pipeline within 500 m of a regulated area of depression wetlands (HGM 7); and
    - Pipeline within 500m of wetland (HGM2).
- Harmony One Plant slurry pipelines (x2) Two slurry pipeline from Harmony One Plant to St Helena Booster pump station.
    - Pipeline with 500m of the Wit Pan, Pan wetland;
    - Pipeline within 500 m of a regulated area of depression wetlands (HGM 7).
- Central Plant slurry pipeline (x1) One slurry pipeline from Brand D TSF to St. Helena TSF booster pump station.
    - Pipeline within 500 m of a regulated area of depression wetlands (HGM 7).

<u>Registration and licensing requirements</u>

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:

- Nooitgedacht TSF
- Nooitgedacht Return Water Dam
- Low Pressure water supply system

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.

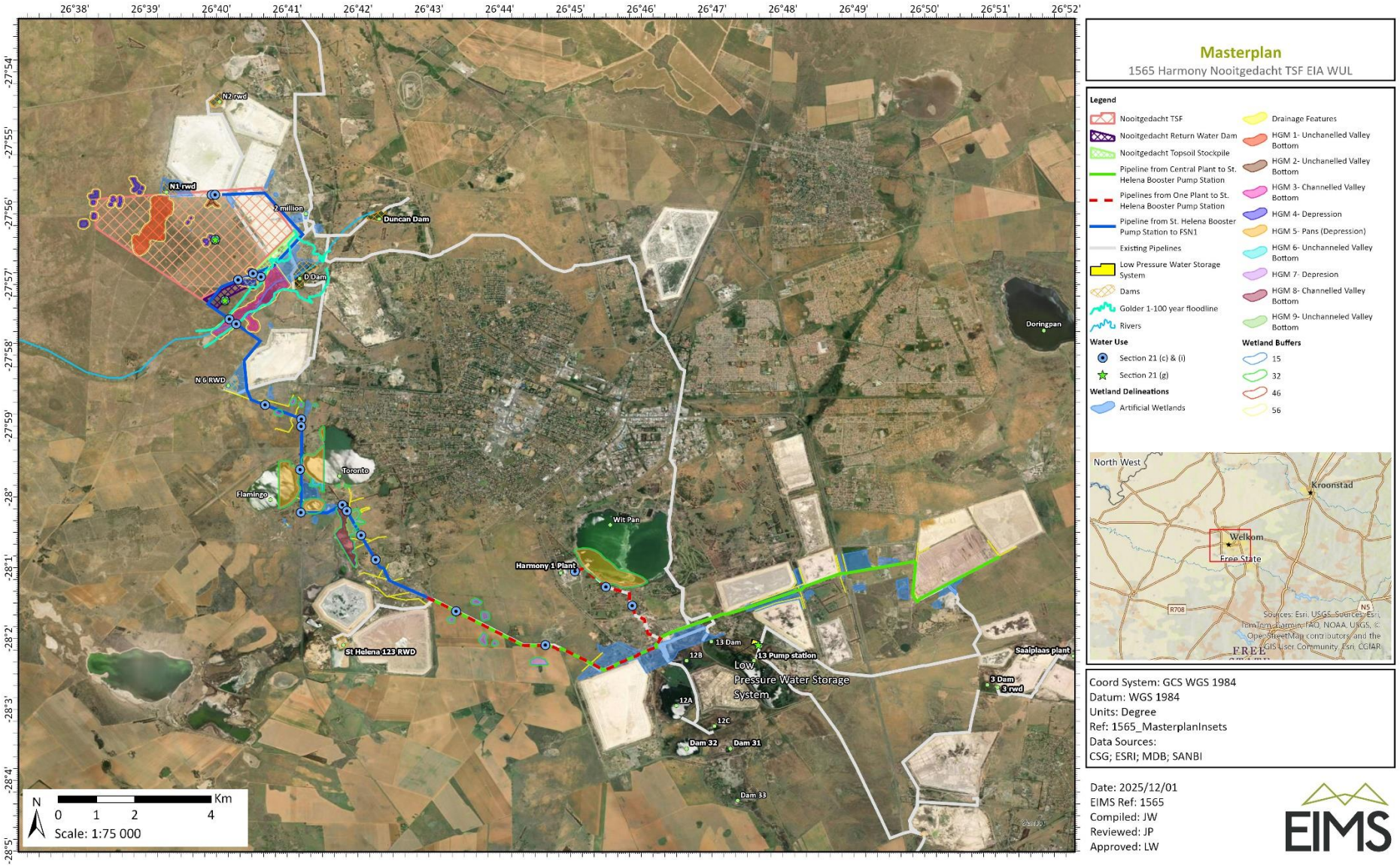


Figure 13: Master layout Plan holistic

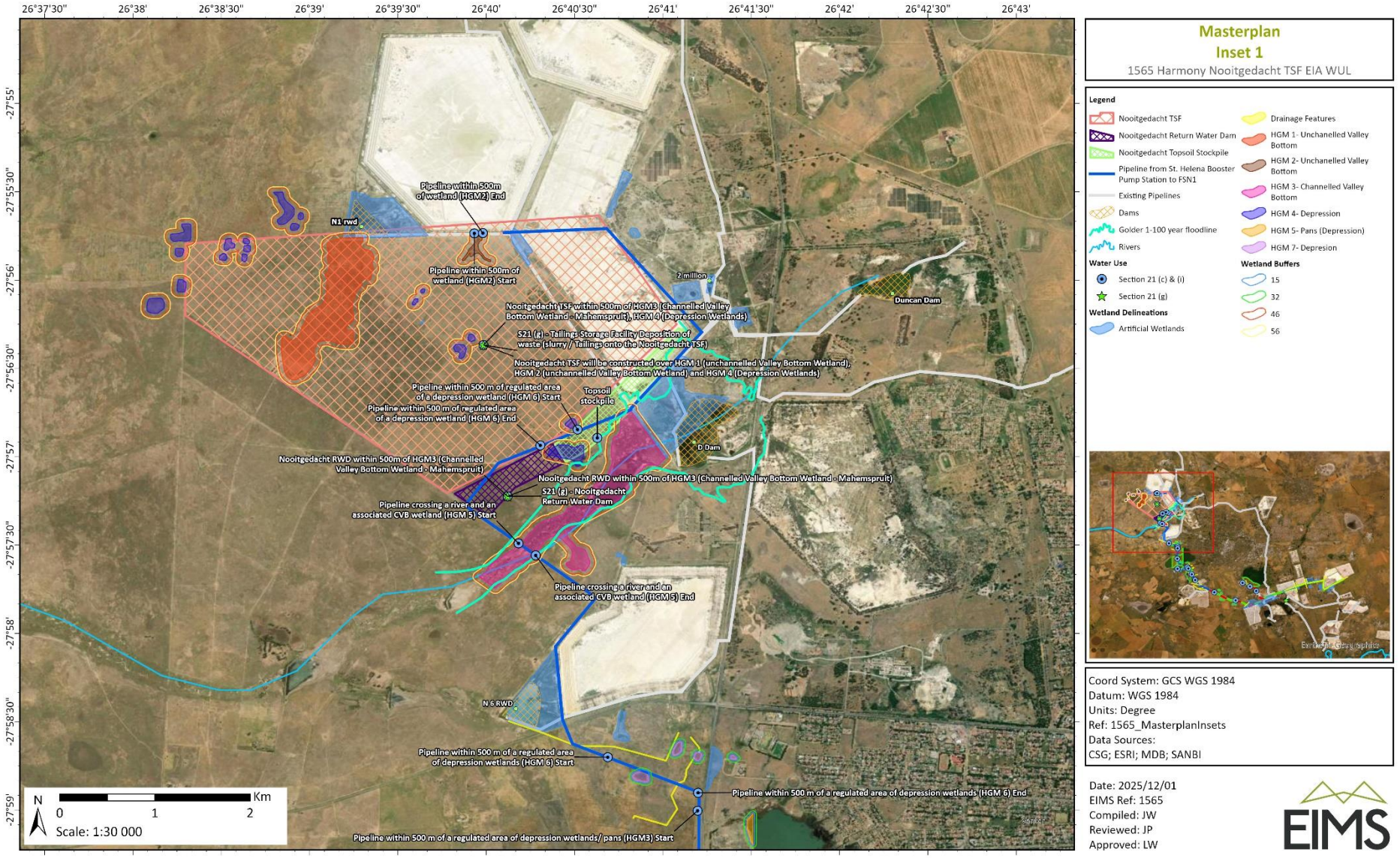


Figure 14: Master layout plan inset 1

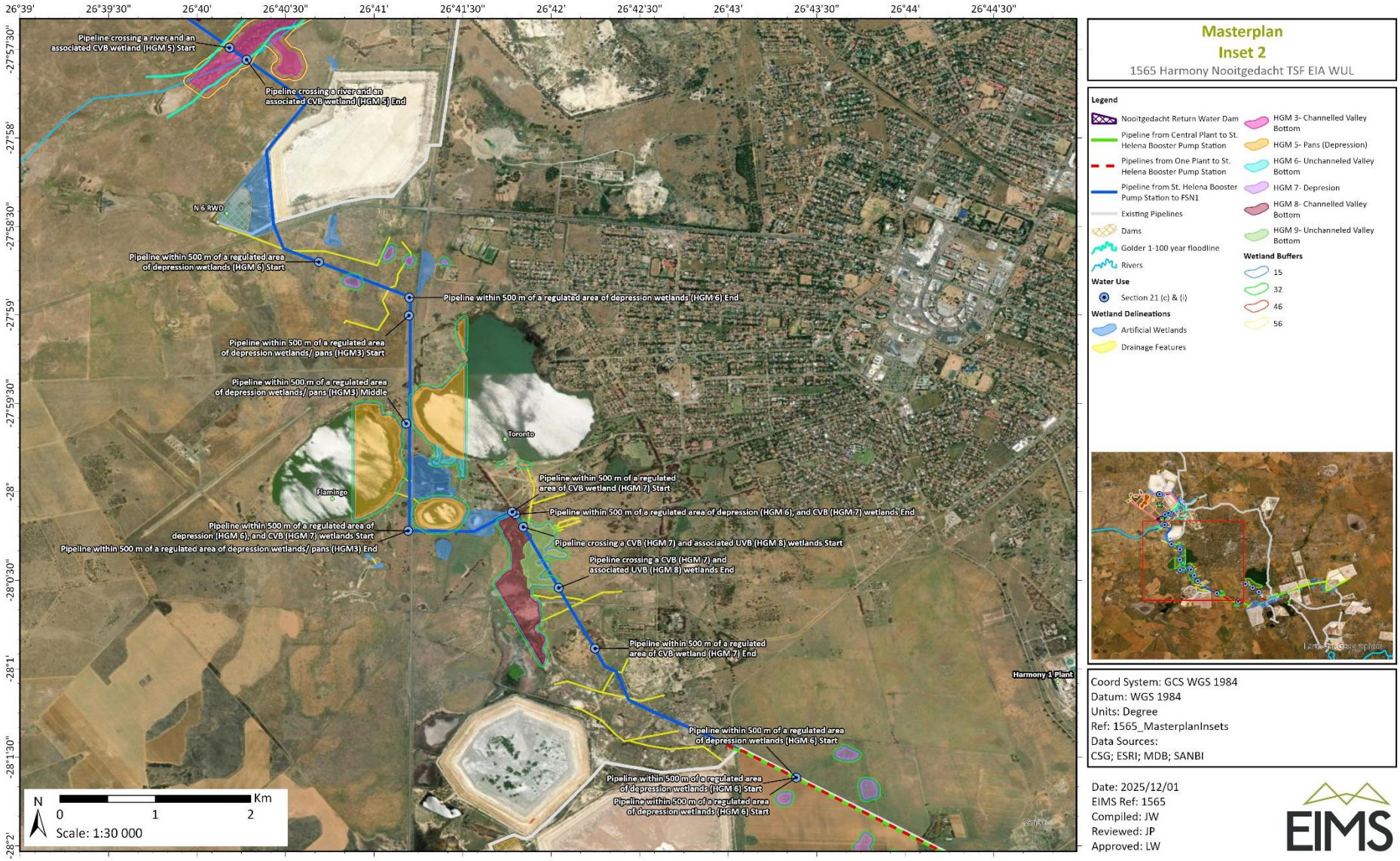


Figure 15: Master layout plan inset 2

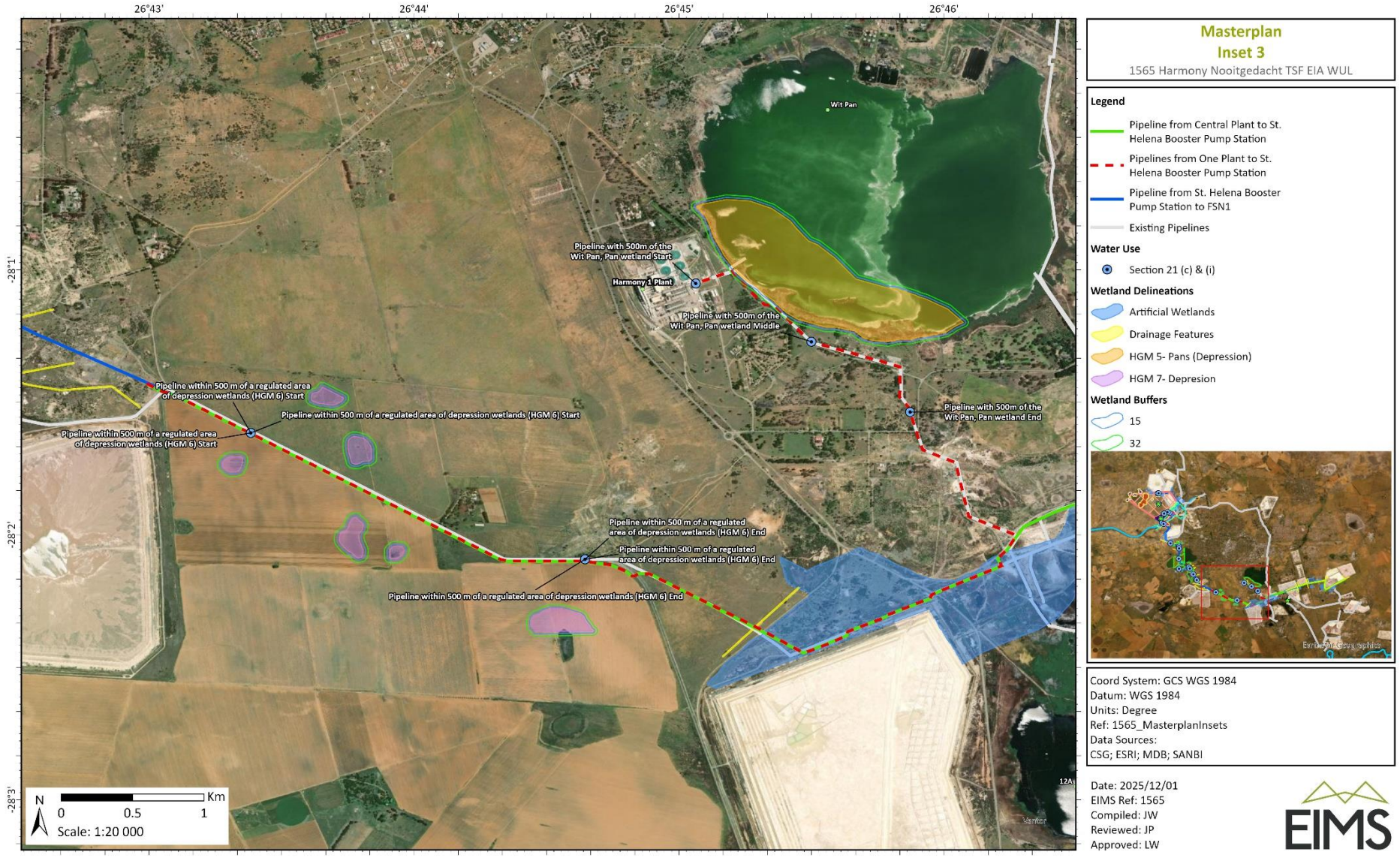


Figure 16: Master layout plan inset 3

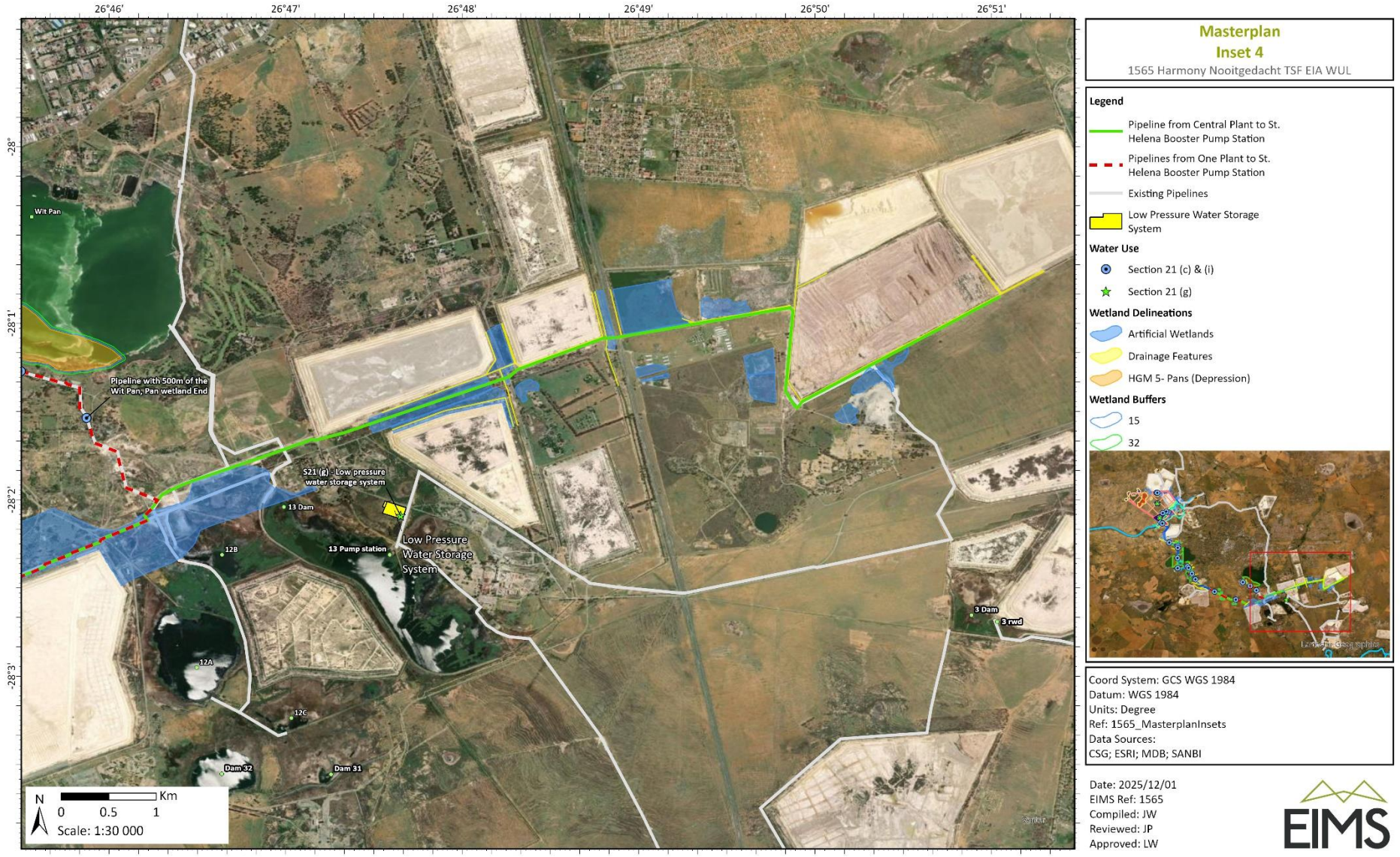


Figure 17: Master layout plan inset 4

3.6 WASTE RELATED AUTHORISATIONS

The Harmony Nooitgedacht 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 Nooitgedacht TSF Project area, the applicant is required to conduct 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 must be submitted to the DMR for adjudication. The listed activities in terms of NEMA are listed in Below.

Table 5: NEMA listed activities relevant to the Nooitgedacht 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	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.

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
	(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.	
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, 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."	Various wetlands were identified within and in close proximity to the proposed TSF site. 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	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.

Activity No(s):	Activity	Portion of the proposed project to which the applicable listed activity relates.
	wastewater discharge capacity will not exceed 50 cubic metres per day.	
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 (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	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.
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	Nooitgedacht TSF	Impact assessment:

No.	GN 704 Regulation	Activity requiring exemption	Motivation and reason for exemption
	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 the 1:100-year flood-line or within a horizontal distance of 100 metres from any watercourse.		The watercourses were delineated as part of the Wetland Baseline and Risk Assessment for the Proposed Harmony Nooitgedacht Tailings Storage Facility (TSF) Project. The impacts on the watercourses were assessed as part of the above-mentioned report that are attached as Appendix 3. The risk assessment is also included in Appendix 4. <u>Management plan:</u> The Wetland Baseline and Risk Assessment for the Proposed Harmony Nooitgedacht Tailings Storage Facility (TSF) Project study includes various mitigation measures to minimise the impact on the watercourses. Refer to Appendix 3 for the assessment. <u>Monitoring plan:</u> Refer to Section 11 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.	<u>Impact assessment:</u> The geohydrological environment was assessed as part of the Geohydrological Impact Assessment for the Proposed Nooitgedacht Tailings Facility, Free State Province. The impacts on the groundwater environment were assessed as part of the above-mentioned report that are attached as Appendix 5. The risk assessment is also included in Table 27 <u>Management plan:</u> The Wetland and Functional Impact Assessment for the Proposed Nooitgedacht Tailings Facility (TSF) Project and Geohydrological Impact Assessment for the Proposed Nooitgedacht Tailings Facility, Free State Province studies includes various mitigation measures to minimise the impact on the watercourses. Refer to Appendix 3 and Table 27 for the assessment. <u>Monitoring plan:</u> Refer to Section 4 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 Nooitgedacht 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 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.

Sediments of the Vryheid Formation of the Ecca Group underlie the study area. The Vryheid Formation (Ecca Group) mainly comprises mudstone, siltstone and fine- to coarse-grained sandstone (pebbly in places).

Within the Free State Goldfield, the Ventersdorp Supergroup can be divided into the Pniel sequence, the Platberg Group and the basal Klipriviervberg Group consisting of alternating sediments, amygdaloidal and non-amygdaloidal andesitic lavas, tuffs and agglomerates (Minter et.al; 1986). Based on prospecting/exploration drilling, the Ventersdorp Supergroup has an average thickness of 1 319m in the study area.

The Witwatersrand Supergroup is unconformably overlain by the volcanic and sedimentary rock of the Ventersdorp Supergroup. Within the Free State Goldfield, the Witwatersrand Supergroup, comprising a thick succession of clastic sediments with minor intercalated lava flows, rests on the granites and schist of the Archean Basement. The Central Rand Group of the Witwatersrand Supergroup contains the economic reef horizons mined throughout the basin. The Central Rand Group is dominated by quartzite with minor shale and conglomerate. Several unconformities in the succession are overlain by the economic auriferous paleoplacers (reefs). Refer to Figure 18 for a map showing the regional geology. It should be noted that the project area is a seismically active area,

The site is underlain by stiff clays and will provide suitable liner material for the tailings dam. Due to their inherently impermeable properties, together with the drainage designs, will minimise potential downward migration of contaminated water. Geotechnical engineering parameters were developed based on correlations between the findings from the geotechnical site investigation, similarly classified material as well as the analysis of the June 2023 CPTu test results.

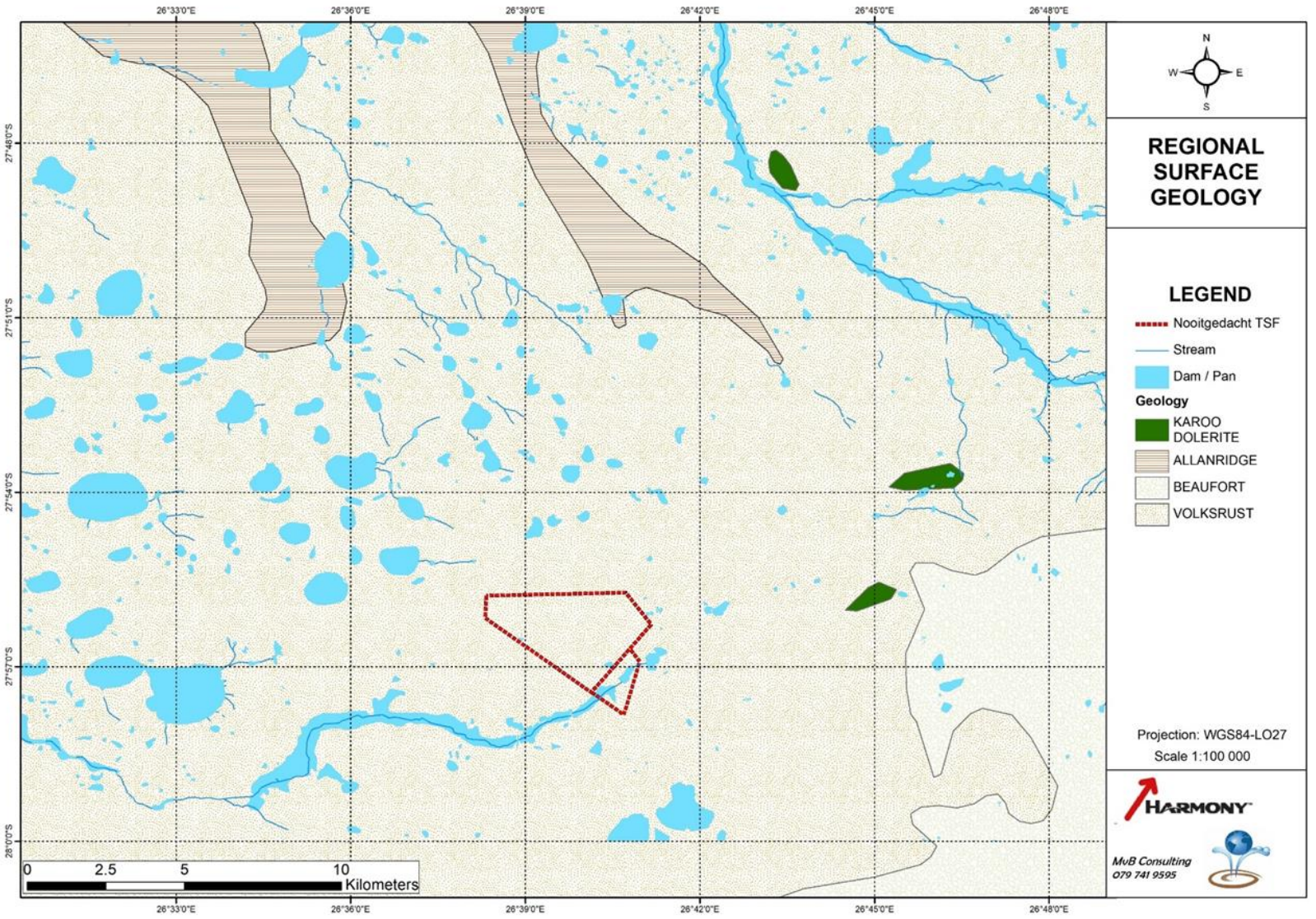


Figure 18: Regional surface geology

4.3 CLIMATE

The average climate for the site is presented in Figure 19 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 classification1.

4.3.1 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 19 below.

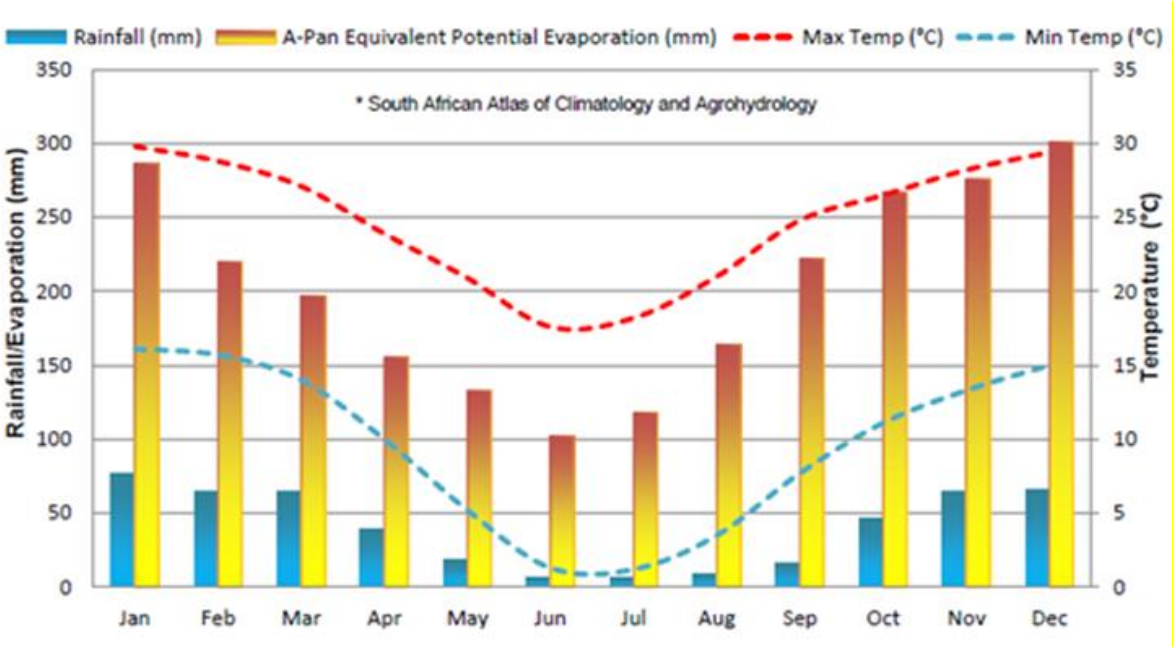


Figure 19: Climate summary

4.3.2 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

4.3.3 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

4.4 SOILS

In considering the Soil Conservation Service for South Africa (SCS-SA) dataset of the site, soils are classified as being of hydrological C (moderately high runoff potential). The soils in the TSF area are mostly medium potential agricultural soils. The natural vegetation of the site is classified as Western Free State Clay Grassland (according

to SANBI, 2018). ‘Grassland’ is predominant over the site according to the DFFE’s 2020 land-cover dataset, with ‘mines & quarries’ positioned to the east in association with an existing TSF (FSN 4.2). Refer to Figure 20 for a map showing the soil types in the study area.

An assessment of the soils present within the project area was conducted during a field survey in March 2023. The site was traversed on foot. A soil auger was used to determine the soil form/family and depth. The soil was hand augured to the first restricting layer or 1,5 m. Soil survey positions were recorded as waypoints using a handheld Global Positioning System (GPS). Soils were identified to the soil family level as per the “Soil Classification: A Taxonomic System for South Africa” (Soil Classification Working Group, 2018). Landscape features such as existing open trenches were also helpful in determining soil types and dep

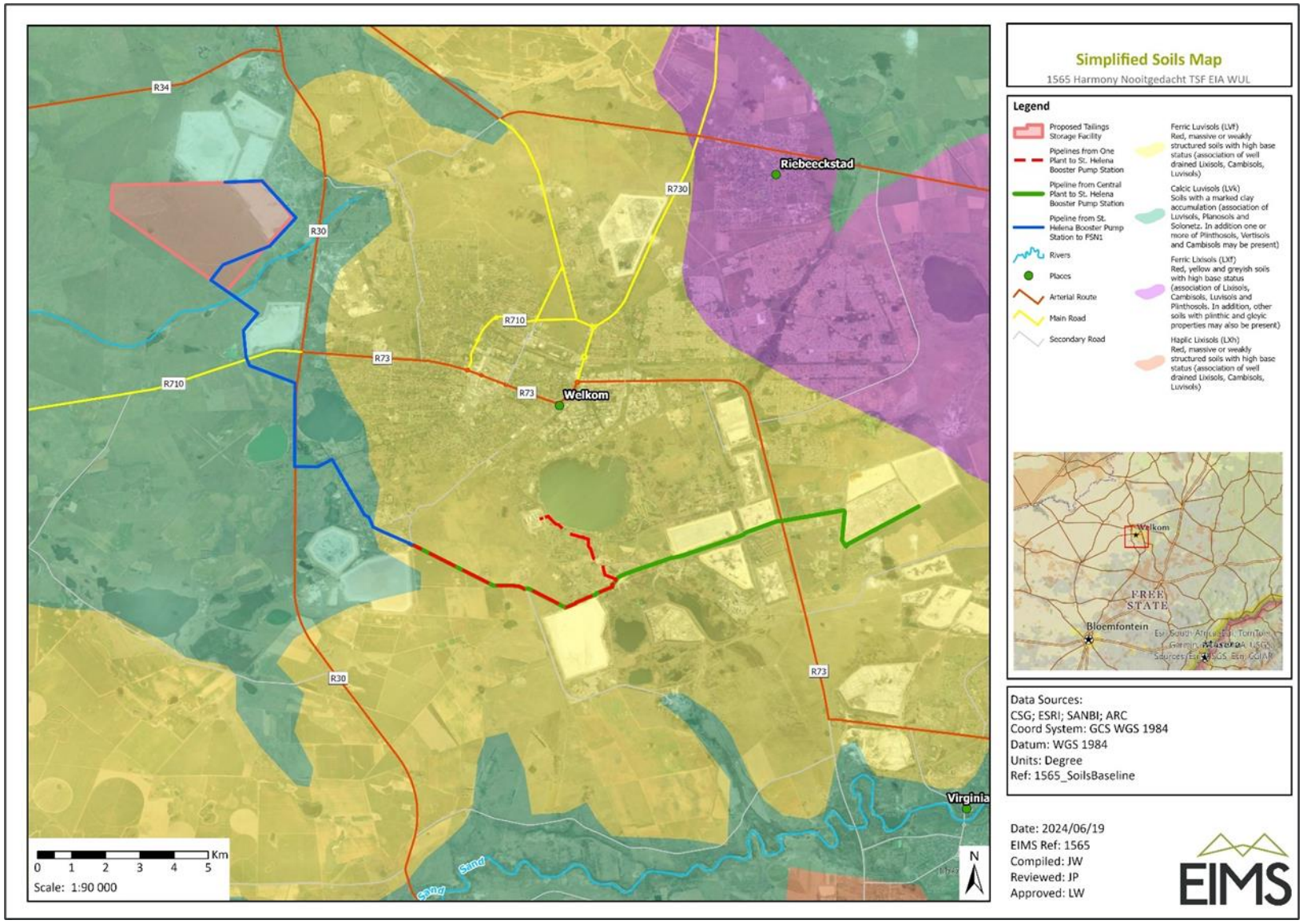


Figure 20 Soil types within study area

4.5 SURFACE WATER

The site is positioned within quaternary catchment C43B. 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 TSF site and are the focus of future flood modelling. This includes D-Dam Complex. This dam complex partitions water in various compartments and adds some complexity to understanding the routing of water towards the Mahemspruit River. Figure 23 illustrates the hydrological setting of the site. The Mahemspruit River located to the immediate east (200m at the closest point) of the TSF site is the only defined river relevant to this assessment. The hydrological environment is presented in Figure 23. The Nooitgedacht TSF is located outside of the calculated 100 year floodline for the watercourse. The TSF footprint has been based on the calculated floodline and specifically avoids this area (Figure 24). In considering the flood results, the 1:50 and 1:100 RI events are noted as not affecting the site with the 1:100 RI event coming close to but not intersecting the proposed topsoil stockpile. PMF flood results (plus climate change) do not intersect the TSF and the topsoil stockpile which is positioned outside of the 1:100 RI flood-line. Since the topsoil stockpile is not a sensitive piece of site works (if affected by flooding), its avoidance of the 1:100 RI floodline and not the PMF flood-line is warranted.

The proposed TSF straddles a watershed and does not intersect any defined 1:50,000 topographical map rivers. There is one dam present in the TSF boundary, however, it is not associated with a defined river and has a relatively minor contributing catchment. The most significant river near the site is the Mahemspruit River to the south-east of the site. This river has a contributing catchment of approximately 32km^2 up to its point of assessment south of the site and was the primary focus of potential flooding to the site which is made possible by some lower-lying terrain slowly rising towards the TSF boundary.

4.5.1 WATER MANAGEMENT AREA

A site visit was conducted by an aquatic specialist in April 2023. Several wetlands were identified and delineated within and in close proximity to the TSF site Figure 22, including preliminary buffer areas. Avoiding wetlands will not be possible for all the delineated systems as there are several delineated wetlands that occur in the TSF footprint area.

During the site visit, nine HGM units were identified within the overall project area that relate to the proposed project (Figure 22). The wetland types were classified as four unchannelled valley bottoms (HGM 1, 2, 6 and 9), two channelled valley bottoms (HGM 3 and 8), and three depressions (HGM 4, 5 and 7). Multiple artificial wetlands, mostly seepage from the tailing's facilities were id3entified.

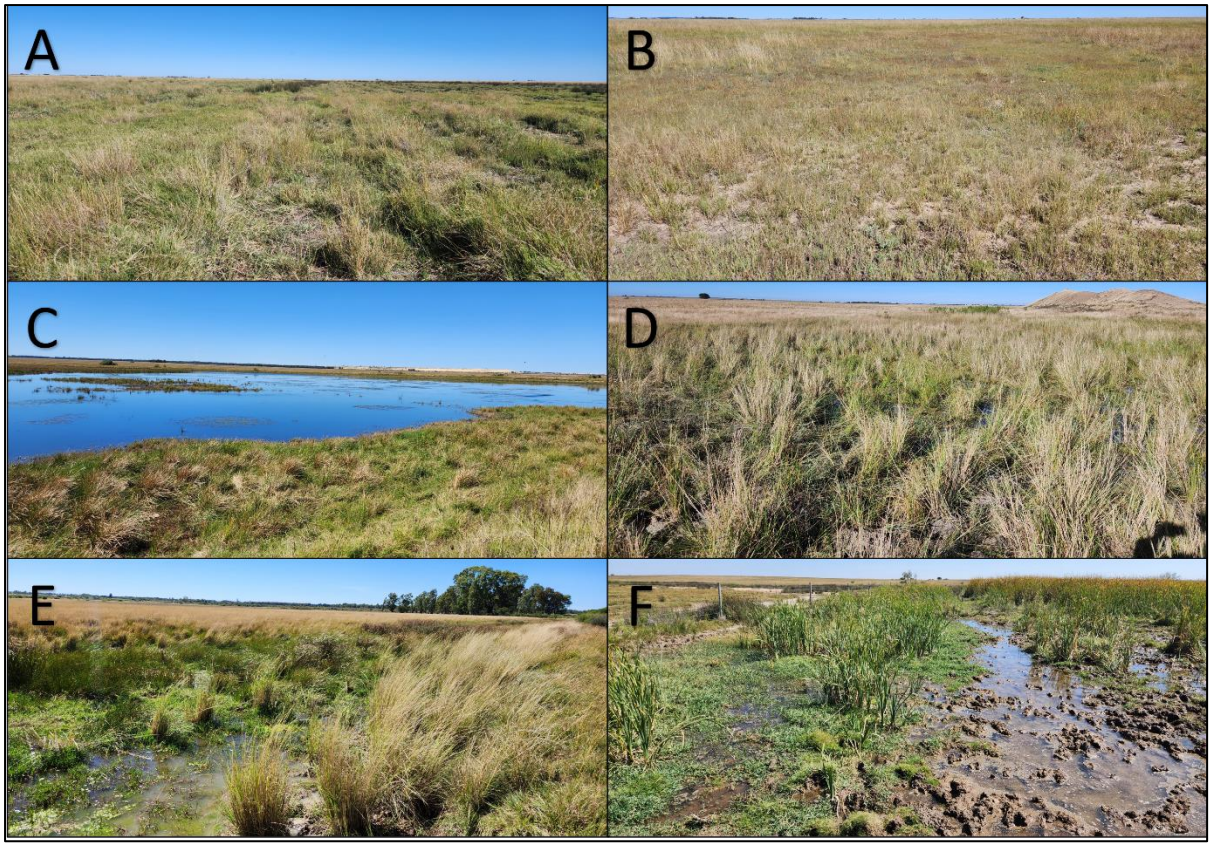


Figure 21: Photographical evidence of the different HGM units found within the study area. A) Unchanneled valley bottom., B) Depression wetland., C) Dam., D) Depression wetland., E & F) Channel valley bottom.

The ecosystem services provided by the wetland units identified on site were assessed and rated using the WET-EcoServices method (Kotze et al., 2008). The average ecosystem service scores for the delineated systems are illustrated in Table 9. The ecosystem services scores of the delineated wetlands ranges from intermediate to moderately high. Ecosystem services contributing to these scores include flood attenuation, streamflow regulation, sediment trapping, phosphate assimilation, nitrate assimilation, toxicant assimilation and, erosion control.

Table 9: Average ecosystem service scores for delineated wetlands

High	Moderately High	Intermediate	Moderately Low
HGM 5	HGM 3	HGM 1	HGM 2
	HGM 4	HGM 8	
	HGM 6	HGM 9	
	HGM 7		

HGM 1 scored “Intermediate” ecosystem services scores. The wetland has been modified to an extent that some function has been lost. The wetlands have only a few hydrophyte species present attributed to the level of modification but will still play an important role in flood attenuation and streamflow regulation and water purification.

HGM 2, scored “Moderately Low” on the provision of benefits due to its small size, isolated nature and the low cover of hydrophyte vegetation present inside the wetland. Hydrophytes help with the accumulation of toxicants as well as phosphates and nitrates from the environment as well as provides habitat and resources so the removal of them lower the ecosystem services dramatically.

HGM 3, and 4 scored "Moderately High" on the provision of ecosystem services. The valley bottom wetlands will play a major role in streamflow regulation and flood attenuation which is important in terms of runoff from the tailing's facilities. The wetlands are well vegetated with hydrophytes which increases the potential to remove toxicants from water entering these systems. The depression wetlands are particularly important for the provision habitat and resources for a variety of fauna. The depression will also act as a sink where toxicants, nitrates, and phosphates from the environment.

HGM 5 scored the highest ecosystem services form all the HGM units due to the wide variety of habitats the systems provide for important species. This system plays a very important role for water birds that uses the pans for different lifecycle stages, the pans also play an important role in the assimilation of nitrates and phosphates as well as toxicants that flows from the residential areas into the pans. HGM 5 plays an important role in streamflow regulation as well as sediment trapping from the TSF. The HGM unit has high volumes of hydrophytes that plays an important role in sediment trapping and the assimilation of toxicants from the TSF and thus filters the water for cleaner water downstream.

HGM 6 and 7 have scored "Moderately High". HGM 6 is a grouping of depression wetlands that have good coverage of hydrophytes with surface water present making them a valuable resource point for fauna and hence are important in maintaining biodiversity within a relatively disturbed environment. HGM 7 is a channelled valley bottom wetland flowing from the TSF in the south towards the pans. The HGM unit thus plays an important role in the assimilation of toxicant from the TSF cleaning the water before it reaches bigger water courses.

HGM 8 scored "Intermediate" due to the low cover of hydrophytes within the wetlands. HGM 8 flows from HGM 7 into the surrounding grassland, where the wetland is subjected to overgrazing. The HGM unit is also subjected to erosion that removes high volumes of hydrophytes from the systems, subsequently lowering the potential to provide ecosystem services on a substantial scale.

Attributed to private ownership of most of the land that the wetlands are located within and, the subsequent restricted access to the public, the potential to be used for tourism, recreation and the provisioning of cultural benefits was assumed to be limited.

The results of the ecological Importance and Sensitivity assessment are shown in Table 10. Various components pertaining to the protection status of a wetland are considered for the IS, including Strategic Water Source Areas (SWSA), the National Freshwater Ecosystem Priority Areas (NFEPA). A wetland vegetation (wet veg) threat status and the protection status of the wetland. The IS for both the valley bottoms and the seep (artificial) 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.

Table 10: The IS results for the delineated HGM units

HGM Type	NFEPA Wet Veg			NBA Wetlands			SWSA (Y/N)	Calculated IS
	Type	Ecosystem Threat Status	Ecosystem Protection Level	Wetland Condition	Ecosystem Threat Status 2018	Ecosystem Protection Level		
Unchannelled Valley Bottom (HGM 1, 2, 6 and 9)	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	D/E/F Largely Modified	Critically	Not Protected	N	**High**
Channelled Valley Bottom HGM 3 and 8)	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	A/B Largely Natural	Critically	Not Protected	N	**High**
Depression HGM 4, 5 and 7)	Dry Highveld Grassland Group 3	Least Threatened	Not Protected	A/B Largely Natural	Least Concerned	Not Protected	N	**Moderate**

The Recommended Ecological Category (REC) and Recommended Management Objective (RMO) for the wetland areas was determined from the results of the PES and EIS assessments. These assessments indicated that all wetland features within the site, had to an extent, underwent transformation as a result of historical and current impacts. Nevertheless, despite the altered ecological integrity of these systems, they are considered to provide some important ecological services. The appropriate REC and RMO estimated for the wetland areas is presented in Table 11 below.

Table 11: Summary of the REC and RMO categories assigned to the relevant wetlands

Wetland Unit	REC - RMO
HGM 1	D - Maintain
HGM 2	E - Maintain
HGM 3	D - Maintain
HGM 4	D - Maintain
HGM 5	D - Maintain
HGM 6	E - Improve
HGM 7	D - Maintain
HGM 8	C/D - Improve
HGM 9	E - Improve

It is worth noting that the scientific buffer calculation (Macfarlane et al., 2014) was used to determine the size of the buffer zones relevant to the proposed project. A pre-mitigation buffer of 56m and a post-mitigation wetland and watercourse buffer of 46 m is applicable in relation to the proposed TSF. Furthermore, a 32 m pre-mitigation and 15 m post-mitigation buffer is applicable to the wetlands in relation to the proposed pipelines. The buffer widths are attributed to pre-existing modifications to the wetlands and their immediate surrounding catchment and in consideration that pipelines are linear structures and are not anticipated to have a large impact radius.

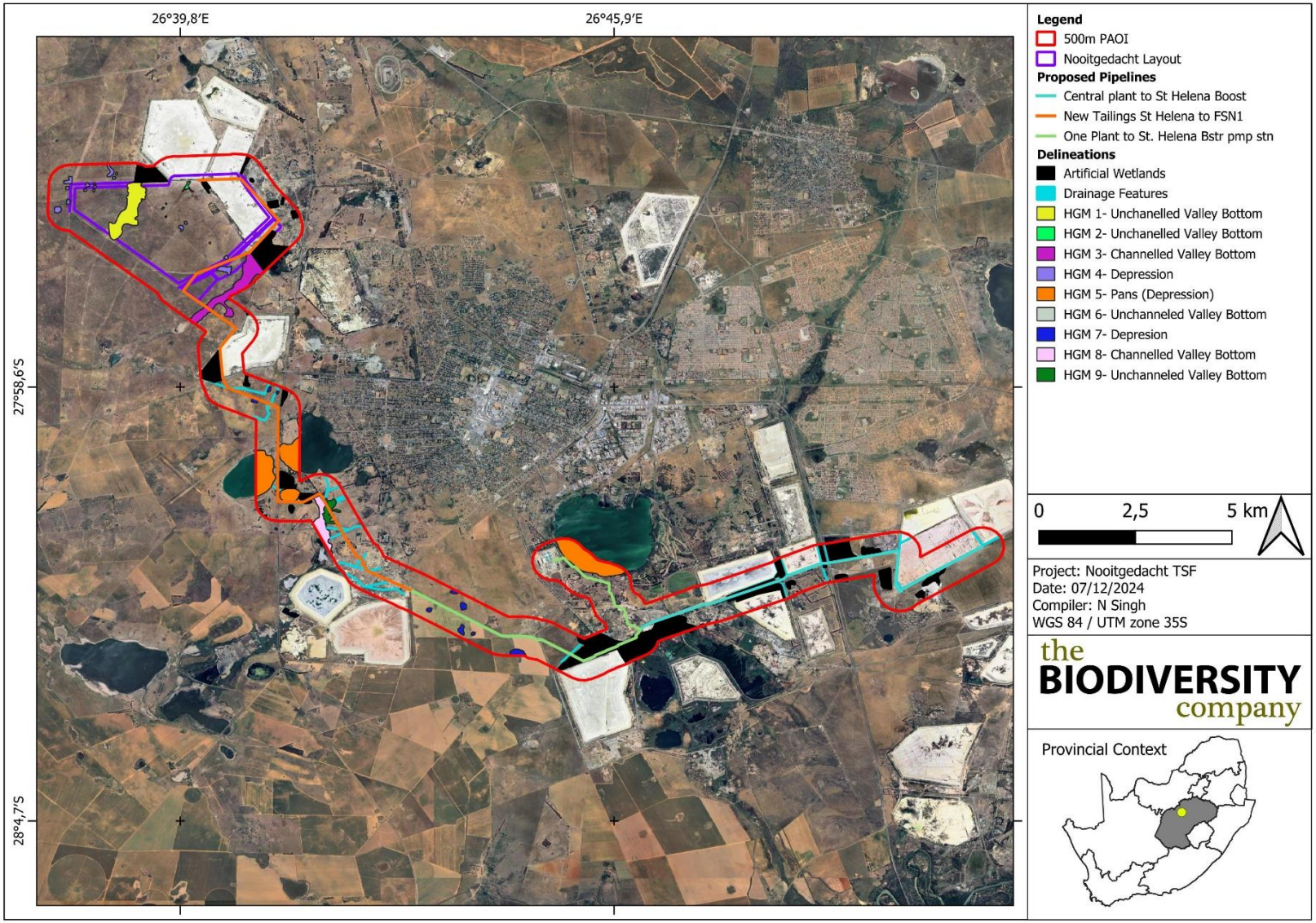


Figure 22: Identified delineated wetlands.

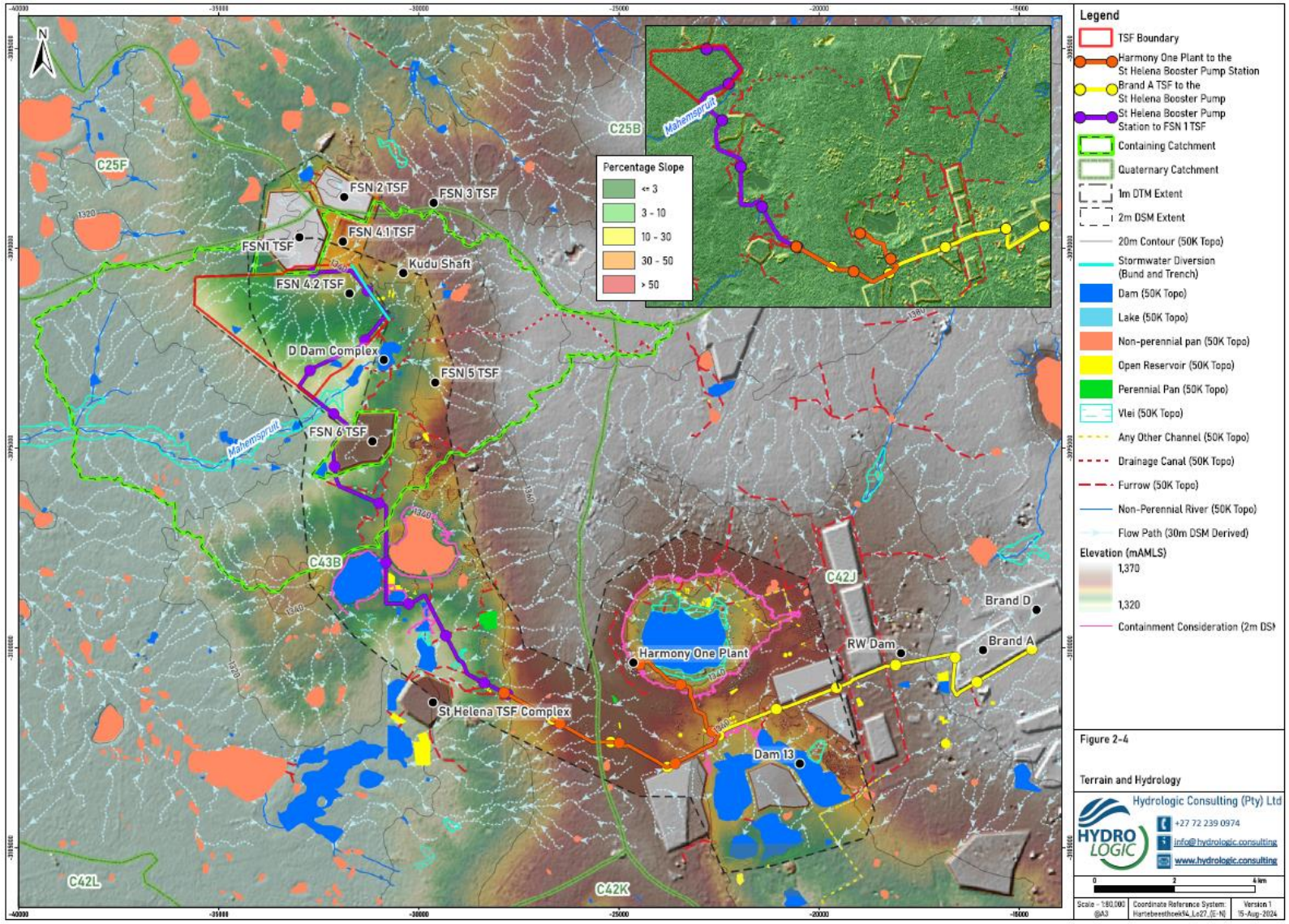


Figure 23: Terrain and Hydrology

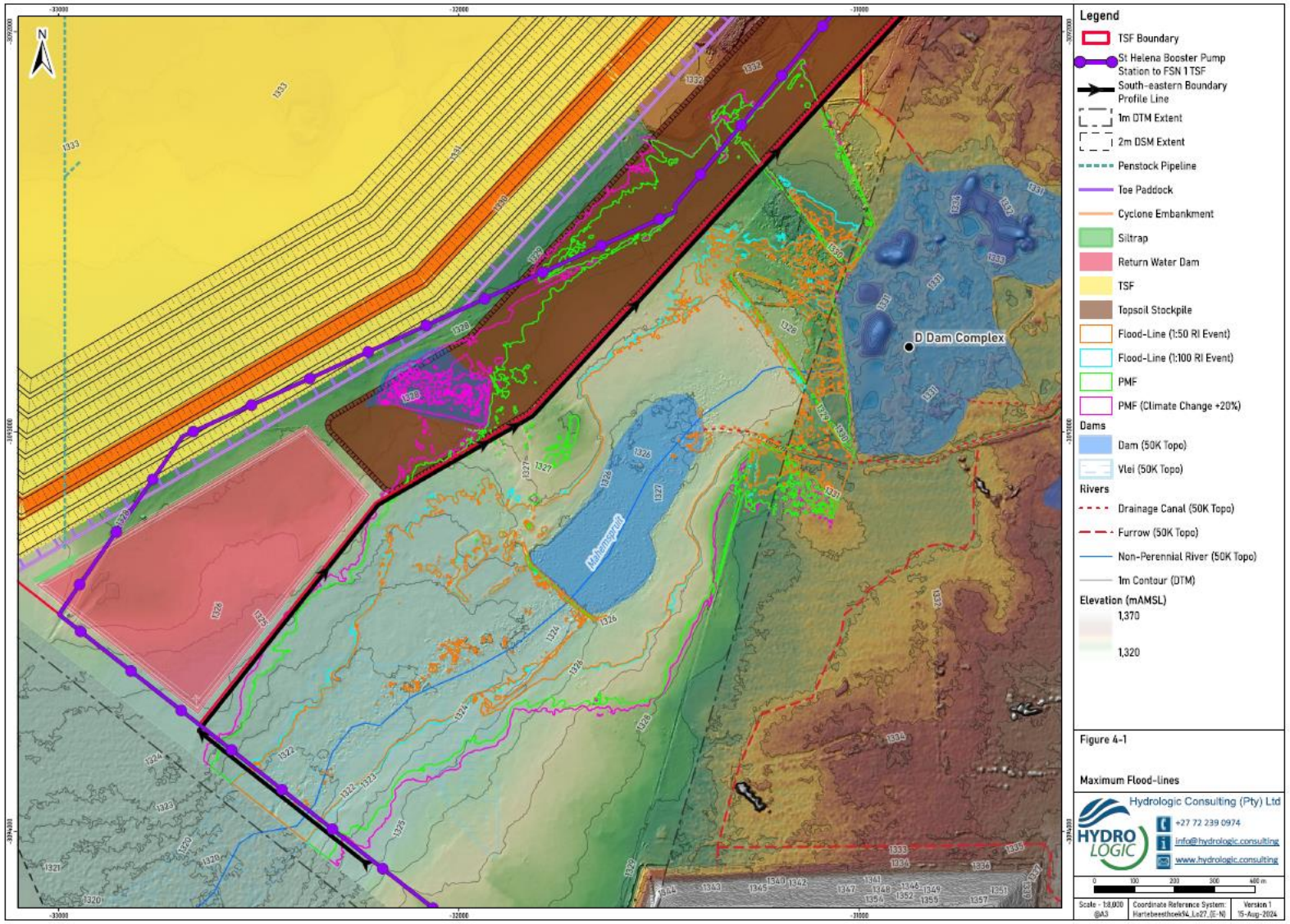


Figure 24: Flood lines in relation to TSF

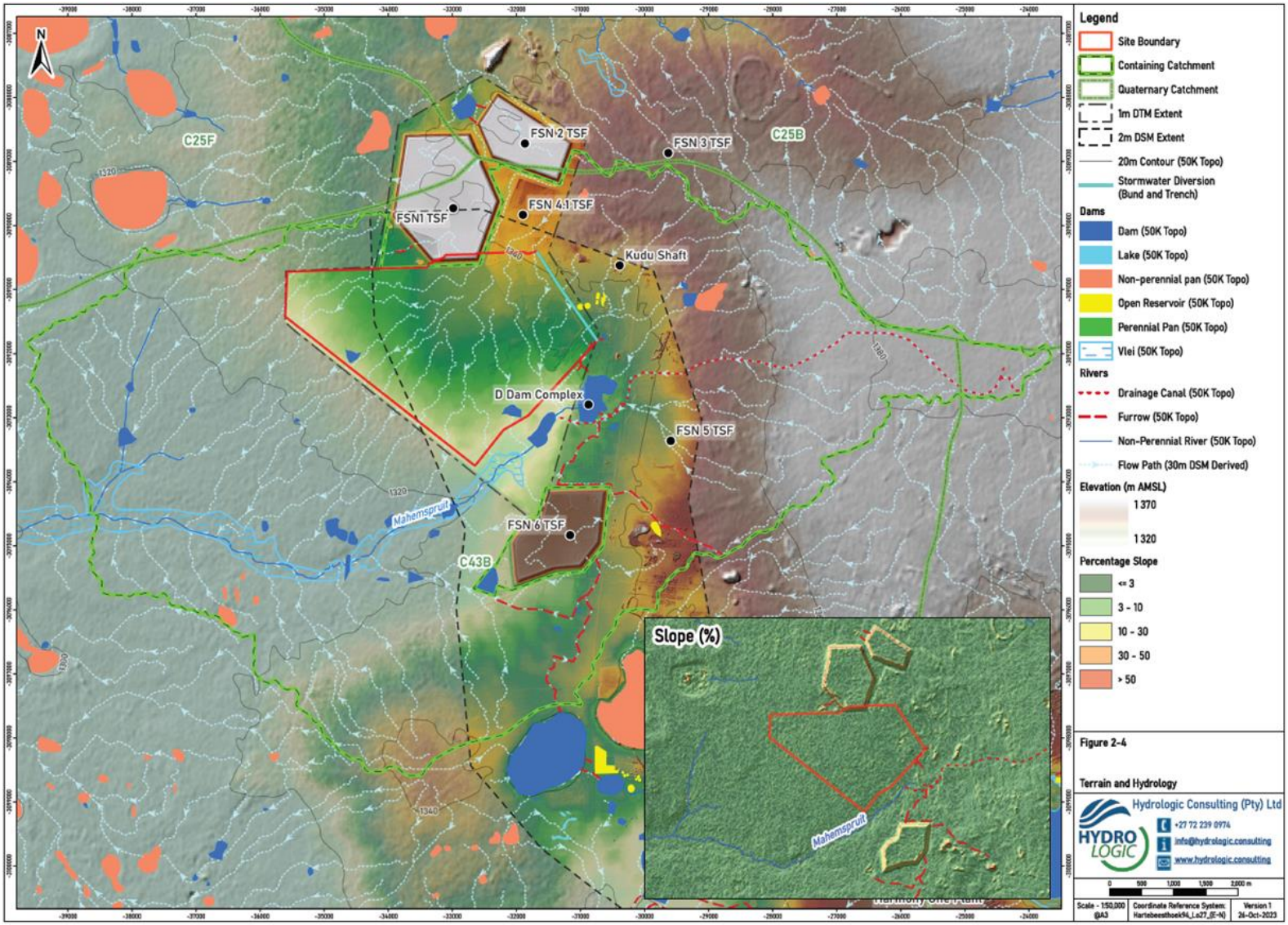


Figure 25: Terrain and Hydrology

4.5.2 SURFACE WATER USES AND QUALITY

This section will establish the current status of surface water sites around the proposed Nooitgedacht TSF. The data was obtained from the Harmony water monitoring for its operations around Welkom. The data in the report was reported on as recently as May 2025. The water quality results are presented in Table 12.

Table 12: Surface water status

Site Name	Date Time	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	Fe mg/l	Mn mg/l
ESW113	2024/03/21 11:05	7.88	619.1	4192	309.4664051	93.7261557	1054.120608	25.8357331	1503.961	992.412	12.017	0.004	0.186752
	2024/09/20 08:12	7.92	838.115	5634	467.5737622	166.2699597	1381.769133	35.9408259	2094.983	1551.781	1.486	0.0728719	0.4256528
	2024/12/18 12:21	7.22	627.485	5984	284.3449	62.9565	902.0342	67.4659	1716.493	627.067	36.182	0.009	1.6377
	2025/03/11 11:04	8.06	120.475	992	72.2339461	23.0183099	130.8466662	23.7763202	137.045	58.994	0.459	7.9941498	2.5199438
	2025/07/01 11:54	7.53	706.23	4821.391	345.361368	115.691158	1308.092371	21.0492836	1998.243	965.402	0.459	0.009	0.0310431
ESW17	2024/01/24 09:39	8	277.4	1734	238.9780377	91.1908932	319.6791543	29.86293	355.832	484.663	0.222	0.6414462	2.4885136
	2024/02/29 16:22	8.13	914.9	4958	190.1284677	20.3926474	2044.408027	21.1019718	2760.554	180.775	0.194	0.004	0.001
	2024/03/21 13:54	8.29	911.7	4846	163.4749872	18.7838094	1827.068804	15.4195928	2962.287	176.68	0.252	0.004	0.1887254
	2024/04/25 14:04	8.15	900.9	4970	159.9034544	16.1275661	1709.110259	17.1055741	2840.806	173.671	0.21	0.1758917	0.0568482
	2024/05/23 15:08	8.35	907.2	5450	161.0245695	15.1879901	1729.180522	13.5422728	2887.383	177.596	0.355	0.004	0.001
	2024/06/20 11:03	8.11	814.9	4738	183.6872472	16.8518393	1794.281456	21.2132962	3257.975	207.9	2.078	0.07326	0.4475611
	2024/07/24 11:10	8.42	926.811	5412	185.1748759	14.809737	1799.342022	20.7462894	2496.425	170.28	1.819	0.004	0.0088608
	2024/08/19 16:29	8.1	883.86	5312	178.0759856	16.2892046	1886.269543	20.7469276	2477.759	159.435	0.317	0.004	0.001
	2024/09/17 12:28	8.21	906.487	4540	158.1889434	14.3763562	1818.173238	12.488043	3123.342	163.998	0.333	0.1104282	0.1884295
	2024/10/23 15:26	7.89	909.115	5260	156.2681402	14.9334516	1712.519145	26.9733141	2924.545	161.844	0.459	0.009	0.001
	2024/11/28 09:32	7.84	918.464	5388	154.3359798	21.0503838	1687.022117	15.3970114	2928.202	179.134	0.745	0.009	0.001
	2024/12/12 12:10	7.95	903.743	5578	153.4776	17.5328	1739.3859	14.3506	3460.031	168.249	0.459	0.009	0.001
	2025/01/24 07:54	8.23	883.747	5360	156.9368945	10.4473294	1815.784653	12.2776655	3022.874	181.692	0.459	0.009	0.001
	2025/02/14 12:13	8.66	909.642	4776	155.9140568	20.0733112	1758.310682	11.4224212	2736.228	143.675	0.459	0.009	0.001
	2025/03/11 12:44	8.24	917.42	6058	155.5403905	18.780734	1726.795346	12.5106703	2954.164	144.445	0.459	0.009	0.001
	2025/04/22 15:18	8.39	868.536	5205.771	164.4829045	14.0393168	1782.985055	13.0932507	2915.742	155.395	0.459	0.009	0.001
	2025/05/21 07:58	8.21	778.697	5382.645	164.9272809	15.4095856	1851.601444	11.849756	3095.792	167.664	0.459	0.009	0.038121
	2025/06/17 16:15	8.33	888.991	5171.615	173.9839861	15.9579032	1751.806338	12.1799063	3008.042	123.92	0.459	0.0101529	0.0575979
	2025/07/15 09:49	8.25	887.615	5158.525	156.5197267	16.3389426	1712.05923	12.1053485	3025.381	166.275	0.459	0.009	0.0223032
ESW17A	2025/04/22 15:34	7.44	382.619	2298.072	80.5469531	11.5010971	676.538	10.90923	959.415	125.143	0.459	0.044463	0.001
	2025/07/14 15:52	7.47	1247.526	7303.861	211.1321371	40.0030644	2390.63	21.7159798	4203.952	359.171	0.459	0.009	0.1341678

Site Name	Date Time	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	Fe mg/l	Mn mg/l
ESW17B	2024/01/23 13:25	7.26	266.7	1546	118.4781814	46.0005529	422.3834893	7.7300294	641.112	200.949	0.299	0.004	0.001
	2024/02/28 16:52	7.18	334.1	2336	135.7427306	65.4719135	588.5604846	6.5940677	782.915	97.337	0.294	0.004	0.2802864
	2024/04/22 16:26	7.07	1974.9	12466	515.851118	76.6429218	3876.041066	55.9957663	6802.358	755.208	0.237	1.9298556	2.5406105
	2024/05/23 15:08	7.32	2364	14064	505.2490237	92.0296789	4353.102853	36.9872272	8132.418	608.971	0.472	0.004	0.68458
	2024/06/20 10:49	6.91	1234.4	9260	413.2117828	67.5361868	2717.809002	42.9295114	4914.229	776.345	2.108	0.6666919	3.0953216
	2024/07/24 10:59	6.94	1324.007	9208	309.5688181	40.2857481	2661.053183	29.847792	3930.486	336.117	1.736	1.4936533	0.4049199
	2024/08/21 14:32	7.51	1391.496	10616	308.5310332	42.4822634	3085.514141	36.2545997	3782.847	306.481	0.194	3.5588504	0.8219215
	2024/09/17 16:50	7.86	1988.614	11566	379.7488392	59.3864805	4140.032325	26.0351425	7160.058	256.91	0.367	18.5342636	1.6084173
	2024/10/30 11:25	8.84	1631.047	10846	468.758255	68.1377171	3571.412314	54.3260626	5822.009	850.39	0.459	0.009	0.001
	2024/11/20 08:44	7.23	983.688	6320	348.6258352	100.7597543	1765.580877	41.0937974	2756.765	774.112	1.349	0.4217193	2.5078448
	2025/01/24 07:44	7.95	230.65	1888	143.8389991	43.3848195	345.2419966	11.1814623	473.9	318.342	0.459	0.1688816	0.1863051
	2025/04/22 15:30	7.72	630.38	3661.788	141.6124918	31.9894388	1208.983886	9.3259384	2008.257	187.863	0.459	0.06086	0.0320263
	2025/05/21 09:12	7.36	938.623	6268.532	225.006737	33.9615296	2159.138053	15.514079	3539.228	208.461	0.459	0.009	0.0771776
	2025/07/14 15:49	7.18	1189.211	7012.681	249.2001868	44.275413	2323.82873	20.7491696	3996.795	283.345	0.459	0.009	0.3108148
MAHEM1	2024/01/23 13:48	6.63	543.3	3738	362.9840629	119.2716839	852.8203883	16.2205511	1282.418	1049.655	0.549	0.004	2.0950779
	2024/04/22 16:31	6.86	539.3	3102	324.126	66.8745651	809.3078721	33.8308279	1316.47	768.804	6.996	0.004	0.427087
	2024/07/24 10:50	7.38	1561.626	9456	353.7096932	48.5496959	3333.324899	34.4309925	4754.457	382.729	1.695	0.004	0.0387088
	2024/08/21 14:39	7.98	1594.822	10352	348.2327841	51.7932887	3604.670441	34.9225846	5857.632	334.044	0.194	0.004	0.001
	2024/09/17 16:54	7.31	1775.584	10206	346.8387649	56.0227856	3861.927334	22.0689945	6433.667	407.1	1.326	6.8963638	2.2770768
	2024/10/22 08:00	7.83	511.429	2944	141.1010237	29.5785943	898.3405628	33.6943114	1504.014	817.45	1.057	0.0151553	0.4300331
	2024/11/20 08:40	7.24	860.026	5410	219.3708815	42.0672088	1631.581026	24.8667392	2608.188	203.981	1.187	0.6608439	4.8171843
	2025/04/23 08:16	7.48	190.332	1049.659	57.1340335	15.708188	235.7687821	17.6033685	413.555	84.443	0.817	0.1122832	0.001
	2025/05/21 09:06	7.51	1014.282	7119.496	240.0179314	46.4822449	2313.126137	13.3036939	4031.512	379.461	0.459	0.009	0.001
	2025/06/17 16:23	7.42	1322.648	8134.436	297.0516665	53.6685772	2691.867135	15.2185901	4592.138	404.645	0.459	0.009	0.0655165
	2025/07/14 15:58	7.3	1251.712	7177.258	268.9159617	55.866967	2421.263332	19.5812973	3918.954	399.969	0.459	0.009	0.0249937
MAHEM2	2024/01/23 14:04	6.19	461.6	3146	325.4244725	112.9842022	647.3818657	13.0365689	923.839	1085.531	1.127	0.004	6.8297307
	2024/02/19 14:45	7.06	526.6	3562	346.3327806	117.859812	835.1318942	26.6032306	1189.122	1123.525	1.262	0.004	1.8092765
	2024/03/21 09:32	7.26	677.4	4676	401.6697031	140.4175664	1217.876849	32.0083889	1595.718	1411.532	7.278	0.004	0.2172861

Site Name	Date Time	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	Fe mg/l	Mn mg/l
	2024/04/25 13:06	7.33	563.4	3906	272.6915448	86.0653469	811.427413	27.3445186	1288.266	889.327	3.309	0.004	0.3851023
	2024/05/21 17:50	7.59	552.8	3242	230.8953987	57.6352356	767.5995071	22.1264724	1351.105	615.56	7.54	0.004	0.0025267
	2024/06/20 08:09	6.75	1326.7	9220	505.586774	100.8034592	2921.042975	34.7528371	5410.854	1091.515	2.033	0.0769022	6.5180199
	2024/07/24 10:05	6.55	1376.467	8392	381.7758309	98.7398287	2679.630813	33.9931683	3750.99	937.7	2.074	0.004	0.6827369
	2024/08/21 15:02	7.42	1569.889	9448	378.7491379	67.5878744	3440.476379	38.5590236	5469.74	463.914	0.194	0.004	3.3595612
	2024/09/17 12:07	7.76	1742.053	9232	458.9618186	96.4832894	3640.303031	32.8567234	5906.057	930.785	1.265	0.004	2.8876736
	2024/10/30 12:08	7.3	1080.3	7500	291.8249338	96.0109674	1805.825331	36.0321332	2264.504	976.297	0.459	0.009	6.5564411
	2024/11/20 08:24	7.21	978.904	5796	297.0874539	92.8995545	1743.848351	21.1891277	2671.588	744.224	1.314	1.0911716	6.1192316
	2024/12/12 11:20	4.64	977.336	8202	558.9244	289.2935	1380.5532	28.0722	2360.491	2568.416	0.528	0.009	16.8834
	2025/01/23 16:38	4.3	877.245	5240	549.8560955	379.2131156	1233.186339	17.9806005	1445.773	3435.76	0.459	0.187027	40.8091393
	2025/03/11 09:51	7.72	96.759	946	66.8565661	13.0113537	107.3074703	4.7393831	145.158	186.812	0.752	0.009	0.011581
	2025/04/23 07:43	7.23	220.845	1430.401	121.6262827	31.3064522	337.2941633	11.0984961	546.642	344.18	0.744	0.009	0.2040648
	2025/05/21 08:59	8.21	865.943	5457.84	234.130435	61.5710406	1750.153952	16.9816484	2908.036	386.279	1.856	0.009	0.001
	2025/06/19 17:27	7.43	623.453	3979.682	209.0962163	58.102808	1152.721612	15.9826105	2004.294	395.996	7.018	0.0140055	0.0487031
	2025/07/14 16:08	7.44	1254.152	7554.347	267.5811727	54.9852379	2413.769124	19.2725736	4309.499	401.014	0.459	0.009	0.0202228
MAHEM4B	2024/01/25 16:04	7.53	1498.8	9782	657.5638389	277.7034476	2696.952086	46.1835836	4178.982	1958.763	0.218	0.004	1.4085436
	2024/02/19 14:10	7.24	1748.4	12096	790.1680909	367.8749121	3635.263351	84.0548661	5503.315	2776.308	0.287	0.004	1.7470144
	2024/03/20 16:03	7.69	2209.1	15318	1027.341375	517.9809376	4932.160869	99.814261	6993.563	3689.718	0.259	0.004	0.3279451
	2024/04/25 12:24	7.7	2422	18014	966.1235203	461.1805948	4616.774	114.6161636	7572.467	3966.673	0.199	0.0723883	0.1562197
	2024/05/21 17:50	7.68	2791.9	19954	1296.768606	557.6387535	4831.53771	123.0395817	8762.006	3229.899	0.568	0.004	1.1394905
	2024/06/21 07:19	7.05	2671.2	23056	1439.617476	662.9234564	6271.460176	175.4179935	9458.254	4301.892	1.47	0.2056675	2.8652964
	2024/07/24 09:10	6.94	3485.567	24608	1524.869101	739.4801305	7171.892913	190.198024	9253.324	4550.192	1.576	0.1122492	13.0979017
	2024/08/22 10:44	7.78	3637.902	25308	1732.088349	836.386608	8267.583272	228.3303171	11350.039	5344.26	0.26	0.004	15.3392241
	2024/09/17 09:21	7.57	4047.873	25232	1500.891468	769.4784771	7064.755934	135.8419231	13411.823	5791.162	1.213	0.6356165	20.5714495
	2024/10/30 13:31	8.6	4461.665	38262	2030.529868	1074.799156	10405.25053	281.34822	15157.436	4958.24	0.459	0.009	9.9837508
	2024/11/28 08:51	7.28	4353.026	32168	11348.04657	5947.041062		1768.810759	15387.746	6472.29	0.459	0.009	53.9009587
	2024/12/12 08:58	7.19	4951.19	42328	2840.21	1489	13690.59	433.5464	19400.557	7636.24	0.459	0.009	28.7958
	2025/01/23 16:05	7.92	2513.728	17688	1941.09717	865.0727124	8138.747508	187.4624989	7673.39	4697.936	0.459	0.009	1.923399

Site Name	Date Time	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO4 mg/l	NO3-N mg/l	Fe mg/l	Mn mg/l
	2025/02/11 11:10	7.86	3004.3	20344	1343.224753	639.3222716	5548.510275	121.4618759	7709.023	4165.173	0.459	0.009	0.001
	2025/03/11 08:43	7.98	1958.257	17236	874.9274082	380.5444867	3330.981108	79.3265273	6249.354	3147.088	0.459	0.009	1.0684759
	2025/04/23 08:51	7.16	106.558	913.511	57.4106804	13.8329625	115.74	9.0875461	186.051	130.766	0.459	0.0763065	0.001
ESW19	2024/01/23 15:48	3.9	797.1	6302	668.1404972	308.690379	1028.564441	4.7667361	1325.098	3005.821	0.587	0.212507	17.1934046
	2024/02/19 14:25	3.81	883.2	6562	699.8638395	361.9879758	1208.923218	37.3551887	1670.813	3611.018	0.476	0.004	23.7769846
	2024/03/20 16:45	3.8	1213.1	10266	690.1854289	489.5337032	1726.641779	45.3751406	2192.231	4625.964	0.381	0.3074437	34.2562343
	2024/04/25 12:47	3.84	1189.5	10418	655.7028036	456.3302231	1626.993426	47.3338372	2262.108	4489.167	0.496	0.995248	26.7346868
	2024/05/24 17:38	3.72	1390.9	11318	688.8399372	492.8922231	1836.841324	46.5582342	2691.331	3620.358	0.194	0.2251353	34.4919569
	2024/06/21 08:01	3.71	1337.3	12270	738.1771282	634.8615599	2218.82939	67.537371	3357.102	5039.733	1.322	0.6028628	41.741561
	2024/07/24 09:40	3.68	2273.429	19298	796.0163908	1106.090489	3819.264523	102.3081752	4442.687	6563.998	1.16	1.4172912	68.8569419
	2024/08/21 15:22	3.47	4027.86	36178	793.8057806	2675.506265	8648.828266	242.7985482	10388.037	12543.89	0.194	2.2536985	160.6574179
	2024/10/30 13:49	4.01	824.194	7976	388.3282949	354.1457928	964.037639	17.9106838	1516.791	3521.899	1.898	0.9913682	18.9415209
	2024/11/28 09:04	4.44	781.675	5872	440.8804655	293.1172455	1014.903039	20.8262461	1494.624	2530.546	1.696	0.0119161	17.7412619
	2024/12/12 09:51	3.9	1145.139	11150	672.834	445.1007	1602.3286	26.15	2482.317	3477.206	1.342	0.56	24.1603
	2025/01/23 16:15	4.04	929.586	8164	508.1250752	423.2323988	1237.668816	14.6996093	1573.988	4116.912	1.108	0.4052925	28.3752845
	2025/02/11 10:48	4.04	1114.913	11378	588.9003303	492.3863484	1414.559532	16.4055906	1903.707	3347.873	1.412	1.1391739	37.3731943
	2025/03/11 08:26	4.04	421.843	3494	256.0654416	124.5085041	421.4069963	7.6929027	714.89	1272.814	0.775	0.3594195	9.6284326
	2025/04/23 08:35	4.57	231.37	1676.565	174.0515161	81.0997362	232.0077211	4.9121187	352.902	792.609	0.586	0.0926388	4.0775961
	2025/05/22 11:49	4.74	247.71	1910.562	187.7463842	98.1007915	280.1333488	5.917801	416.265	911.647	0.642	0.0459122	4.7756444
	2025/06/19 17:08	4.58	305.81	1993.698	173.848	109.8081875	320.0157191	6.9315932	503.53	855.757	0.499	0.0488804	5.1679001
	2025/07/15 10:32	4.6	336.684	2452.512	202.3673296	110.4680086	351.2878158	8.0354963	543.741	1200.914	0.862	0.0655195	5.5654638

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 LP water system. From the LP water system, water will be pumped back to the plants 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 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.

A graphical illustration of the aquifers is presented in Figure 26.

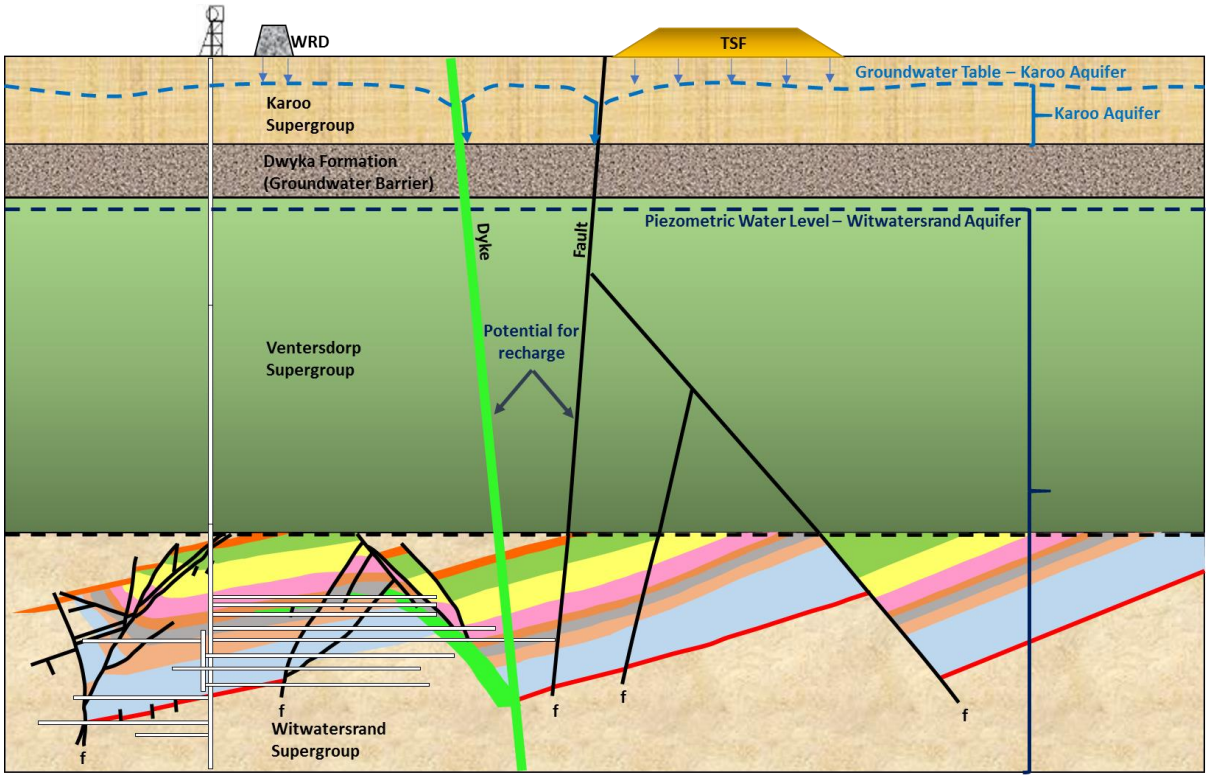


Figure 26: Graphical illustration of the aquifers in the study area

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. Geographical locations where groundwater was sampled for the specialist study are presented in Figure 28 alongside the recommended monitoring locations.

During the specialist study conducted as part of the EIA process, the following is observed:

- The groundwater in the Free State is generally saline and most of the boreholes have EC and 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.

Table 13: 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 14: 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

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 27) 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.

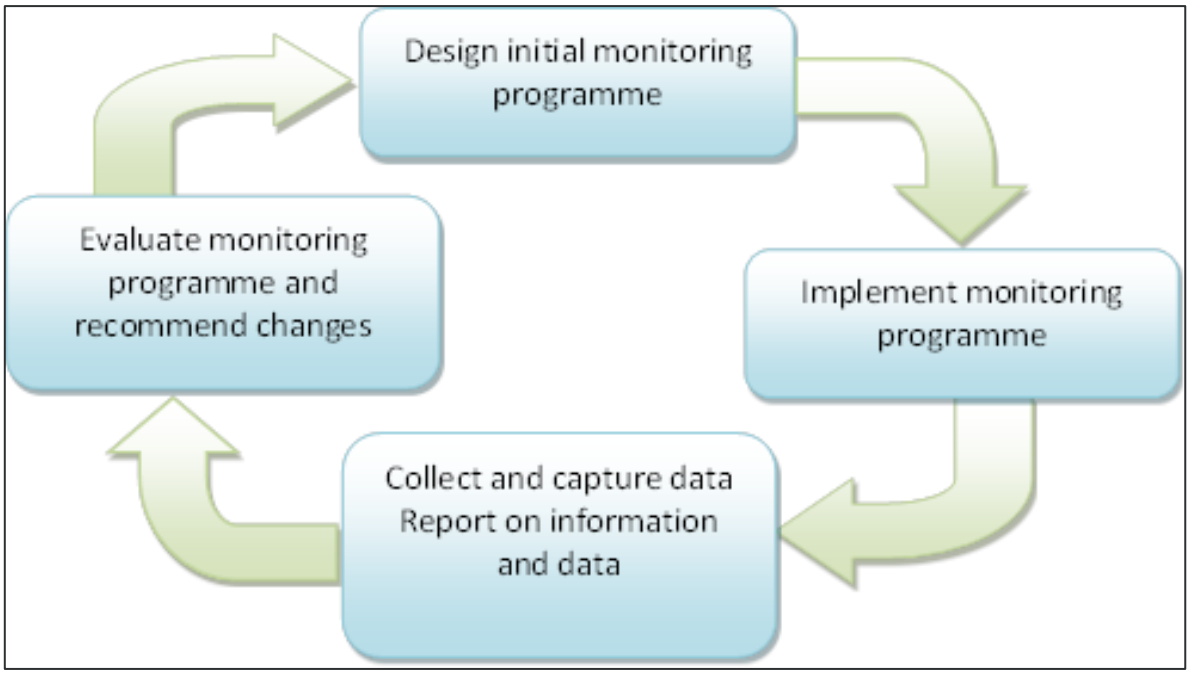


Figure 27: Monitoring process (DWA, 2007)

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 28.

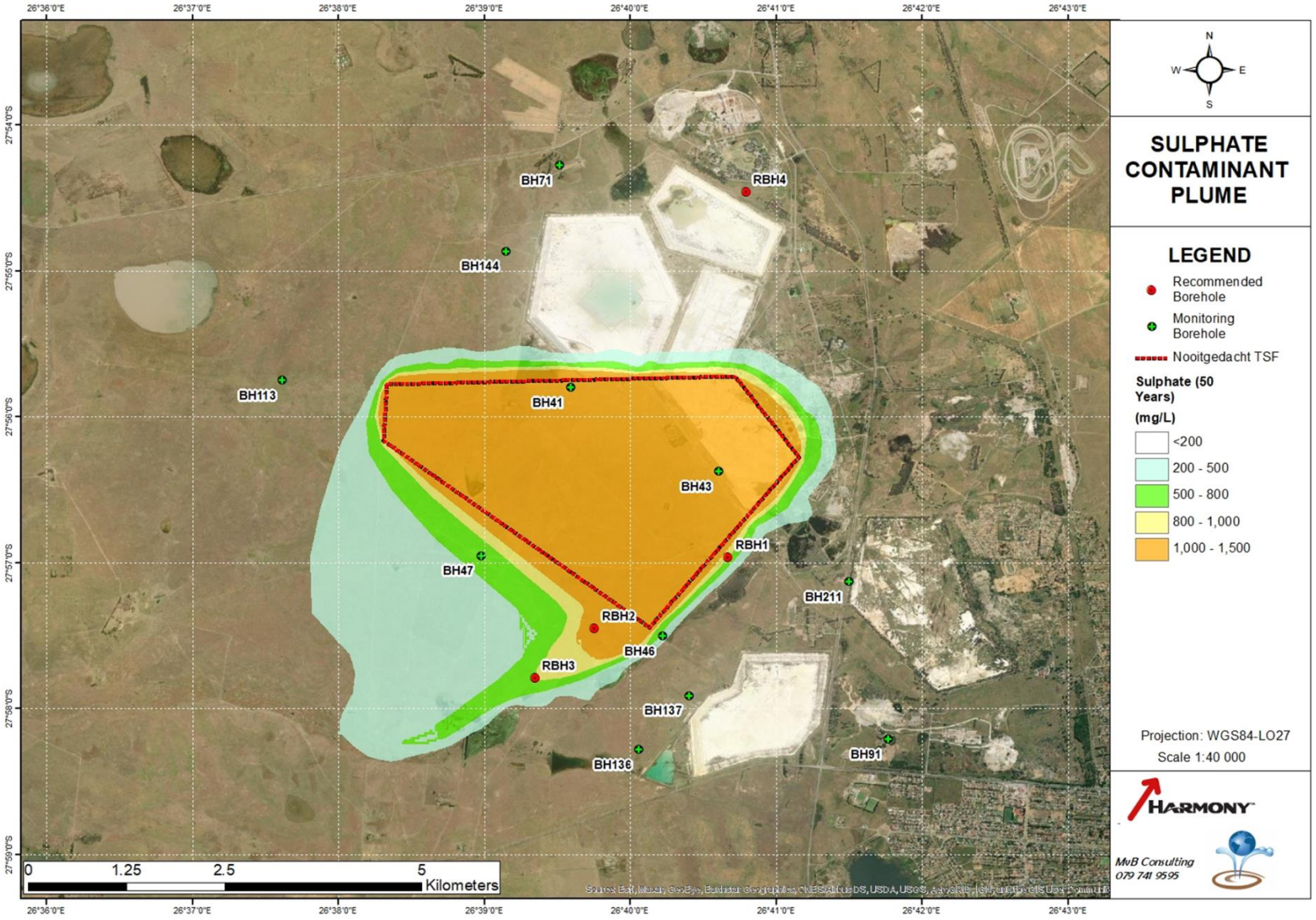


Figure 28:Recommended and existing groundwater monitoring network

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, NO3, NH4, Cl, SO4, F, Fe, Mn, Al, Cr).

4.8 AQUATIC BIO-MONITORING

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

4.9 SITE DELINEATION FOR CHARACTERISATION

The planned TSF will be located on the farm portions mentioned in section 1 of this report and lies adjacent to already existing tailings facilities with return water dams already present adjacent to the site.

4.10 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 TSF as well as non-compliance with the requirements of Regulation GN 704, dated 1999. The water balance estimate is included in Figure 29.

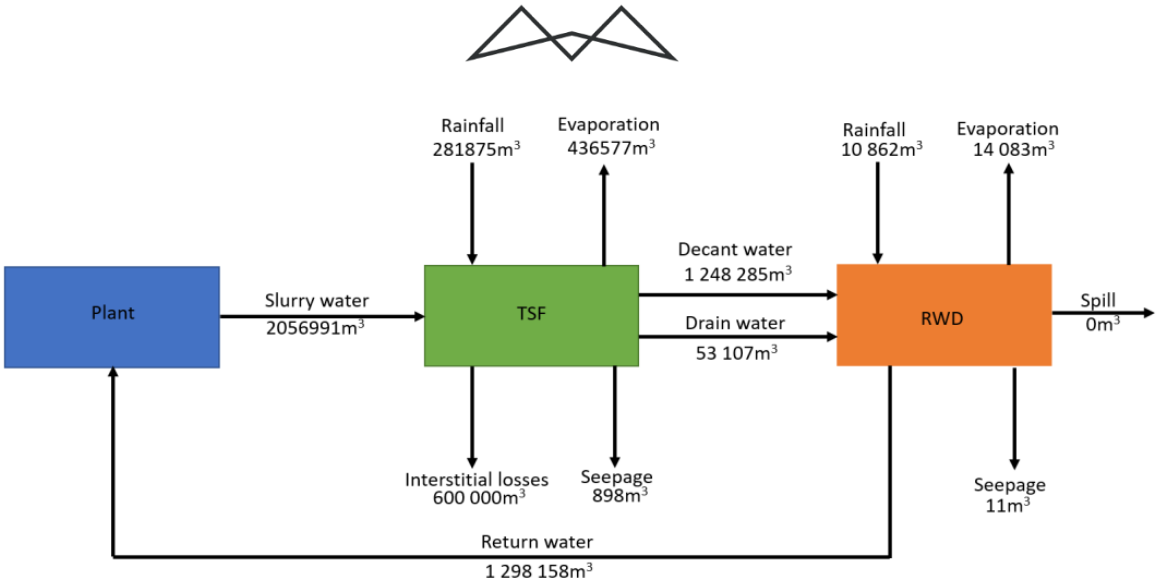


Figure 29: Water balance estimate

4.11 **SOCIO-ECONOMIC**

The Lejweleputswa District Municipality is situated in the northwestern 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 32 286 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 2021/22). 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, tourism, agriculture, gold jewellery, transportation (logistics), and retail (Matjhabeng LM IDP 2022/2023).

The number of households in the study area has increased on all levels (Table 15). The proportionate increase in households were greater than the increase in population on all levels and exceeded the growth in households of 12.3% on a national level. The average household size has shown a decrease on all levels, which means there are more households, but with less members.

Table 15: Population density and growth estimates (sources: Census 2011, Community Survey 2016)

Area	Size in km2	Population 2011	Population 2016	Population density 2011	Population density 2016	Growth in population (%)
Free State Province	129,825	2,745,590	2,834,714	21.15	21.83	3.25
Lejweleputswa DM	31,930	627,626	649,964	19.66	20.36	3.56
Matjhabeng LM	5,155	406,461	428,843	78.85	83.19	5.51

The intensity of poverty experienced refers to the average proportion of indicators in which poor households are deprived (Statistics South Africa, 2014). The intensity of poverty has increased slightly on all levels. The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. The SAMPI score in the Matjhabeng LM area has decreased, suggesting an improvement in some respects relating to poverty in this area (Table 16).

Table 16: Poverty and SAMPI scores (sources: Census 2011 and Community Survey 2016).

Area	Poverty headcount 2011 (%)	Poverty intensity 2011 (%)	SAMPI 2011	Poverty headcount 2016 (%)	Poverty intensity 2016 (%)	SAMPI 2016
Free State Province	5.5	42.2	0.023	5.5	41.7	0.023
Lejweleputswa DM	5.6	42.8	0.024	4.8	42.2	0.020
Matjhabeng LM	5.5	43.0	0.024	4.3	41.8	0.018

Ward 35 has the highest proportion of people of economically active age (aged between 15 years and 65 years) that are employed (Figure 9). Since 2010 employment in the gold mining industry showed a steady decline from 157 019 in 2010 to 93 841 in 2022 (www.mineralscouncil.org.za). As such the proportion unemployed people in the area are likely to have increased since 2011. Ward 35 has the highest average household income (Figure 30), indicating more employed people than on local, district or provincial level.

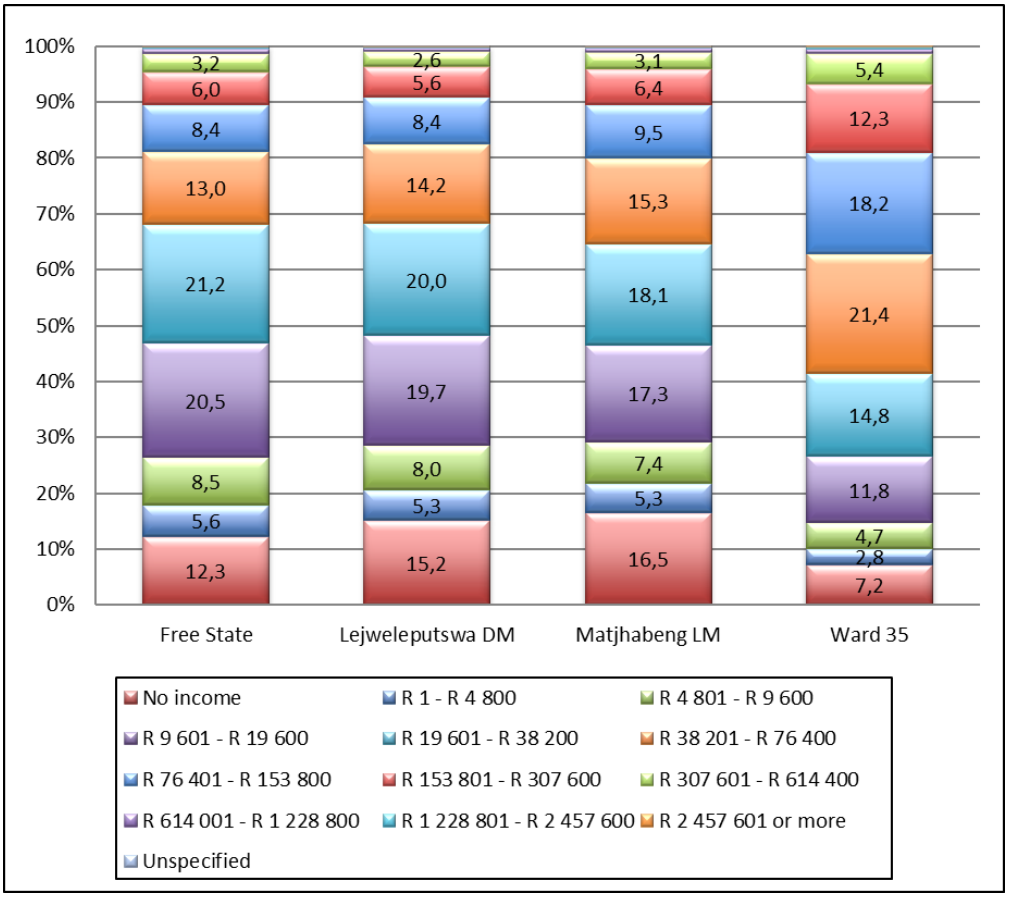


Figure 30: Annual household income (shown in percentage, source: Census 2011)

Ward 35 has the lowest incidence of households that access to water from a local or a regional water scheme, but the highest incidence of households that get their water from another source. Census 2011 does not specify what the 'other' water sources include. Access to piped water, electricity and sanitation relate to the domain of Living Environment Deprivation as identified by Noble et al (2006). Just over three quarters of households in Ward 35 has access to piped water inside the dwelling. This is much higher than on local, district and provincial level. The majority of households in Ward 35 have access to any sanitation services, with the bulk of the households in the ward having access to flush toilets that are connected to a sewerage system.

5 OPERATIONAL MANAGEMENT

The Procedures are in place at the Harmony Nooitgedacht 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 17 below.

Table 17: 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 organisational structure of the facility is presented in Figure 4 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.

5.2 RESOURCES AND COMPETENCE

John van Wyk is currently the Environmental Manager for Harmony Nooitgedacht 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 at the Harmony Nooitgedacht 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 18 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 19 below.

Table 18: Internal communication procedure (ISO 14001:4.1, 7.4.2 – 7.4.3/MHO/00/2018)

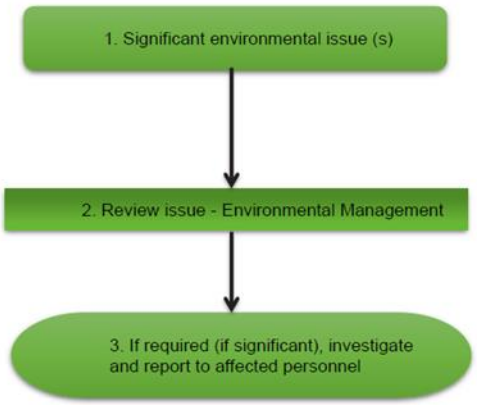
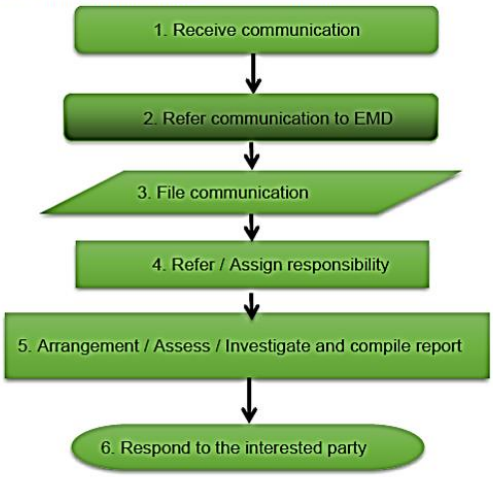
	Internal Communication Process	Notes	Responsibility/Who	When
Internal Communication	**Internal Communication** 	1. Significant environmental issues are communicated through: • Quarterly environmental topics/reports (environmental awareness, on notice boards) • Environmental Policy/EMS Procedures, Aspects • 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 19: 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:

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

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 20 below.

Table 20: 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 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 Table 21.

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 21: Probability/ Likelihood Scoring

Probability	1	Improbable (Rare, the event may occur only in exceptional circumstances, the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <5% chance).
	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 22: 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 Table 23.

Table 23: 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 24: 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 Table 24. The impact priority is therefore determined 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 25).

Table 25: Determination of Prioritisation Factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25

Priority	Prioritisation Factor
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 26: 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.**
<-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.

Table 27: Impact matrix for the Nooitgedacht TSF based on water and soils.

		Pre-Mitigation							Post Mitigation								Priority Factor Criteria			
Impact	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
Impacts on Visual Environment and Sense of Place	Construction	-1	3	2	2	2	3	-6.75	-1	3	2	3	2	3	-7.5	Medium	1	1	1.00	-7.5
Impacts on Visual Environment and Sense of Place	Operation	-1	4	4	3	4	4	-15	-1	4	4	3	4	4	-15	High	2	1	1.13	-16.875
Impacts on Visual Environment and Sense of Place	Rehab and closure	-1	4	2	2	3	3	-8.25	-1	3	2	2	3	2	-5	Medium	2	1	1.13	-5.625
Increase in air quality impacts due to construction of the TSF	Construction	-1	3	2	3	2	4	-10	-1	2	2	3	2	3	-6.75	Medium	1	1	1.00	-6.75
Increase in air quality impacts due to the operation of Valley TSF	Operation	-1	3	4	4	4	3	-11.25	-1	3	4	2	3	3	-9	Medium	1	1	1.00	-9
Increase in air quality impacts due to decommissioning and closure	Rehab and closure	-1	3	2	3	2	4	-10	-1	2	2	3	2	3	-6.75	Medium	1	1	1.00	-6.75
Disturbance / destruction of sites of heritage significance	Construction	-1	2	4	3	5	3	-10.5	-1	1	5	1	2	1	-2.25	Medium	1	1	1.00	-2.25
Disturbance / destruction of palaeontological resources	Construction	-1	1	5	4	5	4	-15	1	1	5	2	5	2	6.5	Medium	1	1	1.00	6.5
Impact on livelihoods	Construction	-1	3	4	5	4	5	-20	-1	2	2	4	3	4	-11	High	3	3	1.50	-16.5
Impact on livelihoods	Operation	-1	3	4	5	3	5	-18.75	-1	3	4	4	4	4	-15	High	3	3	1.50	-22.5
Impact of community expectations and social licence to operate	Construction	-1	4	4	4	3	5	-18.75	-1	3	3	3	3	4	-12	High	3	2	1.38	-16.5
Impact of community expectations and social licence to operate	Operation	-1	3	4	4	3	4	-14	-1	2	2	3	3	4	-10	High	2	2	1.25	-12.5
Impact on health and wellbeing	Construction	-1	2	2	3	3	5	-12.5	-1	2	2	3	3	4	-10	High	2	1	1.13	-11.25
Impact on health and wellbeing	Operation	-1	2	3	5	4	5	-17.5	-1	2	2	3	3	4	-10	High	2	1	1.13	-11.25
Impact on health and wellbeing	Decommissioning	-1	2	3	5	3	5	-16.25	-1	2	2	4	3	4	-11	High	2	1	1.13	-12.375

Economic impacts from social perspective	Construction	1	3	2	4	2	4	11	1	3	3	4	2	4	12	High	2	1	1.13	13.5
Economic impacts from social perspective	Operation	1	3	3	4	2	4	12	1	2	2	3	2	3	6.75	High	3	3	1.50	10.125
Increase in social pathologies	Construction	-1	3	2	4	3	4	-12	-1	3	3	4	3	4	-13	High	2	1	1.13	-14.625
Noise impacts	Construction	-1	1	1	2	1	2	-2.5	-1	1	1	1	1	2	-2	Medium	1	1	1.00	-2
Noise impacts	Operation	-1	1	1	2	1	2	-2.5	-1	1	1	1	1	2	-2	Medium	1	1	1.00	-2
Noise impacts	Decommissioning	-1	1	1	2	1	2	-2.5	-1	1	1	1	1	2	-2	Medium	1	1	1.00	-2
Noise impacts	Rehab and closure	-1	1	1	2	1	2	-2.5	-1	1	1	1	1	2	-2	Medium	1	1	1.00	-2
Exhalation and dispersion of radon gas to the atmosphere during the operational phase of the Projects	Operation	-1	2	5	1	3	2	-5.5	-1	2	5	1	3	1	-2.75	Medium	1	1	1.00	-2.75
Emission and dispersion of particulate matter that contains radionuclides to the atmosphere during the operational phase	Operation	-1	2	5	1	2	2	-5	-1	2	5	1	2	1	-2.5	Medium	1	1	1.00	-2.5
Implementation of the NNR-approved decommissioning plan	Rehab and closure	1	2	5	4	5	4	16	1	2	5	4	5	4	16	Medium	1	1	1.00	16
Reclamation of existing Harmony TSFs	Operation	1	4	5	5	5	4	19	1	4	5	5	5	5	23.75	Medium	3	1		0
Exhalation, emission and dispersion of radon gas and particulate matter that contains radionuclides during the post-closure phase	Rehab and closure	-1	2	5	1	2	2	-5	-1	2	5	1	2	1	-2.5	Medium	1	1	1.00	-2.5
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	5	4	3	4	-15	-1	3	3	3	3	3	-9	Medium	2	2	1.25	-11.25

Introduction of alien and invasive species, especially plants;	Construction	-1	3	4	3	3	3	-9.75	-1	2	3	3	2	2	-5	Medium	2	2	1.25	-6.25
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	5	5	4	5	-21.25	-1	3	5	4	3	5	-18.75	Medium	2	3	1.38	-25.7815
Potential leaks, discharges, pollutant from machinery and storage leaching into the surrounding environment.	Construction	-1	3	3	3	3	3	-9	-1	3	3	1	3	2	-5	Medium	2	2	1.25	-6.25
Continued encroachment of an indigenous vegetation community by alien invasive plant species as well as erosion due to disturbed soils	Operation	-1	3	4	3	3	3	-9.75	-1	2	3	3	3	2	-5.5	Medium	2	2	1.25	-6.875
Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Operation	-1	3	5	4	3	4	-15	-1	3	5	4	2	4	-14	Medium	2	3	1.38	-19.25
Potential leaks, discharges, pollutant from the TSF spreading into the surrounding environment.	Operation	-1	2	3	4	2	4	-11	-1	2	3	3	2	4	-10	Medium	2	2	1.25	-12.5

Loss of land capability, Soil compaction, Soil erosion, Land degradation, Nutrient and water storage	Planning	-1	3	3	4	4	3	-10.5	-1	1	1	1	1	1	-1	Low	1	1	1.00	-1
Loss of land capability, Soil compaction, Soil erosion, Land degradation, Nutrient and water storage	Construction	-1	3	4	4	3	4	-14	-1	2	3	3	3	3	-8.25	High	2	3	1.38	-11.34375
Loss of land capability, Soil compaction, Soil erosion, Land degradation, Nutrient and water storage	Operation	-1	3	3	3	3	3	-9	-1	2	3	2	3	2	-5	Medium	2	3	1.38	-6.875
Loss of land capability, Soil compaction, Soil erosion, Land degradation, Nutrient and water storage	Decommissioning	-1	2	2	2	3	3	-6.75	-1	2	2	1	3	2	-4	Low	2	2	1.25	-5
Loss of land capability, Soil compaction, Soil erosion, Land degradation, Nutrient and water storage	Rehab and closure	-1	2	2	2	2	2	-4	-1	2	2	1	2	1	-1.75	Low	1	2	1.13	-1.96875
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 and potential for erosion	Construction	-1	2	1	3	3	3	-6.75	-1	2	1	2	3	3	-6	High	2	2	1.25	-7.5
Degradation of wetland vegetation and the 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	Construction	-1	2	1	3	3	2	-4.5	-1	2	1	2	3	2	-4	High	2	2	1.25	-5

with human sewerage and other waste.																			
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
Siltation of water resources	Operation	-1	2	4	2	3	3	-8.25	-1	2	4	2	3	3	-8.25	High	2	2	1.25	-10.3125
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	Operation	-1	3	3	3	3	4	-12	-1	2	2	3	3	4	-10	Medium	2	2	1.25	-12.5
Cumulative groundwater contamination	Operation	-1	3	4	3	3	4	-13	-1	2	3	3	3	4	-11	Medium	2	2	1.25	-13.75
Groundwater contamination	Decommissioning	-1	3	3	3	3	4	-12	-1	2	2	2	3	3	-6.75	Medium	2	2	1.25	-8.4375
Cumulative groundwater contamination	Decommissioning	-1	3	4	3	3	4	-13	-1	2	2	2	3	3	-6.75	Medium	2	2	1.25	-8.4375
Soil Erosion	Construction	-1	4	4	3	3	4	-14	-1	1	2	2	2	3	-5.25	Medium	2	1	1.13	-5.90625
Soil Erosion	Operation	-1	3	4	2	2	4	-11	-1	1	2	2	2	3	-5.25	Medium	2	2	1.25	-6.5625
Pollutants Entering the Surface Water Environment	Construction	-1	4	2	3	5	4	-14	-1	3	2	1	3	2	-4.5	Medium	2	1	1.13	-5.0625
Pollutants Entering the Surface Water Environment	Operation	-1	5	4	5	5	3	-14.25	-1	5	2	5	5	2	-8.5	Medium	2	3	1.38	-11.6875
Decrease in Runoff	Construction, operation, decommissioning	-1	4	4	2	5	5	-18.75	-1	4	4	2	5	5	-18.75	Medium	2	1	1.13	-21.09375
Decrease in Runoff	Rehab and closure	-1	4	4	2	5	5	-18.75	-1	1	1	1	1	5	-5	Medium	2	1	1.13	-5.625
flood Risk	All phases	-1	4	1	5	5	1	-3.75	-1	4	1	5	5	1	-3.75	Medium	1	3	1.25	-4.6875
Traffic Related Impacts	Construction	-1	2	2	4	5	3	-9.75	-1	2	2	3	3	1	-2.5	Medium	2	2	1.25	-3.125
Erosion due to overland flow	Construction	-1	2	3	3	3	3	-8.25	-1	1	2	2	2	2	-3.5	Medium	2	1	1.13	-3.9375

Decrease in subsurface flows and return flows	Construction	-1	3	3	3	3	3	-9	-1	2	2	2	2	2	-4	Medium	2	1	1.13	-4.5
Erosion due to overland flow	Operation	-1	2	2	3	2	3	-6.75	-1	1	2	2	2	2	-3.5	High	2	1	1.13	-3.9375
Decrease in subsurface flows and return flows	Operation	-1	2	3	3	3	3	-8.25	-1	2	2	2	2	2	-4	High	2	1	1.13	-4.5
Erosion due to overland flow	Rehab and Closure	-1	2	2	1	2	2	-3.5	-1	1	1	1	1	2	-2	Medium	2	1	1.13	-2.25
Decrease in subsurface flows and return flows	Rehab and Closure	-1	2	2	2	2	2	-4	-1	1	1	1	1	2	-2	Medium	2	1	1.13	-2.25

6.4 CONSTRUCTION PHASE IMPACTS

This section describes the potential construction phase impacts.

6.4.1 SURFACE WATER QUALITY

The removal of vegetation during the construction of infrastructure, stripping of topsoil and construction of the TSF footprint area increases the erodibility of soils which implies a higher silt loading of water running over exposed soil.

The probability that surface water quality may be negatively impacted is likely to occur during the removal of vegetation and topsoil and construction of surface infrastructure:

- Sedimentation caused by runoff from cleared areas;
- Sedimentation caused by dust deposition. And;
- Increase in erosion due to stormwater runoff.

Spillages from the earthmoving equipment during the construction phase may result in the contamination of runoff with hydrocarbons. Due to the nature of tailings material, it is likely that spillages will occur. However, the spillage will be contained to the immediate site and cleaned within a reasonable time and with the necessary materials. The materials will be disposed-off to a suitably qualified licenced site.

Water quantity in the quaternary catchment will also be impacted due to the following:

- The development of haul roads and access roads will negatively impact on the quantity of water that reports back to the watercourse.

6.4.2 GROUNDWATER QUALITY:

The potential spillage of hydrocarbons from construction machines during the construction of infrastructure, topsoil and overburden stripping, opencast areas construction and haul road construction has the potential to cause the pollution of groundwater resources. The risk is low and localised and of short term. However, if one large spill from a hydrocarbon tanker occur this may have a severe negative impact over a longer time.

6.4.3 GROUNDWATER QUANTITY

The establishment of hard paved areas during infrastructure construction and haul road construction reduces the recharge of aquifers due to increased runoff. This is normally a low impact, localised and short duration, however if not mitigated and carefully managed large-scale erosion could be the end product, which potentially could have a negative long-term impact.

The establishment of the opencast areas is expected to have a negative effect on the surrounding aquifers within the immediate area which can cause lowering of water levels in boreholes below actual total depth, causing adjacent boreholes to become decommissioned.

6.5 OPERATIONAL PHASE IMPACTS

During the operational phase the activities that are undertaken include but may not be limited to the following:

- Deposition of slimes;
- Use and maintenance of haul roads and construction equipment;
- Concurrent rehabilitation; and
- Potential seepage of wastewater from slimes.

6.5.1 SURFACE WATER

Operational activities will result in the contamination of surface water due to hydrocarbon spillages from mining equipment. The spillage will be contained to the immediate working area or site and cleaned within a reasonable

time with the necessary materials. The contaminated materials will be disposed of responsibly to a suitably qualified licenced site.

Runoff occurring from haul roads during the application of water for dust suppression and or rainfall events will contain high concentrations of suspended solids, salts and potentially some hydrocarbons. This impact will occur for the duration of the life of the TSF, but it will be contained to the immediate site.

6.5.2 GROUNDWATER

The establishment of hard paved areas during infrastructure construction and haul road construction reduces the recharge of aquifers due to increased runoff. Low potential and very localised with short duration. The removal of vegetation during topsoil and overburden pre-stripping for haul road construction reduces the recharge of rainwater to aquifers due to increased run-off. Low potential and very localised with short duration. Since the materials to be deposited is wet material, the potential of seepages of the process water beyond protective measures does exist.

6.6 DECOMMISSIONING AND REHABILITATION

The decommissioning and rehabilitation phase will include the following activities:

- Removal of the infrastructure;
- Rehabilitation of the void;
- Spreading and levelling of subsoil and topsoil;
- Re-vegetation of areas disturbed; and
- Profiling and countering the area to assist drainage lines.

6.6.1 SURFACE WATER

The removal of infrastructure is likely to negatively impact on surface water through contamination of clean water runoff from leakage or seepage of removed waste material, and hydrocarbon contamination from vehicular activity. Although this impact will have a medium low significance prior to the implementation of mitigation measures it will be for the duration of the decommissioning phase and it will restore the area that was previously occupied by the infrastructure back to the runoff catchment.

6.6.2 GROUNDWATER

The quality of groundwater will be impacted upon by deposition. Although not much can be done about the actual groundwater quality, mitigation is required to prevent the deterioration of the surface water quality. The footprint area might produce a seepage zone or decant. Mitigation is not economically possible and the only reasonable control measures are to contain the polluted water and to prevent minimise recharge (closed circuit).

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.

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.

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 Basic Assessment 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 INTERRESTED 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.

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.

7.2.2 LIST OF ORGANS OF SATET 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

7.2.3 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 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.

7.3.2 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.

7.3.3 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.

7.3.4 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 28 provides a summary of the opportunities provided to I&APs for participation in the public participation process to date.

Table 28: Opportunities Provided for Public Participation

PUBLIC PARTICIPATION PHASE			
ACTION	**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.	**17 June 2025**
	Placement of site notices.	Ten (10) A2 site notices (English, Afrikaans and Setswana) and three (3) A3 poster notices within and around the study area (13 placement locations).	18 June 2025
	Newspaper advertisement	Vista News Newspaper (in English, Afrikaans, and Sesotho)	**12 June 2025**
		Notices were placed in the Welkom News Newspaper	13 June 2025
		National Government Gazette (in English, Afrikaans, and Sesotho) on	**20 June 2025**

PUBLIC PARTICIPATION PHASE			
ACTION	DESCRIPTION	PUBLICATION/PLACE	DATE
IWWMP Availability	Proposed public review timeframes for the IWWMP	DSR and IWWMP placed in the Welkom Public Library	TBC

7.4.1 PROPOSED PUBLIC REVIEW TIMEFRAMES FOR THE IWWMP

The Integrated Waste and Water Management Plan will be made available to all I&APs for 60 days. 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 accompanied the Integrated Waste and Water Management Plan.

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 Nooitgedacht 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:

- The solution trench is 150mm thick reinforced concrete lined. It is 1m deep with side slopes of 1V:1.5H and a base width of 1m. The designed maximum flow depth in the channel is 800mm and accommodates the maximum peak discharge from the penstock.
- A concrete lined solution trench will be installed since the effluent is contaminated dirty water. This will prevent seepage of the drain effluent into the underlying soils. It also provides a durable surface for cleaning and maintenance.
- An HDPE liner was considered as an alternative to the concrete lined trench. The liner would however be exposed. This will result in UV deterioration over time, potential animal puncturing, and also cleaning and maintenance damage. This will result in continuous or regular repairs over the operation period of the facility and post closure. This design was therefore abandoned in favour of the concrete lining.
- The solution trench conveys effluent from the drain outlets, penstock, and other contaminated water from the facility to the silt trap of the RWD.
- The drainage collector sump is situated to the south-west of the TSF. The sump has been designed to accommodate a volume of 110 m3. Water collected in the sump will be pumped by a vertical spindle pump into the solution trench to the east of the sump and flow to the RWD.

9.3 PERFORMANCE OBJECTIVE GOALS

The following key performance objectives have been identified for the Harmony Nooitgedacht TSF as stated in Table 29.

Table 29: 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 Nooitgedacht 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 Nooitgedacht 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 Nooitgedacht TSF
- Cumulative groundwater contamination

9.6 PROJECT ALTERNATIVES

As this application relates only to a new TSF and associated pipelines, 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 part of a 2008 study completed by Golder Environmental. Additional newer site options were also assessed. The Nooitgedacht site remains the only viable and suitable site alternative identified at this stage.

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, Central Plant and Saaiplaas 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. Details regarding the height and slope gradient of the facility will be discussed in the EIA report once engineering designs are complete.

The EIA process being undertaken includes 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.

9.6.3 TECHNOLOGY ALTERNATIVES

The only 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. Liner requirements will be discussed in further detail in the EIA phase report.

There are 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.

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.

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. 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.

Currently cyclone deposition is the vastly preferred method of deposition for the majority 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. The Nooitgedacht TSF is designed to have a mix of Spiggot and Cyclone deposition in the areas as shown in the diagram below. As such no other deposition methods or technologies will be considered in the EIA phase and cyclone deposition along with Spiggot deposition is nominated as the preferred alternative.

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. The current planned Life of Mine (LOM) of the Free State operations exceed the available deposition capacity of these TSFs and the applicant is therefore proposing to construct the proposed Nooitgedacht TSF to cater for this additional capacity 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. The current planned Life of Mine (LOM) of the Free State operations exceed the available deposition capacity of these TSFs and the applicant is therefore proposing to construct the proposed Nooitgedacht TSF to cater for this additional capacity. The no go option would mean that the new TSF project and associated pipelines would not proceed and this would therefore negatively affect the future viability of Harmony's Welkom mining operations from late 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 Nooitgedacht TSF is indicated in Table 30. This table outlines the impacts, objectives, performance indicators and mitigation measures that need to be implemented.

Table 30: IWWMP action plan

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
10.1 SITE ESTABLISHMENT						
Construction camp sewage management **Dust suppression**	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	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
Earthworks **Fencing** **Hazardous substances management** **Site security**	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

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Soil Management **Truck and heavy machinery operation** **Utilization of portable toilets and generation of sewage** **Vegetation clearance**		Groundwater quality impacts Long-term groundwater quality, and radiation impacts				
	Construction	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 Disruption of wetland soil profile and alteration of hydrological regime Erosion due to storm water runoff Groundwater quality impacts	A waste storage area must be established within the site camp/construction camp that provides for appropriate and adequate waste 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 .	Avoid environmental Pollution	ECO report	Environmental Manager 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	Protect watercourses and sources of water.	ECO report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			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.	Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.		
	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	Construction Operation	Impacts on wetlands Land degradation	Any equipment that may leak, and does not have to be transported regularly, shall be placed on watertight drips trays	Protect watercourses and sources of water.	ECO report	Environmental Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Water management Infrastructure construction **General Construction** **TSF operations**	Decommissioning Rehabilitation and Closure	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	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.	Prevent soil contamination Avoid pollution caused by fuel spillages and improper storage of materials.	Waste manifests	
Maintenance and operation of site infrastructure and facilities **General decommissioning activities**	Construction Operation Decommissioning	Long-term groundwater quality, and radiation impacts	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. 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,	ECO report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
				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 (washing of visible signs into the ground is not acceptable); and All excess aggregate shall also be removed.	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 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 refuelling (e.g. a sealed	Protect watercourses and sources of water. Prevent soil contamination Avoid pollution caused by fuel spillages and	ECO report	Environmental Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			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.	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

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Construction Operation Decommissioning		Hazardous waste may only be disposed of at a licensed hazardous waste disposal facility. A specialist waste contractor shall dispose of such waste and shall be required to provide waste manifests and safe disposal certificates. The 'cradle-to-grave' principle must be complied with.	No contamination of the surrounding environment will occur.	ECO Report Waste Manifest	Environmental Manager Site Manager
	Construction Operation Decommissioning	River and surface water flood risk	The concrete LP Water System (tanks) are to be established above-ground on a concrete foundation slab which will improve flood resistance.	Minimise flood risk to infrastructure	ECO Report	Environmental Manager Site Manager
	Construction Decommissioning	Erosion of Soils	Ensure Low Pressure Water Supply System stability by ensuring that the foundation of the concrete slab is not undermined by erosion.	Stability of the low pressure water supply system.	ECO Report	Environmental Manager Site Manager
		Pollutants entering the surface water environment	Develop the TS, pipelines, and LP Water System using sound engineering to limit the likelihood of a failure. Keep pipelines and LP Water System well-maintained to prevent leakage Monitor pipelines and LP Water System to identify any leaks. Monitor the LP Water System to identify any potential failures.	Prevent contamination of the surrounding environment and surface water by ensuring that adequate maintenance is carried out along with frequent inspections.	ECO Report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Construction	Pollutants Entering the Surface Water Environment	Develop the TSF, pipelines, and LP Water System using sound engineering to limit the likelihood of a failure.	Prevent the failure of infrastructure.	ECO Report	Project Engineer Environmental Manager Site Manager
			Keep pipelines and LP Water System well-maintained to prevent leakage. Monitor pipelines and LP Water System to identify any leaks.	Prevent contamination of the surrounding environment and surface water by ensuring that adequate maintenance is carried out along with frequent inspections.	ECO Report Audit Report	Environmental Manager Site Manager
	Rehabilitation	Pollutants Entering the Surface Water Environment	Monitor the pipelines and LP Water System to identify any potential failures/leaks.	Prevent contamination of the surrounding environment and surface water by ensuring that adequate maintenance is carried out along with frequent inspections.	ECO Report Audit Report	Project Engineer Environmental Manager Site Manager
10.3 WASTE MANAGEMENT						

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Maintenance and operation of site infrastructure and facilities **Site establishment** **Construction**	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
TSF operations **Maintenance and operation of site infrastructure and facilities**	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
General decommissioning activities	Construction Operation Decommissioning		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 bins will be responsibly emptied and secured. Temporary storage of	Avoid pollution caused by fuel spillages and improper storage of materials Limit the spread of pollution due to waste storage	Waste manifest ECO Report Audit report	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			domestic waste shall be in appropriate receptacles.			
	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	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
					Audit reports	
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	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	Groundwater quality impacts Long-term groundwater quality, and radiation impacts	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	Prevent soil contamination Prevent pollution of water sources	ECO report Waste certificate	Environmental Manager Site Manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Rehabilitation and Closure		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 pollution of groundwater		
	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	Construction	Erosion due to storm water runoff	Make sure that the function of HGM 1 will be the same after the upgrades to	Avoid contamination of wetlands	ECO Reports	Environmental Control officer

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
General Construction **TSF Operations** **General decommissioning activities**		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	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 loss of wetland habitats Avoid the loss of biodiversity in wetlands Prevent the pollution of water sources Prevent pollution of watercourses	Surface water quality monitoring Biodiversity monitoring	Environmental manager Site manager
	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	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

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Operation		Contain wastewater in a 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	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.	Prevent the pollution of groundwater	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		ECO Reports Biodiversity monitoring	Environmental Control officer Environmental manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
	Rehab and closure		in or near wetlands (opt for mechanical removal).			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 Avoid the loss of biodiversity in wetlands	ECO Reports	Environmental Control officer Environmental manager Site manager
	Construction		Make sure all excess consumables and building materials / rubble is removed		ECO Reports	Environmental Control officer

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			from site and deposited at an appropriate waste facility.	Prevent the pollution of water sources Prevent pollution of watercourses Prevent the pollution of groundwater		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 Site manager
10.6 RADIATION						

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
Site establishment	Operation Rehabilitation and Closure	Erosion due to storm water runoff Impacts on wetlands	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
TSF Operations **General decommissioning activities**	Construction Operation Decommissioning Rehabilitation and Closure	Soil erosion, Land degradation Degradation of wetland vegetation Disruption of wetland soil profile and alteration of hydrological regime	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
Post Closure Monitoring and Maintenance	Construction Operation Decommissioning Rehabilitation and Closure	Groundwater quality impacts Long-term groundwater quality, and radiation impacts Loss of Biodiversity	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 this EMPr.		Eco REPORTS Specialist studies	Environmental manager Site manager
10.7 GROUNDWATER						
General decommissioning activities	Construction Operation Decommissioning	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 Avoid and control through	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** **Post Closure Monitoring and Maintenance**	Rehabilitation and Closure	Groundwater quality impacts Long-term groundwater quality impacts	otherwise, of chemicals, oils, fuels, sewage, waste water 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.	implementation of preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)		
	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	Avoid contamination of groundwater resources Avoid and control through implementation of	ECO Reports Groundwater monitoring	Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			organisations called to assist in pollution control and/or to clean up polluted areas.	preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)		
	Planning Operation Rehabilitation and Closure		For the Nooitgedacht 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.	Avoid contamination of groundwater resources Avoid and control through implementation of	ECO Reports Groundwater monitoring	Environmental manager Site manager

Activities	Phase	Impact	Mitigation Measures	Objectives	Performance Indicator	Responsible Person
			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).	preventative measures Control through implementation of mitigation measures (barrier system, monitoring and phytoremediation)		

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 groundwater monitoring programmes as described in Section 4. These have been conducted internally by Harmony. The 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. The detailed environmental monitoring schedule has been developed in the EMPr and is also detailed in this report, the social and environmental aspects that act as environmental indicators and are most common have been considered.

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 and the proposed WULA.

12.1 REGULATORY STATUS OF ACTIVITY

The Harmony Nooitgedacht TSF is a new project and at the moment concurrent EIA and WUL application processes are underway. As part of the EA process, an application for an EA as well as a waste licence application is being conducted by EIMS.

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 6 above).

13 REFERENCES

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Appendices

Appendix 1: Mining Right, Permits and existing WULs

Appendix 2: Design Reports

Appendix 3: Wetland and Baseline Risk Assessment

Appendix 4: DWS Risk Assessment

Appendix 5: Geohydrological assessment

Appendix 6: Hydropedology Assessment Report

Appendix 7: Hydrology Assessment Report