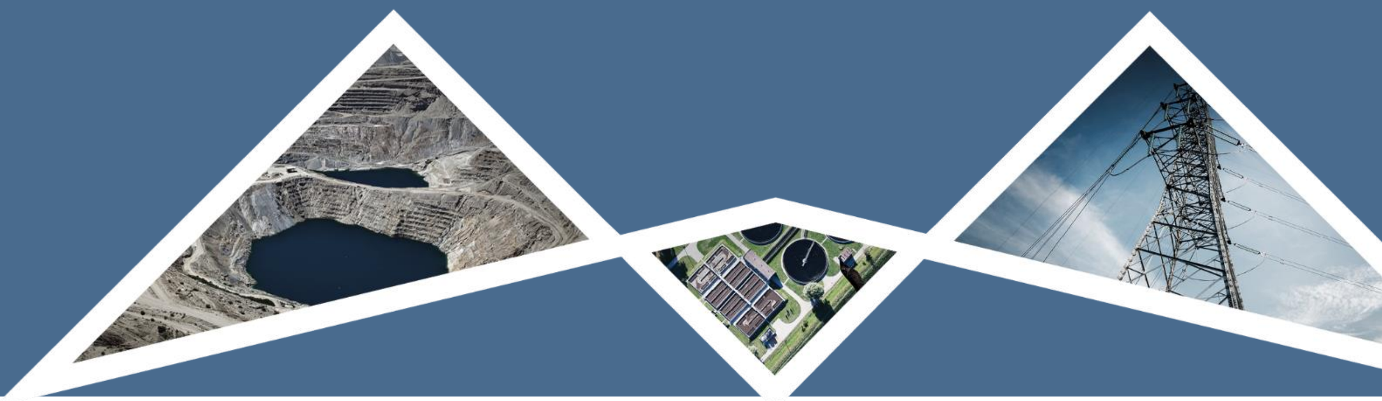
ENVIRONMENTAL IMPACT MANAGEMENT SERVICES

T 011 789 7170 E info@eims.co.za W www.eims.co.za

INTERGRATED WATER AND WASTE MANAGEMENT PLAN UPDATE

HARMONY KUSASALETHU AND DEELKRAAL OPERATIONS



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CHECKED:	John von Mayer	No Signed - Sent Electronically	2023/03/09
AUTHORIZED:	Liam Whitlow	No Signed - Sent Electronically	2023/03/10

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Appendices

Appendix A: Licences

Appendix B: Environmental Policy

Abbreviations

ABET	Adults Basic Education Training
CMA	Catchment Management Area
CMS	Catchment Management Strategy
COD	Chemical Oxygen Demand
DEA	Department of Environmental Affairs
DEEEP	Direct Estimation of Ecological Effect Potential
DMRE	Department of Mineral Resources and Energy
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation (formerly DWA)
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
EO	Environmental Officer
GDP	Gross Domestic Product
HGM	Hydro-geomorphic
I&AP	Interested and Affected Party
EMPr	Environmental Management Programme
IHIA	Intermediate Habitat Integrity Assessment
IHAS	Invertebrate Habitat Assessment System (IHIA),
ISO	International Organisation for Standardisation
IWRM	Integrated Water Resource Management
IWUL	Integrated Water Use Licence
IUA	Unit of Analysis
IWWMP	Integrated Water and Waste Management Plan
LOM	Life of Mine
mamsl	Mean Sea Level
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
NNR	National Nuclear Regulator
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
PPR	Public Participation Report
RE	Remaining Extent
RQO	Resource Quality Objectives
RoM	Run of Mine
ROR	Rate of Rise
RWD	Return Water Dam
SANS	South African National Standards
SASS	South African Scoring System
SAWIS	South African Waste Information System
SAWQG	South African Water Quality Guidelines
SHE	Safety, Health and Environmental
SHEQ	Safety, Health, Environment and Quality
SLP	Social and Labour Plan
SGP	Savuka Gold Plant
TSF	Tailings Storage Facilities
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

EXECUTIVE SUMMARY

Harmony Gold Mining Company Limited (Harmony) is the owner and operator of the Kusasalethu Mine (Kusasalethu), which comprises of the Kusasalethu Operation and the Deelkraal Operation. The mine is situated approximately 8 km south west of the town Carletonville within the Merafong City Local Municipality in Gauteng Province.

The mine operates under the jurisdiction of the Gauteng Department of Mineral Resources and Energy (DMRE), has an approved Mining Right (MR), Ref No. GP/30/5/1/1/2/07 MR, in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) and an Environmental Management Programme (EMPr).

Kusasalethu, which came into operation in 1978, was purchased from AngloGold Ashanti in 2001.The mining method consists of underground sequential grid mining. The mined ore is processed at the Kusasalethu Gold Plant. Gold is extracted by means of milling, thickening, cyanide leaching and carbon in-pulp (CIP) absorption. No smelting is done on site and the processed ore is sent to Rand Refinery for smelting. Currently, gold and gold-bearing slag is produced, with silver as a by-product. Mining activities at Deelkraal ceased in 2004, where after the mine was decommissioned in 2005. Rehabilitation activities were undertaken until 2015.The LOM for Kusasalethu based on the reserve estimates is 2037.

On 14 December 2020, the mine was granted a Water Use Licence (WUL) (Licence No. 08/C23J/AJFG/10192) in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA). The following water uses are authorised in terms of the new WUL:

- Section 21 (a) of the NWA: Taking of water from a water resource;
- Section 21 (f) of the NWA: Discharging waste or water containing waste into a water resource;
- Section 21 (g) of the NWA: Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21 (j) of the NWA: Removing, discharging or disposing of water found underground.

In terms of the WUL requirements, the mine must update the Integrated Water and Waste Management Plan (IWWMP) and submit to the Department of Water and Sanitation (DWS) Regional Director annually. However, it should be noted that this version of the IWWMP does not constitute an annual update as per the requirements of the current WUL but serves an amendment to add the proposed new water uses associated with the Proposed Kusasalethu Return Water And Backfill Pipelines Project to the current WUL.

PURPOSE OF THE REPORT

The original version of this IWWMP was prepared by Digby Wells Environmental in 2022 to fulfill Condition 12.2 of Appendix IV of the IWUL (refer to Appendix A) which states that "The IWWMP and RSIP shall thereafter be updated and submitted to the Provincial Head for approval, annually". The IWWMP is currently being amended by Environmental Impact Management Services (Pty) Ltd (EIMS) to specifically add the new water uses associated with the Proposed Kusasalethu Return Water and Backfill Project. It should be noted that this document does not serve as an annual IWWMP update but is only an amendment to include new water uses and the only information that EIMS has added to the document is information regarding the new water uses being applied for. All other information contained in this report regarding the annual update of the IWWMP was prepared by Digby Wells Environmental.

This IWWMP was developed in line with the "Operational Guideline: Integrated Water and Waste Management Plan" of 2010:

- To integrate a site-specific, implementable water management program addressing all the identified water uses and waste management related components (process water balances, stormwater management, groundwater management, water re-use and reclamation, water conservation and demand management, waste minimization and recycling) at the mine to comply with the set objectives of the Integrated Water Resource Management (IWRM);

- To present a plan of how water and waste management is integrated and demonstrate that the monitoring plans are in place to achieve such management; and
- To achieve environmental legal compliance.

AUTHORISED WATER USES

The water uses listed in the Table 1 below have been authorised in the operations WUL (Licence No. 08/C23J/AJFG/10192) by DWS in accordance with the NWA.

Table 1: Summary of Authorised Water Uses

Section 21 Water Use	Description	Related Activity
S 21 (a)	Abstraction of water.	Surface stormwater run-off contained in a Tailings Storage Facility (TSF) for the mining process; Surface stormwater run-off contained in the return water dam for the mining process; and Dewatering of the underground water from the Kusasalethu operation.
S 21 (f)	Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	The discharge of treated domestic wastewater into the Wedela stream (a tributary to the Loopspruit); and Discharge of excess underground water dewatered from Kusasalethu into the Varkenslaagtespruit.
S 21 (g)	Disposing of waste in a manner which may impact on the water resource.	Disposal of coarse material from mining process; Slimes affected water from the mining process; Returned affected water from the TSF for re-use within the plant; Storage of dirty (in spillage Pond No. 1) water from spillages of the process plant area. The dirty water will be re-used within the plant; Storage of affected water (in Spillage Pond No. 2) so as to prevent the pollution of the environment and this affected water is stored for evaporation; Sewage sludge (stored in Drying Beds) from the sewage treatment plant; Mine affected water is used for dust suppression at the Deelkraal TSF; and Storage of affected wastewater (Surface: Hot Water Dam) used for drilling and cooling which form part of the underground affected water management system. Storage of affected wastewater that is used for drilling and cooling which form part of the underground affected water management system.

Section 21 Water Use	Description	Related Activity
		Storage of affected wastewater (Surface: Hot Water Dam No 1 and 2) used for cooling which forms part of the underground affected water management system.
S 21 (j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	Removing of underground water from the Kusasalethu mine in order to keep the mine dry.

BASELINE ENVIRONMENT

Kusasalethu is located within the Merafong City Local Municipality in Gauteng Province. The operation falls within the quaternary catchment C23J and partially falls within the C23E quaternary catchment within the Upper Vaal Water Management Area (WMA). At Kusasalethu, the surface run-off water from the northern section of the West Rand Region flows into the Wonderfonteinspruit. The Deelkraal part of the operation lies on the catchment divide between the Loopspruit to the south and the Mooirivierloop to the north.

Artificial wetlands have been created at the Kusasalethu Operation due to the waste facilities having altered the topography and drainage of the landscape. No wetlands have been identified at the Deelkraal Operation.

The aquifers identified include a weathered aquifer, which is shallow and lies in the weathered shale and quartzite. Groundwater depths vary between 0.47 m and 14.31 Metres Below Ground Level (mbgl). There is also a fractured aquifer, with a depth that ranges from artesian to 37.82 mbgl. Lastly, there is an important aquifer situated 500 m north of the Deelkraal TSF. Seepage from the Deelkraal TSF and Waste Rock Dump (WRD) can potentially impact on this aquifer over time.

CONCLUSION

In order to address the existing and anticipated potential environmental impacts, an updated IWWMP action was compiled incorporating all the identified WUL non-compliances and include the recommendations as provided on the latest WUL audit for implementation to improve or enhance water and waste management on the mine. The updated IWWMP Action Plan is shown on Table 2 below.

Kusasalethu commits to the following:

- Implementing the IWWMP action plan to ensure that the potential impacts are identified, prevented, minimised or mitigated on the receiving water environment;
- Monitoring surface and groundwater quality monthly;
- Maintaining separation of clean and dirty water; and
- Implementing and maintaining all recommendations made in the specialist reports.

Table 2: IWWMP action plan

Infrastructure area	Specific Goals	Management Plan	Responsibility
Roads, Railways and Pipelines	All the roads, railways, pipelines and powerlines may be required to service the residential communities. After mine closure, the services not required to sustain the residential communities (e.g., villages) will be removed.	The redundant infrastructure services will be removed as soon as the various mining sections they serve close.	The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Sewage Treatment Plant	The sewage works forms part of the infrastructure servicing the residential community. Upon mine closure, the ownership of the sewage works will be transferred from the mine to the responsible municipality when the residential areas are proclaimed.	The sewage works and their surrounds will be maintained in good working order until the transfer of ownership.	The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Decommissioning of Mineral Processing Plant	To remove all gold plant buildings, associated structures and any debris arising from the demolition, or removal, from the gold plants in the most cost-effective manner. In addition, to ensure that in the removal of the materials the effect on the environment is minimised, and rehabilitated areas are sustainable into the future.	During the decline of the plant tonnages all non-operational structures and associated infrastructure will be demolished. The debris is to be reprocessed through the plant and all steel structures to be washed before removal for sale. (Any associated offices that have been declared for sale are to be inspected and cleared of any possible mineral concentrates). All non-operational roads will be graded, and the debris processed through the plants. Operating units will be dismantled as the tonnages declines and will be washed or processed.	The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.

Infrastructure area	Specific Goals	Management Plan	Responsibility
		All equipment that cannot be reprocessed through the plant (electrical motors, etc.) will be disposed of. All concrete foundations and contaminated underlying soil will be managed in terms of the closure plan. On the removal of all buildings and plant infrastructures, the surface will be rehabilitated to a pre-determined standard as agreed to by the various stakeholders. A rehabilitation program, as part of the closure plan, is to be implemented to ensure that the area is completely rehabilitated.	
Workshops, Administration and other Buildings	There is a possibility that these buildings will not be demolished but disposed of or transferred to a third party in line with the SLP.	The ownership of this infrastructure will be transferred from the mine to the responsible municipality or other third party when the areas are proclaimed.	The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Housing, Recreation and other Buildings	The mine villages will be proclaimed as townships. The housing, recreation and other buildings will form part of this township.	Application to have Kusasalethu village a proclaimed township will be made. The hostels will be sold to a developer to develop as flat accommodation within the Kusasalethu Township.	The manager engineering is responsible for the proclamation of the townships. The townships will be sold to a third party.
Mine Residue Deposits			
Disposal Facilities (Pipes, Solution Trenches, Return Water Dams etc.)	To ensure that all the TSF's are removed, and any remaining facilities are converted to a permanent topographical feature with no adverse environmental impacts and have	The toe trenches and outlets to the filter drains will remain open to allow free flow of solution out of the dams. The outer slopes of the trenches are to be flattened to about 1:3 and the trenches grassed and vegetated. This is to prevent any collapse along the slopes. Any	The plant manager and appointed contractor's personnel shall be responsible for the complete rehabilitation of the Tailings dams. Personnel training and financial actions.

Infrastructure area	Specific Goals	Management Plan	Responsibility
	low maintenance costs. All dams will be maintained until final closure.	trenches that may constitute a hazard will be fenced off and signposted. Catchment paddocks and surrounding areas will be cleaned out and their walls raised if necessary to contain any solids from the dam within their boundaries. The penstocks on the dams will be blocked with concrete plugs of safely sealed, and the catwalks to and from theses penstocks will be removed. Any associated pipework shall also be removed. The return water dams will be retained as natural water run-off retention dams with adequately designed spillways to safely discharge excessive storms. The access roads will remain open to allow access for maintenance and inspections. Any roads that do not require usage will be ploughed and vegetated. The pump station buildings will be stripped and all pumps and associated equipment removed, once these facilities are no longer of use to the rehabilitation program. All overland pipelines and plinth will be removed. All the fences and access gates around the dam will remain and be adequately signposted.	The plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructure. He will be responsible for the provision of funds until the closure of mine, thereafter funds will be made available from and environmental trust fund.
Ongoing Seepage, Control of Rainwater	On mine closure the Tailings dams will be rehabilitated to prevent any harmful seepage or dam run-off that could have an adverse environmental impact.	All water dams will be retained to control the run-off of any water caused by rainstorms. Toe trenches will also stay open to allow the flow of seepage from the dams.	The gold plant manager will be responsible for the complete rehabilitation of the tailings dams.

Infrastructure area	Specific Goals	Management Plan	Responsibility
		The fate of any water will be determined by the quality and if suitable will be allowed to enter the existing water and boundary dams. The establishment of vegetation will result in evapotranspiration of most (65%-85%) of rainfall, reducing the groundwater pollution potential, plus the introduction of hydrophilic trees to ameliorate groundwater pollution. The catchment paddocks capacities will be confirmed and reconstructed to contain a 1:100-year 24-hour duration flood.	The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructure. He will be responsible for the provision of funds until the closure of the mine, thereafter the funds will be made available from an environmental trust fund created for environmental rehabilitation.
Long-term Stability	The gold plant manager will ensure that the stability of the dams will be maintained after mine closure.	Long term stability of the dams will be achieved with the vegetation of the side slopes and surface area by grassing or vegetating.	The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructures. He will be responsible for the provision of funds until the closure of the mine, thereafter funds will be made available from and environmental trust fund created for environmental rehabilitation.
Final Rehabilitation with Respect to Erosion and Dust Control: TSFs	To ensure that the tailings dams and infrastructures are rehabilitated in a way that no dust can be allowed into the atmosphere and that no erosion may occur on the dam walls to be of any damaging effect to the environment.	Final rehabilitation would be done by the stabilising of the dam by vegetation (grassing). The surface areas would be allowed to dry for access by agricultural equipment for vegetation of the areas. The top will be divided into a number of small paddocks. These paddocks will prevent the movement of water, reducing the possibility of erosion. The surface would be seeded and irrigated. Similar paddocking would be done on any un-stabilised or exposed levels.	The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructures to prevent any dissemination of dust or erosion. He will ensure there are sufficient funds made available during the mine's operation. An environmental trust fund will be made available after mine closure for further rehabilitation.

Infrastructure area	Specific Goals	Management Plan	Responsibility
		The planting of hydrophilic trees is to be introduced around the dams and paddocks to ameliorate groundwater pollution and act as wind breaks preventing dust dissemination.	
Final Rehabilitation with Respect to Erosion and Dust Control: Waste Rock Dumps	All rock dumps will be reprocessed prior to final closure of the mine if economically viable. However, should re-treatment of the dumps prove to be inappropriate a revised management plan will be developed approximately 5 years prior to mine closure. Maintain plant production by the re-treatment of the waste rock dump as the underground mining activities are reduced/cease. Preparation of the rock dump site area for the rehabilitation on the complete removal of all gold bearing ore, sand, soil and material. Rehabilitation of the area by grassing and planting local flora. Maintenance and monitoring of the area until self-sustaining.	Preparation of the area to begin with the removal of the underlying surface to depth of 2m to ensure the complete removal of all economic gold bearing material followed by covering the excavated site with topsoil for revegetation. Rehabilitation of the entire area to be achieved by the reintroduction of natural flora that was removed/damaged during the construction phase of the waste rock dump. In conjunction with the DWS ensure a complete rehabilitation phase has taken place and the area returned to a self-perpetuating ecosystem.	Reclamation and production of the waste rock dump to fall under the authority of the gold plant manager. The manager metallurgy will be responsible for all metallurgical environmental issues who will appoint designated personnel to ensure complete rehabilitation of the metallurgical plant areas on closure.
Revise the Water Monitoring Programme			
Groundwater monitoring	The expansion of the groundwater monitoring network in 2017 provided valuable information and these boreholes should be included in the routine groundwater monitoring program.	Several of the existing monitoring boreholes are dry/blocked. These boreholes are important to the overall monitoring of the aquifers and the cleaning, deepening or replacing of the boreholes should be considered.	The Environmental Officer together with the mine manager are responsible for ensuring that the groundwater monitoring program is adequate and in line with the WUL and should ensure that the monitoring boreholes are

Infrastructure area	Specific Goals	Management Plan	Responsibility
			cleaned, deepened or replaced within 8 months.
Stormwater Management and Water Management Infrastructure			
Management of Stormwater and water management infrastructure.	The maintenance program of Stormwater and water management infrastructure should be improved.	Increase the frequency of inspections and the subsequent maintenance of infrastructure. Note cracks and damage observed in these maintenance inspections and make provision for rectification during maintenance times. Certainty should be gained on whether the entire Stormwater system can handle a 1:50 year flood. Remove vegetation found in the various systems on a regular basis and the inspection thereof included into the regular maintenance program. Remove all obstructions and litter from Stormwater systems to ensure the unimpeded flow of water through these systems. As per GNR 704: prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act. Maintenance all water and Stormwater infrastructure should be improved. The frequency of inspections should be improved.	The Environmental Officer together with the mine manager are responsible for ensuring that the maintenance program of Stormwater and water management infrastructure is improved.

Infrastructure area	Specific Goals	Management Plan	Responsibility
Sealing of Underground Workings and Rehabilitation of Dangerous Excavations			
Shafts	All the shafts will be capped in accordance with the DMRE requirements.	A concrete cap will cover the open shaft.	The mine managers are responsible for the shaft capping. This capping will form part of the mine manager's closure plan.
Submission of Information after Decommissioning up to Closure	Relevant data and information as identified during the compilation of the decommissioning and closure plan will be submitted to the relevant authority at agreed intervals.	Compilation of the relevant data and information identified during the compilation of the decommissioning and closure plan.	The mine manager is responsible for the compilation and submission of the data to the relevant authority as per the agreed intervals.
Maintenance			
Maintenance of rehabilitated areas	All rehabilitated land, tailings dams and infrastructures will be maintained as described in the previous sections for a period of three years after operations in that particular area have ceased	For each facility, the maintenance on vegetation will be maintained for 18 months after germination. Once rehabilitation has been completed, a three-year period will be allowed to ensure that this vegetation is self-sustaining. If so, a partial closure certificate will be applied for. If not, a contingency sum will be allowed for in the trust fund to bring the vegetation to this self-sustaining level.	The mine manager is responsible for the maintenance of rehabilitated areas.

1 INTRODUCTION

Harmony Gold Mining Company Limited (Harmony) has appointed Environmental Impact Management Services (Pty) Ltd (EIMS) as the Environmental Assessment Practitioner (EAP) to undertake the necessary Water Use Licence Application (WULA) and associated consultation processes for the Proposed Kusasalethu Return Water and Backfill Pipelines Project. EIMS will compile and submit the required documentation in support of application for:

- Water Use Licence Application (WULA) in accordance with the National Water Act – NWA (Act 36 of 1998)- Water uses: Section 21 (c), Section 21 (i) and Section 21 (g).

As part of the current appointment EIMS will undertake an amendment of the Integrated Water and Waste Management Plan (IWWMP) for the Kusasalethu Mine (Kusasalethu), which comprises of the Kusasalethu Operation and the Deelkraal Operation to specifically include the new water uses associated with the Proposed Kusasalethu Return Water and Backfill Pipelines Project.

The mine is situated approximately 8 km south west of the town Carletonville within the Merafong City Local Municipality in Gauteng Province.

Kusasalethu was issued with an Integrated Water Use Licence (IWUL) (Licence Number: 08/C23J/AJFG/10192) on 14 December 2020 (Attached in Appendix A). The IWUL authorises the following water uses as per Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA):

- Section 21 (a): Taking of water from a water resource;
- Section 21 (f): Discharging waste or water containing waste into a water resource;
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource; and
- Section 21 (j): Removing, discharging or disposing of water found underground.

Condition 12.2 of Appendix IV of the IWUL (refer to Appendix A) states that "*The IWWMP and RSIP shall thereafter be updated and submitted to the Provincial Head for approval, annually*". The last IWWMP update was conducted in 2022 by Digby Wells Environmental. Therefore, this document serves as an amendment to add new water uses to the previous IWWMP report that was submitted to the Department of Water and Sanitation (DWS) in 2022. The document does not however serve as an annual IWWMP update as per Condition 12.2 of Appendix IV of the IWUL.[1]

1.1 ACTIVITY BACKGROUND

Harmony holds an approved Mining Right (MR) (Ref No. GP/30/5/1/1/2/07 MR) and an Environmental Management Programme (EMPr) for the Kusasalethu Operation. The Kusasalethu operation currently produces gold and gold bearing slag, with silver as a by-product. The primary ore body is the Ventersdorp Contact Reef. Production started in 1978 with mining operations comprising twin vertical and twin sub-vertical shaft systems and a processing plant. Conventional mining methods in a sequential grid layout are used and at the current depth of 3388 metres (m). Kusasalethu is considered one of the deepest of Harmony's gold mines. The ore mined is delivered by conveyor to an open or closed stockpile and treated at the Kusasalethu processing plant.

1.2 PURPOSE OF THE IWWMP

The Operational Guideline (2008) defines the purpose of an IWWMP as providing a simple, feasible, implementable plan for selected water users based on site specific programmes, by incorporating the National

[1] The information contained in this document is mainly from the IWWMP Update compiled by Digby Wells in 2022 and EIMS has amended the document to specifically include the new water uses being applied for as part of the Proposed Kusasalethu Return Water and Slurry Pipelines Project.

Water Resource Strategy (NWRS), Catchment Management Strategy (CMS), Resource Quality Objectives (RQOs) and sensitivity of the receiving water resource, as well as upstream and downstream cumulative impacts of water use activities.

Furthermore, an IWWMP is a system that can be audited and improved on a continuous basis so that Harmony's management can constantly improve their environmental performance and reduce impacts, particularly on surface water and groundwater aspects. 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 original version of this IWWMP was prepared by Digby Wells Environmental in 2022 to fulfill Condition 12.2 of Appendix IV of the IWUL (refer to Appendix A) which states that "The IWWMP and RSIP shall thereafter be updated and submitted to the Provincial Head for approval, annually". The IWWMP is currently being amended by Environmental Impact Management Services (Pty) Ltd (EIMS) to specifically add the new water uses associated with the Proposed Kusasalethu Return Water and Backfill Project. It should be noted that this document does not serve as an annual IWWMP update but is only an amendment to include new water uses and the only information that EIMS has added to the document is information regarding the new water uses being applied for. All other information contained in this report regarding the annual update of the IWWMP was prepared by Digby Wells Environmental.

The objectives of this IWWMP are as follows:

- To integrate a site-specific, implementable water management program addressing all the identified water uses and waste management related components (process water balances, stormwater management, groundwater management, water re-use and reclamation, water conservation and demand management, waste minimisation and recycling) at the mine to comply with the set objectives of the Integrated Water Resource Management (IWRM);
- To present a plan of how water and waste management is integrated and demonstrate that the monitoring plans are in place to achieve such management; and
- To achieve environmental legal compliance.

2 ADMINISTRATIVE INFORMATION

This section provides the administrative information related to the Kusasalethu Operation, details of the Environmental Assessment Practitioner (EAP) and information relating to the location of the Kusasalethu Operation.

2.1 CONTACT DETAILS OF THE KUSASALETHU OPERATION

Table 3 below provides the contact details for the Kusasalethu operation.

Table 3: Contact Details of Applicant

Company	Harmony Gold Mining Company
Physical address	Randfontein Office Park, Corner Main Reef Road and Ward Street, Randfontein, 1760
Postal address	P.O Box 2 Randfontein 1760

Contact person	Litshani Makhuvha
Position	Environmental Officer
Telephone	018 782 9543
Email	Litshani.Makhuvha@harmony.co.za

2.2 CONTACT DETAILS OF THE EAP

EIMS has been appointed by Harmony to undertake an amendment of its Integrated IWWMP for the Kusasalethu operation to include the new water uses associated with the Proposed Kusasalethu Return Water and Backfill Pipelines Project, situated in the magisterial area of the Merafong City Local Municipality. The details of the EAP are included in Table 4 below.

Table 4: Contact Details of the EAP

Company Name	Name of Practitioner	Telephone:	Email:
Environmental Impact Management Services (Pty) Ltd (EIMS)	Sinalo Matshona	011 789 7170	sinalo@eims.co.za

2.3 REGIONAL SETTING AND LOCATION OF ACTIVITY

The Kusasalethu operation is situated approximately 90 km from Johannesburg, on the border of Gauteng and North-West Provinces. The mine is located near the towns of Carletonville, Westonaria and Fochville (Table 5). The Kusasalethu operation is situated in the magisterial area of Merafong City Local Municipality jurisdiction and in the Southern District Municipality. The mine is located 800 m north of the national road N12 (Refer to Figure 1 and Figure 2 below for an indication of the Regional and locality map of the area).

Table 5: Distance of the Kusasalethu and Deelkraal Operation from Closest Towns

Name of Town	Distance of Kusasalethu Operation from town (km)	Distance of Deelkraal Operation from town (km)
Carletonville	20	22
Westonaria	40	47
Johannesburg	83	87
Fochville	16	20

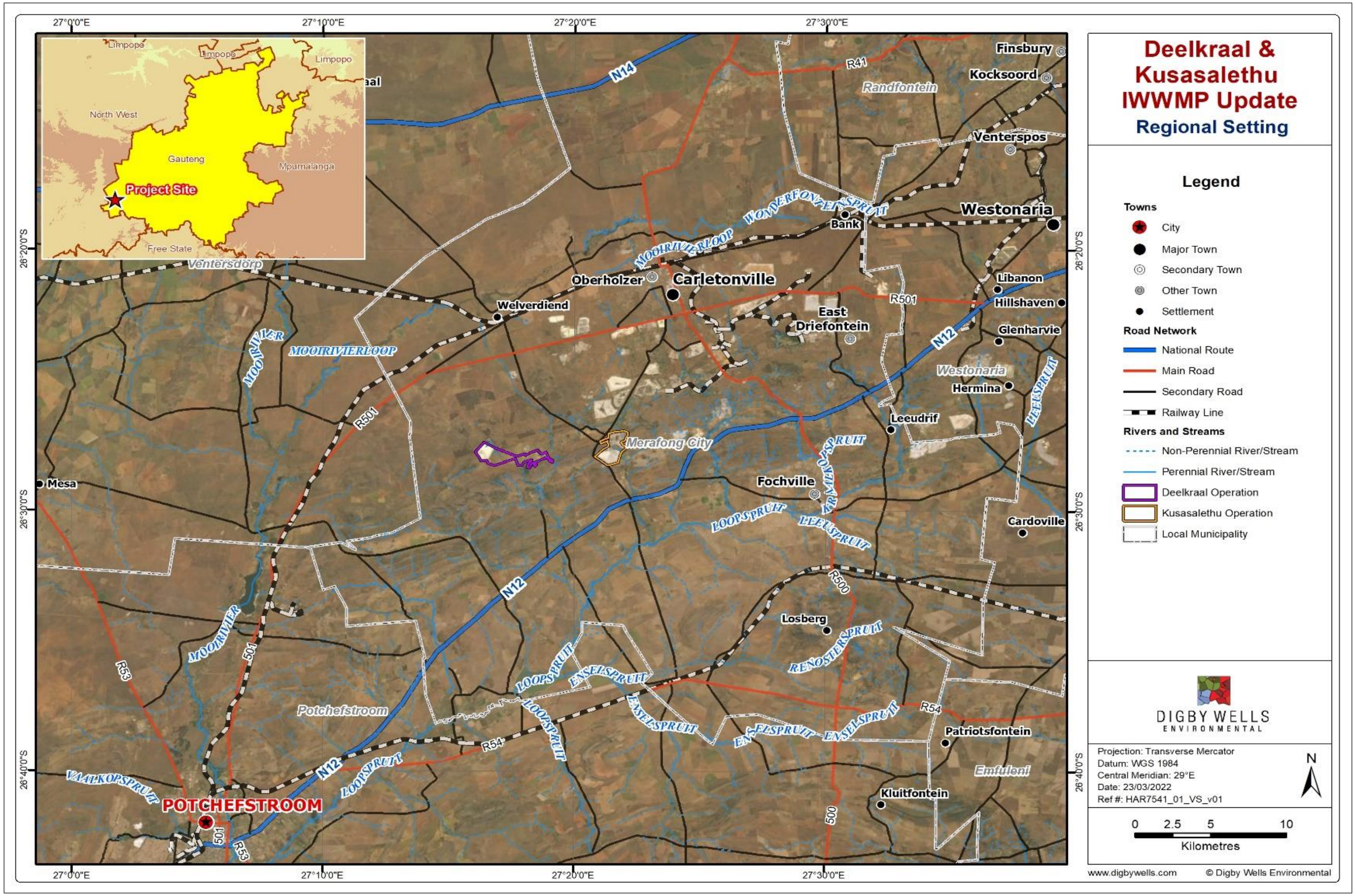

Figure 1: Regional Map

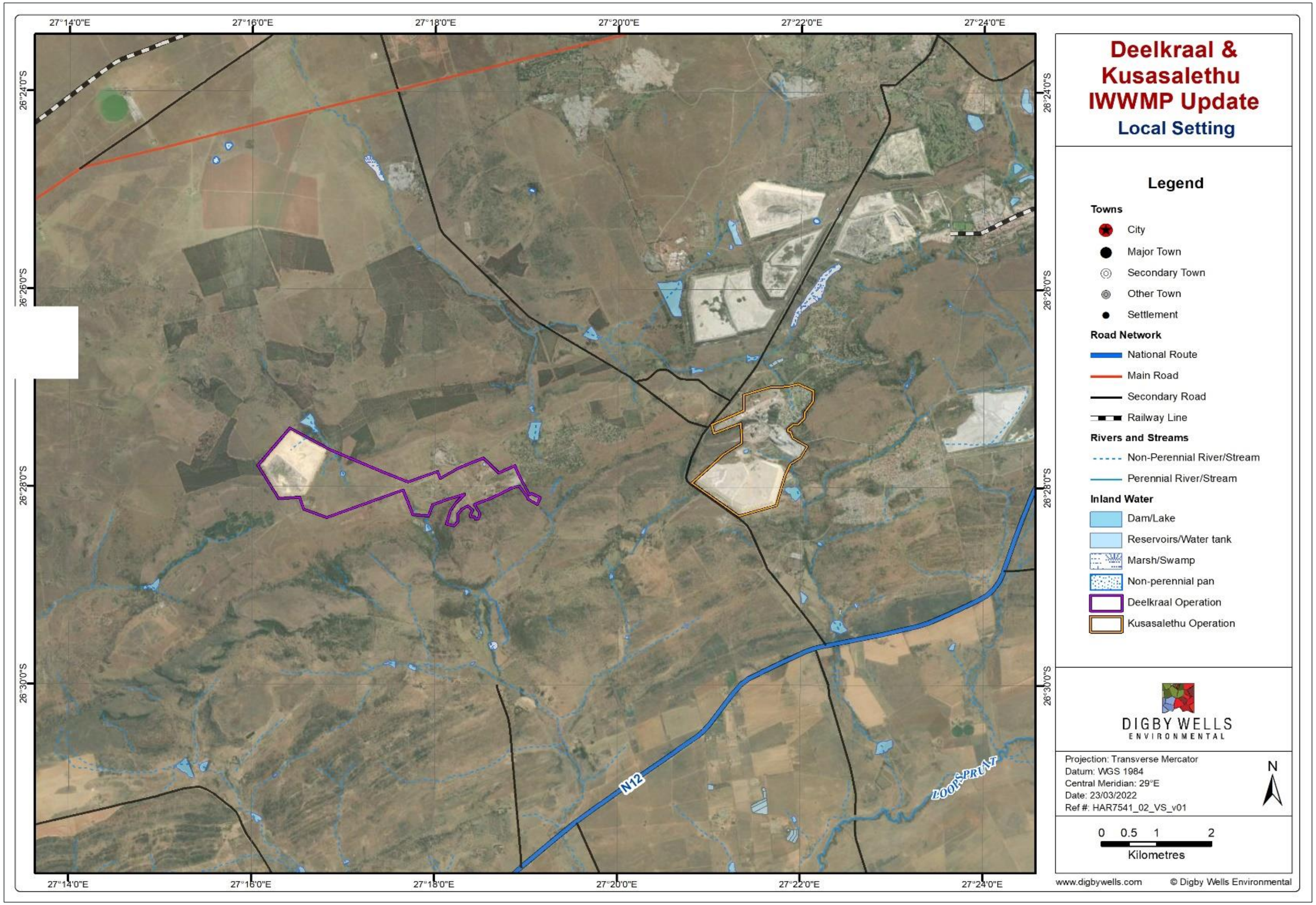

Figure 2: Location of the existing Kusasalethu Operations

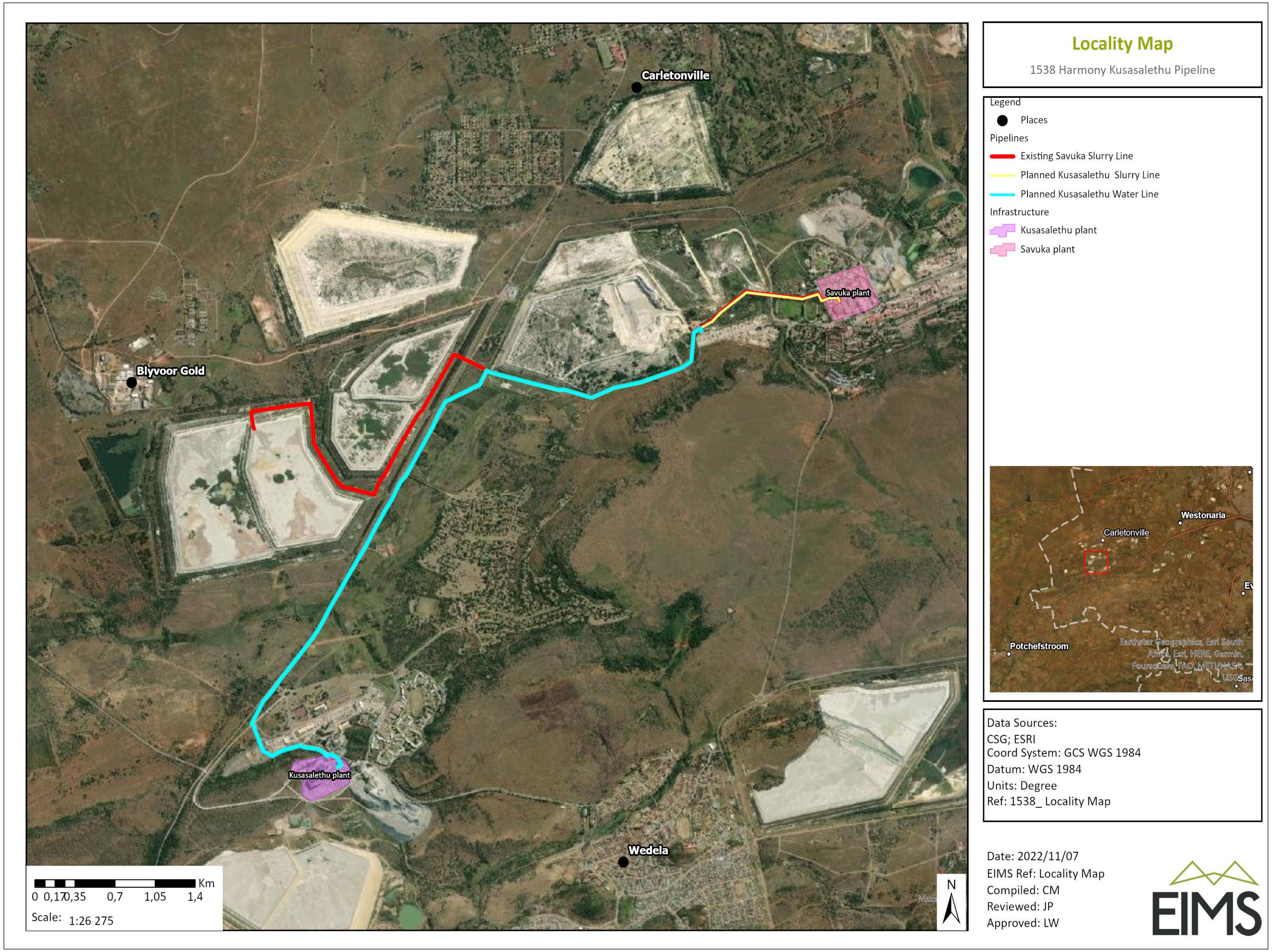

Figure 3: Location of the Proposed Kusasalethu Return Water and Backfill Pipelines

2.4 PROPERTY DESCRIPTION

The mining activities of the Kusasalethu operation takes place on the following farms:

- Remainder of Buffelsdoorn 143 IQ;
- Portion 3 of the farm Deelkraal 142 IQ; and
- Portion 2 of the farm Kleinfontein 141 IQ.

Most of the mining infrastructure of the Kusasalethu operation is located on the farm Buffelsdoorn 143 IQ, including the Tailings Storage Facility (TSF), the Return Water Dam (RWD), the Sewage Treatment Plant (STP), the Kusasalethu shaft and the Kusasalethu plant Figure 2The mining infrastructure of Deelkraal is located on the farm Deelkraal 142 IQ, and includes the Deelkraal (DK) village dam, the STP which now belongs to Morgan Creek, the Old Deelkraal shafts and the Waste Rock Dump (WRD) (refer to Figure 2).

The Kusasalethu operation consists of one metallurgical plant (Kusasalethu Plant) with associated infrastructure and various shafts at Deelkraal and Kusasalethu with surface infrastructure. The Deelkraal operational area is not in use; however, the water storage facilities are still present in the Deelkraal area.

The proposed return water and backfill pipelines are located approximately 7km south of Carletonville (See Figure 3). The proposed pipelines traverse the following properties: Portion 31 of Farm Buffelsdoorn 143 IQ, Portion 7 of Farm Buffelsdoorn 143 IQ, Portion 35 of Farm Buffelsdoorn 143 IQ, Portion 9 (RE) of Farm Buffelsdoorn 143 IQ, Portion 3 (RE) of Farm Blyvooruitzicht 116 IQ, Portion 93 of Farm Blyvooruitzicht 116 IQ, Portion 25 (RE) of Farm Doornfontein 118 IQ. The pipelines have the following start, middle and end points (Pipelines traverse the same route): Start: (26°25'19.19"S and 27°23'58.04"E); Midpoint: (26°25'53.22"S and 27°22'2.69"E); End: (26°27'24.38"S and 27°21'36.15"E).

2.5 PROPOSED LICENCE AMENDMENTS

There are no proposed amendments to the existing WUL.

3 CONTEXTUALISATION OF THE ACTIVITY

The section below provides a detailed Project description. The information in this section was collated from the IWWMP compiled by Digby Wells in 2022.

3.1 DESCRIPTION OF THE ACTIVITY

Harmony is the owner and operator of Kusasalethu mine, which comprises of the Kusasalethu Operation (formerly Elandsrand operations) and the Deelkraal Operation, situated within the Merafong City Local Municipality and West Rand District Municipality, Gauteng Province. The mine has an approved MR (Ref No. GP/30/5/1/1/2/07 MR) and EMPr and is under the jurisdiction of the Gauteng Department of Mineral Resources and Energy (DMRE). The Kusasalethu Operation is located approximately 12 km southwest of Carletonville and 14 km west of Fochville. The mining undertaken at the Kusasalethu Operation entered into production in December 1978 and produces gold bearing slag with silver as a by-product. Harmony bought the Elandsrand operations from AngloGold Ashanti in 2001. The Deelkraal operational area is not in use, however, the water storage facilities are still present in the Deelkraal area.

3.1.1 MINING METHOD

The mining method that is utilised at the existing Kusasalethu operation is sequential underground grid mining. Mining is conducted by means of blasting, drilling and excavation equipment. For underground mining to occur, a shaft is required to access the gold ore reserve below.

In terms of the technology used in the operations, excavation and process plant equipment are being used in the process. Currently there is underground mining that is taking place, where blasting is undertaken and the material transported to the processing plant and transported off site to Rand Refinery. As the mine is in the operational phase, all required infrastructure is in place. The deep mining venture of the tabular ore body will not give rise to any subsidence.

3.1.2 MINERAL DEPOSITS AND MINE PRODUCTS

3.1.2.1 **KUSASALETHU OPERATION**

3.1.2.1.1 MINERAL DEPOSITS

The Kusasalethu operation exploits the Ventersdorp Contact Reefs and the Carbon Leader Reef. The Ventersdorp Contact Reef lies on the unconformity which separates the Ventersdorp lavas (Kliprivierberg formation) from the underlying Witwatersrand Supergroup. The tabular conglomerate reef is usually less than 1 m (may reach up to five meters in thickness), has a strike of 60° and dip of 21° SE; and lies at a depth of 1700 to 3700 m below mine datum which is 1828 m above mean sea level (mamsl).

The Carbon Leader Reef comprises a thin small pebble conglomerate of several centimetres thickness often with a carbon seam of a few millimetres to centimetres usually developed at or near its base. The reef may on occasion develop into channels in excess of 1 m thick. This reef lies within the main conglomerate formation near the base of the Central Rand Group (the upper division of the Witwatersrand). It has a strike of 75° and dip of 22° S; and lies at a depth of 2550 to 3800 m below mine datum.

3.1.2.1.2 MINE PRODUCTS

The Kusasalethu Operation produces gold, with silver slag as a by-product.

3.1.2.2 **DEELKRAAL OPERATION – MINERAL DEPOSITS**

The mineral deposit at Deelkraal Operation is gold bearing reefs from beds which strike N75°E and dip at an average 24° SSE, within the Witwatersrand Supergroup. Both the Ventersdorp Contact Reef and the Deelkraal Reef are mined.

The Deelkraal Operation shafts are non-operational.

3.1.3 ESTIMATED RESERVES OR EXTENT OF TARGET AREA

The mining area is approximately 2619 ha in surface area. The proven pay ore reserves are 37 645 476 tons. The remaining Life of the Mine (LoM) is calculated to be ±28 years at the current rate of production and processing.

The estimated grade is 6.23 g/t (head grade). In 2014, the mine submitted a Section 102 Application to extend the underground mining area, which consists of approximately 1620 ha and is adjacent to the existing underground workings of Kusasalethu Operations to the east and northeast and the Deelkraal Operations to the north. The expanded mining area will be an extension of the existing underground workings, approximately 3.5 km below ground level. No additional surface infrastructure will be constructed as part of the expansion.

3.2 EXTENT OF THE ACTIVITY AND KEY ACTIVITIES

The extent of the existing MR (Ref No. GP/30/5/1/1/2/07 MR) of the Kusasalethu Operations is 5 112.723 ha.

3.3 MINING PROCESS

The Kusasalethu operation exploits the Ventersdorp Contact Reefs and the Carbon Leader Reef. Access to the reef horizon including workers, material and production is from surface shafts. Access for rock hoisting and the provision of ventilation, services, workers and materials are provided through the surface shafts.

Underground waste is generally separated from the ore, although waste development in the remnant mining areas is relatively low. Mining operations are conducted principally by conventional narrow stoping methods with tracked haulages on a 3-shift basis.

The (LoM) is calculated to be ±28 years. The LoM could be extended should the rate of the production improve from the current forecasted rate. The mining operations include the removal of the ore, the metallurgical process of gold ore and all other supporting operations such as workshop areas, administrative buildings, accommodation, etc. The mining process entails the following activities:

- Gaining access to the gold ore (shaft operations);
- Removal of gold ore (excavator operations);
- Kusasalethu Mineral processing plant;

- Kusasalethu Plant, Kusasalethu and Deelkraal shaft mining related activities;
- Loading of gold ore, and
- Transportation of product.

3.3.1 UNDERGROUND WATER OPERATIONS AT KUSASALETHU

Water used in the underground operations is transferred to the underground water storage dams located at various levels (Refer to Table 5) of the existing mining operations. These dams are constructed with cement so that affected underground water and the water from Rand Water Board is retained within these storage facilities.

Underground water stored within the water storage dams will be treated before re-used. Water purifiers consisting of neutralisation sections and a settling/coagulation section, are used at the Kusasalethu shaft.

Sludge extracted at the settlers is conveyed to the metallurgical process plant for beneficiation and ultimately to the TSF. The mine must ensure that all underground water storage facilities are included in a planned maintenance programme and that inspections are also undertaken (ensure that records are kept). The underground water storage dams have different storage capacities as indicated Table 8.

3.3.2 GAINING ACCESS TO THE GOLD ORE (SHAFT OPERATIONS)

Gaining access to the underground mine workings is via shafts at the Kusasalethu operation. Access to the different operational area shafts is available.

3.3.3 REMOVAL OF GOLD ORE (EXCAVATOR OPERATIONS)

Conventional underground mining methods are employed by the Kusasalethu operation. The existing gold reserve underground requires drilling and blasting activities before gold ore can be excavated and transported to Kusasalethu Plant for processing. The gold ore reserve is blasted and thereafter an excavator loads the blasted rock chunks into underground trucks.

Mining at the existing underground areas takes place at depths in excess of 300 m vertical from the surface. It is a deep mining venture and all structures required for mining and personnel requirements are placed such that there will be no impact by blasting vibrations.

3.3.4 MINERAL PROCESSING PLANT

3.3.4.1 **KUSASALETHU OPERATION**

The Kusasalethu processing plant comprises of run of mine milling, thickening, cyanide leaching and carbon-in-pulp (CIP) absorption. The plant feed source is restricted to underground reef, with a total capacity of approximately 90 000 tonnes per month. The gold production is approximately 500 kg per month. Generally, the plant is considered to be in very good condition both mechanically and structurally and subject to adequate ongoing maintenance will meet the LoM requirements.

Process water spillage in the process plant is contained within bunded areas and spillage ponds are reclaimed for process water use.

The operational activities taking place during the gold ore processing include the following:

- Mills (used for the crushing of gold ore) - The milling plant consists of three, 4.8 m diameter by 9.15 m long Run of Mine (ROM) mills and one, 4.8 m diameter by 6 m long secondary mill. Classification of all milled products is done by cyclones prior to thickening in three convectional thickeners;
- Thickener (used for process water storage and the use of flocculants) - Three 45 m diameter reinforced concrete thickeners are used;
- Leach (use of chemicals e.g., lime, cyanide) - 12 flat bottom pachucas, 8 m diameter by 19 m high are used for cyanide leaching;
- Adsorption;
- Residue (pumping of mud from residue to tailings tanks); and

- Elution (Use of chemicals – Hydrochloric acid, cyanide and caustic soda).

3.3.4.2 ORE TRANSPORT AND STORAGE

Ore is delivered by conveyor to an open or closed stockpile.

3.3.4.3 FILTER PLANT AND PRECIPITATION STELLARS

The plant consists of 14,8 m diameter by 5.4 m long rotary drum filters, five clarification stellars and five precipitation stellars. Dissolution of gold is by cyanidation and the liquid solid separation of the gold bearing solution is done using vacuum rotary drum filters. The gold bearing filtrate from the filters is clarified before gold precipitation by zinc/lead nitrate addition takes place. The zinc/gold precipitate is filtered over a pre-coat filter before calcining in a continuous calciner.

3.3.4.4 BACKFILL PLANT

A backfill plant is situated within the plant boundary for underground filling using de-slimed tailings. The milling, filter plant, precipitation is all housed in a single building complex. Services, including workshops, stores and offices are located on the boundaries of the main complex.

3.3.5 SAMPLING, ANALYSIS AND GOLD ACCOUNTING

All plant feed sources are individually sampled. Underground ore is generally sampled at the shaft head or on the main plant feed conveyor with the aid of Go-Belt samplers. Waste rock is generally sampled from a plant feed conveyor with Go-Belt samplers. Where manual samples are taken, particularly in the case of the third-party samples, detailed procedures have been laid down and are followed. Daily composites of Go-Belt and other bulk samples are prepared in dedicated sample preparation plants.

Plant head and residue samples are almost exclusively taken automatically with cross-stream pulp cutters or in-stream poppet samplers; composites are accumulated and prepared in the standard way. In most cases, actual gold recovered is apportioned to the various sources in proportion to the estimated content in each source after allowance has been made for any differential metallurgical recovery. The latter is determined from bottle roll test on monthly composite samples.

3.3.6 KUSASALETHU OPERATION PRODUCT TRANSPORT

3.3.6.1 RAW MATERIALS

Methods of transporting materials include a conveyor system, as well as trucks. The transportation used for the different material is indicated in Table 6 below.

Table 6: Transportation of Materials

Type of Material	Transportation Method
Underground Reef	Conveyor system
Current Waste	Trucks
Rock Dumps	Road (by truck) and conveyor belts

3.3.6.2 FINAL PRODUCTS

Gold dried sludge produced at the plant is transported by air to the Rand Refinery.

3.4 ACTIVITY INFRASTRUCTURE DESCRIPTION

As mentioned above the Kusasalethu operation consists of one metallurgical plant (Kusasalethu Plant). A summary of the existing surface infrastructure at the Kusasalethu operation is indicated in Table 7 below.

Table 7: Surface infrastructure at the Kusasalethu operation

Kusasalethu Operational Area	Deelkraal Operational Area
TSF; East reservoir and west reservoir; RWD; Spillage pond Nos. 1 and 2; STP; Rock dump stockpile; Chemical laboratories; Training centres; Sub-stations; Electrical workshop; Fitting workshop rockdrill; Boiler-making workshop; Carpenter and related building workshop; Petrol and diesel garage; Salvage yard and repair bay; Compressor house; Salvage yard at the shaft and at the Met-plan; Refrigeration plant; Man and material shaft; Rock and ventilation shaft; Kusasalethu management offices; Kusasalethu shaft offices; and Plant office at Kusasalethu gold plant.	Deelkraal Village dam; TSF; Stormwater dam; WRD (Deelkraal); Village houses and hostel; Sub-station; Ventilation shaft; and Demolished metallurgic plant.

3.5 KUSASALETHU AND DEELKRAAL MINING RELATED ACTIVITIES

3.5.1 WASTE STORAGE AREA (KUSASALETHU)

The storage area is used for the storage of hazardous material (e.g., oil, paint, gearboxes, etc.) and non-hazardous material (e.g., paper, wood, asbestos, and plastics). Further storage activities within the storage area includes the storage of cement and the temporary storage of recyclable material such as jumpers. Sandblasting of contaminated radioactive equipment also takes place at the storage area.

3.5.2 WATER STORAGE FACILITIES AND WASH BAY

The water storage facilities located at the Kusasalethu operational area are used for the storage of water from the Rand Water Board (east reservoir and west reservoir). The East reservoir supplies potable water to the village and hostel. The West reservoir supplies domestic water to shaft offices, change houses and make-up water to the Kusasalethu plant and shaft operation.

The Deelkraal operational area is not in use; however, the water storage facilities are still present of the Deelkraal area. Underground storage dams form part of the underground chilled service water used for drilling at the Kusasalethu operation. The underground storage dams receive Rand Water Board water from the Kusasalethu Shaft.

The water storage facilities at the Kusasalethu operation include the following:

- TSF;
- East reservoir and west reservoir;
- Underground and surface storage dams;
- RWD; and
- Spillage ponds number 1 and 2.

The water storage facilities at the Deelkraal Operation includes:

- Deelkraal Village dam;
- TSF; and
- Old Stormwater dam.

Table 8: Kusasalethu water storage dams and capacities

Level	Dam	Capacity
Surface Water Dams	Hot Water Dam	**2 240 m^3**
	Chill Water Dam 1	**5 320 m^3**
	Chill Water Dam 2	**3 000 m^3**
	Condenser/Pre-Cool Dam	**2 500 m^3**
29 Level (underground)	Hot Water Dam 1	**768 m^3**
	Hot Water Dam 2	**1 623 m^3**
	Chill Water Dam	**1 045 m^3**
52 Level (underground)	Hot Water Dam 1	**1 243 m^3**
	Hot Water Dam 2	**2 344 m^3**
	Chill Water Dam	**1 045 m^3**
71 Level (underground)	Hot Water Dam 1+2	**2 125 m^3**
	Hot Water Dam 3	**2 000 m^3**
	Chill Water Dam 1	**2 016 m^3**
	Chill Water Dam 2	**2 246 m^3**
75 Level (underground)	Hot Water Dam 1	**1 505 m^3**
	Hot Water Dam 2	**1 945 m^3** **Total hot water: 3 450 m**
	Buffer Dam	**2 500 m^3**
100 Level (underground)	Hot Water Dam 1	**4 712.4 m^3**
	Hot Water Dam 2	**4 712.4 m^3**

Level	Dam	Capacity
		Total hot water: 14137 m^3
	Hot Water Dam 2	**4 712.4 m^3**
115 Level (underground)	Hot Water Dam 1	**2 749 m^3**
	Hot Water Dam 3	**2 749 m^3** **Total hot water: 5498 m^3**

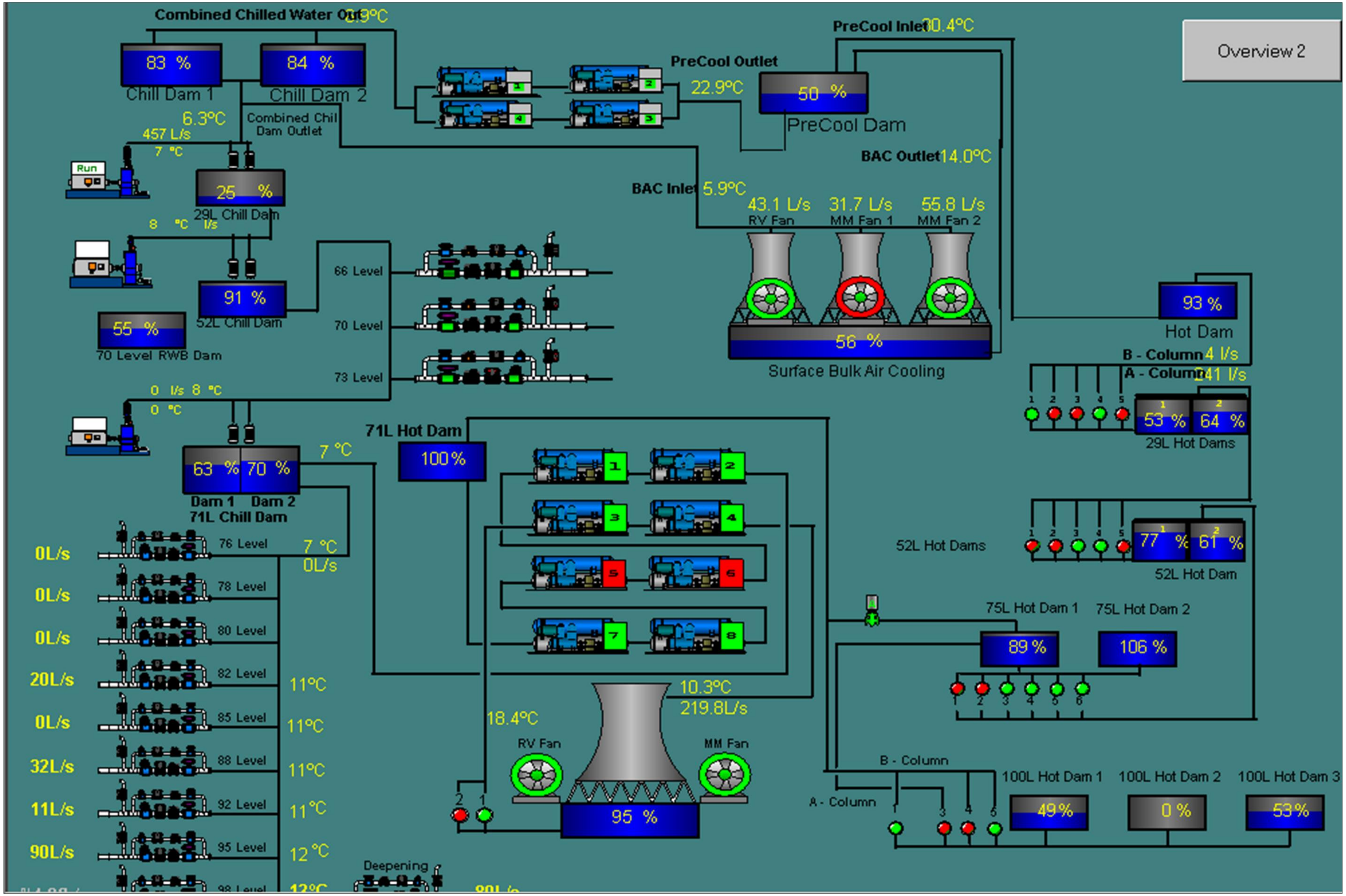

Figure 4: Depicting Underground Water Management System with Storage Facilities

3.5.3 BOILER SHOP

The boiler shop is used for the maintenance of equipment and the storage of spare parts. Boiler shop activities will include the following:

- Use of oils and lubricants during maintenance, service and repair of mining equipment and machinery;
- Storage of spare parts;
- Activities including grinding, cutting and welding;
- Storage and use of paint;
- Storage and use of chemicals and gases;
- Storage of transformers, electrical motors, equipment and concrete;
- Storage of molasses; and
- Storage of old oil outside gate.

3.5.4 SALVAGE YARD

The salvage yard is the area where all non-hazardous waste and hazardous waste are removed to. The salvage yard also stores non-hazardous waste and hazardous waste, prior to be removed and disposed of by a waste removal contractor. At the salvage yard waste will be put in drums that will be emptied directly into the contractor's containers. Different types of containers are made available by the contractor for the different waste material stored at the salvage yard. When full, the containers are removed to the salvage yard for radiation clearance, further separation and final disposal. Records of disposal will be kept at the salvage area.

3.5.5 HOIST ROOM

At the Hoist Room, which is located at the Kusasalethu Operation, the following operational activities take place:

- Operation and maintenance of winder drum;
- Operation and maintenance of hydraulic power pack (braking and lubrication of bearings;
- Operation and maintenance of gearboxes, filters and fans; and
- Loading and off-loading of equipment.

3.5.6 BANK

The bank is used for temporary storage of materials at the Kusasalethu Operation, prior to being used underground for mining purposes. The bank is responsible for the temporary storage of the following material:

- Temporary storage of fuels, lubricant, chemicals, etc. before going down the shaft;
- Temporary storage of waste coming from underground;
- Temporary storage of radioactive material; and
- Temporary storage of conveyor belts and cables.

3.5.7 BATCH PLANT

The batch plant is still in operation and the following activities will take place within the plant:

- Use of lubrication oil for bearings;
- Use of chemicals in water softeners for cooling towers;

- Use of transformers;
- Use of generators;
- The storage of material containing hazardous substances; and
- Use of process water - water overflow from cooling towers.

3.5.8 REEF SILOS

The reef silos at the Kusasalethu Operation are used for the storage of gold ore, prior to being transported to the Kusasalethu plant for processing. The reef silos do generate waste that is removed to the shaft salvage yard.

3.5.9 TIMBER YARD

All timber and pellets are stored at the timber yard for re-use by the mine or for recycling. Timber is made available for re-use by the local community.

3.5.10 EXPLOSIVES HANDLING

The explosive handling and destruction bay is used for the storage of explosives.

3.5.11 SEWERAGE TREATMENT PLANT (KUSASALETHU)

Kusasalethu has its own STP, which operates on the biological filtration digestion process. The Kusasalethu STP is authorised to treat effluent from the processing plant. The quality of the water containing waste to irrigate may not exceed the values ranges as indicated in the WUL (refer to Table 9 below).

Table 9: Wastewater Effluent Standards

Substance/Parameter	Licence Limit
Faecal coliforms (per 100 ml)	250
E. coli (Count/100ml)	0
Chemical Oxygen Demand (mg/l)	5000
pH	5.0-9.5
Electrical Conductivity (EC) (mS/m)	70 mS/m above intake to a maximum of 150 mS/m
Nitrate (NO2/NO3 as N) (mg/l)	5
Total Dissolved Solids (TDS) (mg/l)	30
Calcium (as CaCO3) (mg/l)	5000

3.5.12 WORKSHOPS, ADMINISTRATION AND OTHER BUILDINGS

3.5.12.1 KUSASALETHU OPERATION

There are a large number of well-equipped and high standard workshop facilities for Kusasalethu. These can be briefly classified as follows:

- Electrical workshop;
- Fitting workshop rockdrill;
- Boiler-making workshop;

- Mechanical workshop;
- Sub-shaft workshop;
- Winch workshop;
- Carpenter and related building workshop;
- Petrol and diesel garage;
- Salvage yard and repair bay; and
- Housing depot.

The workshop areas are used for regular maintenance and servicing of mining vehicles and machinery. Workshop activities include the following:

- Use of oils and lubricants during maintenance, service and repair of mining vehicles and machinery;
- Washing of parts;
- Activities including grinding, cutting, welding;
- Dismantling of vehicles and storage of parts at the “scrap yard”; and
- Disposal of material containing hazardous substances and non-hazardous substances.

The administration buildings in the Kusasalethu Operation area are as follows:

- Regional main offices;
- Materials management – regional estate offices;
- Kusasalethu management offices; and
- Kusasalethu shaft offices.
- Plant office at Kusasalethu Gold Plant. Other buildings include:
- Chemical laboratories;
- Engagement centres;
- Training centres;
- Sub-stations; and
- Various other smaller buildings.

3.5.13 HOUSING, RECREATION AND OTHER EMPLOYEE FACILITIES

3.5.13.1 **KUSASALETHU OPERATION**

3.5.13.1.1 HOUSING

Ideally, all employees should have the opportunity of living at or near their place of work with their families if they so choose. Where circumstances or financial constraints make this impossible, the company offers accommodation for employees in single status hostels, where an attempt is being made to ensure an acceptable quality of life. There are five single status hostels in the region and major efforts are being made to provide higher standards of accommodation and recreation facilities. Flats have been erected to enable wives of employees to visit them and dining halls and clubs have been upgraded.

3.5.13.1.2 RECREATION AND OTHER EMPLOYEE FACILITIES

The mines are actively involved with socio-economic upliftment within the less privileged communities. Financial and advisory assistance is given for the establishment of small businesses, education and local government affairs.

There are pre-primary schools in Kusasalethu village. Various training centres are available on the mines and an adult education centre has been commissioned. Primary health services are provided from medical stations in the hostels and the resuscitation centres at each mine shaft. The following supportive services are available at the mine hospital:

- Pharmaceutical;
- Physiotherapy;
- Laboratory;
- Radiography;
- Biokinetics;
- Primary health care;
- Occupational therapy;
- Pathology laboratory;
- Audiology;
- Social services; and
- Public health.

A full range of sport facilities have been provided in the different communities. These facilities include the following:

- Stadium for athletics, soccer;
- Stadium for rugby and cricket;
- Tennis courts;
- Indoor sport facilities;
- Various other smaller sports facilities;
- Recreation clubs in the mine villages; and
- Recreation clubs at the five hostels.

3.5.13.1.3 SHOPS

There are various shops on the mines that are rented to tenants to provide a service to the employees.

3.5.13.1.4 TRANSPORT OF EMPLOYEES

Vehicle transport for employees is satisfied by mine busses, private taxis and motor cars.

3.5.13.2 **DEELKRAAL OPERATION**

3.5.13.2.1 HOUSING

Deelkraal Operation is not in use and all mine infrastructures on Deelkraal has been demolished with the exception of Village houses and hostels, which belong to Moria Mining. Occupants of the village houses and hostels will use the recreation and other employee facilities as described above at the Kusasalethu Operation.

3.6 PROPOSED INFRASTRUCTURE

This section provides details of the new infrastructure proposed in the Proposed Kusasalethu Return Water and Backfill Pipelines Project. This infrastructure will be operated alongside the existing infrastructure if this project is approved.

3.6.1 PIPELINES

Harmony is planning to construct the following for the Kusasalethu Operation:

- Two (2) new backfill pipelines (1 x duty and 1 x standby). The estimated daily volume of backfill that will be pumped to Kusasalethu Plant will be approximately 1 100 tons (311 4853 litres). The backfill pipelines will have an internal diameter (ID) of 200 mm and flow rate of between 36 l/s and 40 l/s;
- One (1) new return water pipeline for pumping an estimated volume of 186 000 litres daily to Savuka Gold Plant (SGP). The return water pipeline will also have an ID of 200 mm with a flow rate of between 15 l/s and 20 l/s; and
- The estimated distance of the three pipelines is 7 750 metres (7.75km), and all will be steel and flanged pipes installed on prefabricated concrete plinths above ground. The proposed pipelines will be installed within existing pipeline corridors and road reserves.

3.7 KEY WATER USES AND WASTE STREAMS

The following WULs have been approved for the Kusasalethu operation in terms of the NWA:

- WUL License No.: 01/C23E/ABEFGJ/2802 superseded by the 2020 WUL; and
- WUL License No.: 08/C23J/AJFG/10192 issued on 14 December 2020.

Table 10 shows the previously approved water uses for the Kusasalethu operation. The new authorised water uses at Kusasalethu operation are listed in Table 11 below.

Table 10: 2015 WUL (WUL No. 01/C23E/ABEFGJ/2802)[2]

No	Section 21 Water Use	Description of Water Use	Property	Title Deed No.
1	21(a) Taking water from a water resource.	A total volume of 941 448 m^3/a of surface water run-off is contained in the TSF to be used in the mining processes.	Buffelsdoorn 143 IQ, Portion 0	T51657/2003
		A total volume of 92 016 m^3/a of surface water run-off is contained in the RWD to be used in the mining processes.		
		A total volume of 600 000 m^3/a of underground water may be dewatered from Deelkraal for the use of mining processes.		
2	21(b) storing water.	The storing of 3 500 m^3/a of water from the Rand Water Board for village and hostels in the East Reservoir.		
		The storing of 3 500 m^3/a of water from the Rand Water Board for village and hostels in the West Reservoir.		
3	21(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1).	Discharging of 980 676 m^3/a of domestic treated wastewater for irrigation of the golf course.		
4	21(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	Discharging of 5400 000 m^3/a of Stormwater collected at the plant and is discharged to the Loopspruit.		
5	21(g) Disposing of waste in a manner which may	Section 21(g): Disposing of 30 000 m^3/a of course material on the rock dump stockpile following process activities.		

[2] This licence has been superseded by the licence issued in 2020 (WUL Ref. No.: 08/C23J/AJFG/10192).

No	Section 21 Water Use	Description of Water Use	Property	Title Deed No.
	detrimentally impact on a water resource	Disposing of 1400 000 m^3/a of slimes affected water from the mining processes in the TSF.		
		Disposing of 227 820 m^3/a of returned affected water (RWD) from the TSF dam for reuse within the plant.		
		Storing of 25 302 m^3/a affected water in the spillage pond 2 to prevent the pollution of the environment and allow for evaporation.		
		Disposing of 75 m^3/a sewage sludge from the sewage treatment plant on the drying beds.		
		257 904 m^3/a of mine affected water is used for dust suppression at the TSF.		
		The storage of 4 125 m^3/a of affected water used for drilling and cooling as part of the closed system is stored in the underground storage dam: Level 71 hot water dam 1/2.		
		The storage of 4 262 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: Level 71 chill water dam 1/2.		
		The storage of 5 950 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: Level 75 chill water dam 1/2.		
		The storage of 14 137 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: Level 100 hot water dam 1/2.		
		The storage of 5 498 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: Level 115 hot water dam 1/2.		

No	Section 21 Water Use	Description of Water Use	Property	Title Deed No.
		The storage of 1 623 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: Level 29 hot water dam 1/2.		
		The storage of 1 045 m^3/a of affected water from the shaft to be used for chilled service as part of drilling is stored in the underground storage dam: chill water dam Level 29 chill water dam 1/2.		
		The storage of 8 320 m^3/a of affected wastewater used for drilling and cooling that forms part of the underground affected water management system in the surface dam: chill water dam no 1 and 2.		
		The storage of 2 500 m^3/a of affected wastewater used for drilling and cooling that forms part of the underground affected water management system in the surface dam: condenser/pre cooled dam.		
6	21(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation if an activity or for the safety of people.	The removal of 600 000 m^3/a of water from underground from Deelkraal for the water to be used in the mine processes.		

Table 11: 2020 WUL (License No. 08/C23J/AJFG/10192)

No	Section 21 Water Use	Description of Water Use	Property	Coordinates
1	21(a) Taking water from a water resource.	A total volume of 941 448 m^3/a of surface stormwater water run-off is contained in the TSF to be used in the mining processes.	Buffelsdoorn 143 IQ, Portion 0	S 26°27'55.3" E 27°20'52.8"
		A total volume of 92 016 m^3/a of surface stormwater water run-off is contained in the RWD to be used in the mining processes.		S 26°28'00.1" E 27°21'54.7"

No	Section 21 Water Use	Description of Water Use	Property	Coordinates
		A total volume of 178 763 m^3/a of underground water may be dewatered from the Kusasalethu operation.		26°27’13.4”S; 27°21’32.4”E
4	21(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit.	Discharging of 950 000 m^3/a of treated domestic wastewater into the Wedela stream (a tributary to the Loopspruit).	Buffelsdoorn 143 IQ, Portion 109	26°27’36.9”S; 27°21’42.9”E
		Discharging of 1608 870 m^3/a of excess underground water dewatered from Kusasalethu operations into the Varkenslaagtespruit.	Buffelsdoorn 143 IQ, Portion 9	26°27’18.9”S; 27°21’36.5”E
5	21(g) Disposing of waste in a manner which may detrimentally impact on a water resource.	Disposing of 30 000 m^3/a of course material on the rock dump stockpile from process mining processes.	Buffelsdoorn 143 IQ, Portion 0	26°27’38.4”S; 27°21’55.4”E
		Disposing of 1400 000 m^3/a of slimes affected water from the mining processes in the TSF.		26°27’55.3”S; 27°20’35.9”E
		Disposing of 227 820 m^3/a (on a 149 223 m^3 capacity) of returned affected water (Return Water Dam) from the TSF dam for reuse within the plant.		26°28’00.1”S; 27°21’54.7”E
		Storing of 25 302 m^3/a dirty water in the spillage pond 1 from spillages of the process plant area. This dirty water will be re-used within the plant.		26°27’38.1”S; 27°21’54.7”E
		Storing of 25 302 m^3/a affected water in the spillage pond 2 to prevent the pollution of the environment and allow for evaporation.		26°27’39.1”S; 27°21’19.3”E
		Disposing of 75 m^3/a sewage sludge from the STP on the drying beds.		26°27’38.9”S; 27°21’39.4”E
		257 904 m^3/a of mine affected water is used for dust suppression at the TSF.		26°27’55.3”S;

No	Section 21 Water Use	Description of Water Use	Property	Coordinates
				27°20’52.8”E
		The storage of 2 240 m^3/a of affected water used for drilling and cooling as part of the underground affected water management system.		26°27’12.68”S; 27°21’33.70”E
		The storage of 8 320 m^3/a of affected wastewater used for drilling and cooling which form part of the underground affected water management system: Level 71 chill water dam 1/2 (Hot Water Dam No 1 and 2).		26°27’12.68”S; 27°21’33.70”E
		The storage of 2 500 m^3/a of affected wastewater used for drilling and cooling that forms part of the underground affected water management system in the surface dam: condenser/pre-cooled dam.		26°27’12.68”S; 27°21’33.70”E
6	21(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.	The removal of 1 787 634 m^3/a of underground water from Kusasalethu Mine in order to keep the mine dry.	Buffelsdoorn 143 IQ, Portion 0	26°27’13.4”S; 27°21’32.4”E

Table 12: New Water Uses to be Licensed

No	Section 21 Water Use	Description of Water Use	Property	Volume(tonnes/annum)	Coordinates
1	21(c)	Pipeline within 500 m of regulated area of a watercourse	Blyvooruitzicht 116 IQ, Portion 93 Buffelsdoorn	N/A	Start: 26°25'41.07"S; 27°23'0.97"E

No	Section 21 Water Use	Description of Water Use	Property	Volume(tonnes/annum)	Coordinates
			143 IQ, Portion 7		End: 26°27'8.37"S; 27°21'13.78"E
2	21(i)	Pipeline within 500 m of regulated area of a watercourse	Blyvooruitzicht 116 IQ, Portion 93 Buffelsdoorn 143 IQ, Portion 7	N/A	Start: 26°25'41.07"S; 27°23'0.97"E End: 26°27'8.37"S; 27°21'13.78"E
3	21(c)	Pipeline crossing an Artificial Wetland (HGM 1)	Blyvooruitzicht 116 IQ, Portion 93	N/A	Start: 26°25'43.82"S; 27°22'43.25"E End: 26°25'38.12"S 27°22'18.78"E
4	21(i)	Pipeline crossing an Artificial Wetland (HGM 1)	Blyvooruitzicht 116 IQ, Portion 93	N/A	Start: 26°25'43.82"S; 27°22'43.25"E End: 26°25'38.12"S

No	Section 21 Water Use	Description of Water Use	Property	Volume(tonnes/annum)	Coordinates
					27°22'18.78"E
5	21(c)	Pipeline crossing a Channelled Valley Bottom and River (HGM 3)	Buffelsdoorn 143 IQ, Portion 31	N/A	Start: 26°26'38.26"S; 27°21'35.66"E End: 26°26'46.99"S; 27°21'30.53"E
6	21(i)	Pipeline crossing a Channelled Valley Bottom and River (HGM 3)	Buffelsdoorn 143 IQ, Portion 31	N/A	Start: 26°26'38.26"S; 27°21'35.66"E End: 26°26'46.99"S; 27°21'30.53"E
7	21(g)	Backfilling at the Kusasalethu Shaft	Buffelsdoorn 143 IQ, Portion 9(RE)	300 000 tpa	26°27'12.27"S; 27°21'33.54"E

3.7.1 WASTE STREAMS

The following waste streams are relevant to the mine:

- 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);
- Sludge handling (Sludge removed from the trenches);
- TSF for storing of slimes affected water;
- Rock dump site for disposal of course material after process activities;
- RWD for re-use of water from the TSF dam;
- Two spillage ponds for storing dirty water;
- Domestic Waste is sorted on site and disposed to a registered landfill site;
- Drying beds for the sewage sludge from the sewage treatment plant; and
- Various underground storage dams.

3.8 ORGANISATIONAL STRUCTURE

The organisational structure of the Kusasalethu Operation is indicated in Figure 5 below.

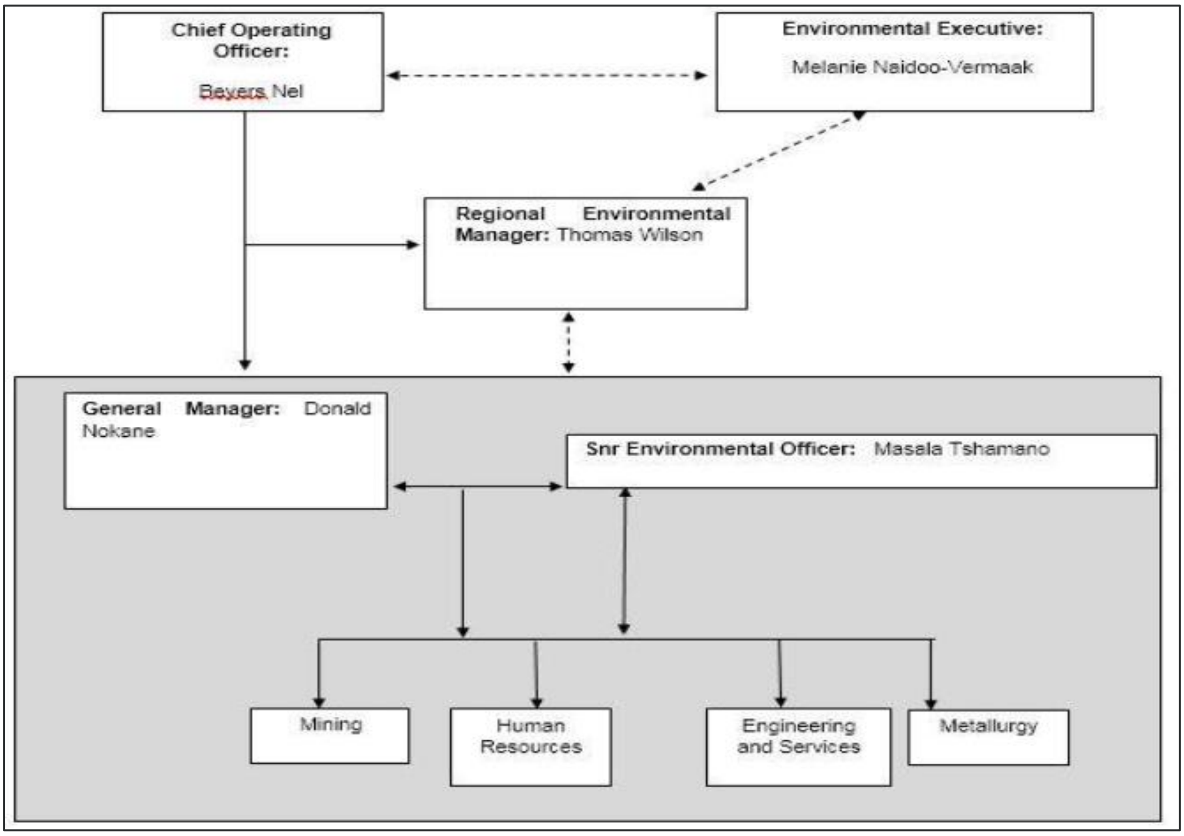

Figure 5: Organogram of the Kusasalethu and Deelkraal Operation

3.9 BUSINESS AND CORPORATE POLICIES

The Kusasalethu Operations is owned by Harmony Gold Mining (Pty) Ltd. Harmony has various business and corporate policies in place, which are applicable to the Kusasalethu Operation. This includes an Occupational Health and Safety Policy, dated October 2017, as well as an Environmental Policy, dated October 2017. Refer to Appendix B.

4 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

From an environmental and social perspective, the Deelkraal operations are required to comply with all the obligations in terms of the provisions of the National Environmental Management Act, 107 of 1998 (NEMA) and MPRDA. The additional legislative guidelines directing the operations are outlined in further detail in Table 13 below.

Table 13: Policy and Legislative Context

Applicable legislation and guidelines used to compile the report	Reference where applied
The Constitution of the Republic of South Africa, 1996 **Under Section 24 of the Constitution of the Republic of South Africa, 1996 (the Constitution) it is clearly stated that:** **Everyone has the right to** **(a) an environment that is not harmful to their health or well-being; and** **(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -** **(i) Prevent pollution and ecological degradation;** **(ii) Promote conservation; and** **(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.**	The Constitution of the Republic of South Africa of 1996 (the Constitution) ushered in an era aiming at the promotion of sustainability, where social, ecological and developmental issues are considered to be equally important. Section 24 of the Constitution states that everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures, that:– i. Prevent pollution and ecological degradation; ii. Promote conservation; and iii. Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.
National Environmental Management Act, 1998 (Act No 107 of 1998) and EIA Regulations (as amended in 2021) **The Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment.** **Section 24 (1)(a) and (b) of NEMA state that:** **The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.** **The EIA Regulation, 2014 was published under GN R 982 on 4 December 2014 (EIA Regulations) and came into operation on 08 December 2014. Together with the EIA Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended. The EIA Regulations have been made applicable to prospecting and mining activities.**	The NEMA, as amended was set in place in accordance with section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: "The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity."
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) **The MPRDA sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.**	The Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) sets out the requirements relating to the development of the nation's mineral and petroleum resources. It also aims to ensure the promotion of economic and social development through exploration and mining related activities. The MPRDA ensures that environmental management principles as set out in the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) are applied to all mining operations. The MPRDA serves as a guideline for interpretation, administration and implementation of environmental requirements and ensures that mineral resources are exploited in a sustainable manner to serve both present and future generations. The Kusasalethu operation has an approved Mining Right (Ref. No. GP/30/5/1/1/2/07 MR) which permits the mining and extraction of gold.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) **On 29 November 2013, the list of waste management activities published under GN R718 of 3 July 2009 (GN R718) was repealed and replaced with a new list of waste management activities under GN R921 of 29 November 2013. Included in the new list are activities listed under Category A, B and C. These activities include inter alia the following:** **<u>Category A</u> describes waste management activities requiring a Basic Assessment process to be carried out in accordance with the EIA Regulations supporting an application for a waste management licence;** **<u>Category B</u> describes waste management activities requiring an Environmental Impact Assessment process to be conducted in accordance with the EIA Regulations supporting a waste management licence application; and** **<u>Category C</u> describes waste management activities that do not require a WML but these activities will have to comply with the prescribed requirements and standards as prescribed by the Minister, which includes the Norms and Standards for Storage of Waste, 2013. These activities include the storage of general waste at a facility with a capacity to store in excess of 100 m^3 and storage of hazardous waste in excess of 80 m^3.**	The Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits from a Prospecting, Mining, Exploration or Production Operation were published in GN R 632 on 24 July 2015 under section 69(1)(i) of the National Environmental Management: Waste Act (NEM: WA). The purpose of the Regulations is to regulate the planning and management of residue stockpiles and residue deposits from prospecting, mining, exploration or production operations. Harmony has a certificate for the Deelkraal landfill site (Certificate #: D04278-01) and for the Kusasalethu Operation, a certificate for hazardous waste generator (Certificate #: D04279-01) (refer to Appendix B for all licences, permits and certificates).

Applicable legislation and guidelines used to compile the report	Reference where applied
The Waste Classification and Management Regulations published under GN R 634 of November 2013 require that all wastes be classified according to SANS10234 and managed according to its classification.	
National Water Act, 1998 (Act No. 36 of 1998) (NWA) **The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.** **GN R 704 was published in June 1999 and aims to regulate the use of water for mining and related activities for the protection of water resources and states the following: Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution;** **Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution;** **Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, and** **Regulation 7 details the requirements necessary for the protection of water resources.**	The NWA provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA. Section 26 of the NWA allows for the promulgation of regulations for the protection of water resources from impacts as a result of mining and related activities. The DWS has promulgated the Government Notice Regulations in terms Section 26 (1) (b), (g) and (i) of the NWA to provide minimum requirements which will allow the fulfilment of the goal to protect the water resources. Section 21 of the NWA defines a list of water uses which requires a Water Use Authorisation. Listed activities in terms of Section 21 include the following: Section 21(a) taking water from a water resource; Section 21(b) storing water; Section 21(c) impeding or diverting the flow of water in a watercourse; Section 21(d) engaging in a stream flow reduction activity contemplated in Section 36 of the Act; Section 21(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1); Section 21(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; Section 21(g) disposing of waste in a manner which may detrimentally impact on a water resource; Section 21(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; Section 21 (i) altering the bed, banks, course or characteristics of a watercourse; Section 21(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and Section 21(k) using water for recreational purposes. Water uses applicable to Kusasalethu and Deelkraal's current activities comprise Section 21 (a), (f), (g) and (j) water uses (refer to Table 11 above; License No.: 08/C23J/AJFG/10192).
GN R704 Regulations on the Use of Water for Mining and Related Activities under the NWA **Regulations on Use of Water for Mining and Related Activities aimed at the Protection of Water Resources (GN. 704 of 1999). Regulations on Use of Water for Mining and Related Activities aimed at the Protection of Water Resources (GN. 704 of 1999). These Regulations place restrictions on mining operations for purposes of protecting water resources.**	Regulations 4 and 5 of the regulation on Use of Water for Mining and Related Activities aimed at the protection of water resources, GN R704 published in June 1999, states the following: Regulation 4 restricts the placement of any waste disposal facilities: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance in old workings of underground or open cast excavations that may result in water pollution; Regulation 5 restricts the use of any material that can cause water pollution: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution; Regulation 6 is concerned with the capacity requirements of clean and dirty water systems; Regulation 7 details the requirements necessary for the protection of water resources; and Regulation 8 provides the requirements that need to be implemented to ensure that access control is implemented at all working areas where impoundment and dams store contaminated water.

Applicable legislation and guidelines used to compile the report	Reference where applied
	The provisions of GN 704 are applicable to the Kusasalethu Operation as the activities are related to mining activities. Therefore, these regulations are duly considered.

4.1 PROJECT SPECIFIC REGULATORY WATER AND WASTE FRAMEWORK

Harmony was issued a WUL in December 2020 which supersedes all previous Water Use Authorisations (i.e., License No.: 01/C23E/ABEFGJ/2802). The subsections below detail the approved water uses associated with the operation.

4.1.1 EXISTING LAWFUL USES

Harmony is in possession of a WUL (License No.: 08/C23J/AJFG/10192; file number: 27/2/2/C923/3/9, dated 14 December 2020) for water uses associated with the current operation as detailed in Table 11.

4.1.2 GENERALLY AUTHORISED WATER USES

The NWA makes provision for General Authorisations (GAs) which allow for a specific type of water use or category of water user to be generally authorised through a registration process, negating the need for a WUL.

No generally authorised water uses have been issued or are applicable to the Kusasalethu Operations.

4.1.3 PERMITS

The following permits/exemptions are available for the Kusasalethu Operation:

- Permit 668B, dated 17 June 1977, Purification and disposal of effluent in terms of Section 21 of the Water Act, 1956 (Act No. 54 of 1956) (Ref. No. JEP/VW/WDL4-059-253.);
- Permit 999B, dated 8 June 1982, Permit in terms of Section 21(5) (a) of the Water Act, 1956 (Act No. 54 of 1956) in reference to no 1 Shaft, South complex, Western Deep Levels (Ref. no. B33/2/323/11);
- Purification or treatment of water used for industrial purposes, including effluent resulting from such use, and disposal of such water, including water recovery from any effluent, exemption 756B granted in terms of section 21(4) of the Water Act, 1956 (Act No. 54 of 1956) (Ref. No. B33/3/323/52, dated 1987/06/29;
- Permit 569N, dated 23 June 1957, Permit in terms of Section 21(1) of the Water Act, 1956 (Act No. 54 of 1956) in terms of the use for industrial purposes. Issue of permit 569 in terms of section 21(c) of the Water Act,1956; and
- Use of the public water for industrial purposes in terms of Section 12 of the Water Act, 1956 (Act No. 54 of 1956), dated 17/06/1977. (Ref. no. 33/2/323/11).

The following permits/exemptions are available for the Deelkraal Operation:

- Permit in terms of section 20(1) of the Environmental Conservation Act, 1989 (Act No. 73 of 1989), For a waste disposal facility, dated 1992/10/16 (Ref. No. B33/2/323/56S).

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

Due to the age of the mine and based on the level of the associated risks versus the cost in order to comply; some activities have been identified for, which it has been established that compliance to GN 704 (1999) is not possible. Therefore, exemption from GN 704 has been granted for the activities presented in Table 14. The mine is an existing operation. GN 704 audits are conducted annually to identify the status of compliance against the requirements of GN 704 of 4 June 1999. In addition, monitoring programmes are reviewed and strengthened to assess the level of impact for areas of noncompliance with the requirements of GN 704.

Table 14: Activities Requiring Exemption from Regulation GN 704 of 4 June 1999

Regulation	Activity	Motivation
Regulation 4: Restriction on locality of reservoirs, deposits, dams, underground and opencast mining, prospecting and related activities.	The Kusasalethu RWD, TSF and the Waste Rock Dump are constructed in the non-perennial tributary of the Loopspruit.	The Kusasalethu RWD, TSF and the Waste Rock Dump were constructed during 1970 in the non-perennial tributary of the Loop Spruit. The Return Water Dam was constructed to prevent the contamination of clean water (Loopspruit) by affected Stormwater and recovered affected water from the TSF.
Regulation 6 (a): Confinement of unpolluted water to clean water system; and Regulation 6(b) Clean water system may not spill into any dirty water system more than once in 50 years, and (d) vice versa.	Stormwater from the non-perennial tributary of the Loop Spruit will report to the affected water circuit (RWD).	
Regulation 4c): Residue or other substances, which may cause pollution, may not be disposed within workings of any underground or opencast mine, excavation, prospecting diggings, pits or any other excavation.	Kusasalethu Operation uses tailings residue for underground support (Backfill) at a rate of ± 25 000 tonnes per month.	The tailings residue used for underground support helps with underground stability and, therefore, improved mining operation and safety.
Regulation 4 (a): Restriction on locality of the proposed return water and backfill pipelines.	The proposed return water and backfill pipelines will traverse a stream and will be within a determined 1: 100 year flood line at the stream crossing point.	SGP has been identified as the feasible source of backfill for the Kusasalethu Mine. The proposed pipelines will be used for transporting backfill material which will help with providing underground stability and support underground to improve mining operations and safety at the Kusasalethu mine. One new return water pipeline is required for pumping an estimated volume of 186 000 litres daily to SGP.

4.1.5 PROPOSED AMENDMENTS

There are no proposed amendments applicable to the Kusasalethu WULs. Approximately 300 000 tonnes per annum (t/a) of the 3 600 000 t/a tailings currently being disposed at the Savuka TSF will be redirected from Savuka plant for disposal at the Kusasalethu Shaft where the tailings will be used as backfill material to provide support underground. A separate amendment of the West Wits WUL (08/C23E/AFGJCE/12157) is therefore being undertaken for these new volumes.

4.1.6 NEW WATER USES TO BE LICENSED

Harmony wishes to construct new return water and backfill pipelines from their existing Savuka Gold Plant to the Kusasalethu Plant. The proposed pipelines will pass through watercourses and therefore Section 21 (c and i) of the NWA water uses will be triggered. The proposed backfilling at the Kusasalethu shaft also triggers a Section

21 (g) water use, hence a water use licence application process is being undertaken for this project. The water uses being applied for have been shown in the map on Figure 6 below.

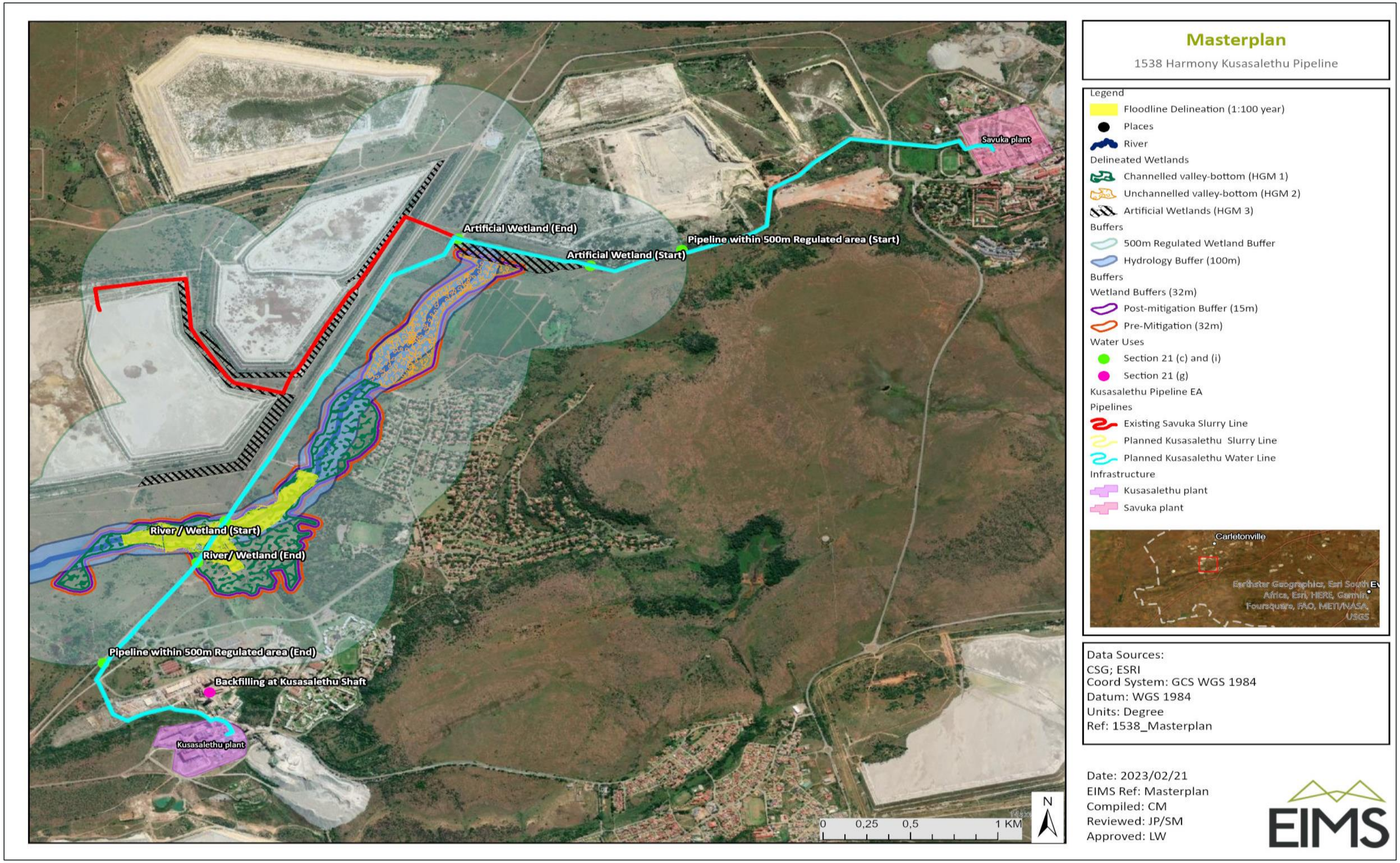

Figure 6: Master Layout Plan

A summary of all new water uses to be licenced is included in the Table 15 below (see Table 16 for more detail).

Table 15: Summary of new water uses to be licenced

Water Use	Name	Purpose
Section 21 (c)	Pipeline within 500 m of regulated area of a watercourse	Pipeline
Section 21 (i)	Pipeline within 500 m of regulated area of a watercourse	Pipeline
Section 21 (c)	Pipeline crossing an Artificial Wetland (HGM1)	Pipeline crossing
Section 21 (i)	Pipeline crossing an Artificial Wetland (HGM1)	Pipeline crossing
Section 21 (c)	Pipeline crossing a Channelled Valley Bottom Wetland and an associated stream	Pipeline crossing
Section 21 (i)	Pipeline crossing a Channelled Valley Bottom Wetland and an associated stream	Pipeline crossing
Section 21 (g)	Backfilling with tailings at Kusasalethu Shaft	Backfilling for underground support

Table 16: Detailed new water uses to be licenced

No	Section 21 Water Use	Description of Water Use	Property	Volumes (tonnes/annum)	Coordinates
1	21(c)	Pipeline within 500 m of regulated area of a watercourse	Blyvooruitzicht 116 IQ, Portion 93 Buffelsdoorn 143 IQ, Portion 7	N/A	Start: 26°25'41.07"S; 27°23'0.97"E End: 26°27'8.37"S; 27°21'13.78"E
2	21(i)	Pipeline within 500 m of regulated area of a watercourse	Blyvooruitzicht 116 IQ, Portion 93 Buffelsdoorn 143 IQ, Portion 7	N/A	Start: 26°25'41.07"S; 27°23'0.97"E End: 26°27'8.37"S; 27°21'13.78"E
3	21(c)	Pipeline crossing an Artificial Wetland (HGM 1)	Blyvooruitzicht 116 IQ, Portion 93	N/A	Start: 26°25'43.82"S; 27°22'43.25"E End: 26°25'38.12"S 27°22'18.78"E

No	Section 21 Water Use	Description of Water Use	Property	Volumes (^{tonnes}/annum)	Coordinates
4	21(i)	Pipeline crossing an Artificial Wetland (HGM 1)	Blyvooruitzicht 116 IQ, Portion 93	N/A	Start: 26°25'43.82"S; 27°22'43.25"E End: 26°25'38.12"S 27°22'18.78"E
5	21(c)	Pipeline crossing a Channelled Valley Bottom and River (HGM 3)	Buffelsdoorn 143 IQ, Portion 31	N/A	Start: 26°26'38.26"S; 27°21'35.66"E End: 26°26'46.99"S; 27°21'30.53"E
6	21(i)	Pipeline crossing a Channelled Valley Bottom and River (HGM 3)	Buffelsdoorn 143 IQ, Portion 31	N/A	Start: 26°26'38.26"S; 27°21'35.66"E End: 26°26'46.99"S; 27°21'30.53"E
7	21(g)	Backfilling at the Kusasalethu Shaft	Buffelsdoorn	Approx.	26°27'12.27"S;

No	Section 21 Water Use	Description of Water Use	Property	Volumes (^{tonnes}/annum)	Coordinates
			143 IQ, Portion 9(RE)	300 000	27°21'33.54"E

4.1.7 WASTE RELATED AUTHORISATIONS

The Kusasalethu operation has a Hazardous Waste Generator certificate (Ref. No. D04279-01, dated 2014-04-02) and has been registered with the South African Waste Information System (SAWIS) established in terms of chapter 6 of the NEM:WA. The Deelkraal operation has a registered Landfill Site for the Disposal of waste to landfill (e.g., non-engineered landfill) and has been registered with the SAWIS established in terms of chapter 6 of the NEM:WA (Certificate No.: D04278-01, dated 2014-04-02).

Harmony also has a certificate (COR-28) for the Kusasalethu operation in terms of the NNR, which allows the mine to carry out activities associated with radioactive material.

4.1.8 OTHER AUTHORISATIONS AND REGULATIONS

The Kusasalethu operation has an approved Mining Right (Ref. No. GP/30/5/1/1/2/07 MR) and EMPr (GP/30/5/1/2/3/2/1/08EM) in terms of the MPRDA. Refer to Appendix A for a copy of the Mining Right.

5 PRESENT ENVIRONMENTAL STATUS

This section provides a description of the existing status of the environment associated with the project area and region (where relevant), focussing on the applicable water resources. The description of the baseline receiving environment (on site and surrounding) was obtained from the studies undertaken by the specialist team as well as the existing documentation as part of the 2022 IWWMP.

5.1 REGIONAL CLIMATE

5.1.1 TEMPERATURE

Meteorological data from Lakes Environmental were obtained for modelling purposes as the South African Weather Service does not have upper data parameters. The one year maximum, mean and minimum temperatures for the Kusasalethu operation are displayed in Table 17 and Figure 7 below. The average daily, maximum temperatures range from 16°C in July to 29.8°C in December. The daily minimum temperatures range from 0.6°C in August to 15.5°C in January. The annual mean temperature for Kusasalethu operation is 16.2°C.

5.1.2 PRECIPITATION

The 2012 to 2014 total monthly rainfall (maximum) and average total monthly rainfall that was reported is indicated in Table 18. The annual total maximum and average rainfall of 1,065 mm and 591 mm are reported for this time period.

Table 17: Average monthly minimum, maximum and mean temperature values for Kusasalethu Operation (Modelled Data, 2009)[3]

Temperature (°C)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly maximum	29.9	27.1	25.1	23.6	21.0	18.1	16.0	22.4	25.3	26.6	29.1	29.8	24.4
Monthly minimum	15.5	12.6	7.1	7.1	3.1	-1.4	-3.0	-0.6	5.5	10.4	9.1	13.1	6.5
Monthly mean	22.1	20.7	18.9	17.0	12.2	9.8	7.1	11.0	16.8	18.2	19.8	22.4	16.2

Table 18: Total monthly and average precipitation values[4]

Precipitation (mm)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly maximum	204.2	115.1	70.9	46.2	6.9	4.1	0.5	8.6	53.1	178.3	148.6	228.1	1065
Monthly minimum	122.0	64.1	35.8	25.1	2.6	1.4	0.3	5.8	19.2	72.9	99.1	142.5	591

[3] Source: Stats SA accessed April 2022
[4] Source: Stats SA Accessed April 2022

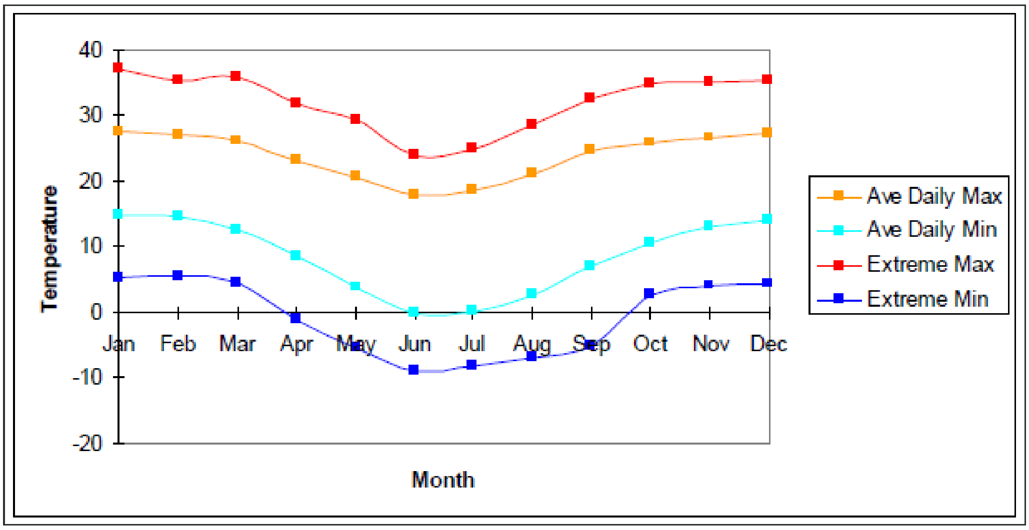

Figure 7: Temperatures indicated at the Carletonville weather station [5]

5.1.3 EVAPORATION

Potential A-Pan evaporation figures recorded for the area are high and indicate that the area is a water deficit area. The average annual A-Pan evaporation is 2 141 mm as indicated in Table 19.

[5] Source: Stats SA Accessed April 2022

Table 19: Average Annual A-Pan Evaporation[6]

Month	Potential Evaporation (MM0 Mean A-Pan
January	235.4
February	194.7
March	175.1
April	136.5
May	114.9
June	92.7
July	110.0
August	156.0
September	203.5
October	239.1
November	232.7
December	250.1
Annual	2141

Surface Water

The information in this Section was taken from the 2022 IWWMP, as well recent audit reports.

5.1.4 WATER MANAGEMENT AREA

The mine falls within the secondary catchment C2. This secondary catchment area forms part of the Upper Vaal Primary Catchment area and therefore, falls within the Upper Vaal Water Management Area (WMA) 08 in the upper catchment areas of quaternary catchment C23J and partially falls into the C23E quaternary catchment (refer to Figure 23). The C23E catchment has a mean annual rainfall of 630.63 mm, with a Mean Annual Run-off (MAR) of 25.9 mm. The quaternary catchment C23J has a mean annual rainfall of 620.21 mm and a mean annual run-off of 383 mm (WR2005: Middleton & Bailey, 2005).

The Upper Vaal Catchment Area includes the Vaal, Klip, Wilge, Liebenbergsvlei and Mooi Rivers and extends to the confluence of the Mooi and Vaal Rivers. It covers a catchment area of 55 565 km². This area includes the very important dams Vaal Dam, Grootdraai Dam and Sterkfontein Dam. The southern half of the area extends over the Free State, the north-east mainly falls within Mpumalanga and the northern and western parts in Gauteng and Northwest provinces, respectively. The largest proportion (46%) of the surface flow in the area is contributed by the Vaal River upstream of Vaal Dam, together with its main tributary the Kliprivier. The Wilge River and the Liebenbergsvlei River contribute 36%, with the remaining 18% originating from the tributaries downstream of Vaal Dam. There are increases in runoff due to impermeable surfaces in urbanised areas. No

[6] Source: Stats SA Accessed April 2022

significant afforestation occurs in the water management area. Numerous farm dams have also been built in the area, which negatively impact on the inflow to Vaal Dam.

5.1.5 WATERCOURSES

At the Kusasalethu operation, the surface run-off water from the northern section of the West Rand Region flows into the Wonderfonteinspruit which in turn flows into the Mooi River and then into the Boskop Dam. The catchment to the south of the mine flows into the Loopspruit which then flows into the Klipdrift Dam and eventually into the Mooi River south of Potchefstroom.

The Deelkraal operation area lies on the catchment divide between the Loopspruit to the south and the Mooirivierloop to the north. The Mooirivierloop flows into the Mooi River and eventually into the Vaal River. The Loop Spruit flows into the Klipdrift Dam and eventually into the Mooi River south of Potchefstroom.

5.1.6 SURFACE WATER USES

Water uses in the area include agriculture activities, irrigation farming and livestock rearing. Water leaving the Kusasalethu operation on the northern boundary enters a canal system, which joins the Mooi River and eventually discharges into the Boskop Dam. Water from the southern boundary of Kusasalethu flows through farms where it is used for irrigation purposes. It then enters a dam where it mixes with water from the Wedela sewerage plant. This water flows into the Loop Spruit River, used for irrigation and eventually flows into the Klipdrift Dam. The water leaving Kusasalethu on the western boundary is used for irrigation by farmers downstream, and eventually flows into the Mooi River and into the Boskop Dam.

The water leaving the Deelkraal operation flows into an area consisting of natural vegetation for approximately 4 km. Thereafter cultivated lands occur until the receiving water body of the Wonderfonteinspruit is reached. Natural run-off mainly occurs during wet weather conditions and no direct abstraction of water occurs from the stream. The users downstream of the sewage plant include cattle farmers, however, some irrigation is undertaken.

5.1.7 SURFACE WATER QUALITY

The recent surface water information was sourced from the most recent quarterly water quality assessment report conducted by Aquatico Scientific (Pty) Ltd (Aquatico) in November 2021. Aquatico conducts surface water quality monitoring on a monthly basis at 18 surface water monitoring localities on and around the Kusasalethu Mine. The recorded water quality for the receiving environment water monitoring localities is displayed in Table 20 and Table 21. The mine currently does not submit the results of analysis reports as per the WUL requirements.

5.1.7.1 **C23E CATCHMENT LOCALITIES**

The C23E catchment monitoring localities consists of the following points: DK Village Dam, Mangaan Drive, Varkenslaagte Dam, GC Outlet and Kusasa GC (Table 20).

The general physical water quality of the receiving environment monitoring localities of this section can be described as neutral to alkaline, non-saline to extremely saline. All the C23E catchment localities with the exception of Kusasa GC exceeded the IWUL discharge limit in terms of Total Dissolved Solids (TDS) and copper (Cu) concentrations while all the C23E catchment localities with the exception of Deelkraal Village Dam exceeded the IWUL discharge limit in terms of manganese (Mn) concentrations. The Varkenslaagte Dam locality exceeded the IWUL discharge limit in terms of Electrical Conductivity (EC) value, concentration of sulphate (SO_4) and Total Suspended Solids (TSS). TSS concentrations also exceeded the limit at localities Mangaan Drive and Kusasa GC while the GC Outlet locality exceeded the IWUL discharge limit in terms iron (Fe).

Furthermore, all receiving environment monitoring localities recorded bacterial counts in terms of E. coli counts. All Localities except Deelkraal Village Dam recorded E. coli counts above the IWUL discharge limit. In addition, Chemical Oxygen Demand (COD) concentrations at all the localities exceeded the IWUL discharge limit. No concentrations of Cyanide (CN), in the analysed forms, or Arsenic (As) was recorded above detection limit at any of the receiving environment monitoring localities of this section. A dissolved Uranium (U) concentration above detection limit and IWUL discharge limit was recorded for locality Deelkraal Village Dam.

5.1.7.2 C23J CATCHMENT LOCALITIES

The C23J catchment monitoring localities consists of the following points: Wedela Stream, Loopspruit US and Loopspruit DS. The water quality is displayed in Table 21. The general physical water quality of the receiving environment monitoring localities of this section can be described as neutral and non-saline. The majority of the variables analysed for recorded concentrations were below the set IWUL limit. However, TSS concentration was noted to exceed the set IWUL limit for all recorded localities. Localities Ammonium (NH4_N) concentration decreased slightly from Wedela Stream to Loopspruit US but increased from Loopspruit US to Loopspruit DS. No concentrations of analysed CN and dissolved Uranium (U) were recorded above detection limit for the localities of this section. All receiving environment monitoring localities of this section recorded elevated bacterial counts in terms E. coli counts.

Table 20: Water Quality Analysis Results of the Receiving Environment Localities (C23E) at Kusasalethu.

DATA TA+A35+A5+A5:I36								
PROJECT NAME	Harmony - Kusasalethu Mine						DATE COMPILED	18 December 2021
ASSESSMENT SET 1	IWUL Discharge Limit for Dewatering into Varkenslaagte spruit						SELECTED DATE	22 November 2021
ASSESSMENT SET 2	DWAF (1996) SAWQG TWQGR for Aquatic Ecosystems						COMPILED BY	Immaculata Famah
								Value exceeds the assessment set 1
VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES				
				DK Village Dam	Maangaan Drive	Vaarkenslaagte Dam	GC Outlet	Kusasa GC
pH @ 25°C	pH	5.0/9.5	-	8.69	9.16	6.47	8.59	7.78
Electrical conductivity (EC) @ 25°C	mS/m	183	-	93.2	108	538	90	24
Total Dissolved solids @ 180°C	mg/l	459	-	570	786	4726	586	224
Fluoride (F)	mg/l	0.6	0.75	0.267	<0.263	<0.263	<0.263	<0.263
Sulphate (SO4)	mg/l	692	-	190	302	2848	187	19.8
Ammonium (NH_4) as N	mg/l	-	0.5	0.087	0.203	1.12	0.892	0.363
Aluminium (Al)	mg/l	-	0.005	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	mg/l	0.01	-	<0.004	<0.004	<0.004	0.033	<0.004
Manganese (Mn)	mg/l	0.01	0.18	<0.001	0.293	13.4	0.109	0.015
Arsenic (As)	mg/l	0.001	0.01	<0.006	<0.006	<0.006	<0.006	<0.006
Boron (B)	mg/l	0.1	-	<0.013	<0.013	<0.013	<0.013	<0.013
Chromium (Cr)	mg/l	0.001	0.007	<0.003	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	mg/l	0.01	0.0003	0.019	0.017	0.07	0.045	0.007
Cadmium (Cd)	mg/l	0.001	0.00015	<0.002	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	0.001	0.0002	<0.004	<0.004	<0.004	<0.004	<0.004
Mercury (Hg)	mg/l	0.001	0.00004	<0.004	<0.004	<0.004	<0.004	<0.004
Dissolved Uranium (U)	mg/l	0.016	-	0.071	<0.015	<0.015	<0.015	<0.015
Zinc (Zn)	mg/l	0.1	0.002	<0.002	<0.002	0.003	<0.002	<0.002
Free Cyanide (CN)	mg/l	0.5	0.001	<0.008	<0.008	<0.008	<0.008	<0.008
Cyanide WAD	mg/l	-	-	<0.003	<0.003	<0.003	<0.003	<0.003
Total Cyanide (CN)	mg/l	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Total suspended solids (TSS)	mg/l	19	100	18	28	222	12	36
Chemical oxygen demand (COD)	mg/l	20	-	41.3	39.6	55.7	36	68.4
E. coli	CFU/100ml	72	-	53	440	1500	4300	1600
Total coliform	CFU/100ml	-	-	170	3300	2800	46000	17000

Table 21: Water Quality Analysis Results of the Receiving Environment Localities (C23J) at Kusasalethu.

DATA TABLE						
PROJECT NAME	Harmony - Kusasalethu Mine				DATE COMPILED	18 December 2021
ASSESSMENT SET 1	Discharge Limit from the WWTW				SELECTED DATE	22 November 2021
ASSESSMENT SET 2	DWAF (1996) SAWQG TWQGR for Aquatic Ecosystems				COMPILED BY	Immaculata Famah
						Value exceeds the assessment set 1
VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES		
				Loopspruit US	Loopspruit DS	Wadela Stream
pH @ 25°C	pH	5.5/8.5	-	7.58	7.58	7.47
Electrical conductivity (EC) @ 25°C	mS/m	75	-	33.3	33.4	31.1
Total Dissolved solids @ 180°C	mg/l	-	-	172	184	186
Calcium (Ca)	mg/l	-	-	23.6	23.5	17.4
Magnesium (Mg)	mg/l	-	-	9.4	9.37	7.8
Sodium (Na)	mg/l	90	-	21.5	21.3	23.4
Potassium (K)	mg/l	-	-	4.8	4.73	4.97
Fluoride (F)	mg/l	-	0.75	<0.263	<0.263	<0.263
Sulphate (SO_4)	mg/l	-	-	45.9	42.8	26.5
Orthophosphate (PO_4) as P	mg/l	1	0.005	0.057	0.074	0.1
Nitrate (NO3) as N	mg/l	6	0.5	1.28	1.37	0.99
Ammonium (NH_4) as N	mg/l	-	0.5	3.23	3.32	4.55
Aluminium (Al)	mg/l	-	0.005	0.003	0.003	0.013
Iron (Fe)	mg/l	-	-	0.189	0.16	0.384
Manganese (Mn)	mg/l	-	0.18	0.086	0.084	0.021
Arsenic (As)	mg/l	-	0.01	<0.006	<0.006	<0.006
Boron (B)	mg/l	-	-	<0.013	<0.013	<0.013
Chromium (Cr)	mg/l	-	0.007	<0.003	<0.003	<0.003
Copper (Cu)	mg/l	-	0.0003	0.006	0.005	0.004
Cadmium (Cd)	mg/l	-	0.00015	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	-	0.0002	<0.004	<0.004	<0.004
Mercury (Hg)	mg/l	-	0.00004	<0.004	<0.004	<0.004
Dissolved Uranium (U)	mg/l	-	-	<0.015	<0.015	<0.015
Zinc (Zn)	mg/l	-	0.002	<0.002	<0.002	<0.002
Free Cyanide (CN)	mg/l	-	0.001	<0.008	<0.008	<0.008
Cyanide WAD	mg/l	-	-	<0.003	<0.003	<0.003
Total Cyanide (CN)	mg/l	-	-	<0.005	<0.005	<0.005
Dissolved oxygen (DO)	mg/l	75	-	4.47	4.11	3.35
Total suspended solids (TSS)	mg/l	25	100	37	34	44
Chemical oxygen demand (COD)	mg/l	75	-	61.1	69.3	74
Total coliform	CFU/100ml	-	-	10700	18000	115000
E.coli	CFU/100ml	130	-	2900	3900	60000
Free chlorine (Cl_2)	mg/l	0.1	0.0002	<0.02	<0.02	0.02

5.1.8 STORAGE OF WATER CONTAINING WASTE

The recorded water quality for the wastewater monitoring localities is displayed Table 22. It should be noted that no assessment set is available in the IWUL and as a result data was not evaluated against any assessment set. However, the general limit for water resources was used for comparison purposes only. The process water monitoring localities that form part of the monitoring programme will be discussed in two sections. The first is the process water monitoring localities for the Deelkraal area and the second the process water localities for the Kusasalethu area.

5.1.8.1 **DEELKRAAL AREA**

The Deelkraal process water monitoring localities consist of the following localities: DK RWD, and DK underdrain. No data was recorded for Deelkraal localities as it was reported to be dry at the time of sampling during the November 2021 sampling run.

5.1.8.2 **KUSASALETHU**

The Kusasalethu process water monitoring localities consist of the following localities: KL Underdrain, KL RWD, KL RWD OF and KL Seepage. The water quality is displayed in Table 22. Kusasalethu process water monitoring localities KL RWD OF was reported to be dry at the time of sampling thus no data is available for this locality.

The general physical water quality of the sampled process water monitoring localities of this section can be described as neutral and very saline to extremely saline.

Kusasalethu process water monitoring localities KL Under Drain, KL RWD and KL RWD Seepage, recorded high EC and concentrations of NH_4-N, Cu and Mn when compared against the General limit for water resources. Locality KL Under Drain and KL RWD further recorded high TSS concentration as well as KL RWD and KL RWD Seepage recorded high Zn concentration. Locality KL Under Drain also recorded high COD concentration when compared against the General limit. No concentrations of Arsenic, and dissolved uranium above detection limit were recorded for any of the Kusasalethu process water localities. Locality KL Under Drain recorded total CN concentration above detection limit. All other remaining Kusasalethu process water localities recorded total Cyanide (CN) concentration below detection limit.

It is recommended that no water from any of the storage facilities be discharged or allowed to seep into the receiving environment (inclusive of groundwater) as it may pose potential negative effects to both aquatic and human health.

Table 22: Water Quality Results for Wastewater Disposed into Wastewater Facilities Localities at Kusasalethu

DATA TABLE			
PROJECT NAME	Harmony - Kusasalethu Mine	DATE COMPILED	18 December 2021
ASSESSMENT SET 1	General Authorisation Limit, Section 21f and h, 2013	SELECTED DATE	22 November 2021
ASSESSMENT SET 2	IWUL Quality of the water containing waste to irrigate with	COMPILED BY	Immaculata Famah
		Value exceeds the assessment set 1	

VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES					
				DK underdrain	DK RWD	KL Under Drain	KL RWD	KL RWD OF	KL RWD Seepage
pH @ 25°C	pH	5.5/9.5	5.0/9.5			8.07	7.66		7.81
Electrical conductivity (EC) @ 25°C	mS/m	150	200			448	256		256
Total Dissolved solids @ 180°C	mg/l	-	30			3564	1784		1890
Calcium (Ca)	mg/l	-	25			546	247		252
Magnesium (Mg)	mg/l	-	-			26.2	25.3		28.6
Sodium (Na)	mg/l	-	-			405	248		249
Potassium (K)	mg/l	-	-			126	47.7		48.7
Fluoride (F)	mg/l	1	-			<0.263	0.459		0.363
Sulphate (SO4)	mg/l	-	-			2047	954		972
Ammonium (NH_4) as N	mg/l	6	-			39.7	10.3		6.37
Iron (Fe)	mg/l	0.3	-			<0.004	<0.004		<0.004
Manganese (Mn)	mg/l	0.1	-			9.71	5.64		4.44
Boron (B)	mg/l	1	-			<0.013	<0.013		<0.013
Chromium (Cr)	mg/l	-	-			<0.003	<0.003		<0.003
Copper (Cu)	mg/l	0.01	-	Dry		0.039	0.311	Dry	0.077
Cadmium (Cd)	mg/l	0.005	-			<0.002	<0.002		<0.002
Lead (Pb)	mg/l	0.01	-			<0.004	<0.004		<0.004
Zinc (Zn)	mg/l	0.1	-			<0.002	0.333		0.153
Arsenic (As)	mg/l	0.02	-			<0.006	<0.006		<0.006
Mercury (Hg)	mg/l	0.005	-			<0.004	<0.004		<0.004
Dissolved Uranium (U)	mg/l	-	-			<0.015	<0.015		<0.015
Free Cyanide (CN)	mg/l	-	-			2.47	<0.008		<0.008
Cyanide WAD	mg/l	-	-			2.76	<0.003		<0.003
Total Cyanide (CN)	mg/l	-	-			3.19	<0.005		<0.005
Chemical oxygen demand (COD)	mg/l	75	5000			92.2	38		31.4
Total suspended solids (TSS)	mg/l	25	-			60	25		14
Total coliform	CFU/100ml	-	-			430	36		101
E.coli	CFU/100ml	1000	0			250	8		7

5.1.9 WASTEWATER EFFLUENT

The recorded water quality for the sewage monitoring localities is displayed in Table 23 (Aquatico, 2021). The Kusasalethu IWUL indicates that the effluent shall no longer be used for irrigation, however, it will be discharged into the Wedela stream.

The Deelkraal wastewater works is assessed at the inflow water and again at the outflow water. The 2021 water quality assessment results show that the water from the treatment works does not comply with the set IWUL Quality of the water discharge limits from the STP (discharge into the Wedela Stream) and is recommended not to be discharged into the receiving environment.

The Kusasalethu STP is also assessed at the inflow water and again at the outflow water. No improvement in bacteriological content in terms of faecal coliforms was noted from the inlet water of the Kusasalethu STP to the outlet. Furthermore, bacteriological content in terms of total coliforms and E. coli counts decrease from inlet to outlet water. The water from the STP does not comply with the set IWUL Quality of water discharge limits from the STP (discharge into the Wedela Stream) and is recommended not to be discharged into the receiving environment.

5.1.10 SENSITIVE AREAS

No wetlands have been identified in the Deelkraal operation. Artificial wetlands have been created at the Kusasalethu operation due to the waste facilities having altered the topography and drainage of the landscape. The artificial wetland drains into the dirty water management area and RWD to the south of the TSF. Wetlands have also formed as a result of the construction of small dams within the region's boundary.

Table 23: Water Quality Results for Wastewater Effluent Localities at Kusasalethu.

DATA TABLE: November 2021							
PROJECT NAME	Harmony - Kusasalethu Mine						
ASSESSMENT SET 1	Discharge Limit from the WWTW						
ASSESSMENT SET 2	General Authorisation Limit, Section 21f and h, 2013						
							Value exceeds the assessment set 1
VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES			
				DK Sewage Inlet	DK Sewage Outlet	KL Sewage Inlet	KL Sewage Outlet
pH @ 25°C	pH	5.5/8.5	5.5/9.5	7.73	7.89	7.15	7.61
Electrical conductivity (EC) @ 25°C	mS/m	75	150	93.3	107	48.1	44.5
Total Dissolved solids @ 180°C	mg/l	-	-	482	686	240	312
Calcium hardness	mg CaCO3/l	-	-	78	109	54	55
Sodium (Na)	mg/l	90	-	85	95.4	38.4	33.1
Fluoride (F)	mg/l	-	1	0.277	0.267	<0.263	<0.263
Sulphate (SO4)	mg/l	-	-	19.6	4.94	32.5	29.2
Nitrate (NO3) as N	mg/l	6	15	0.278	0.289	0.234	0.221
Nitrite (NO_2) as N	mg/l	-	-	0.074	0.075	0.074	0.073
Ammonium (NH_4) as N	mg/l	-	6	33.3	28.1	12.4	12
Iron (Fe)	mg/l	-	0.3	0.046	0.18	0.212	0.141
Manganese (Mn)	mg/l	-	0.1	0.218	0.618	0.032	0.051
Boron (B)	mg/l	-	1	<0.013	<0.013	<0.013	<0.013
Chromium (Cr)	mg/l	-	-	<0.003	<0.003	<0.003	<0.003
Copper (Cu)	mg/l	-	0.01	0.007	0.006	0.007	0.005
Cadmium (Cd)	mg/l	-	0.005	<0.002	<0.002	<0.002	<0.002
Lead (Pb)	mg/l	-	0.01	<0.004	<0.004	<0.004	<0.004
Zinc (Zn)	mg/l	-	0.1	0.005	<0.002	<0.002	<0.002
Arsenic (As)	mg/l	-	0.02	<0.006	<0.006	<0.006	<0.006
Mercury (Hg)	mg/l	-	0.005	<0.004	<0.004	<0.004	<0.004
Dissolved Uranium (U)	mg/l	-	-	<0.015	<0.015	<0.015	<0.015
Free Cyanide (CN)	mg/l	-	-	<0.008	<0.008	<0.008	<0.008
Cyanide WAD	mg/l	-	-	<0.003	<0.003	<0.003	<0.003
Total Cyanide (CN)	mg/l	-	-	<0.005	<0.005	<0.005	<0.005
Total suspended solids (TSS)	mg/l	25	25	78	36	101	68
Chemical oxygen demand (COD)	mg/l	75	75	147	206	146	117
Total coliform	CFU/100ml	-	-	119000	108000	124000	117000
Faecal coliform	CFU/100ml	-	1000	127000	98000	109000	117000
E.coli	CFU/100ml	130	1000	117000	96000	119000	112000
Free chlorine (Cl_2)	mg/l	-	0.25	<0.02	<0.02	<0.02	<0.02

5.2 GROUNDWATER

The information in this section was taken from the 2018 IWWMP, Aquatico report titled Harmony Kusasalethu Water Quality Report – July to September 2021" and Auctus Project Management and Consulting (Auctus) report titled "Harmony Gold Mining Ltd. Kusasalethu Gold Mine Hydrogeological Description and Field Report, dated September 2011."

5.2.1 GEOLOGY AND AQUIFER CHARACTERISATION

Mining at Kusasalethu takes place within the Witwatersrand Supergroup, which is a thick sequence of shale, quartzite and conglomerate. Figure 8 shows the geology of the region.

There are two main divisions in the Witwatersrand Supergroup, a lower predominantly argillaceous unit, which is known as the West Rand Group and an upper unit that is composed almost entirely of quartzite and conglomerates and is known as the Central Rand Group. The Central Rand Group is divided into the Johannesburg and Turffontein Subgroups and is composed largely of quartzite, within which there are numerous conglomerate zones. The conglomerate zones may contain any number of conglomerate bands, with individual bands interbedded with quartzite. An argillaceous zone known as the Booysens Shale (also known as the Kimberley Shale) separates the Johannesburg and Turffontein Subgroups. The economic gold deposits (reefs) are contained within the Central Rand Group. Mining depths at Kusasalethu ranges between 1 920 m and 3 200 m below surface.

The younger Ventersdorp Supergroup overlies the Witwatersrand rocks. The Ventersdorp is composed largely of andesitic lavas and related pyroclastics. The Ventersdorp Supergroup consists of the Platberg Group and the Klipriviersberg Group.

The Klipriviersberg Group consists of the Alberton and Westonaria Formations. The Alberton Formation is composed of green – grey amygdaloidal andesitic lavas, agglomerates and tuffs. The thickness amounts to 1 500 m. The lack of sediments in this sequence indicates a rapid succession of lava flows, which probably came from fissure eruptions. Material of similar composition forms the oldest dykes that have intruded the Witwatersrand rocks. The abundant agglomerates provide indications of periodic explosive activity. The removal of huge volumes of volcanic material from an underlying magma chamber gave rise to tensional conditions and as a result several faulted structures, horst and grabens, were formed.

Overlying the Ventersdorp Lavas are the Black Reef quartzite and dolomite of the Transvaal Supergroup. The Black Reef quartzite comprises coarse to gritty quartzite with occasional economically exploitable conglomerates (reefs). The entire area was peneplain in post-Ventersdorp time and it was on this surface that the Transvaal Supergroup was deposited, some 2 200 million years ago. The deposition commenced with the Kromdraai Member with the Black Reef at its base. The Black Reef has eroded the Witwatersrand outcrop areas and as a result contains zones (reef) in which gold is present. The occurrence of the gold is not as widespread as in the Witwatersrand and mainly restricted to north-south trending channels. The Black Reef is overlain by a dark, siliceous quartzite with occasional grits or small pebble bands. The quartzite grades into black carbonaceous shale. The shale then grades into the overlying dolomite through a transition zone of approximately 10 m thick.

Overlying the Kromdraai Member is the dolomite of the Malmani Subgroup of the Chuniespoort Group. The dolomites are present on surface just north of the study area. The dolomites are overlain in the south by the Pretoria Group rocks. The Rooihoogte Formation forms the basal member of the Pretoria Group, consisting of the Bevets conglomerate, shale and quartzite. The Bevets conglomerate varies in thickness between 3 m and 60 m (Parsons and Killick, 1985). Overlying the Bevets conglomerate is shale and sporadically developed quartzite, referred to as the Pologround quartzite. Where developed the Pologround quartzite is overlain by 150 m – 200 m of pink to purple shale, forming the basis of the Timeball Hill Formation. The shale is overlain by quartzite, which forms the linear north-easterly trending ridges in the south of the study area. The Kusasalethu surface lease area is predominantly underlain by the sediments of the Pretoria Group.

5.2.2 DOLOMITIC GROUNDWATER COMPARTMENTS

About 1 300 million years ago the region was subjected to tension resulting in the formation of a number of large north to north-easterly striking faults. Many of the faults penetrated the full Transvaal sequence as well as the underlying Ventersdorp and Witwatersrand Supergroups. Some of the faults were filled by Pilanesberg age dykes, which subdivided the dolomite into watertight groundwater compartments (Figure 9).

The Deelkraal TSF is situated on the Transvaal sediments, approximately 500 m south of the dolomite outcrop. These dolomites belong to the Bosbok –Turffontein dolomitic groundwater compartment. This compartment is not dewatered, although deeper groundwater levels are noticeable near the Blyvooruitzicht 6 Shaft (refer to Figure 9). The groundwater levels in the dolomite are generally deeper than the groundwater levels in the weathered and fractured aquifers of the Transvaal sediments.

Dolomitic groundwater flow in the region is generally from east to west and groundwater decants from one compartment to the next at the various eyes that are present along the western boundaries of each compartment (refer to Figure 9). These eyes occur in low lying areas within the Wonderfontein Spruit. Groundwater flow within the Boskop – Turffontein compartment is, therefore, also in a westerly direction towards the Turffontein eye (refer to Figure 9).

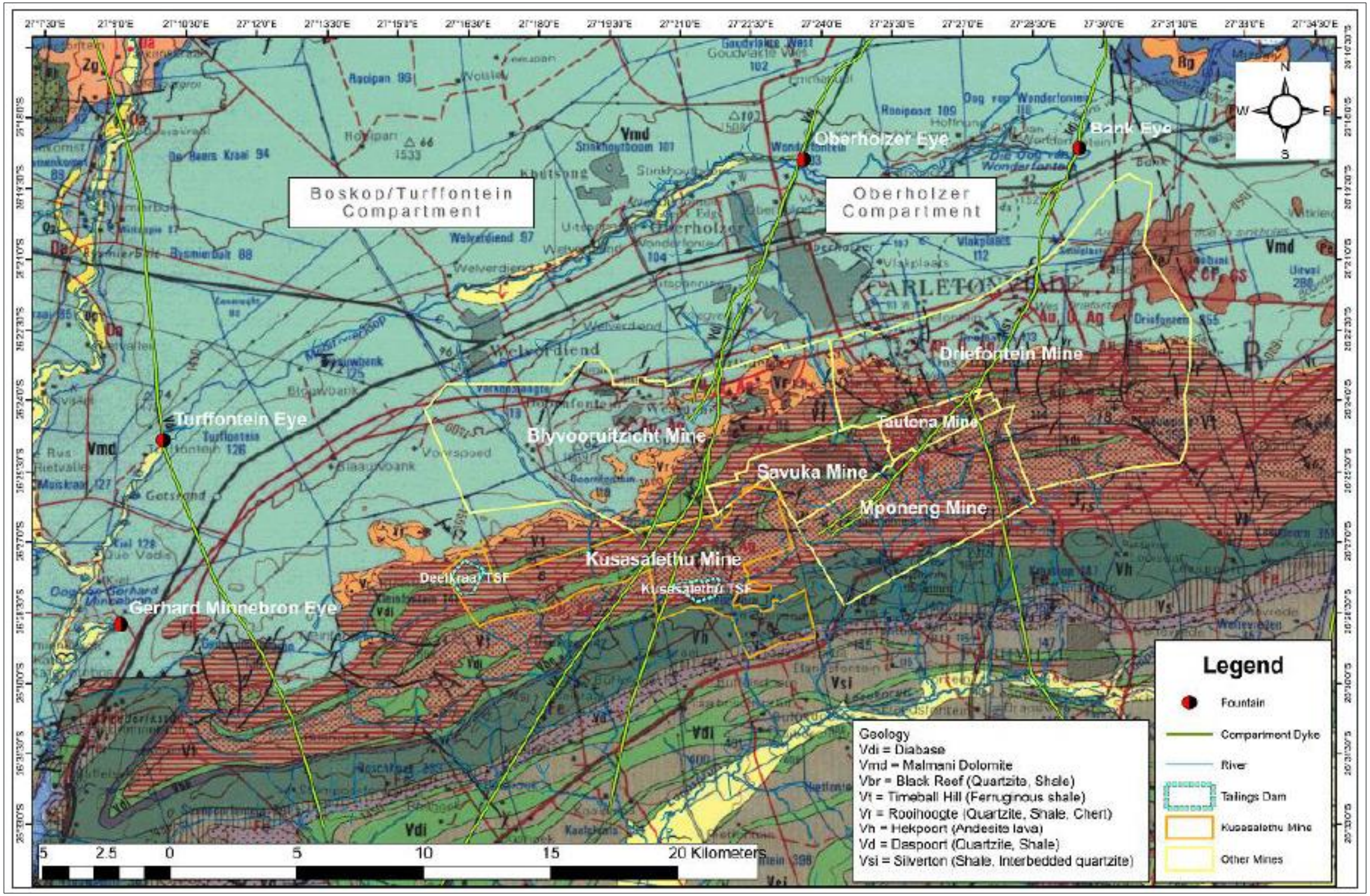

Figure 8: Regional Geology

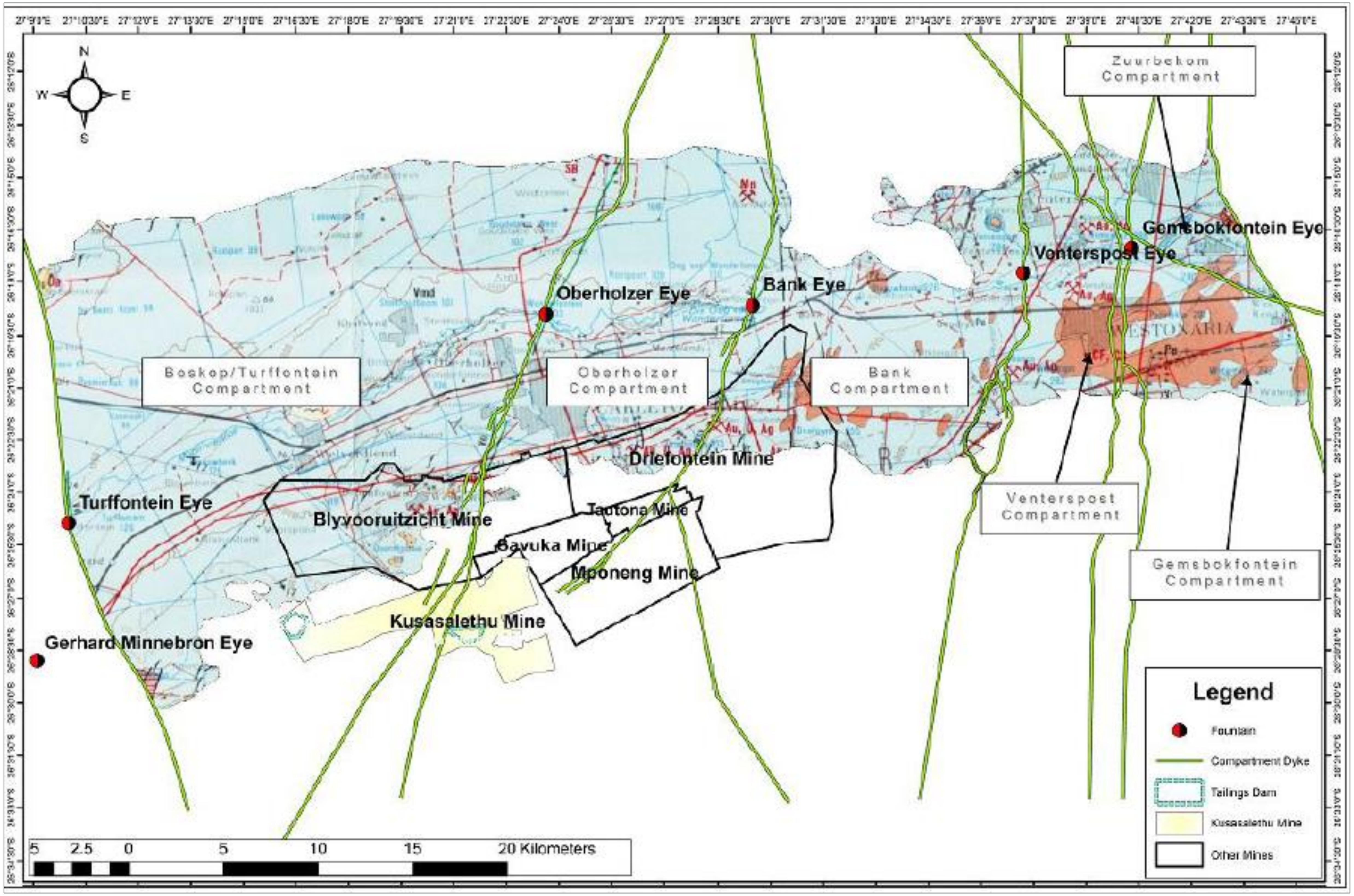

Figure 9: Dolomitic Groundwater Compartments

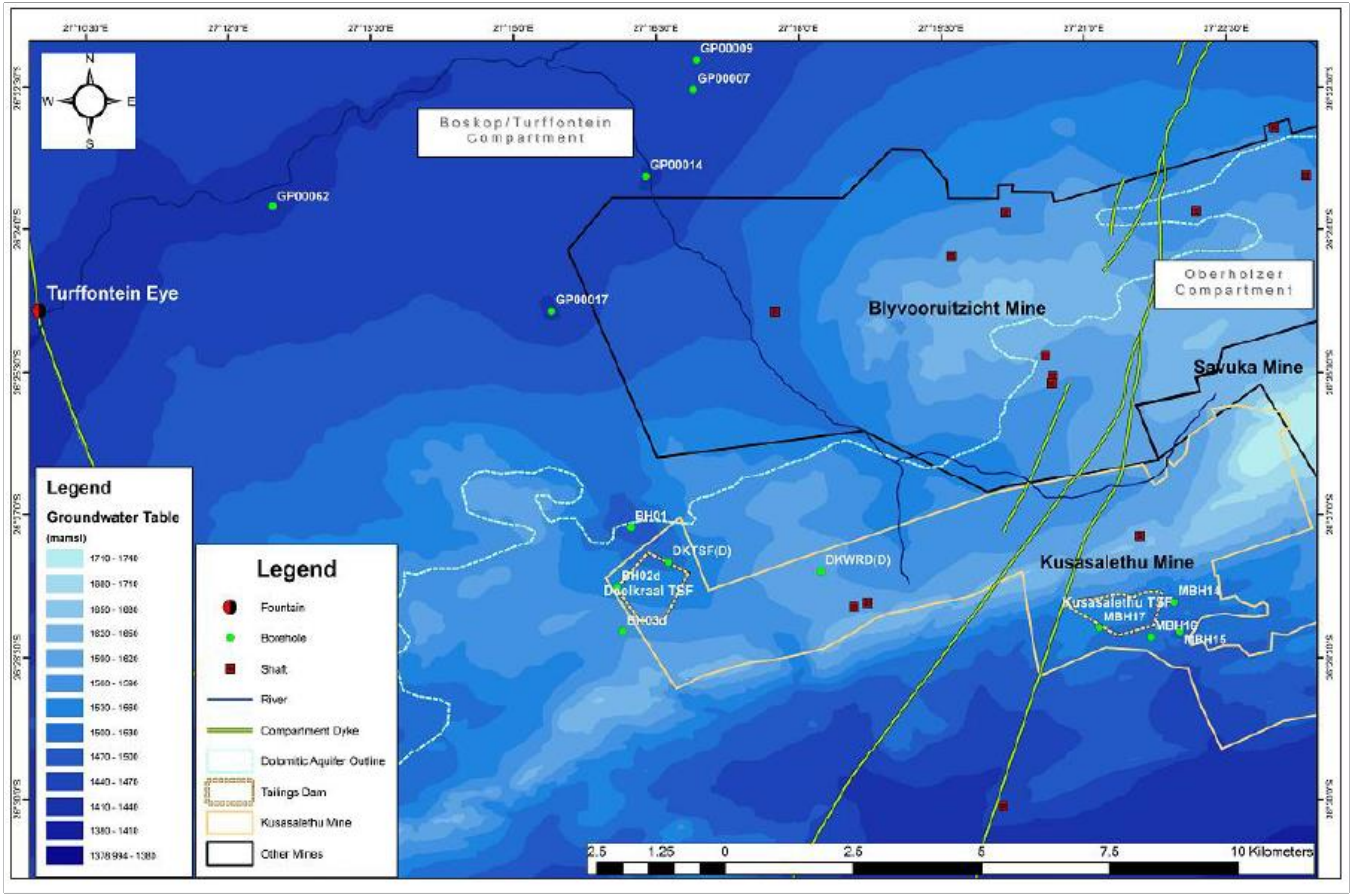

Figure 10: Regional Groundwater Table

5.2.3 GROUNDWATER QUALITY

Groundwater quality monitoring is conducted on a quarterly basis at sixteen groundwater monitoring localities. This section focusses on the average water quality results obtained for July to September 2021 (latest groundwater quality assessment conducted by Aquatico). Quaternary Catchment C23E

The recorded groundwater quality for the monitoring localities located in C23E is displayed in Table 20. The general physical water quality of the C23E groundwater monitoring localities of this section can be described as acidic to alkaline and non-saline to extremely saline. None of the monitoring localities recorded dissolved U or CN concentration, in its analysed forms, above detection limit. Locality DK BH TFS S recorded exceeding EC value and concentrations of total dissolved solids, calcium, magnesium, sodium, sulphate, fluoride iron and manganese. Locality KBH4 recorded exceeding electrical conductivity value and concentration of total dissolved solids, calcium, sulphate and nitrate. Nitrate concentration exceeding the Groundwater Quality Limit was further reported for locality DK BH 04D.Acidic pH value was recorded for locality DK BH TSF S. No E. coli counts were recorded for locality DK BH TSF S. Very high total coliform counts were recorded for majority of the groundwater localities.

The site reports provide a comparative summary of the July to September 2021 groundwater quality. Majority of the sampled localities recorded a decrease in concentration of analysed variables from the previous quarter. All the sampled monitoring boreholes for the groundwater localities of C23E plotted in field 2, field 4 and field 5 of the Expanded Durov Diagram (EDD) (Figure 12).

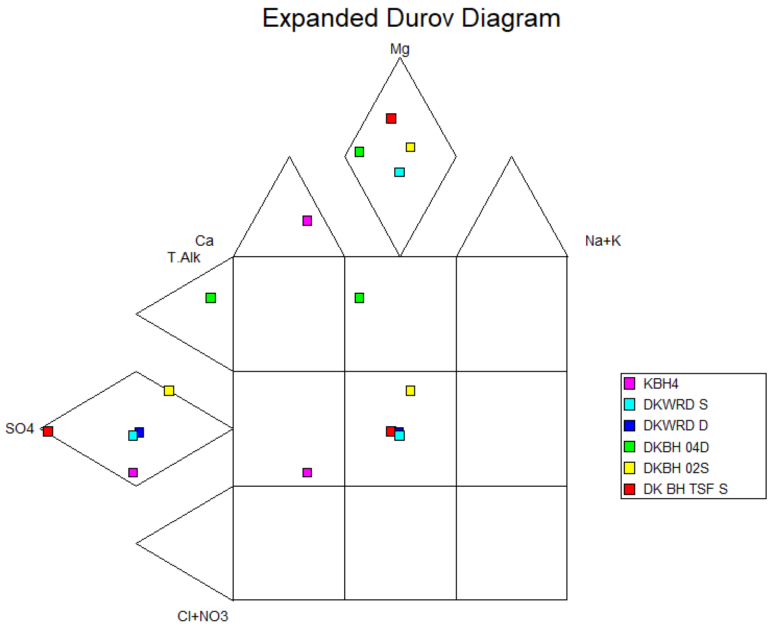

Figure 11: The Expanded Durov Diagram of the Kusasalethu Mine C23E Groundwater Monitoring Localities

Table 24: C23E Groundwater Quality Results for Kusasalethu (September2021)

PROJECT NAME	Harmony - Kusasalethu Mine	DATE COMPILED	02 November 2021
ASSESSMENT SET 1	Groundwater Quality Limit	SELECTED DATE	20 September 2021
ASSESSMENT SET 2	IWUL Quality of the water containing waste to irrigate with	COMPILED BY	Izelda Mbatha

Value exceeds the assessment set 1

VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES										
				DK BH TSF S	DK BH TSF D	DKRW DN S	DKRWD N D	DKWRD S	DKWRD D	KBH4	DKBH 02D	DKBH 02S	DKBH 04D	
pH @ 25°C	pH	5.0/9.7	5.0/9.5	6.37				9.25	9.28	7.99		6.79	7.25	
Electrical conductivity (EC) @ 25°C	mS/m	200	200	769				26.6	26.5	235		9.11	130	
Total Dissolved solids @ 180°C	mg/l	1200	30	7380				174	208	1870		56	710	
Turbidity	NTU	-	-	363				8.15	7.08	15		7.34	61.4	
Calcium (Ca)	mg/l	200	25	430				14.5	14.8	303		3.49	104	
Magnesium (Mg)	mg/l	100	-	926				12.6	12.9	56.8		6.37	78.4	
Sodium (Na)	mg/l	200	-	268				13.7	13.9	136		5.18	10	
Potassium (K)	mg/l	-	-	44.8				4.41	4.47	20.1		1.39	10.3	
Total alkalinity	mg CaCO3/l	-	-	68.2				28.6	32.6	63.9		22.8	581	
Chloride (Cl)	mg/l	300	-	158				25.1	25.3	174		3.92	67.2	
Sulphate (SO4)	mg/l	600	-	5967				67.2	62.3	627		14.4	83.3	
Fluoride (F)	mg/l	1	-	1.12				<0.263	<0.263	<0.263		<0.263	<0.263	
Nitrate (NO_3) as N	mg/l	10	5	0.264				0.248	0.245	85.5		0.638	0.268	
Nitrite (NO_2) as N	mg/l	-	-	<0.065				<0.065	<0.065	3.25		<0.065	<0.065	
Ammonium (NH_4) as N	mg/l	-	-	0.385	Dry	Dry	Dry	0.193	0.315	3.99	Pump Installed	0.113	21	
Aluminium (Al)	mg/l	0.5	-	<0.002				<0.002	<0.002	<0.002		0.024	<0.002	
Iron (Fe)	mg/l	3	-	26				<0.004	<0.004	<0.004		<0.004	0.099	
Manganese (Mn)	mg/l	0.5	-	343				<0.001	0.003	0.036		0.03	1.37	
Chromium (Cr)	mg/l	-	-	0.05				<0.003	<0.003	<0.003		<0.003	<0.003	
Copper (Cu)	mg/l	-	-	0.125				<0.002	<0.002	<0.002		<0.002	<0.002	
Cadmium (Cd)	mg/l	-	-	<0.002				<0.002	<0.002	<0.002		<0.002	<0.002	
Lead (Pb)	mg/l	-	-	0.199				<0.004	<0.004	<0.004		<0.004	<0.004	
Nickel (Ni)	mg/l	-	-	41.8				<0.002	<0.002	0.011		<0.002	<0.002	
Cobalt (Co)	mg/l	-	-	43.3				<0.003	<0.003	0.036		<0.003	0.016	
Zinc (Zn)	mg/l	-	-	12.2				<0.002	<0.002	<0.002		<0.002	<0.002	
Dissolved Uranium (U)	mg/l	0.03	-	<0.015				<0.015	<0.015	<0.015		<0.015	<0.015	
Free Cyanide (CN)	mg/l	-	-	<0.008				<0.008	<0.008	<0.008		<0.008	<0.008	
Cyanide WAD	mg/l	-	-	<0.003				<0.003	<0.003	<0.003		<0.003	<0.003	
Total Cyanide (CN)	mg/l	-	-	<0.005				<0.005	<0.005	<0.005		<0.005	<0.005	
Total coliform	CFU/100ml	-	-	0				140	43	34		7400	270	
E.coli	CFU/100ml	-	0	0				16	3	6		800	26	

5.2.3.1 **QUATERNARY CATCHMENT C23J**

The recorded groundwater quality for the monitoring localities located in C23J is displayed in Table 21.

The general physical water quality of the C23J groundwater monitoring localities of this section can be described as acidic to neutral and non-saline to very saline. None of the monitored localities for this section recorded a CN or dissolved U concentration above detection limit. Exceeding EC values and concentrations of TDS, magnesium and manganese was recorded for locality MBH16. Locality MBH15 further exceeded the IWUL Groundwater quality limit in terms of total dissolved solids, calcium and sulphate concentrations. All of the analysed variables at locality MBH17 complied with the IWUL Groundwater quality limits during March 2021. Counts of total coliforms and E. coli were also recorded for the sampled groundwater localities. All monitoring boreholes for the groundwater localities of C23J plotted either in fields 4 or 5 of the EDD (Figure 12).

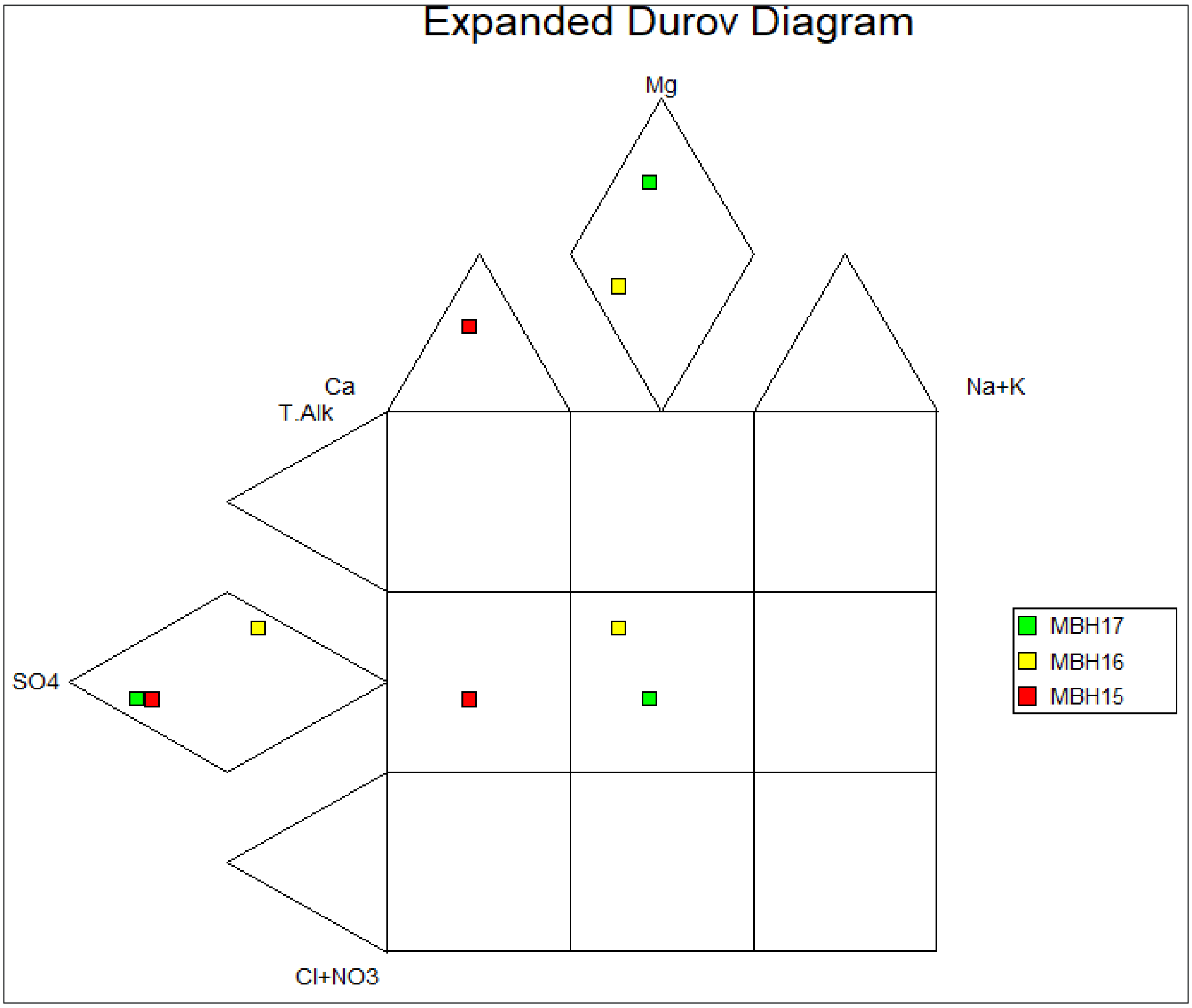

Figure 12: The Expanded Durov Diagram of the Kusasalethu Mine C23J Groundwater Monitoring Localities

Table 25: C23J Groundwater Quality Results for Kusasalethu (September 2021)

DATA TABLE:			
PROJECT NAME	Harmony - Kusasalethu Mine	DATE COMPILED	02 November 2021
ASSESSMENT SET 1	Groundwater Quality Limit	SELECTED DATE	20 September 2021
ASSESSMENT SET 2	IWUL Quality of the water containing waste to irrigate with	COMPILED BY	Izelda Mbatha

Value exceeds the assessment set 1

VARIABLE	UNITS	ASSESSMENT 1	ASSESSMENT 2	MONITORING LOCALITIES				
				AS BH	MBH14	MBH15	MBH16	MBH17
pH @ 25°C	pH	5.0/9.7	5.0/9.5	No Access	Blocked	7.32	8.09	5.38
Electrical conductivity (EC) @ 25°C	mS/m	200	200			184	207	62.1
Total Dissolved solids @ 180°C	mg/l	1200	30			1382	1654	504
Turbidity	NTU	-	-			0.96	2.26	1.73
Calcium (Ca)	mg/l	200	25			289	200	22
Magnesium (Mg)	mg/l	100	-			73.7	116	58.5
Sodium (Na)	mg/l	200	-			44.7	87	15.4
Potassium (K)	mg/l	-	-			5.49	25	0.697
Total alkalinity	mg CaCO3/l	-	-			87.2	588	20.7
Chloride (Cl)	mg/l	300	-			132	140	20.4
Sulphate (SO4)	mg/l	600	-			749	505	250
Fluoride (F)	mg/l	1	-			<0.263	<0.263	<0.263
Nitrate (NO_3) as N	mg/l	10	5			0.947	0.378	6.32
Nitrite (NO_2) as N	mg/l	-	-			<0.065	0.186	<0.065
Ammonium (NH_4) as N	mg/l	-	-			0.064	4.98	0.075
Aluminium (Al)	mg/l	0.5	-			0.158	<0.002	0.091
Iron (Fe)	mg/l	3	-			<0.004	0.042	<0.004
Manganese (Mn)	mg/l	0.5	-			<0.001	0.749	0.073
Chromium (Cr)	mg/l	-	-			<0.003	<0.003	<0.003
Copper (Cu)	mg/l	-	-			<0.002	<0.002	<0.002
Cadmium (Cd)	mg/l	-	-			<0.002	<0.002	<0.002
Lead (Pb)	mg/l	-	-			<0.004	<0.004	<0.004
Nickel (Ni)	mg/l	-	-			<0.002	<0.002	0.126
Cobalt (Co)	mg/l	-	-			<0.003	0.057	0.012
Zinc (Zn)	mg/l	-	-			<0.002	<0.002	0.258
Dissolved Uranium (U)	mg/l	0.03	-			<0.015	<0.015	<0.015
Free Cyanide (CN)	mg/l	-	-			<0.008	<0.008	<0.008
Cyanide WAD	mg/l	-	-			<0.003	<0.003	<0.003
Total Cyanide (CN)	mg/l	-	-			<0.005	<0.005	<0.005
Total coliform	CFU/100ml	-	-			102000	27	45
E.coli	CFU/100ml	-	0			17000	5	9

5.2.4 WATER LEVEL ASSESSMENT

Figure 13 and Figure 14 presents the last four water levels recorded for the groundwater monitoring localities of Kusasalethu. Figure 15 presents the historical water level trends for the groundwater monitoring localities of Kusasalethu.

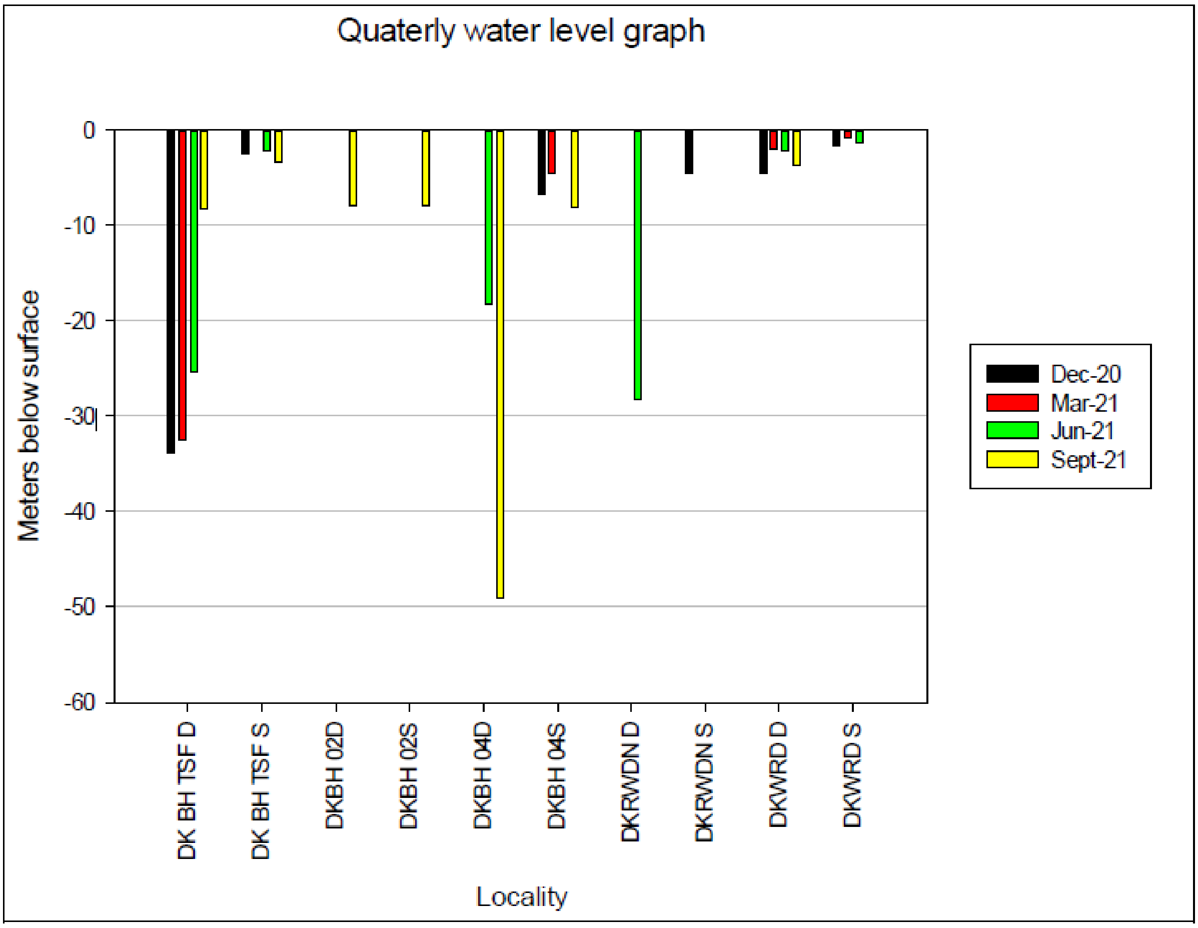

Figure 13: Last Four Water Level Datasets Recorded for C23E Groundwater Monitoring Localities

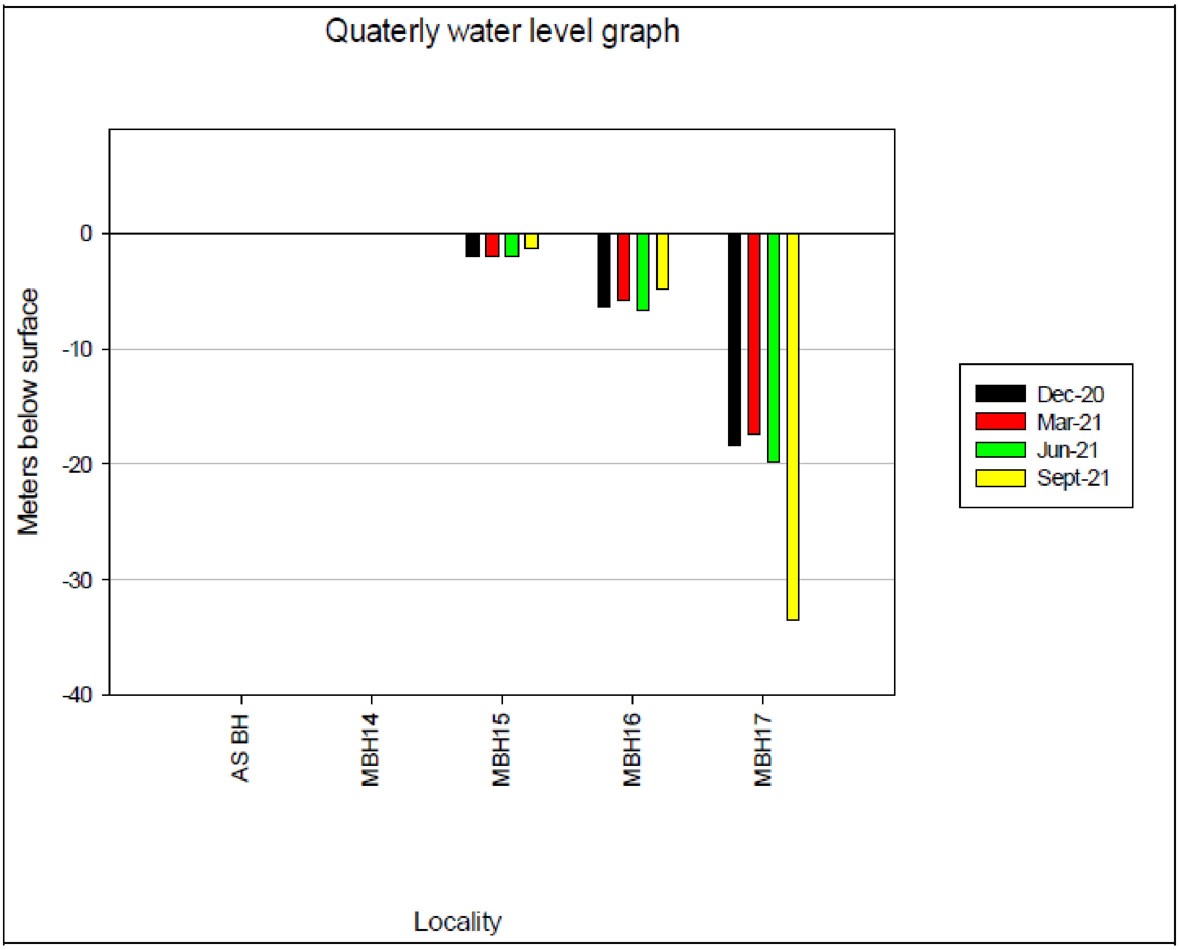

Figure 14: Last Four Water Level Datasets Recorded for C23J Groundwater Monitoring Localities.

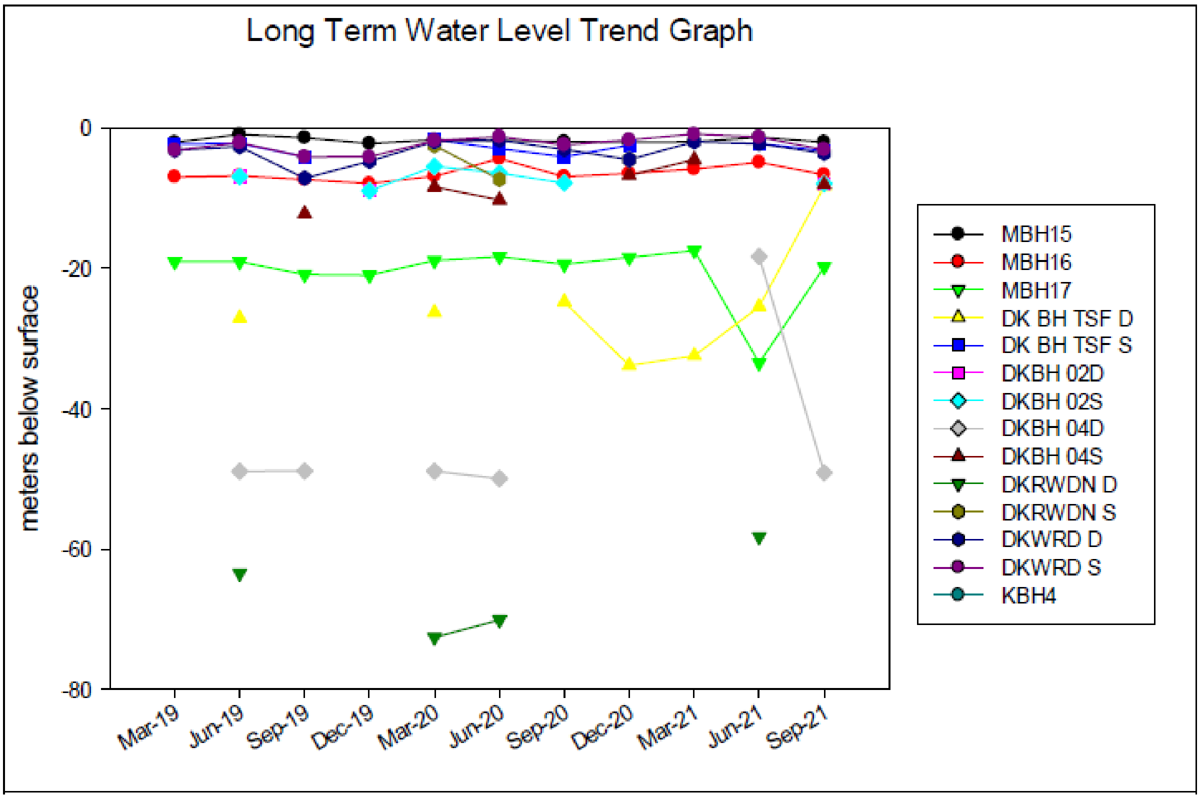

Figure 15: Long Term Water Trend for Groundwater Monitoring Localities

5.2.5 HYDROCENSUS

A hydrocensus was conducted in 2011 for the EMPr Amendment by Auctus to determine the groundwater impact from the mining waste facilities, specifically the two TSFs located at Kusasalethu operations.

The 2011 hydrocensus was conducted within a 2 km radius of the waste facilities on the Kusasalethu operations. Several mine monitoring, as well as privately owned boreholes were identified. Most boreholes are located in the southern catchment (C23J) and no privately owned boreholes were found in the northern catchment (C23E). Six groundwater samples were collected from representative private boreholes, which were used to evaluate the regional groundwater quality. This was done in conjunction with the mine monitoring data.

Seven surface water samples were also collected in areas that may potentially be impacted on by mining activities. The localities of the hydrocensus points in relation to the mine waste facilities are shown in Figure 16 and the hydrocensus information is summarised in Table 26. The identified monitoring localities are monitored as part of the Kusasalethu monitoring programme on a bi-annual basis.

Several groundwater monitoring boreholes were identified around the TSFs but are not situated on Kusasalethu operations' properties. However, at the time of the study these boreholes were locked and could not be sampled as part of the hydrocensus. The localities of the new boreholes are shown in Figure 17.

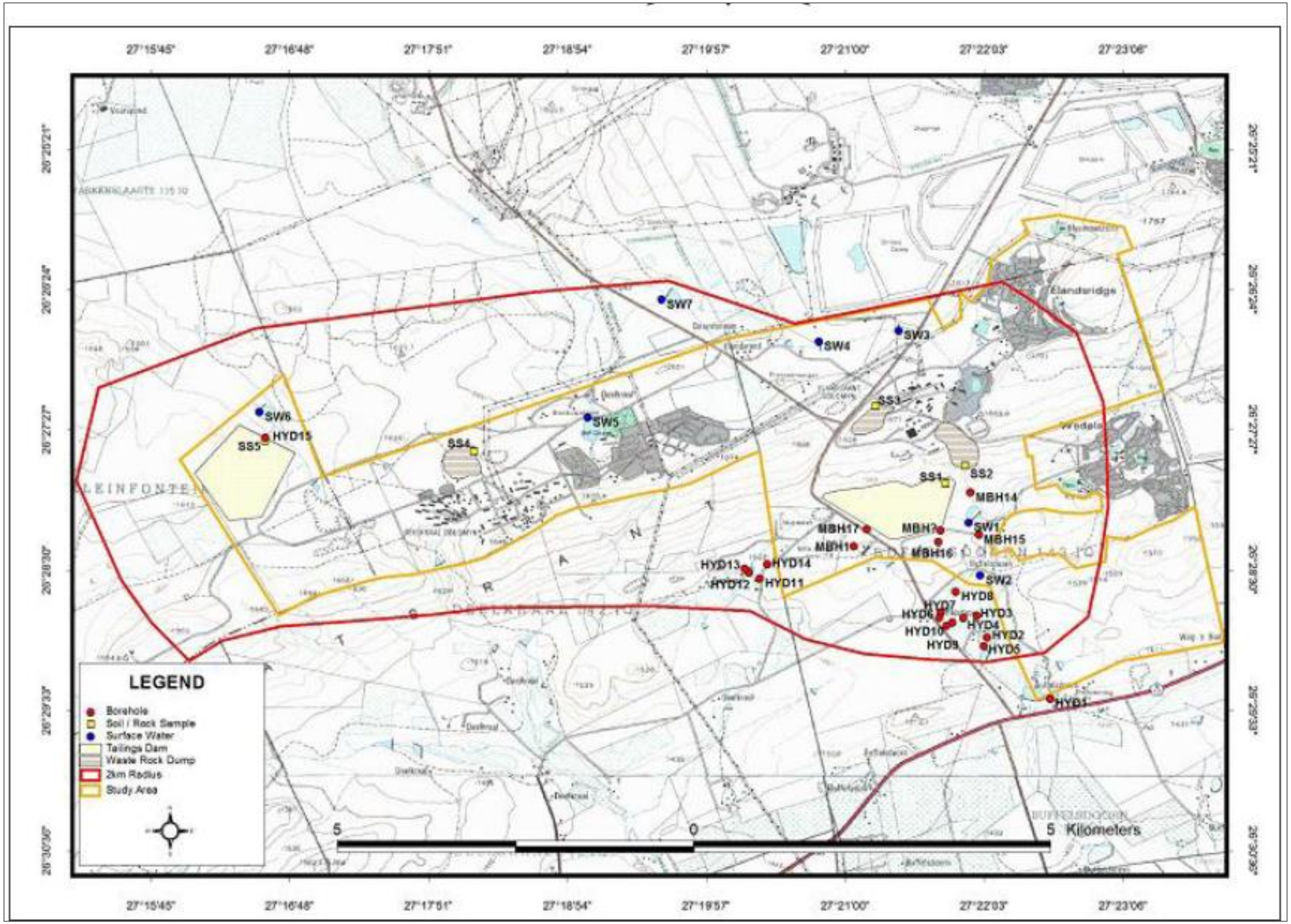

Figure 16: Hydrocensus Points (Aucpas, 2011)

Table 26: Hydrocensus Information

BH ID	Longitude	Latitude	Z(m)	SWL (mbc)	BH Depth (mbc)	Cas dia (m)	Collar height (m)	Owner	Borehole Use	Volumes abstracted (l/per day	Sampled	Comments
HYD1	27.37586	-26.49101	1453	No access	Unknown	No access	0	Hugo	Domestic	Unknown	Yes	Electric pump
HYD2	27.36794	-26.48335	1462	5.46	18	0.165	0.25	AJ Nel	Domestic	2500	Yes	Electric pump
HYD3	27.36665	-26.48068	1473	3.92	50	0.17	0.36	J P Cronje	Domestic/ Livestock	5000	Yes	Electric pump
HYD4	27.36490	-26.48092	1481	9.92	48.15	0.165	0.31	J P Cronje	Not used	0	No	Open borehole
HYD5	27.36752	-26.48440	1477	5.21	39.52	0.165	0.23	J P Cronje	Not used	0	No	Open borehole
HYD6	27.36194	-26.48085	1489	19.69	Unknown	0.165	0.31	Wedela Agricultural Project	Not used	0	No	Electric pump broken
HYD7	27.36213	-26.48022	1488	18.85	Unknown	0.155	0.18	Wedela Agricultural Project	Not used	0	No	Windmill broken
HYD8	27.36399	-26.47766	1490	11.57	Unknown	0.17	0.24	Wedela Agricultural Project	Not used	0	No	Electric pump broken
HYD9	27.36358	-26.48146	1479	17.29	40.93	0.155	0	Wedela Agricultural Project	Not used	0	No	Open borehole
HYD10	27.36283	-26.48188	1479	18.62	Unknown	0.165	0.28	Wedela Agricultural Project	Domestic/ Livestock	Unknown	Yes	Electric pump
HYD11	27.33925	-26.47600	1515	No access	70	No access	0.17	DD Modibedi	Domestic/ Livestock/ Irrigation	5000	Yes	Mono-pump
HYD12	27.33791	-26.47527	1504	1.68	28.71	0.165	0.08	DD Modibedi	Not used	0	No	Open borehole
HYD13	27.33738	-26.47480	1507	17.28	30	0.17	0	VRD Williams	Domestic/ Livestock	5000	Yes	Electric pump. SWL - recovering.
HYD14	27.34026	-26.47426	1524	9.97	17.84	0.165	0.21	J P Cronje	Not used	0	No	Windmill, broken
HYD15	27.27699	-26.45841	1563	2.17	3.31	0.05	0.23	Deelkraal Tailings dam	Monitoring	0	No	Open BH with cap
MBH1	27.35111	-26.47196	1560	No access	Unknown	No access	-0.28	Kusasalethu	Domestic/ Stores	Unknown	No	Anglo store BH, electric pump
MBH14	27.36583	-26.46530	1521	1.82	29.98	0.152	0.54	Kusasalethu	Monitoring	0	No	Open BH with cap
MBH15	27.36688	-26.47058	1499	2.17	29.26	0.152	0.59	Kusasalethu	Monitoring	0	No	Open BH with cap
MBH16	27.36178	-26.47145	1521	5.72	33.3	0.152	0.76	Kusasalethu	Monitoring	0	No	Open BH with cap
MBH17	27.35275	-26.46983	1547	17.03	29.86	0.152	0.83	Kusasalethu	Monitoring	0	No	Open BH with cap
MBH?	27.36206	-26.47000	1535	Blocked	Unknown	0.205	0.9	Kusasalethu	Monitoring	0	No	Open BH with cap. Blocked.

Note: SWL = static water level; mbc = metres below casing

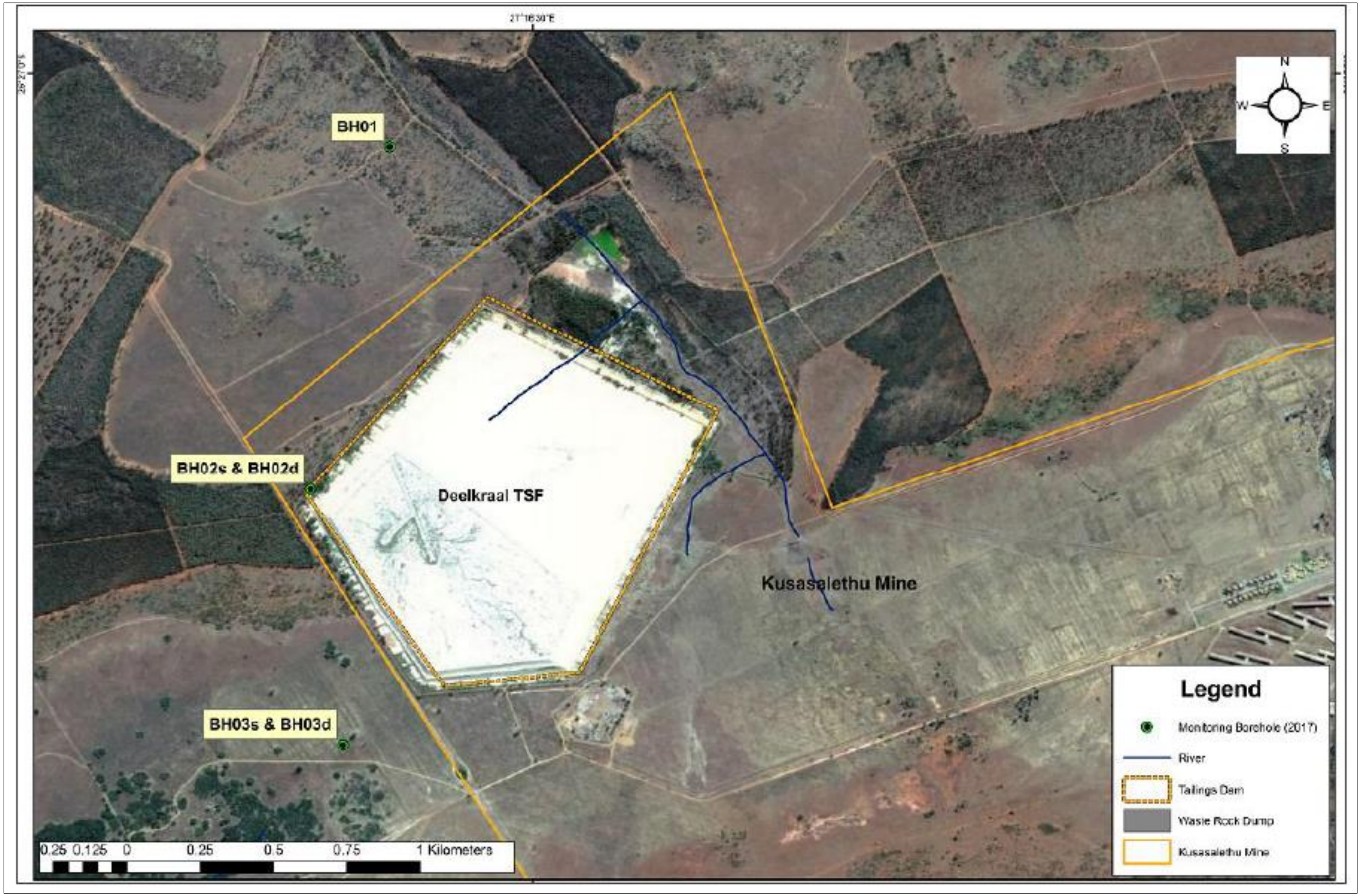

Figure 17: Newly Drilled Boreholes at Deelkraal Operation (Jones and Wagner, 2017)

5.2.6 AQUIFER TYPES

The following aquifers were identified from the hydrocensus, drilling, aquifer test and geological data:

- Weathered Aquifer: A shallow, weathered aquifer in the weathered shale and quartzite. The most consistent water strike is located at the fresh bedrock/weathering interface. Groundwater depths vary between 0.47 m and 14.31 mbgl;
- Fractured Aquifer: A deeper, fresh shale/quartzite aquifer where fracture flow dominates. Groundwater migration within the upper portion of this aquifer appears to be governed by jointing, while major faults and intrusions form the preferred groundwater flow paths at depth. The depth to groundwater in this aquifer ranges from artesian to 37.82 mbgl. This is indicative of confined conditions; and
- Dolomitic Karst Aquifer: The mine surface area does not overlie the dolomite exposed on surface, but this important aquifer is situated only 500m north of the Deelkraal TSF. Seepage from the Deelkraal TSF and WRD can potentially impact on this aquifer over time.

The dolomite aquifer is unlikely to be impacted on by the activities at Kusasalethu, but it is in close proximity to the Deelkraal TSF. Monitoring at this facility should be such that it can confirm the extent of migration from the TSF. The weathered and fractured aquifers are present beneath the entire Kusasalethu infrastructure, although the weathered aquifer may not always be well developed. The monitoring network should take cognisance of both aquifers and it is also important to understand the connectivity between the weathered and fractured zone. The monitoring boreholes should be constructed such that a distinction can be made between the weathered and fractured aquifer.

5.2.7 AQUIFER CHARACTERISATION

An aquifer classification system provides a framework and objective basis for identifying and setting appropriate levels of groundwater resource protection. The aquifer classification system used to classify the aquifers is the proposed National Aquifer Classification System of Parsons (1995).

As per the aquifer classification system and information included in hydrogeological studies, Auctus Consulting (2011) classified the aquifers on the mine as indicated in Table 27 Jones & Wagner (2017) calculated the average aquifer parameters as indicated in for the mine.

Table 27: Aquifer classification at the Kusasalethu Operation

Aquifer		Vulnerability	Rating	Protection
Weathered Aquifer	Minor (2)	2	4	Medium
Fractured Aquifer	Minor (2)	1	3	Low

Table 28: Average aquifer parameters

Aquifer	Transmissivity (T)	Hydraulic Conductivity (K)
Weathered Aquifer	0.37 m^2 /day	0.044 m/day
Fractured Aquifer	0.522 m^2/day	0.033 m/day

The above classification means that both aquifers are less sensitive due to the fact that the aquifers are not considered potential future resources. Low to medium protection is therefore required, which will primarily include monitoring.

5.2.8 GROUNDWATER GRADIENT AND FLOW

The groundwater monitoring and hydrocensus data showed a 98% correlation exists between the surface elevation and groundwater table elevations from water level measurements. This is a high correlation and indicates that the groundwater table and flow mimics the topography of the region. The groundwater contours and flow directions from interpolated results show that the flow is perpendicular to the groundwater contours and flows to the north and south, away from the ridge.

5.3 AQUATIC BIOMONITORING ASSESSMENT

The information below is based on the information obtained from the recent aquatic biomonitoring assessment (Digby Wells, October 2021. The findings encompassed below serve to provide a representation of the dry season aquatic ecological conditions for the water resources associated with Kusasalethu. A wet season survey must be undertaken to account for seasonal variation and spatial-temporal trend data.

5.3.1 MONITORING SITES

The locations of the monitoring sites were based on the 2018 dry season report (African Environmental Development, 2018). A total of 18 sites were selected for assessment. A total of 11 sites were selected for *ex situ* analysis and four sites for ecotoxicological analysis. Table 29 presents GPS co-ordinates and brief descriptions of the monitoring sites presents the graphical representation of the sites.

Table 29: Aquatic Biomonitoring Sites selected within the Study Area

New Name	Old Name	Coordinates	Description
Mooirivierloop Catchment (C23E)			
Golf 1	Golf Course Up 1	26°27'2.81"S 27°21'24.01"E	These monitoring sites lie within canalised streams north of the Kusasalethu Operations. The streams drain water stemming from various sources into the Golf Wetland area. Site Golf 2 leak refers to a man-hole leak draining into Site Golf 2 (see Figure 18).
Golf 2	Golf Course Up 2	26°26'58.67"S 27°21'38.52"E	
Golf 2 leak	-	26°26'58.90"S 27°21'38.45"E	
Golf 4	Golf Course up 4	26°26'58.42"S 27°21'52.02"E	
Golf 3	Golf Course Up 3	26°26'58.24"S 27°21'50.44"E	
Doornfontein in	Name unchanged	26°26'37.14"S 27°21'44.24"E	Most upstream monitoring site associated with the Wonderfonteinspruit system.
Golf Dwn	Golf Course Down (New)	26°26'40.45"S 27°21'32.22"E	Located within a channelled stream which drains into a floodplain wetland creating a confluence with the Golf Course Wetland stream.
Golf Wetland	Golf Course Wetland	26°26'44.12"S 27°21'31.14"E	Located within a channelled stream which drains into a floodplain wetland from the Kusasalethu Operations area.
Doornfontein TSF Dwn	Name unchanged	26°26'31.45"S 27°21'21.74"E	Lies downstream of the Doornfontein TSF at the base of a TSF.
Kusasalethu North	Kusasalethu Out North	26°26'49.20"S 27°20'40.42"E	Located approximately 1.2 km downstream of the Golf Course Wetland area.
Deelkraal Up	Deelkraal Dam Up	26°27'32.26"S 27°19'5.12"E	These monitoring sites lie along streams which form inlets of the Deelkraal dam. Deelkraal Up lies at a dam below a pumpstation whilst Deelkraal 1 and 2 appear to be fed by wetland systems.
Deelkraal 2	Deelkraal Dam 2	26°27'31.43"S 27°18'59.98"E	
Deelkraal 1	Deelkraal Dam 1	26°27'27.79"S 27°18'59.58"E	

New Name	Old Name	Coordinates	Description
Mooirivierloop Catchment (C23E)			
Piet se Dam	Name unchanged	26°27'2.20"S 27°19'1.60"E	Located downstream of the Deelkraal Dam.
Loopspruit Catchment (C23J)			
Wedela Up	Name unchanged	26°28'5.88"S 27°22'10.42"E	Located within a non-perennial stream west of the Wedela Township and east of the Kusasalethu RWD & STP. Previously Wedela Up
Kusasalethu RWD & STW	Name unchanged	26°28'9.19"S 27°22'1.34"E	Located below the Kusasalethu RWD & STPW.
Wedela Dwn	Wedela Down	26°28'31.58"S 27°22'1.06"E	Located approximately 750m downstream of the Kusasalethu RWD & STP. Previously Wedela Down
Wedela Dam Dwn	Wedela Dam Down	26°28'34.57"S 27°22'14.81"E	Site lies at a dam which drains a stream flowing south of the Wedela township. Sampling was undertaken approximately 100m downstream of the 'original' point due to ease of access. New sampling point GPS coordinates are 26°28'37.89"S 27°22'9.48"E.
Kusasalethu South	Kusasalethu Out South	26°29'34.73"S 27°22'19.56"E	This a the most downstream site within the Loopspruit tributary, lies at N12 river crossing, approximately 2 km downstream of Wed Dam.

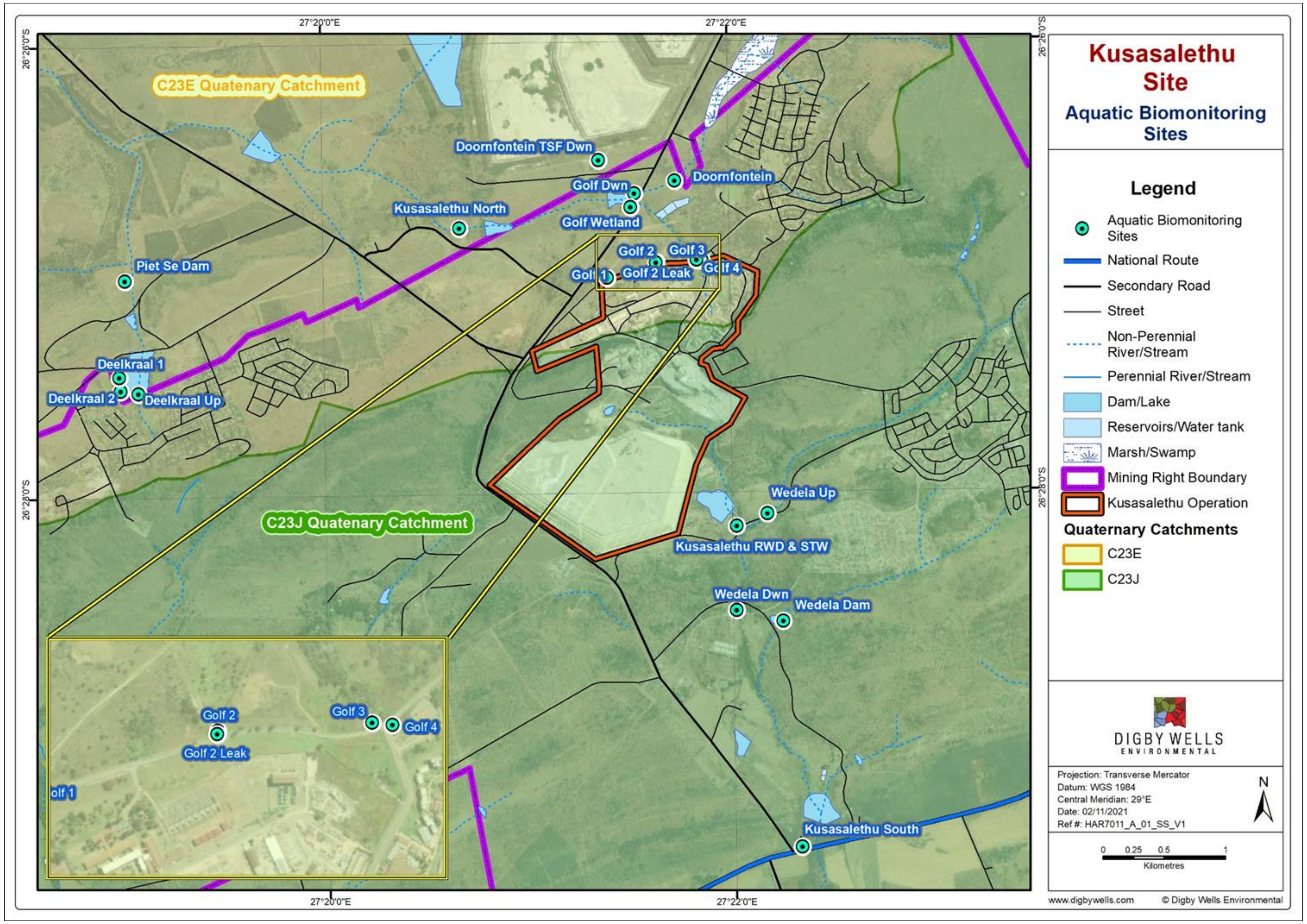

Figure 18: Aquatic Biomonitoring Locations

Figure 19: Manhole Leak at Site Golf 2

5.3.2 FINDINGS

The below sub-sections provide brief descriptions of the field observations and the laboratory analysis results of the water samples collected during the field survey. Standard River EcoStatus Monitoring Programme (REMP) techniques were utilised in order to collect the presented data. Detailed descriptions of the specific techniques utilised will be provided for in the final report following completion of the wet season survey.

For purposes of the assessment, each of the *in situ* values recorded during the survey were compared against various water quality guidelines originating from the following sources:

- pH and dissolved oxygen saturation percentage guidelines obtained from Department of Water Affairs and Forestry (1996a);
- Conductivity guideline value of 500 µS/cm stipulated in U.S. Environmental Protection Agency (2010); and
- Dissolved oxygen concentration guideline for macroinvertebrates from Nebeker *et al*. (1996).

Each of the *ex situ* water quality results were compared against various water quality guidelines originating from the following sources:

- Classes and Resource Quality Objectives (RQOs) of Water Resources for Catchments of the Upper Vaal in Terms of Section 13(1)(A) and (B) of the National Water Act, 1998 (Act No.36 of 1998), 2016. The Mooi River [(Resource Unit (RU) – 71)] has been use as the Integrated Unit of Analysis. Where guideline limits were not available, guideline limits for the Vaal River (RU – 73) were used;

- Department of Water Affairs and Forestry (1996a); and
- WUL (Licence No. 01/C23E/ABEFGJ/2802).

For the ease of interpreting the data gathered for the various assessed riverine ecosystems, the results have been discussed separately for each considered catchment. The monitoring sites have been displayed from an upstream to downstream progression with sites Piet se Dam and K Out South being the most downstream site within the Sub-quaternary Reaches (SQRs) Mooirivierloop tributary SQR C23E-01465 and Loopspruit tributary SQR C23J-01543, respectively.

5.3.2.1 **MOOIRIVIERLOOP CATCHMENT (C23E)**

5.3.2.1.1 IN-SITU WATER QUALITY

The in situ water quality results for the monitoring sites associated with the Mooirivierloop Catchment are shown in Table 30 and discussed below.

Table 30: *In situ* Water Quality Results for the Monitoring Sites associated with the Mooirivierloop Tributary

Parameter	Temp. (ºC)	pH	EC (µS/cm)	DO (mg/l)	DO (% sat.)
Guidelines	5 - 30	6 - 8	<500	>5	80 - 120
Golf 1	18.3	7.75	4553.0	6.15	61.8
Golf 2	19.8	8.46	702.0	6.15	61.8
Golf 4	17.2	8.43	202.2	6.24	67.0
Golf 3	18.6	8.91	109.2	7.84	86.7
Golf Wetland	21.1	6.81	2070.0	5.18	60.3
Doornfontein In	12.4	6.88	714.0	3.08	27.3
Golf Dwn	19.1	6.81	1352.0	7.93	84.9
Doornfontein TSF Dwn	19.2	7.47	4091.0	6.02	66.5
Kusasalethu North	17.8	7.05	1924.0	7.26	75.9
Deelkraal Up	Not assessed				
Deelkraal 2	Dry				
Deelkraal 1					
Piet se Dam					
***Red shading indicates water quality constituents that exceed the recommended guideline values; EC = Electrical Conductivity; DO = Dissolved Oxygen**					

The pH was variable among the monitoring sites, recording marginally alkaline at the Gold Course sites (i.e., sites Golf 2, 3 and 4), marginally acidic at the wetland sites (i.e., Doornfontein In, Golf Dwn and Golf Wetland) and neutral at the downstream site Kusasalethu North. The recorded conductivity levels were predominantly high and recorded above the recommended guideline of 500 µS/cm (USEPA, 2010) at all the sites except at sites Golf 3 and Golf 4. Some concerning conductivity levels were recorded at sites Golf 1 and Doornfontein TSF Dwn. At the time of the survey, these sites were observed to be flowing, thus the notably high conductivity potentially pose a threat to aquatic biota within the downstream reaches. The dissolved oxygen levels were predominantly above the recommended guideline of 5 mg/l (Nebeker et al., 1996; DWAF, 1996). Only the levels within Site Doornfontein, it was recorded below the recommended guideline. In contrast, dissolved oxygen saturation percentage levels were predominantly low, recording below the lower limit of the recommended guideline (DWAF, 1996) at all the sites except at sites Golf 3 and Golf Course Dwn (New).

5.3.2.2 **EX-SITU ANALYSIS**

The selection of analytes for *ex situ* water quality analysis was based on the previous 2018 dry season report (African Environmental Development, 2018). Only analytes that have exceeded at least one of the guideline limits (presented in red in Table 31) are discussed below.

5.3.2.2.1 INORGANIC COMPOUNDS:

Sulphate levels were found to exceed the WUL limit of 120 mg/l at all the sites except at the Golf 2 leak, Golf 4 and Golf 3. Water stemming from the canalised Golf Course sites merge into a single stream which discharges into a wetland system composed of sites Golf Dwn and Gold Wetland. The notably elevated sulphate-content water stemming from Site Golf 1 appears to be diluted by the lower sulphate-content water stemming from the Golf Course sites. This is deduction is supported by the lower sulphate levels recorded at the downstream sites Gold Dwn and Golf Wetland. Furthermore, the wetland system (wherein sites Golf Wetland and Gold Dwn lie) potentially acts as a filtration system for the incoming water, assimilating pollutants in the soil and vegetation (Tuladhar & Iqbal, 2020). Despite being diluted prior to reaching the Mooirivierloop tributary, care should be taken to prevent the water emanating from Site Golf 1 from further increasing in sulphate levels. Doornfontein TSF Dwn recorded the highest sulphate concentration. This water however was not observed to be draining into the Mooirivierloop tributary.

Nitrate levels were recorded within the RQO recommended guideline of 4 mg/l at seven of the assessed 11 sites. Water stemming from sites Golf 1 and 2, including the downstream Site Golf Dwn were found to exceed the guideline limit, whilst the sites Golf 3 and 4 were recorded within the guideline limit. This indicates that the dilution by water stemming from sites Golf 3 and 4 was not sufficient to reduce the notably elevated nitrate level from Site Golf 1. Subsequently, Site Golf 1 appeared to impact the downstream reaches of the Mooirivierloop tributary, also indicated by the exceedance recorded at Site Kusasalethu North.

5.3.2.2.2 NON-METAL:

Chloride levels were found to exceed the Department of Water Affairs and Forestry (DWAF, 1996) recommended guideline limit of 0.0002 mg/l at all the assessed sites. Similar to the nitrate levels, the chloride levels were also elevated at Site Golf 1 and then suspected to be diluted by water stemming from the downstream Golf course sites reducing the magnitude of impact at the downstream reaches of the Mooirivierloop tributary. The elevated chloride level at the Doornfontein TSF Dwn was a potential concern for the Mooirivierloop catchment.

5.3.2.2.3 METALS:

Amongst the analysed metals, aluminium, chromium, copper, iron, lead, manganese, uranium and zinc levels that typically followed a similar pattern to that shown by the inorganic compounds and chloride (as discussed above). Selenium levels were recorded within the DWAF (1996) recommended level of 0.002 mg/l at all the assessed sites except at Site Doornfontein TSF Dwn.

It is worth noting that Site Doornfontein TSF Dwn exhibited mostly elevated levels of the tested analytes – in some instances drastically elevated. Although not within the Kusasalethu operation, this site should be monitored closely to ensure that no run-off or seepage into the Mooirivierloop tributary occurs.

Table 31: Ex Situ Water Quality Results for the Monitoring associated with the Mooirivierloop Tributary

Analyte	Units	Golf 1	Golf 2	Golf 2 leak	Golf 4	Golf 3	Doornfontein In	Golf Dwn	Golf Wetland	Doornfontein TSF Dwn	Kusasalethu North	Deelkraal Up	Guidelines		
													RQO	DWAF (1996)	WUL
pH - Value @ 25 ºC	-	6.8	7.9	7.3	7.6	8.4	7.5	7.6	7.4	8.1	7.5	8	-	6-8	≤8
Electrical Conductivity @ 25°C	uS/cm	5170	1520	329	238	239	913	1540	215	4670	2200	872	≤1110	-	<570
Total Alkalinity as CaCO	mg/l	36	300	104	80	84	216	120	312	76	180	224	-	-	-
Total Hardness as CaCO	mg/l	2160	566	89	87	84	317	555	941	1948	897	318	-	-	-
Chloride as Cl	mg/l	497	125	29	15	15	69	129	187	399	199	45	≤0.005	≤0.0002	-
Sulphate as SO	mg/l	1227	230	25	18	18	147	304	583	1959	562	148	≤500	-	<120
Nitrate as N	mg/l	221	22	0.3	1.2	1	0.3	33	0.4	3.8	27	0.3	≤4.0	-	
Free Cyanide as CN	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	≤0.001	<0.05
Lanthanum as La	mg/l	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.021	0.001	0.001	-	-	-
Platinum as Pt	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Sodium as Na	mg/l	328	77	14	9	9	52	76	150	455	137	53	-	-	-
Potassium as K	mg/l	46	38	5.9	2.3	2.3	4.9	12.7	1.6	49	21	9.4	-	-	-
Calcium as Ca	mg/l	708	161	23	18	18	54	166	196	553	251	53	-	-	-
Magnesium as Mg	mg/l	96	40	8	10	10	44	34	110	139	66	45	-	-	-
Aluminium as Al	mg/l	0.29	0.29	0.137	0.186	<0.100	0.111	0.243	0.672	17	0.596	0.395	≤0.15	-	-
Antimony as Sb	mg/l	0.006	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.002	0.001	<0.001	-	-	-
Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.139	<0.001	<0.001	≤0.13	≤0.001	≤0.001
Barium as Ba	mg/l	0.143	0.249	0.093	0.111	0.091	0.079	0.098	0.096	0.089	0.091	0.106	-	-	-
Beryllium as Be	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Bismuth as Bi	mg/l	<0.025	0.042	0.037	0.049	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.047	-	-	-
Total Chromium as Cr	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.167	<0.025	<0.025	≤0.2	≤0.007	<0.001
Cobalt as Co	mg/l	0.147	<0.025	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	0.673	0.064	<0.025	-	-	-
Copper as Cu	mg/l	0.044	0.093	0.029	0.023	0.022	0.021	0.032	0.031	1.8	0.031	0.025	≤0.008	≤0.014	<0.003
Iron as Fe	mg/l	0.127	0.479	0.482	6.66	0.323	0.613	0.446	2.09	59	1.02	0.872	-	-	<0.01
Lead as Pb	mg/l	0.002	0.004	<0.001	0.001	<0.001	<0.001	0.004	0.004	0.377	0.002	0.001	≤0.013	≤0.0012	<0.001
Lithium as Li	mg/l	0.198	<0.025	<0.025	<0.025	<0.025	<0.025	0.034	<0.025	0.028	0.037	<0.025	-	-	-
Manganese as Mn	mg/l	0.492	0.132	0.055	0.29	0.033	2.86	0.364	2.37	20	2.1	0.273	≤1.3	≤0.180	<0.01
Mercury as Hg	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	≤0.0017	≤0.00004	<0.001
Molybdenum as Mo	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-

Analyte	Units	Golf 1	Golf 2	Golf 2 leak	Golf 4	Golf 3	Doornfontein In	Golf Dwn	Golf Wetland	Doornfontein TSF Dwn	Kusasalethu North	Deelkraal Up	Guidelines		
													RQO	DWAF (1996)	WUL
Nickel as Ni	mg/l	0.127	0.043	<0.025	<0.025	<0.025	<0.025	0.032	0.031	1.62	0.041	0.034	-	-	-
Selenium as Se	mg/l	0.001	0.001	0.002	<0.001	<0.001	0.001	0.002	<0.001	0.003	0.001	<0.001	-	≤0.002	-
Tellurium as Te	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Thallium as Tl	mg/l	0.261	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.035	0.246	0.076	<0.025	-	-	-
Tin as Sn	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Titanium as Ti	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.261	<0.025	<0.025	-	-	-
Uranium as U	mg/l	0.298	0.038	0.001	<0.001	<0.001	0.002	0.052	0.022	1.18	0.101	0.092	≤0.015	-	<16
Vanadium as V	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	0.038	<0.025	<0.025	-	-	-
Zinc as Zn	mg/l	0.369	0.04	0.027	<0.025	<0.025	<0.025	0.037	0.027	1.2	0.025	<0.025	≤0.03	≤0.002	<0.003

RQO =Resource Quality Objectives of Water Resources for Catchments of the Upper Vaal in Terms of Section 13(1)(A) and (B) of the National Water Act, 1998 (Act No.36 of 1998), 2016); DWAF (1996) = Department of Water Affairs and Forestry, 1996; WUL = Water Use License (01/C23E/ABEFGJ/2802)

5.3.2.3 TOXICITY DETERMINATION

The results of the toxicity assessment for the water sampled from sites Doornfontein In and Kusasalethu North are presented in Table 32. The water collected from both sites resulted in a 0% mortality of the utilised test biota. Therefore, both sites were classified as no acute environmental toxicity hazards (i.e., Hazard Class I).

Table 32: Toxicity results obtained during the low flow survey

Site	Taxa			Hazard Class
	Daphnia	Poecilia	Weight	
	magna	reticulata	(%)	
Doornfontein In	0	0	0	I
Kusasalethu North	0	0	0	I

5.3.2.4 AQUATIC MACROINVERTEBRATE ASSEMBLAGE

The following sections outline the findings gathered from the aquatic macroinvertebrate assessment conducted along the Mooirivierloop tributary. It should be noted that the water level at Site Golf Wetland was too low for the application of the SASS5 and Site Piet se Dam was dry at the time of the low-flow survey. Consequently, no aquatic macroinvertebrate data was reported for these sites.

5.3.2.4.1 AQUATIC MACROINVERTEBRATE HABITAT

The results of the Invertebrate Habitat Assessment System (IHAS) are provided in Table 33. The two monitoring sites Doornfontein In and Gold Dwn comprised of no through-flow at the time of the survey. These sites were dominated by sand and mud, with marginal vegetation to a lesser extent and lacked the stones and aquatic vegetation biotopes. Consequently, both sites comprised of *Poor* habitat availability according to the determined IHAS scores. In contrast, Site Kusasalethu North was in flow at the time of the survey and comprised of *Good* habitat availability. This site was dominated by the stones biotope which occurred in various velocity-depth classes. Marginal vegetation, gravel, sand and mud were also present in varying degrees. Only aquatic vegetation was found to be absent at the site.

Table 33: IHAS results for the Mooirivierloop tributary

Site	IHAS Score	Interpretation
Doornfontein in	38.2	Poor
Golf Dwn	27.3	Poor
Golf Wetland	Not suitable for assessment	
Kusasalethu North	69.1	Good
Piet se Dam	Dry	

5.3.2.4.2 AQUATIC MACROINVERTEBRATE INTEGRITY

The SASS5 data recorded during the current 2021 dry season survey is shown in Table 34. Interpretation of the results, in relation to the reference scores, was made according to the SASS5 Data Interpretation Guidelines for the Highveld Ecoregion – Upper Zone for the Mooirivierloop. (Dallas, 2007).

Table 34: SASS5 results for the Mooirivierloop tributary

Site	SASS Score	Taxa	ASPT	SASS5 Class
Doornfontein in	22	6	3.7	E/F
Golfcourse Dwn	0	0	-	E/F
Golf Wetland	Not suitable for assessment			
Kusasalethu North	53	13	4.1	E/F
Piet se Dam	Dry			

A total of 15 aquatic macroinvertebrate taxa were sampled from two of the three assessed sites. No taxa were sampled at Site Golf Dwn. The macroinvertebrate assemblages were largely dominated by taxa tolerant to no-flow conditions and water quality modifications. Subsequently, a SASS5 class of E/F, indicating Seriously to Critically modified conditions, was determined for all three sites. This finding was not expected at Site Kusasalethu North since this site was determined to exhibit Good macroinvertebrate habitat availability. Therefore, the recorded water quality modifications, based on in situ measurements (Table 35) and elevated levels of some inorganic compounds and metals (Table 31), were likely the major driver of the ecological conditions within the macroinvertebrate assemblages.

5.3.2.5 **LOOPSPRUIT CATCHMENT (C23J)**

5.3.2.5.1 IN SITU WATER QUALITY

The in situ water quality results for the monitoring sites associated with the Loopspruit tributary reaches are shown Table 35.

Within the upper reaches of the Loopspruit the temperature values were typical of the spring season temperatures in South Africa. Therefore, all recordings were within the normal temperature of inland waters in the country. The pH values were marginally acidic within the upper reaches and marginally alkaline within the downstream reach. Conductivity levels were predominantly low and only recorded above the recommended guideline of 500 µS/cm (USEPA, 2010) at sites K RWD & STW and Wed Dam Dwn. The dissolved oxygen concentrations varied, recorded within the recommended guideline limit of 5 mg/l (Nebeker et al., 1996; DWAF, 1996) at two of the monitoring sites (Wed Up and Wed Dwn), but were very low within sites K RWD & STW and Wed Dam Dwn r. Similarly, dissolved oxygen saturation percentage levels were low, and were recorded below the lower limit of the recommended guideline (DWAF, 1996) at all the sites.

Table 35: *In situ* water quality results for the monitoring sites associated with the Loopspruit tributary

Parameter	Temp. (ºC)	pH	EC (µS/cm)	DO (mg/l)	DO (% sat.)
Guidelines	5 - 30	6 - 8	<500	>5	80 - 120
Wed Up	21.7	6.88	264.7	6.09	69.3
Kusasalethu RWD & STW	18.0	6.22	870.0	2.93	30.7
Wed Dwn	20.3	6.51	257.7	5.63	61.7
Wed Dam	20.9	7.99	761.0	1.23	12.8

Parameter	Temp. (ºC)	pH	EC (µS/cm)	DO (mg/l)	DO (% sat.)
Kusasalethu South	17.5	7.93	321.0	4.43	47.2
***Red shading indicates water quality constituents that exceed the recommended guideline values; EC = Electrical Conductivity; DO = Dissolved Oxygen**					

The recorded in situ water quality was considered to be altered and posed a threat to aquatic biota particularly at sites Kusasalethu RWD & STW and Wed Dam. The marginally acidic pH, coupled with elevated conductivity and low dissolved oxygen were a major concern for the colonisation of aquatic biota. Sources for the water quality modifications were associated with the surrounding townships (e.g., such as the observed raw or inadequately treated sewage), freely roaming cattle and the upstream mining activities.

5.3.2.6 EX SITU ANALYSIS

The selection of analytes tested for ex situ water quality was based on the previous 2018 dry season report (African Environmental Development, 2018). Only analytes that have exceeded at least one of the guideline limits (indicated in red in Table 36) are discussed below.

5.3.2.6.1 INORGANIC COMPOUNDS:

None of the tested inorganic compounds was found to exceed any of the recommended guideline limits.

5.3.2.6.2 NON-METAL

Chloride levels were found to exceed the DWAF (1996) recommended guideline limit of 0.0002 mg/l at all the assessed sites. Notably elevated levels were recorded at sites Kusasalethu RWD & STW and Wed Dam. The lower chloride-content water recorded at Site Wed Dwn – a site below a confluence of sites Kusasalethu RWD & STW and Wed Up – indicates that Water stemming from Site Wed Up diluted the high chloride levels stemming from Site Kusasalethu RWD & STW. Similarly, the elevated chloride level recorded at Site Wed Dam appeared to have been diluted by the water stemming from Site Wet Dwn, this was indicated by the lower chloride level recorded at the most downstream Site Kusasalethu South.

5.3.2.6.3 METALS

Of the analysed metals, only aluminium, copper, iron, manganese and zinc, recorded concentration levels exceeding at least one of the recommended guideline limits. Levels of aluminium and iron were notably elevated at sites Wedela Up and Wedela Dam. Furthermore, zinc levels exceeded the recommended guideline limit at these sites only. These sites lie downstream of the Wedela township which are likely to be driving the water quality modifications to some extent. The somewhat diluted water from Site Kusasalethu RWD & STW appeared to aid in diluting the impacts as shown by the lower metal concentrations within the downstream sites Wed Dwn and Kusasalethu South. Manganese levels were recorded at varying levels; thus no pattern can be seen. A notably elevated level of Manganese was however recorded at Site Wed Dam. Despite the dilution effect stemming from Site Wed Up, water draining from the Kusasalethu RWD & STW should be monitored closely and not allowed to exceed the recommended guidelines.

Table 36: Ex situ Water Quality Results for the Loopspruit Catchment (C23J)

Analyte	Units	Wed Up	Kusasalethu RWD & STW	Wed Dwn	Wed Dam	Kusasalethu South	Guidelines		
							RQO	DWAF (1996)	WUL
pH - Value @ 25 ºC	-	7.2	6.8	7	7.3	7.4	-	06-Aug	≤8
Electrical Conductivity in 25°C	uS/cm	266	991	270	846	354	≤1110	-	<570
Total Alkalinity as CaCO	mg/l	88	60	72	288	116	-	-	-
Total Hardness as CaCO	mg/l	68	328	77	135	95	-	-	-
Chloride as Cl	mg/l	22	85	21	70	28	≤0.005	≤0.0002	-
Sulphate as SO	mg/l	21	272	24	19	26	≤500	-	<120
Nitrate as N	mg/l	0.2	0.8	1.7	0.2	0.4	≤4.0	-	
Free Cyanide as CN	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	-	≤0.001	<0.05
Lanthanum as La	mg/l	0.002	<0.001	0.001	0.001	<0.001	-	-	-
Platinum as Pt	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Sodium as Na	mg/l	17	60	14	51	22	-	-	-
Potassium as K	mg/l	4.5	6.4	4.2	12.5	5.2	-	-	-
Calcium as Ca	mg/l	16	85	19	34	23	-	-	-
Magnesium as Mg	mg/l	7	28	7	13	9	-	-	-
Aluminium as Al	mg/l	0.899	0.156	0.305	0.663	0.179	≤0.15	-	-
Antimony as Sb	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Arsenic as As	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	≤0.13	≤0.001	≤0.001
Barium as Ba	mg/l	0.107	0.078	0.085	0.151	0.09	-	-	-
Beryllium as Be	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Bismuth as Bi	mg/l	0.091	0.079	0.093	0.069	<0.025	-	-	-
Total Chromium as Cr	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	≤0.2	≤0.007	<0.001
Cobalt as Co	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Copper as Cu	mg/l	0.031	0.026	0.033	0.025	0.027	≤0.008	≤0.014	<0.003
Iron as Fe	mg/l	5.06	0.652	1.83	2.99	1.19	-	-	<0.01
Lead as Pb	mg/l	0.008	<0.001	0.002	0.002	<0.001	≤0.013	≤0.0012	<0.001
Lithium as Li	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Manganese as Mn	mg/l	0.271	0.388	0.264	0.594	0.358	≤1.3	≤0.180	<0.01
Mercury as Hg	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	≤0.0017	≤0.00004	<0.001
Molybdenum as Mo	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Nickel as Ni	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Selenium as Se	mg/l	0.001	0.001	0.001	0.001	<0.001	-	≤0.002	-
Tellurium as Te	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Thallium as Tl	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Tin as Sn	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-
Titanium as Ti	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-
Uranium as U	mg/l	<0.001	0.004	0.001	<0.001	0.001	≤0.015	-	<16
Vanadium as V	mg/l	<0.025	<0.025	<0.025	<0.025	<0.025	-	-	-

Analyte	Units	Wed Up	Kusasalethu RWD & STW	Wed Dwn	Wed Dam	Kusasalethu South	Guidelines		
							RQO	DWAF (1996)	WUL
Zinc as Zn	mg/l	0.035	<0.025	<0.025	0.053	<0.025	≤0.03	≤0.002	<0.003

RQO =Resource Quality Objectives of Water Resources for Catchments of the Upper Vaal in Terms of Section 13(1)(A) and (B) of the National Water Act, 1998 (Act No.36 of 1998), 2016); DWAF (1996) = Department of Water Affairs and Forestry, 1996; WUL = Water Use License (01/C23E/ABEFGJ/2802)

5.3.2.7 **TOXICITY DETERMINATION**

The results of the toxicity assessment for the water sampled from sites Wed Up and Kusasalethu South are presented in Table 37. Sample Wed Up resulted in only 5% mortality of Daphnia magma whilst sample Kusasalethu South resulted in 30% mortality. Therefore, sample Wed Up presented a no acute environmental toxicity hazard (Class I) whilst sample Kusasalethu South presented a slight acute environmental toxicity hazard (Class II).

Table 37: Toxicity results obtained during the low flow survey

Site	Taxa			Hazard Class
	Daphnia	Poecilia	Weight	
	magna	reticulata	(%)	
Wed Up	-5	0	0	Class I
Kusasalethu Out S	-30	-8	50	Class II

5.3.2.8 **AQUATIC MACROINVERTEBRATE ASSEMBLAGE**

The following sections summarizes the findings for the aquatic macroinvertebrate assessment conducted along the Loopspruit tributary. It should be noted that due to a warning sign and limited access at Site Kusasalethu RWD & SWT indicating “Water contains cyanide” Figure 20), it was deemed unsafe to undertake the SASS5 protocol, as such no aquatic macroinvertebrate assemblage data is reported for this site.

Figure 20: Warning sign indicating cyanide-containing water at Site Kusasalethu RWD & STW

5.3.2.9 **AQUATIC MACROINVERTEBRATE HABITAT**

The results of the IHAS are provided Table 33. The sampled sites were dominated by sand and mud, with marginal vegetation to a lesser extent and generally lacked the stones and aquatic vegetation biotopes. The stones biotope was present at sites Wedela Up and Kusasalethu RWD & STW and occurred over a variety of velocity-depth classes. Consequently, both sites exhibited *Good* habitat availability whilst sites Wed Dam and Kusasalethu South exhibited *Poor* habitat availability.

Table 38: IHAS results for the Mooirivierloop tributary

Site	IHAS Score	Interpretation
Wed Up	74.5	Good
Kusasalethu RWD & STW	Not Sampled	
Wed Dwn	72.7	Good
Wed Dam	25.5	Poor
Kusasalethu South	35.5	Poor

5.3.2.9.1 AQUATIC MACROINVERTEBRATE INTEGRITY

The SASS5 data recorded during the current 2021 dry season survey are shown in Table 39. Interpretation of the results, in relation to the reference scores, was made according to the SASS5 Data Interpretation Guidelines for the Highveld Ecoregion –Lower Zone for the Loopspruit (Dallas, 2007).

Table 39: SASS5 results for the Mooirivierloop tributary

Site	SASS Score	Taxa	ASPT	SASS5 Class
Wed Up	18	6	3	E/F
Kusasalethu RWD & STW	Not Sampled			-
Wed Dwn	26	9	2.9	E/F
Wed Dam	5	2	2.5	E/F
Kusasalethu South	6	3	2.0	E/F

A total of 10 aquatic macroinvertebrate taxa were sampled from the assessed sites. The macroinvertebrate assemblages were dominated largely by pollution tolerant taxa. Subsequently, a SASS5 class of E/F, indicating Seriously to Critically modified conditions, was assigned for all four sites. This finding was not expected at sites Wed Up and Wed Dwn as these sites were determined to exhibit Good macroinvertebrate habitat availability as noted in the Mooirivierloop sites. Therefore, the recorded water quality modifications, as outlined from the in-situ measurements (Table 35) and elevated levels of some metals and non-metals (Table 36), were likely the major driver of the ecological integrity of macroinvertebrate assemblages at these sites.

5.4 SOCIO ECONOMIC ENVIRONMENT

5.4.1 POPULATION DENSITY AND LOCATION

According to the Merafong City Annual Report (MCAR), 2012/2013, the population of the local municipality was approximately 197 520, spread across 66 505 households, which equates to three persons per household. The 21 629 people reside in Carletonville, with Fochville and its neighbouring informal settlement of Kokosi, home to 9 504 and 3 959 people, respectively. Wedela, the nearest settlement to the WRD and TSF, has a population of approximately 1 372 (MCAR, 2012/2013).

5.4.2 UNEMPLOYMENT ESTIMATE

According to Census 2011, 15.3 % of households within the Merafong City Local Municipality had no income and were dependent on social grants, with a further 50.1 % earning less than R 3200.00 per month. The average weighted household income, in 2012, was R 6619.00 (MCAR, 2012/2013).

5.4.3 MAJOR ECONOMIC ACTIVITIES AND SOURCES OF EMPLOYMENT

Mining is the dominant sector in the economy of the Local Municipality, contributing 50.7 % to the Gross Domestic Product (GDP), but has been in decline since 2009. Trade, Finance and Business, Community Service and Government have all contributed approximately 9 % each to the local GDP.

5.4.4 ACCESS TO BASIC SERVICES

Approximately 83 % of households within the Local Municipality use electricity for lighting, with 12.95 % and 3.56 % utilising candles and paraffin respectively. This is in contrast to the 76.02 % and 20.41 % that utilise electricity and paraffin respectively as an energy source for cooking.

6 ANALYSIS AND CHARACTERISATION OF ACTIVITY

The following section describes the activity, its associated processes and infrastructure in more detail.

6.1 SITE DELINEATION FOR CHARACTERISATION

The Kusasalethu operation is located near the towns of Carletonville and Westonaria to the north-east; and Fochville to the south-east, in the Gauteng Province. The Kusasalethu operation lie on Portion 0 of Buffelsdoorn 143 IQ, Portion 3 of the farm Deelkraal 142 IQ; and Portion 2 of the farm Kleinfontein 141 IQ.

6.2 WATER BALANCE

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

A water balance for the Kusasalethu operation has been developed to meet the requirements of the IWWMP and to meet the requirements of the DWS, as contained in the relevant draft Best Practice Guideline. As per the requirements of the WUL, Jones and Wagner have updated the dynamic water balance for the mine.

The following describes the Water Balance for the Operation:

- The water balance for the Kusasalethu operation is derived from the existing mining activities, which includes the underground mining activities and Kusasalethu plant activities (above ground processing). Both these activities make use of a TSF, RWD and two spillage ponds, No. 1 and No 2. Rand Water Board water is used within the Kusasalethu plant and for underground cooling and drilling as part of a closed system. All Rand Water Board water is supplied from the west reservoir as part of make-up water when required;

- The water balance information includes the annual average in cubic metres, dry season average in cubic metres, and wet season average in cubic metres. Rand Water Board water usage rates were also simulated in accordance with the dry and wet season of the mining area. If the simulations are followed, higher Rand Water Board water consumptions are required for the dry season and less Rand Water Board consumption are required for the wet season for more water is available during the wet season;

- This water balance reflects the water use requirements during the operation of the Kusasalethu process activities (above ground) and the Kusasalethu underground activities;

- Water requirements for the process activities are supplied from the Rand Water Board via west reservoir, the Kusasalethu RWD, which receives affected water from the TSF, and the affected Stormwater from the two spillage ponds, No. 1 and No. 2. Main losses as incurred include evaporation, seepage and loss in terms of interstitial retention from the TSF, Kusasalethu RWD, the two spillage ponds and through coarse rejects used for backfilling (% moisture content) and fine rejects disposed at the tailings facility;
- Stormwater drainage is generally from the north and northwest towards the south and southwest and therefore, the Stormwater drainage will be from the Kusasalethu plant operations towards the TSF, the RWD and the two spillage ponds. All affected water from the RWD and the two spillage ponds will be re-used within the process plant as indicated within the water balance.
- The mine can further refine the process water balance by assessing the exact water loss through Stormwater run-off, seepage, evaporation and interstitial retention (TSF) of all storage facilities;
- It is expected that less Rand Water Board water can be used if the Kusasalethu Operation contains more of the affected water that is lost through seepage, evaporation and Stormwater run-off;
- The mine will also need to define more specific Rand Water Board water usage in terms of process and domestic purposes. Domestic and process water quantity measurements, at the different operational areas, will be conducted so as to further manage and control water usage at the mine;
- All affected water re-used from the RWD within the Kusasalethu plant will be monitored on a monthly basis. This will further improve the water balance (refine) and, therefore, water management measures at the Kusasalethu operation; and
- All affected Stormwater runoff from the Kusasalethu shaft to the Varkenslaagte tributary will need to be monitored on a monthly basis. This will also further improve the water balance (refine) and, therefore, water management measures at the Kusasalethu operation.

6.3 WATER AND WASTE MANAGEMENT

The aspects related to the management of waste and water at the Kusasalethu Operations are described in the following sections, including the relevant aspects related to process-, storm-, groundwater and waste.

6.3.1 POTABLE WATER SUPPLY

All potable water required for domestic use is being supplied by the Rand Water Board reticulation system. The volumes utilised as domestic water by the mine is indicated in the existing water balance.

The Rand Water Board water is used for domestic purposes at the Kusasalethu plant, shaft and underground operations. Rand Water Board water is also used for mining purposes as cooling water in the compressors and refrigerator plant. In addition, Rand Water Board water is also used as make-up water for the treatment processes in the Kusasalethu gold plant.

Independent drinking water supply lines are installed underground and are used to supply drinking water to the underground workforce. The workforce working at the Kusasalethu operation is also supplied with potable water from the Rand Water Board. This includes the residential areas of Elandsridge and Kusasalethu hostels. The residential areas of Deelkraal are also supplied with potable water from the Rand Water Board.

The responsibility for the provision of water in compliance with the Target Water Quality Guideline Ranges for the Domestic Use range of Drinking Water Standards rests with the Rand Water Board.

6.3.2 PROCESS WATER

The ore at the Kusasalethu operation is being extracted from underground workings and conveyed by means of a conveyer belt to the metallurgical plant. Thereafter, water is required in the surface operations to act as a catalyst or conveying media in the metallurgical extraction process. The volumes utilised by the different processes are indicated in the monthly water balance.

Process water sources at Kusasalethu operation are as follows:

- Rand Water Board: This water is used for process water within the plant operation and in the cooling water circuits,
- Tailings water: This is the water recovered from the tailings storage facility and released to the RWD, prior to be pumped to the Kusasalethu plant for use as process water. The ultimate objective is to have no effluent from the property in terms of process water;
- Spillage ponds water: This is the affected Stormwater runoff recovered from the spillage ponds to be pumped to the Kusasalethu plant for use as process water;
- Water pumped out from underground: This underground water is recycled within the shaft systems and when required make-up water from Rand Water Board will be added. After cooling in the refrigeration plants, it is used as chilled service water for drilling and mining operations; and
- Underground water also forms part of the plant operations for underground ore and sludge to be processed at plant – has a large moisture content.

The water used as chilled service water is recycled until a predetermined TDS value is reached. To maintain the TDS below this value, water is discharged from the system and this shortfall is made up with the addition of Rand Water Board water. The discharged slurry water is transferred to the gold plant and forms part of the process activities.

The process water supply used within the Kusasalethu plant is supplied by recovered water from the Kusasalethu RWD, spillage ponds and the Rand Water Board. Kusasalethu plant also receives water from underground ore and sludge to be processed at the plant. Slimes are pumped to the tailings storage facility, which is located to the south of the Kusasalethu plant. The slimes are pumped to the tailings storage facility, settles and water is recovered to the RWD, after which the water is pumped to the Kusasalethu operational area. The ultimate objective is to have zero process water effluent discharged from the property. The Kusasalethu operations is committed to keeping dirty water management areas separate from clean water management areas, thereby ensuring compliance with Regulation 6 and 7 of GN 704 of 4 June 1999.

The Deelkraal operation is not in use, which means that the operation only contains affected mine water within the existing storage facilities. The mine affected water will be left for evaporation after which the existing storage facilities will be rehabilitated.

6.3.2.1 **PROCESS WATER MANAGEMENT**

The primary objective of the Kusasalethu operations water management strategy is to recycle as much water as possible, to minimise losses as far as possible, to prevent spillage and wastage of water and to minimise the volumes of raw water intake. The water management system is based on the principles of pollution prevention, management of affected water at source and optimal re-use/recycling of affected water. Stormwater Management

The following sections discuss the stormwater management measures that are currently in place at the mine.

6.3.2.2 **EXISTING STORMWATER MANAGEMENT MEASURES**

This section of the IWWMP describes the existing Stormwater management measures and infrastructure at the Kusasalethu operation. Currently, the Kusasalethu and Deelkraal areas are considered affected water management areas.

6.3.2.3 EXISTING STORMWATER MANAGEMENT MEASURES AT KUSASALETHU

Some of the affected stormwater runoff (to the south) from the Kusasalethu affected water management area is contained within the existing TSF, from where the water is temporarily stored and released to the RWD through the penstock outlet. Affected Stormwater runoff from the Kusasalethu WRD and STP is also contained within the RWD. All water from the RWD is pumped back to the Kusasalethu metallurgic plant for treatment/ gold recovery processes (Recycling). Affected stormwater and recovered water within the two emergency storage dams/spillage ponds are also re-used in the process plant when water is scarce however water need to be released to the RWD for this to happen. Stormwater on the site is limited to only the rainfall on the site itself.

External stormwater is divided into natural drainage channels. On-site affected stormwater is channelled to the existing TSF and RWD and used as process water in order to reduce the water usage from other sources (i.e., Rand Water Board). Clean Stormwater is separated from process or affected Stormwater in drains, trenches and berms, clean stormwater is released to the environment. Affected Stormwater will be channelled to the closed circuits. The drains, trenches (lined channels), berms, Kusasalethu TSF, Kusasalethu RWD, sewage treatment plant and two emergency dams/spillage ponds are serviced regularly to minimise accidental spillages.

Some of the affected stormwater runoff from Kusasalethu shaft area is being discharged into the tributary of the Wonderfonteinspruit on the northern side of the Kusasalethu operation. Kusasalethu has implemented a water quality and quantity monitoring programme for the stormwater discharged from Kusasalethu Operation. Kusasalethu also conduct a risk-based assessments to determine the impact of such water release onto the neighbouring water resources. The information related to impacts is made available within reports and stored within the mine's environmental database. All affected water including affected stormwater discharged will need to comply with the requirements of the water use licence which clearly stipulate the limits applicable to the discharge of wastewater into a water resource. If stormwater quality is not in accordance with the wastewater limits values, the necessary management measures (quality management) will need to be implemented prior to stormwater being discharged.

6.3.2.4 EXISTING STORMWATER MANAGEMENT MEASURES AT DEELKRAAL

Affected stormwater runoff within the Deelkraal affected water management area is contained within the existing TSF (not operational), from where the water is released to the stormwater dam, for evaporation. Affected Stormwater runoff from the WRD stockpile, domestic waste dump site and Deelkraal shaft operations are contained within the Deelkraal Village Dam. In future it is required that all affected Stormwater runoff from the domestic waste dump site be contained so as to prevent the contamination of clean surrounding environment.

Clean Stormwater will also be separated from process or affected Stormwater in drains, trenches and berms. Affected Stormwater is channelled to the closed circuits. The drains, trenches (lined channels), berms, TSF and RWD will be maintained. No affected water run-off will be allowed into public streams.

6.3.2.5 THE TAILINGS STORAGE FACILITIES AT KUSASALETHU

The TSF has elevated berms or walls to prevent uncontrolled discharge of stormwater. The principle of keeping clean and dirty water separate will be applied at the TSF as far as practicable.

The existing Kusasalethu TSF forms part of a closed reticulation system. Slimes from the Kusasalethu metallurgical plant, is pumped to the TSF, from where the slimes will settle and recovered water is released to the RWD, after which water get pumped to the metallurgical plant. A nominal ±60 000 tons of slimes per month is deposited on the Kusasalethu TSF. The solids settle on the dam surface and thereafter the water flows to a penstock outlet. The TSF is equipped with unlined paddocks around the base. These paddocks serve to contain any side-slope runoff and wash down originating from the dam walls.

6.3.2.6 THE TAILINGS STORAGE FACILITIES AT DEELKRAAL

The Deelkraal TSF also has elevated berms or walls to prevent uncontrolled discharge of water. The principle of keeping clean and dirty water separate is applied at the Deelkraal TSF as far as practicable.

The existing Deelkraal TSF did form part of a closed reticulation system. At present the Deelkraal TSF and the Deelkraal RWD is not in operation. These affected water storage facilities will be rehabilitated as part of the Deelkraal Rehabilitation Plan. The Deelkraal TSF is equipped with unlined paddocks around the base. These paddocks serve to contain any seepage and wash down originating from the dam walls.

Both the TSFs are not fenced off adequately and, therefore, possible unauthorised access to the dirty water management areas. Warning signs or other measures have been put in place to warn the public of the risks involved. The Kusasalethu Operation is committed to assess the condition of current warning signs/access control and upgrade where necessary. The mine will establish warning signs at all areas where water with hazardous contents exist e.g., TSF, RWD, two emergency storage dams/spillage ponds and sewage treatment plants (which has been observed on site)

6.3.2.7 THE PREVENTION OF STORMWATER INFLOW INTO MINE WORKINGS

Kusasalethu shaft is situated on high ground and has suitable preventative measures in place to prevent water ingress into the workings. The Kusasalethu shaft area and, therefore, the underground workings are managed and maintained so that clean Stormwater runoff is prevented from entering dirty water management area. The clean Stormwater runoff is diverted by means of elevated berms or walls. The Kusasalethu shaft area is fenced off to prevent unauthorised access.

6.3.2.8 KUSASALETHU RETURN WATER DAM

The Kusasalethu RWD is situated in close proximity to the Kusasalethu TSF and the STP, it was designed to collect recovered water from the TSF, prior to the usage within the metallurgical plant. The Kusasalethu RWD also collects affected Stormwater from the STP, WRD stockpile and the dirty water management area, prior to be used within the metallurgical plant.

The Kusasalethu RWD will also collect clean water runoff from the surrounding veld. The Kusasalethu Operation will need to investigate and assess the need for an additional diversion berm to divert clean runoff water from the surrounding veldt, around the dam and into the natural receiving environment.

6.3.2.9 DEELKRAAL RETURN WATER DAM

The Deelkraal RWD was situated in close proximity to the Deelkraal TSF and was designed to collect recovered water from the Deelkraal TSF. The Deelkraal RWD is non-existent and the area where it was situated will form part of the Deelkraal Rehabilitation Plan.

6.3.2.10 KUSASALETHU WASTE ROCK DUMP

The Kusasalethu WRD affected Stormwater run-off is collected within the Kusasalethu RWD (affected management area). The Kusasalethu Operation will need to investigate and assess the need for an additional diversion berm to divert clean runoff water from the surrounding veld, around the WRD and RWD; and into the natural receiving environment.

6.3.2.11 DEELKRAAL WASTE ROCK DUMP

Affected Stormwater runoff from the WRD, is contained within the Deelkraal Village Dam. The Deelkraal WRD will be crushed for aggregates as part of concurrent rehab practice. The Deelkraal Village dam will be monitored regularly and if required the necessary management measures will be implemented, which will form part of the rehabilitation programme.

6.3.2.12 GNR 704 AUDIT RESULTS REGARDING THE STORMWATER INFRASTRUCTURE

The 2021 GNR 704 audit conducted by EIMS indicated that the maintenance programme of Stormwater and water management infrastructure should be improved. The following was noted during this audit:

- No formal Stormwater Management Plan is in place that shows the current design of the stormwater management system and the plans to improve the system. Various concerns were noted with regards to the separation of the clean and dirty water and containment of dirty stormwater;
- It was indicated that some work is required to improve dirty and clean water separation and containment around the Kusasalethu mine, especially the northern section of the mining property. Exceedances of the water quality limits was noted at the discharge points to the Varkenslaagtespruit from the Kusasalethu operations;
- Evidence of the release of contaminated stormwater into the Varkenslaagtespruit was noted during the review of the quarterly water quality monitoring report;
- It was not clear if the stormwater system is designed to accommodate a 1:50 year flood event. It was reported that regular overflow of the Kusasalethu RWD is experienced during the rainy season; and
- Some of the stormwater infrastructure (i.e., STP) requires maintenance.

Furthermore, maintenance of all water and stormwater infrastructure should be improved. Maintenance poses a continual issue and could therefore impose increased non -compliance to the site's overall compliance rating. Vandalism of the STP by illegal miners has led to sewage water entering the environment in the area around the plant (however water exiting from the STP drains into the RWD). Continual maintenance and inspections are, therefore, crucial to minimising the impact of leakages.

6.3.3 GROUNDWATER MANAGEMENT

Kusasalethu operation recognises the need for a groundwater strategy that also takes the long-term issues, including the post-closure groundwater issues, into account. A Post Closure Groundwater Management Plan has been compiled entitled, "Post Closure Groundwater Management Plan for the Harmony Randfontein Operations, South Africa by Golder Associates, dated January 2009".

Due to the LoM, changes in legislative requirements, etc., it will be necessary to adopt an approach of continuous improvement where the groundwater management aspects of the IWWMP are concerned.

The mine is in the process of developing and documenting a feasible strategy and methodology for groundwater management, of which the implementation will ensure the mine's ability to comply with its closure objectives.

Jones and Wagner conducted a hydrogeological assessment in 2017 to characterise the prevailing groundwater regime, the establishment of a basic groundwater model, delineate any groundwater pollution plume(s) (especially at the western side of the Kusasalethu TSF and assess whether mitigation and/or remediation is required.

6.3.3.1 UNDERGROUND WATER MANAGEMENT

Water used in the underground operations reports to underground water storage dams located at various levels and with different storage capacities (Refer to Table 8) of the existing mining operations. The underground water storage dams are constructed with cement and affected underground water and Rand Water Board water is retained within these storage facilities. Water purifiers consisting of neutralisation sections and a settling/coagulation section, are used at the Kusasalethu shaft. Sludge extracted at the settlers/sludge settling dams is conveyed to the metallurgical process plant for benefaction and ultimately the TSF. The mine ensures that all underground water storage facilities are included into a planned maintenance programme and that inspections of these dams is also undertaken and keeps records of these inspections. Refer to Figure 4 above for an illustration of the underground storage facilities and underground operations.

Kusasalethu Operation uses tailings residue for underground support (± 20 000 tonnes per month). The usage of tailings residue for underground constructions requires the necessary exemptions in terms of GN 704 of 4 June 1999. Reference can be made to Section 4.1.4 of this IWWMP document for all exemptions in terms of GN 704 of 4 June 1999.

If tailings residue used for underground construction cause the pollution of groundwater recourses the necessary management measures will need to be implemented so as to prevent groundwater pollution and make sure tailings residue water form part of the closed affected water management system.

6.3.3.2 HYDROCARBON MANAGEMENT

Monitoring for indicator hydrocarbon content for boreholes down-gradient of areas where hydrocarbons are handled or stored, or where a hydrocarbon spillage has taken place will be undertaken. After a hydrocarbon spillage it is also essential that hydrocarbon monitoring be conducted so as to determine the damage sustained by the environment.

6.3.3.3 DUST SUPPRESSION

Affected Stormwater from the Kusasalethu RWD may be used for dust suppression. In the underground operations water will be used for dust suppression during percussion drilling, watering down airways and as a wetting agent after blasting operations. Air which is exhausted from the underground workings is saturated with water and poses no problem as far as dust and noxious gases are concerned.

6.3.3.4 SURFACE DAMS

The quality of the affected water resulting from the treatment process at the Kusasalethu Operation will be taken into account when assessing the groundwater contamination possibility. It is suggested that water quality monitoring at all the surface containment facilities be conducted, to determine the quality of the water.

6.3.3.5 TAILINGS STORAGE FACILITY

It should be noted that the seepage from the TSF pose high risk to the environment and the groundwater recourses. The mine will inform the DWS of any seepage or release to the surrounding environment (in accordance with section 20 of NWA and Regulation 2 of GN 704).

The following measure will be implemented at the TSF in future:

- Assess the trenches and paddocks if it has adequate capacity for water flow;
- Assess if the flow of water in the trenches are towards the RWD;
- Maintain trenches and paddocks to keep out all vegetation and blockage that may prevent water flow to the RWD;
- The TSF walls and infrastructure will be inspected regularly to monitor for any probability of wall instability; and
- Security measure (access control measures) will be put into place to prevent people from drowning in the TSF.

6.3.4 WASTE

The following section discusses the waste management and procedures that are in place at the Kusasalethu Operation.

6.3.4.1 SOLID WASTE MANAGEMENT FACILITIES (KUSASALETHU AND DEELKRAAL OPERATION)

The Kusasalethu Operation has implemented an International Organisation for Standardisation (ISO 14001) system and, therefore, a waste management programme has been developed and is implemented as part of the ISO waste management strategy.

Radioactive waste is also handled and disposed of as per the requirements of the Certificate of Registration (COR- 58A 0192) issued in terms of the NNR Act. Waste disposal measures at Kusasalethu Operation comply with the terms of the conditions as stipulated within the Certificate of Registration (COR) (58A 0192).

The purpose of this waste management procedure is to provide guidance on the disposal of waste at source, handling of waste at the site salvage areas, removal and transport to the central salvage area and final disposal of waste at all sites associated with the Operation. The scope of this waste management procedure is applicable to all activities, products Kusasalethu operations and services at the Kusasalethu operation. The waste management procedure is in line with the Waste Management Strategy developed for the Harmony Group. Further reference can also be made to for the flow diagram (Figure 21 below) of the Kusasalethu Operation with regards to waste management.

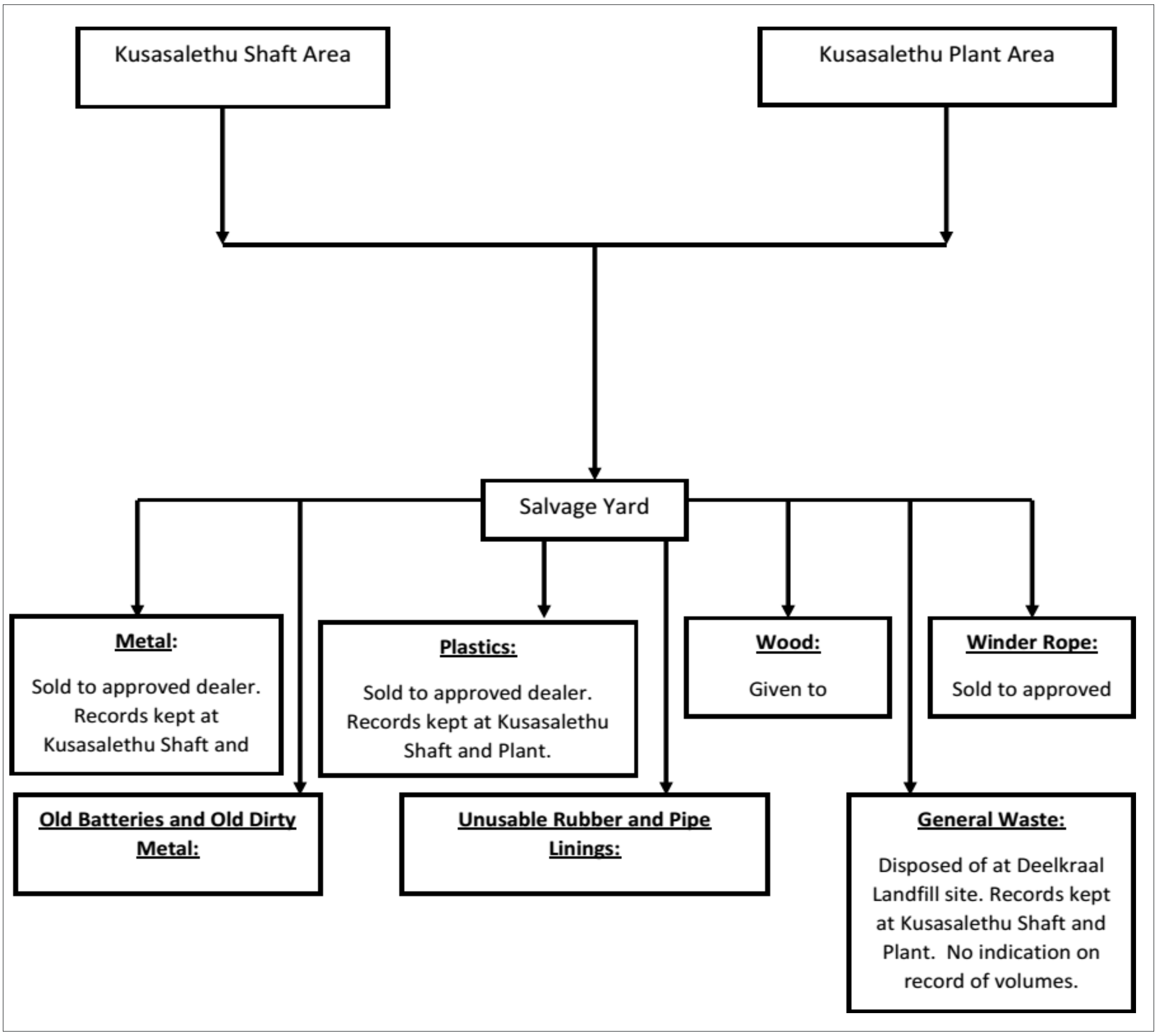

Figure 21: Waste Management at the Kusasalethu Operation

6.3.4.2 DOMESTIC WASTE/GENERAL WASTE

General waste is the generic term for waste that, because of its composition and characteristics, does not pose a significant threat to public health or the environment if properly managed and which is not inherently hazardous. General waste comprises for example of the following: 1) Rubble; 2) Garden waste; and 3) Domestic waste.

General waste generated by the shaft, plant and offices is collected daily from waste bins and collection points and transported to Deelkraal landfill site, located on the farm Kleinfontein 141 IQ. All domestic waste from the Kusasalethu plant and shaft areas are washed for radiation, prior to be disposed of at Deelkraal landfill site.

6.3.4.3 INDUSTRIAL WASTE

The solid industrial waste from underground and the Kusasalethu plant are collected at the salvage facilities established at the Kusasalethu shaft and plant. From here, it is moved to the salvage area for washing and sorting. At the salvage yard the solid waste is divided into reclaimable items, recyclable items (by selling or donating e.g., timber/scrap metal/conveyor belts/plastic pipes) and the remainder of the waste is disposed of. After sorting waste is removed by contractors from Salvage area or taken to an approved scrap yard as required.

6.3.4.4 WOOD

Wood generated by the shaft, plant and offices is also collected daily in waste bins and is either given to the community or sold for their energy needs. This is purely seasonal and in summer times some accumulation of wood products is experienced.

6.3.4.5 PLASTIC

The plastic scrap reaching the Salvage yard will be separated between recyclable products i.e., gumboots, hoses and pipes and non- recyclable products which end up in the waste stream to be disposed of at the landfill site.

6.3.4.6 FERROUS METAL

Ferrous metals includes the following:

- Heavy steel scrap: This is material of thicker than 3 mm in thickness and has a higher commercial value than other grades. The heavy scrap recovered from waste generally will be cut (processed) by cutting torch into the sizes generally required by the end-users i.e., Scaw Metals, Mittal, etc where the steel scrap is used for re-melting as a resource in manufacturing prime steel products;
- Sub-grade steel scrap: This material is less than 3 mm in thickness and uneconomical to process with cutting torch. It is normally taken to larger processing plants where it is either baled (compressed) or shredded into economically viable commodities used by the Smelters; and
- Other Ferrous products: Various other materials like wiring material and hoist ropes used in the mining environment is of lower commercial value but can be disposed of successfully.

6.3.4.7 NON-FERROUS METAL

Non-ferrous metal includes:

- Electrical cable (Contains copper, aluminium and lead): All electrical cables are fully recycled and either re-used or stripped to sell the commodities i.e., copper, aluminium, lead, PVC and steel wire; and
- Electrical motors and switchgear (Contain copper): Due to the small content of non-ferrous metals these products are sold to third parties as is without further reclaiming the metals.

6.3.4.8 BATTERIES (CONTAINING LEAD)

Due to the small content of non-ferrous metals these products are sold to third parties as is, without further reclaiming the metals.

6.3.4.9 GEARS/VALVES (CONTAINING BRASS)

Due to the small content of non-ferrous metals these products are sold to third parties as is, without further reclaiming the metals.

6.3.4.10 AIR LEGS (CONTAINING ALUMINIUM)

Due to the small content of non-ferrous metals these products are sold to third parties as is, without further reclaiming the metals.

6.3.4.11 WINDER ROPING

Winder Roping will be collected as mentioned above and thereafter taken to registered dealer and disposed of to an approved dealer.

6.3.4.12 UNUSABLE RUBBER AND PIPE LINING

Unusable rubber and piper lining includes the following:

- Tyres - In the Mining Industry vast amounts of tyres are generated. It is disposed of to third parties for use as:
- Go-kart tracks, swings and general recreation purposes;
- Protection for boats in docks;
- Weighting down silage heaps on farms; and
- Dust prevention on sand dumps on mines; and
- Conveyor Belting: Conveyor belting can be used as truck linings, floor covering, cattle and game farming and at schools for athletic field applications.

6.3.4.13 **GLASS**

Glass is collected and disposed of by approved dealers.

6.3.4.14 **ELECTRIC AND ELECTRONIC WASTE**

Some mechanical recycling, granulation and shredding techniques exist but are done by third parties to which these products are disposed.

6.3.4.15 **PAPER**

Office paper is suitable to be recycled into higher grade papers such as printing and office papers. Office paper is generally divided into high and low quality. High-quality paper such as printing paper, letterhead and memos are higher in value than newsprint so a recycling scheme may be viable.

In order for an office paper recycling scheme to be successful and sustainable, it is vital that it is part of a 'green office initiative' and simple to adopt. Bins are provided to start an office recycling scheme.

6.3.4.16 **HAZARDOUS WASTE**

Hazardous wastes are those wastes which can, even in low concentrations, have a significant adverse effect on public health and/or the environment. Hazardous industrial wastes are stored at demarcated storage areas (engineering workshops) before removal by a registered contractor for either recycling, such as for waste oils that are sold to contractors, removal to a hazardous waste disposal facility (appropriately licensed waste facility) or are returned to the supplier. A safe disposal certificate is provided to the mine upon the disposal of the waste by a registered contractor at a licensed facility. The frequency of disposal is undertaken as required. Hazardous waste includes:

- Asbestos: The regulations stipulate that asbestos waste can only be transported by carriers licensed to transport special waste and disposal will take place at designated sites. All regulations are followed on founding Asbestos waste;
- Oil, Grease and other Lubricants: Most of the used oils generated on surface are collected by recycling companies such as Oilkol. Where large quantities of oil are generated bulk holding facilities exists which are emptied on a regular basis. Recycling companies however only take clean oil with limited water content and no grease. The market for grease is non- existent and hazardous waste companies like EnviroServe is contracted to remove such contaminated oil and greases; and
- Explosives: Explosive boxes are installed on the sites where explosives can be dumped into daily and removed and exposed according to the prescribed procedure.

6.3.4.17 RADIOACTIVE WASTE

The mine has a "Radioactive Waste Management Programme" in place, which clearly indicates the responsibilities of the individuals with regards for implementing the programme. This includes the following individuals:

- Radiation Protection Monitor: qualified and responsible for radiological clearance screening;
- Radiation Protection Officer: ensures that the requirements of the procedure are adhered to and all necessary records are maintained;
- The General Manager: ensures that there are adequate resources for radiation protection and effectiveness of the implementation of the procedure;
- Radiation Protection Specialist: reviews the waste management programme and statutory returns to the NNR before submission; and
- Mine Employees: must be compliant with posted radiation notices and warning signs, use monitoring equipment and protective devices and clothing provided, implement hygienic practises and provide all information related to radioactive exposure to management.
- The radioactive waste streams must be identified and initial screening will result in the segregation of waste into:
- Non-process related waste: where it is recognised that there is a high level of confidence that the waste is not, or has not been, radioactively contaminated; and
- Process related waste: where it is recognised that the potentials exists for the waste to be radioactively contaminated.
- Non-process waste is discrete non-process waste, which has not been in contact with the gold recovery process and can be released to the public.
- Process related waste may be either:
- Homogenous process waste which is produced in bulk and includes slimes material produced by metallurgical plant; waste rock generated by various shafts; effluent wastewater and contaminated water. Each of these are further categorised into either cleared homogenous waste or a Category 1 Homogenous Process Waste (disposed of on tailings dam); Category II Homogenous Process Waste (disposed of on tailings dam after dilution); Category III Homogenous Process Waste (to be stored in approved storage repository); and
- Monitoring and release of this waste is done according to the procedure.

6.3.5 SOURCE SEPARATION SYSTEM

An at source separation system is implemented at the salvage area of the Kusasalethu Operation. At source separation means that the waste will be separated where it is generated. Waste will be separated into the following classes:

- General waste: consisting of paper (in some areas e.g., offices, separate bins may be made available for the recycling of paper), food, glass bottles, plastic bottles, wrappers, rubber pipes, wood, metal, plastic pipes;
- Hazardous waste: oil-, diesel- and grease- contaminated rags, other material contaminated with oil, diesel or grease, such as oil filters, used absorbent material, paint, thinners, empty paint drums and sludge or screenings from Sewage Plant;

- Chemical waste: Chemicals, chemical drums, rags/other appliances used or contaminated with chemicals will be disposed of according to the material safety data sheet (either hazardous waste or general waste);
- Fluorescent tubes;
- Old oil: Any drained or used oil; and
- Oil contaminated soil: Where small oil spills took place, the contaminated soil will be disposed of in the hazardous waste bin with the absorbent material. Every Harmony Gold employee is responsible to put waste into the correct bins.

6.3.6 SURFACE AREAS AND UNDERGROUND AREA (INCLUSIVE OF THE PLANT)

At source separation of waste will take place in all areas on surface and the different coloured bins will be available where applicable:

- General waste bins (Green) will be available in all areas including along walkways, at security, the parking area, offices, workshops, etc;
- White hazardous waste bins will be available everywhere where oil/grease/diesel/paint or chemicals are used. When an underground hazardous waste bin is full, it will be closed, so as not to leak any waste. It will be put into the car and sent to surface. On surface, the car will be sent to the salvage yard and the white bins will be emptied directly into the hazardous waste container;
- Yellow fluorescent tube bins are available at the Electrical workshop and only electricians are allowed to take out fluorescent tubes. Fluorescent tubes are not broken and are put into the especially made drum. When the drum is full, it is sealed and sent to the salvage yard. When enough fluorescent tube bins have been collected, the contractor responsible for collection of hazardous waste will be informed. Only sealed, full fluorescent tube bins are allowed to be sent to the salvage yard;
- Blue Metal bins are available at the workshops for metal off-cuts. When full, these bins will be sent to the salvage yard; and
- Old oil drums; any drums filled with oil will be closed and sent to the salvage yard, marked “old oil”. No open oil drums are allowed to be sent to the salvage yard.

6.3.6.1 **MEDICAL WASTE**

Medical waste generated by the dressing station/clinic is removed in accordance with the Medical Waste Procedure (HP/INFEC 030). General waste at the clinic will be put into the red and white general waste bins and will be removed with the other general waste bins.

6.3.6.2 **CANTEEN**

Old food generated at the canteen will be put into the red and white bin or, it can be given to a pig farmer. Only old food and old cooking oil will be given to pig farmers. If there are no pig farmers to whom the cooking oil can be given, it will be disposed of into the white bin, marked hazardous waste.

6.3.6.3 **SLUDGE REMOVED FROM TRENCHES**

During the cleaning of trenches, all sludge removed will be disposed of into drums and taken to salvage yard for disposal. Should there be a possibility of the sludge containing gold; the drums will be taken to a designated area in the plant where it can be included into the process activities.

6.3.7 SALVAGE AREA

6.3.7.1 PLANT SALVAGE AREA

All waste will be removed from the plant salvage area to the shaft salvage area for washing and clearance of radiation.

6.3.7.2 SHAFT SALVAGE AREA

Cars will be tipped down the chute into the salvage yard where waste will be sorted, washed and cleared for radiation in accordance with the NNR regulations. General waste and hazardous waste will be put into the bins for removal by the contractor, while steel, wood and old oil will be stored in the designated areas for recycling or selling. General waste will be taken to the Deelkraal landfill site.

Records of disposal will be kept at the salvage area and a copy of safe disposal certificates will be sent to the management representative/environmental responsible person. Only closed, marked old oil drums will be received by the salvage yard. Old oil drums will be taken to the dedicated old oil storage area and stored in the bunded area. When the area is about 80% full and enough oil has been collected to be recycled, the salvage yard responsible person will contact the responsible contractor to remove the oil. If any oil drums are removed, it will be cleared for radiation before removal from site, in accordance with the NNR regulations.

Only sealed fluorescent tube drums will be received by the salvage yard. When a moderate amount of sealed fluorescent drums has been received in the salvage yard, the responsible person for the salvage yard will inform the company responsible for removal of hazardous waste, to remove the fluorescent tube bins. Only sealed fluorescent tube bins will be sent to the salvage yard in order to store the bins for more than 90 days on site. Before the removal of the fluorescent tube bin, it will be cleared for radiation in accordance with the NNR regulations.

If timber has been cleared for radiation, it can be given to the community or sold.

The salvage area will be divided into the commodities, depending on disposal, as is seen in Table 40. A logistics back-up will be maintained to service each site's salvage area and prevent a build-up of waste. From the Salvage Area, each commodity will be processed and disposed of in accordance with Table 40. Waste disposed of from the Kusasalethu Operation will be conducted by a registered waste disposal company that disposes of waste at a waste landfill site (Deelkraal landfill site), which is a registered waste disposal area. Evidence of disposal will need to be obtained and kept as record to indicate the volume and frequency of the final disposal of waste.

Table 40: Waste Disposal at the Salvage Yard

Commodity	Commodity divided into:	Disposal	Bin identification at Kusasalethu operation	Bin identification in Kusasalethu salvage yard
Ferrous metals	Heavy steel scrap	Material thicker than 3 mm. Has higher commercial value. Will be cut into sizes required by end users. Sold to scrap metal handlers.	Green bin – general waste	**Contractor bin - black**
	Sub-grade steel scrap	Less than 3 mm thick.	Green bin – general waste	**Contractor bin - black**

Commodity	Commodity divided into:	Disposal	Bin identification at Kusasalethu operation	Bin identification in Kusasalethu salvage yard
		Uneconomical to process with cutting torch. Taken to larger processing plants where it is compressed or shredded.		
	Other Ferrous products	Includes other materials like wiring and hoist ropes. Lower commercial value. Can be disposed of successfully.	Green bin – general waste	**Contractor bin - black**
Non-Ferrous Metals	Electrical cable (contains copper, aluminium and lead)	Fully recycled. Re-used or stripped..	Green bin – general waste	**Contractor bin - black**
	Electrical motors and switchgear	Sold to third parties without further reclaiming of metals	Green bin – general waste	**Contractor bin - black**
	Batteries (contains lead)	Sold to third parties as is without further reclaiming of metals.	Green bin – general waste	**Contractor bin - black**
	Gears, valves (contains brass)	Sold to third parties as is without further reclaiming of metals.	Green bin – general waste	**Contractor bin - black**
	Air legs (contains aluminium)	Sold to third parties as is without further reclaiming of metals.	Green bin – general waste	**Contractor bin - black**
Wood	Wood/Timber	Disposed of at local community as part of community upliftment project	Green bin – general waste	**Contractor bin - black**
Asbestos	Wall cladding, ceiling tiles, fire doors, linings to gas central heating	If asbestos is found, it is managed according to the Asbestos Regulations	White bin - Hazardous waste	**Contractor bin – Waste tech (light blue)**
Plastics	Recyclable	Gumboots, hoses and pipes- sold to plastic recycling factory	Green bin- general waste	**Contractor bin- black**

Commodity	Commodity divided into:	Disposal	Bin identification at Kusasalethu operation	Bin identification in Kusasalethu salvage yard
	Non-recyclable	Disposed of at landfill site.	Green bin- general waste	**Contractor bin- black**
Tires and other rubber products	Tires	Disposed to third parties for use as: Go-kart tracks, swings and general recreation purposes; At docks; Weighting down silage heaps on farms; and Dust prevention on sand dumps at mines.	Green bin- general waste	**Contractor bin- black**
	Conveyor belting	Disposed to third parties for use as: Truck linings; Floor covering; Cattle and game farming; and At schools for athletic fields.	Green bin- general waste	**Contractor bin- black**
Electric and electronic		Disposed of to third parties where mechanical recycling, granulation and shredding techniques exist.		
Paper		Recycled	If paper recycling bin is provided, otherwise Green bin- General waste	**Contractor bin- black**
Explosives		Refer to explosives procedure	N/A	**N/A**
Oils, greases and lubricating material	Old oil containing very little water	Recycled by contractors. Large quantities requires bulk storage facilities.	Any 210L drum clearly marked: “old oil”. Sealed when full	**Old oil drums to be taken to the old oil storage area next to the bulk storage tank at Kusasalethu shaft.**

Commodity	Commodity divided into:	Disposal	Bin identification at Kusasalethu operation	Bin identification in Kusasalethu salvage yard
	Grease	Disposed of at hazardous landfill site or put through oil separator to reduce water contents.	White bin- Hazardous waste	**Contractor bin- Waste tech (light blue)**
	Old oil containing water	Disposed of at hazardous landfill site or put through oil separator to reduce water contents..	Any 210L drum clearly marked:" Old oil". Sealed when full	**Old oil drums to be taken to the old oil storage area next to the bulk oil storage.**
	Oil grease and lubricating contaminated material	Disposed of at hazardous landfill site.	White bin- Hazardous waste	**Contractor bin- Waste tech (light blue)**
	Oil contaminated absorbent material	Disposed of at hazardous landfill site	White bin- Hazardous waste	**Contractor bin- Waste tech (light blue)**
Paint and paint cans		Disposed of at hazardous landfill site.	Yellow drum at electrical workshop or level 132 or at salvage yard – fluorescent tubes	**Contractor bin – Waste tech (light blue)**
Thinners		Disposed of at hazardous landfill site.	White bin - Hazardous waste	**Contractor bin – Waste tech (light blue)**
Fluorescent Tubes		Disposed of at hazardous landfill site.	Yellow drum at electrical workshop or level 132 or at salvage yard – fluorescent tubes	**Contractor bin – Waste tech (light blue)**
Chemicals	Empty chemical containers (plastic) (All containers made from plastic are included in this group. Empty chemical containers (Steel)	Cleaned and disposed of according to Material Safety data sheet. Cleaned and disposed of according to Material Safety data sheet.	Either white bin or green bin	**Contractor bin – either black bin or Waste tech bin**

Commodity	Commodity divided into:	Disposal	Bin identification at Kusasalethu operation	Bin identification in Kusasalethu salvage yard
Oil contaminated soil	Small oil spills	Small oil spills will be cleaned according to the “Procedure for Handling and Management of Waste” and both absorbent material and contaminated soil will be disposed of into the hazardous waste bin.	White bin	**Contractor bin – Waste tech Blue bin**
	Large oil spills	**Contaminated soil will be removed by a dedicated person and taken to the waste rock area for disposal through the plant.**	**Not Applicable**	**Not Applicable**

6.3.8 OIL, FUEL AND DIESEL TANKS

The Kusasalethu Operation operates a number of fuel (petrol and diesel) and oil tanks, which are located at several points around the mine as indicated in Table 41.

Table 41: Oil, Fuel and Diesel Tanks

Location	Number of tanks	Capacity	Surface/sub-surface
1 diesel tank at the reclamation area (Kusasalethu)	1 tank	±20 000 L	Concrete bunded area
One petrol tank at the stores area (Kusasalethu)	1 tank	±10 000 L	Concrete bunded area
One diesel tank at the stores area (Kusasalethu)	1 tank	±10 000 L	Concrete bunded area

All the above ground oil and fuel storage tanks are constructed on top of a concrete pad and within a bunded area so as to prevent the contamination of soil and water resources. Old oil and other engine liquids (hazardous waste) are stored in containers after which it is collected and disposed of at an appropriately licensed waste facility by waste contractors. Regular maintenance and inspection of silt and oil traps at the existing oil and fuel storage tanks are required.

6.3.9 LOADING, OFF-LOADING AND REFUELLING OF VEHICLES

The fuel and diesel storage, loading and off-loading measures will include suitable measures such as bunding, rehabilitating contaminated soil (from historic spillages) and spill containment measures during loading/off-loading. At all areas of underground fuel storage, it must be ensured that tank integrity testing is undertaken (e.g., tank pressure testing) at the mine oil store area, and that suitable containment facilities are in place in event of oil spillages during loading/off-loading activities.

The purpose of the “Loading, Off-loading and Refuelling of Vehicles” procedure is to provide guidance to the refuelling of diesel vehicles in order to minimise the unnecessary spill of diesel during refuelling activities at Kusasalethu Operation. This procedure is applicable to all activities, products and services of the Kusasalethu Operation.

6.3.9.1 **LOADING AND OFF-LOADING**

The Kusasalethu Operation will appoint a competent person to supervise the loading and off- loading operations. The competent person will be adequately trained in the off-loading procedure.

The competent person or the driver may stop any off-loading if he feels it is unsafe to off-load the vehicle and off-loading may only commence on clearance given by the qualified person or the driver. Responsibilities of the competent person prior to loading and off-loading are as follows:

- Written confirmation is furnished that the vehicle presented for off-loading is the correct vehicle and that it is carrying the correct goods as agreed in the delivery note. The vehicle is properly parked and that the engine has been switched off, except where a running engine is required to facilitate off-loading;
- The operation takes place in an area where all the necessary safety measures associated with the material being transported are observed, and that it is equipped with the necessary safety equipment;

- The operation takes place in a correct, efficient and productive way, with no risk of distraction caused by other operations taking place or by goods stored, in the vicinity;
- That the tank capacity is adequate for receiving the amount delivered through monitoring gauges or using measuring sticks;
- During fluid type transfers, the operator remains in the vicinity of the flow control valves, where the operator can stop the transfer immediately in the event of a rupture, spillage or any other emergency; and
- In the case of packaged cargo, there has been no spillage of contents into the vehicle and that the packages are fit for subsequent handling and storage.

6.3.9.2 AFTER LOADING AND OFF-LOADING

After loading and off-loading the competent person will ensure that the following is conducted:

- Any fluid tanks are securely closed and washed free of any spillage and the shut off valves will be closed to prevent hazards, and
- Any spillages will be cleaned and disposed of as hazardous waste in accordance with the waste management procedure and reported as an incident according to the incident reporting procedure.

6.3.9.3 REFUELLING

- All shift bosses, foremen, mine captains and all operators of underground and surface vehicles are responsible for implementing this procedure. The procedure includes the following:
- Only trained operators are allowed to conduct diesel refuelling of vehicles;
- No smoking or naked flames will be allowed in the refuelling area;
- Operators will ensure good control over the nozzle release mechanism at all times and that there is no leakage at the nozzle when refuelling has been completed;
- A drip tray will be placed under the filling point of the vehicle during refuelling;
- No operator is to leave the vehicle unattended whilst the refuelling is taking place;
- All diesel spillages will be reported using the incident reporting system;
- The operator of the vehicle who caused the diesel spillage is responsible for the clean-up of the spill (See Procedure for Management and Handling of Waste – ER016);
- Leakage or spillage of fuel to be absorbed using absorbent material so as to prevent soil or water contamination;
- Absorbent material will be available at all times in a black lid fitted bin– marked “ABSORBENT MATERIAL;”
- Once absorbent material has absorbed the fuel, it will be swept up and placed in the hazardous waste bin. All clean-up rags to also be put in the “HAZARDOUS WASTE” container;
- This bin will be sent to the salvage yard once it is full;
- The polluted absorbent material will not be mixed with other substances except hazardous waste;
- Major spillage will be immediately phoned through to the control room, where after the incident reporting procedure and spill response procedure will be followed; and

- Fuel storage and refuelling systems will be on a maintenance system for regular inspection and maintenance.

6.3.10 BUND WALL SPECIFICATIONS

The purpose of the bund wall specification procedure is to prevent soil and water pollution around all bunded areas. This procedure is applicable to all sites of the Kusasalethu Operation.

6.3.10.1 SPECIFICATIONS FOR BUNDED AREAS

All new bund walls will have the following specifications:

- It will be built from reinforced concrete;
- It will be able to contain at least 110 % the capacity of the fluid that may be spilled;
- It will be sealed with an impermeable liner;
- It will have an emergency sump connected to the bunded area, with a lockable stop cock; and
- An emergency container and pump will be readily available.

6.3.10.2 CURRENT BUNDED WALLS

All current bund walls are sealed to prevent seepage. All drainage pipes have been fitted with lockable stop cocks, and a program for replacement of current bund walls not complying with requirements has been drawn up.

6.3.10.3 CLEANING OF BUNDED WALLS

Affected water from bunded areas will be pumped into a container or will be emptied through the drainage pipe into a container. In case of spillage the affected area will be cleaned with the appropriate chemicals. The affected water will be disposed of at a wash bay where an oil separator is functional.

6.3.10.4 INSPECTIONS OF BUND WALLS

The responsible person should check on permeability, cracks and pollution of adjacent areas during monthly inspection of bund walls.

6.3.11 MAINTENANCE OF EQUIPMENT

The following mining equipment is used and maintained as part of the mining operation:

- Excavation equipment,
- Mine trucks, and
- Metallurgical Plant equipment:
  - Crusher equipment;
  - Mills equipment;
  - Thickeners; and
  - Smelting equipment.

All maintenance of the mining equipment is conducted at different workshops, which are situated within the mine boundary area. It was also observed that excavation equipment was maintained at the underground site of excavation. Different workshops are located within the Kusasalethu Operation. In the event of a hydraulic pipe break and subsequent spillage the procedures as described in the waste handling and management procedure will be followed to contain and remediate the spillage.

The maintenance of the metallurgical plant will take place on site. This will involve the maintenance of the components of the working plant and the replacement of such components if the need arises.

6.3.12 WORKSHOP AREAS

There are different workshop areas situated within the mine boundary area. The Kusasalethu shaft and Kusasalethu plant both have workshops used for maintenance and storage. The Kusasalethu shaft workshop is used for the routine maintenance of vehicles, washing of vehicles, the storage and use of oxygen TEC and acetylene, storage of wood, temporary storage of old tyres and temporary storage of old oil. The Kusasalethu plant workshop is used for the maintenance and stripping of machine parts containing grease or greasing of spare parts, and temporary storage of old oil.

An electrical workshop is also present at the Kusasalethu plant, which is used for the storage of light bulbs and fluorescent tubes. Waste management is implemented at the electrical workshop so as to prevent possible contamination of the surrounding environment.

All workshop areas have a large concrete slab with sumps that are installed to retain any oil and dirty water spillages. The oil and grease waste are stored in 210 l drums for recycling by competent companies. It is inevitable that hydraulic pipes will burst causing the spillage of hydraulic fluid. In the event of a hydraulic pipe break and subsequent spillage the procedures as described in the Waste Handling and Management Procedure (refer to Section 5.3.5.1) will be followed to contain and remediate the spillage. In short, the material will be prevented from transgressing into clean water systems. Material will be used to clean the contaminated soil and in the event that waste is generated this will be dumped in the hazardous waste bin provided at the workshops. If oil and diesel spillages do occur at the workshop areas the mine is committed to conduct hydrocarbon monitoring so as to determine the impact on the soil and water resources. The mine is committed to contain and manage the oil and diesel spillages within the workshop areas. As part of the surface water monitoring programme hydrocarbon monitoring is conducted.

It is very important that the source of the existing or potential problems be identified. The workshop equipment and infrastructure are regularly inspected and maintained, so as to prevent spillages and leakages within the workshop areas.

6.4 PROCEDURE FOR HANDLING AND MANAGEMENT OF WASTE

The purpose of the "Procedure for Handling and Management of Waste" is to provide guidelines for the handling and clean-up of any spill that may occur at the Kusasalethu Operations. It further aims to ensure these spillages are handled in an appropriate manner, in order to minimise the environmental impact and rectify the damage done to the environment. The procedure for is applicable to all activities, products and services at the mine.

General actions to be taken include the following:

- Any oil, diesel, petrol or hazardous chemical spill, will be reported as an environmental incident (by any employee) to the person responsible for coordination of the corrective action on site;
- The person that first noted the spill will take steps to prevent the spill from spreading and report it;
- Personal Protective Equipment (PPE) will be worn when handling oil, diesel, solvents or other chemicals as required by the Material Safety Data Sheet (MSDS);
- Consult the MSDS to determine the toxicity of the substance and which PPE will be worn; and
- If a spill occurs, the person responsible will take the necessary steps to contain the spill to minimise the area affected and prevent contamination of a water source, e.g., Stormwater. In short, the material will be prevented from transgressing into clean water systems or onto the soil.
- In the event that a spill occurs the following steps will be followed:
- Immediately contain the spillage to prevent spreading to adjacent areas;
- Once the spill has been contained use absorbent material (such as GP cleaning powder) obtainable from the workshop to absorb the spilled material;
- Dispose of absorbent into hazardous waste bin provided at the site;
- Remove contaminated soil and dispose of into the hazardous waste bin provided for at the hazardous waste site;
- If harmful substances, other than oil, fuel or lubricant, are spilled into water, the affected water will be contained and pumped to an area where it can either be rectified or correctly disposed of; and
- The spill will be cleaned up in a manner appropriate to the spill as in Table 42 below.

Table 42: Spillage Management

Surface on which spill occurred	Steps to be taken in the event of a spill
Spillage on concrete or other non- tarmac surface	Contain large spills with fibre booms, bio tubes or sand filled plastic bags. Ensure that all measures are taken to prevent the spread of the substance that was spilled. Pump up and/or scoop excess oil, diesel and liquid chemicals into a holding tank/drum and dispose of according to the waste procedure. Remove oil, diesel, acid or other liquid chemical spillages on concrete cement floors with appropriate absorbent material as provided in the spill kit. Place the used/contaminated fibre into the appropriate container as indicated by the Waste management procedure. Use a degreaser to remove traces of oil left on the concrete surface and wash off with water into the dirty water system, where possible. Important to note: All diesel, oil and petrol contaminated material or soil will be managed as hazardous waste and disposed of according to the waste management procedure. The degreaser used will be compatible with the oil separators.
Spillage on Tarmac Surfaces	Clean spill immediately, since oil and diesel softens the tar surface. Clean as follows: Soak up excess oil and/or other chemicals with a suitable absorbent (loose fibre) as provided in the spill kit and dispose of the material according to the waste management procedure. Clean the remaining spill or stain with the appropriate degreaser.
Spillage on soil	Remove the excess oil/diesel/chemical as quickly as possible to prevent further penetration into the ground by scooping up excess with shovels. Place any excess oil/diesel/chemical in the appropriate container according to the waste management procedure for disposal. Determine the depth and width that the oil/diesel/chemical has penetrated into the soil as far as possible, by digging up the polluted soil (excavating). Dispose of contaminated soil according to the waste management procedure.
Sewage blockages (drains or pipes and pumps)	Report blocked sewage pipes immediately to Foreman. Report block or broken sewage pumps to Foreman. The Foreman will complete an incident or accident report as soon as it is reported to him or her (if not already reported as an incident). The responsible person will remove or attend to the blockage as soon as possible. Spills will be cleaned-up by removing any excess sewerage, where practicably possible with suction into a holding tank, or with long handled shovels into a watertight container. Disposal of sewage will be done through disposal with underground sewage into the sewage system. Personal Protective Equipment will be used. The affected area will be disinfected with a suitable environmentally friendly chemical, as prescribed. Important to note: Lime can be used although it is alkaline and will be handled with care.

The principles for a spillage include the following:

- Contain the spillage;
- Stop the spill from spreading;
- Remove the source of the polluting substance (close any taps or valves where necessary or turn leaking drums upright);
- Clean up the spillage; and
- Rehabilitate the area if required.

6.5 OPERATIONAL MANAGEMENT

The operational management of the activities in terms of the water and waste management are detailed in the sections below, including the organisational structure, competence training and awareness and the internal and external communication.

6.5.1 ORGANISATIONAL STRUCTURE

The organisational structure of the facility is presented in Figure 5 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.

6.5.2 COMPETENCE, TRAINING AND AWARENESS

The purpose of the training is to identify the procedures to be followed in identifying training needs, documenting the needs, scheduling the training and keeping relevant records of the training conducted, as well as the evaluation of competence after training. This procedure applies to all employees and includes contractors that work for or on behalf of Kusasalethu Operation. Thus, all employees and contractors whose work impacts directly and indirectly on the environment, will be able to conduct their work and manage the mine's activities in an environmentally responsible manner. The full information with regards to competence, training and awareness is available in the mine's Social Labour Plan.

The Human Resources Development Programmes of Harmony include appropriate training and skills development programmes as required by the workforce in support of operation specific business plans. Training is offered in portable skills, being competencies that will enable employees to find jobs elsewhere within the mining industry, or to become self-employed. Randfontein Estates will continue to provide skills training to mine workers during their employment at the operation. This training will be fully accredited, ISO registered and all skills development Programmes will be unit standards-driven and thereby portable within the industry. The Workplace Skills Development Plan is formulated; developed and implemented in line with the skills development plan as accorded by the Skills Development Act of 1997 and the Mining Qualifications Authority requirements.

All training, short courses and tertiary studies will adhere to the above-mentioned criteria and will be guided and aligned to affiliate processes inherent of managing downscaling and local economic development.

There is a Mining Qualifications Authority accredited Adults Basic Education Training (ABET) Programme in place for the operation offering both part and full-time classes. The venue where these are presented is appropriate and classrooms can adequately accommodate 20 learners per class.

Training initiatives have focused on the development of both technical and managerial skills of senior and middle management. At the operational level, training initiatives include mine management commitment to ABET initiatives.

Broadly the Skills Development Plan for Harmony details the respective training that is being provided as per the requirements of the shaft business plans and articulates the measures that are in force to ensure that continued career progression of Historically Disadvantaged South Africans (HDSAs) into management levels and women in the mining industry.

- As part of the training process, teams/parties are encouraged to:
- Promote and encourage inspections/reporting on environmental impacting incidents;
- Practice concurrent rehabilitation;
- Support regional environmental management awareness campaigns/programmes and systems; and
- To be aware of your actions on the environment
- Various awareness campaigns are implemented at the mine in the form of:
- Printing and distribution of pamphlets;
- Distribution of the Awareness Presentation;
- Posters distributed through the mine; and
- Articles placed in the Herald newspaper.

6.5.3 INTERNAL AND EXTERNAL COMMUNICATION

The mine has a "Procedure for Environmental Communication" (ref.# EPR No.003) in place. It is necessary to communicate the various types of environmental information internally to employees. Communication demonstrates Management's commitment to the environment while raising awareness internally regarding Harmony's environmental policy and the management systems implemented to achieve the policy. Internal communication is a two-way communication mechanism utilised through the various levels and functions at Harmony, including information communicated from top management to shop-floor level and vice versa. Refer to Table 43 for the various mechanism and responsibilities for communication at the mine.

Table 43: Mechanisms for Communicating Information and Responsibility

Mechanism	Information	Responsibility
Management/Team briefs	General environmental performance, concerns and issues	Top Management
Toolbox Talks (including SHE Match)	Discussion of environmental topics, reported environmental incidents, general awareness, applicable environmental aspects and impacts, changes in legislation, suggestions and recommendations, company policy and other information needed to be communicated to shop-floor level	Supervisors
Policies, Directives, Procedures and Work Instructions	Specified ways to carry out and activity or process of the EMS as well as rules and guidelines for day-to-day management and	Line Management

Mechanism	Information	Responsibility
	monitoring of activities that can have significant environmental impacts, specific legal requirements, management policies regarding environmental issues and operating criteria	
Reports	Monthly, quarterly and annual (e.g., Environmental performance and progress, key characteristics of operations)	Section heads/HODs
Incident/Accident Report Form	Near hits, incidents and accidents, suggestions and recommendations	All personnel
Posters, Notices, Intranet, Newsletters and Bulletin Boards	General environmental awareness such as environmental aspects and impacts, environmental topics, environmental policies and procedures and other EMS information	SHE Managers/Officers and Section Heads/Supervisors
E-mails and Telephonic Communication	Specific environmental and EMS communication and new legislation	Line Management
Contractor Agreements	Company environmental policies, procedures and requirements	Contract Holder and SHE Managers/Officers and Procurement Manager
Meetings **Including management review, steering committee meetings, operational meetings, SHE meetings**	Specific environmental and EMS communication, such as discussion of incidents, environmental performance, progress on EMPs, new legislation and procedures, suggestions and recommendations, changes in operations, etc.	Line Management
Training **Awareness, competency, induction training**	Company environmental policies, procedures and requirements, EMS responsibilities, general awareness, applicable environmental aspects and impacts, changes in legislation, and other information needed to be communicated to personnel	Training Centre/Line Management/Supervisors

Kusasalethu Mine communicates externally with Interested and Affected Parties (I&APs) regarding its significant environmental aspects and environmental performance, using a number of mechanisms. All information communicated externally must be approved by/routed through the Kusasalethu Mine prior to such communication (this excludes the information requested by Head Office). Records of such correspondence are to be maintained by the document controller (or designate). Information communicated should be accurate and understandable.

The following potential I&APs have been identified:

- Neighbouring industries;
- Neighbouring communities or community forums;
- Local Authorities;
- Provincial Authority;
- Government Departments;
- Contractors and Suppliers;
- Corporate Stakeholders;
- Parent Company;
- Non-Governmental Organizations (NGOs) and action groups;
- Clients; and
- Unions.

Should any I&APs request any specific information regarding significant environmental aspects and impacts, a decision will be taken whether to communicate such information and what the most suitable process for communication will be. This decision will be recorded and the records of the decision as well as information communicated, kept by the document controller. The methods of communication are indicated in Table 44.

Table 44: Methods of External Communication

Mechanism	Information	Responsibility
Annual sustainability/environmental reports	Environmental performance objectives and targets, projects, achievements and summary of significant aspects. Refer to Monitoring procedure EPR012 for format of performance report	Group Environmental Manager/Environmental Coordinator
Meetings with IP's and action groups	Specific environmental information as required by IP's & action groups	Group/Regional Environmental Manager/Environmental Coordinator
Press releases	Specific environmental information as required	CEO/COO / Communications Manager
Website/Internet	General Information, Environmental Policy, Sustainability Report, News Flashes	Communications Department

Mechanism	Information	Responsibility
E-mail/Letter/Telephonic	Specific environmental information as required by IP's & action groups	Group/Regional Environmental Manager/Environmental Coordinator

If a request for information has been received, the Promotion of Access to Information Process should be followed, the process should be followed in accordance with the Promotion of Access to Information Act, 2000 (Act No. 2 of 2000) (PAIA).

External complaints can be received either in writing (e-mail/fax/letter) or telephonically. Should a telephonic complaint be received, the complainant will be transferred to regional environmental manager who will ask the complainant to put it in writing. The person receiving the call should still log the complaint with all necessary information in the complaints register. The complainant must be told that the complaint will be logged in the complaint register, and that he/she can expect a reply within 15 working days.

In the case of an emergency incident occurring on the mine, cognisance must be taken of the legal requirements whereby such an incident must be reported to the relevant authorities as well as I&APs.

Other communication with regulatory authorities regarding environmental management issues must be sent directly to the Regional Environmental Manager. Communication sent to authorities must be approved by the General Manager or higher authority as deemed necessary. Any communication with regulatory authorities must be kept on record by the Regional Environmental Manager. If communication from authorities is sent to central services/corporate head office the Management representative and the Environmental Officer on the mine must be informed in writing.

6.6 MONITORING AND CONTROL

In order to determine the impact of the facility on the surface and groundwater regimes, monitoring systems have been implemented, by which data can be continually gathered and analysed, with corrective action being taken as required.

6.6.1 SURFACE WATER MONITORING

As indicated in Section 0 above, the applicant undertakes water monitoring in-line with the WUL conditions, which are integrated in the activities at the facility. The mine also has a Surface Water Monitoring procedure in place. The Kusasalethu Operation conducts monthly surface water monitoring at the positions indicated Table 45 and Figure 22.

Table 45: Surface Water Monitoring Positions

Position and description	Comment
Kusasalethu Sewage Effluent	Source indicator - Sewage plant discharge
Mangaan Drive – stream at Elandsridge village	Source indicator – water ex neighbouring mine
Outlet Dam – mixture of water ex Kusasalethu and neighbouring mine	Receptor indicator
Kusasalethu (EGM) Golf Course outlet	Source indicator – water ex Kusasalethu
Kusasalethu (KL) RWD seepage overflow	Source indicator – seepage ex RWD to Loopspruit

Position and description	Comment
Kusasalethu (KL RWD)	Source Indicator
Stream to Loopspruit	Receptor indicator – mixture of water to Loopspruit (points 5, 7 and 8)
Stream from Wedela	Source indicator
Waste rock Outlet - Deelkraal	Source indicator – ex Deelkraal waste rock dump
DK village dam	Source indicator – water ex Deelkraal at Recreation dam
Deelkraal (DK) RWD	Source indicator – water runoff from slimes dam
Deelkraal sewage effluent	Source indicator - Sewage plant discharge
Piet se Dam Outlet	Receptor indicator

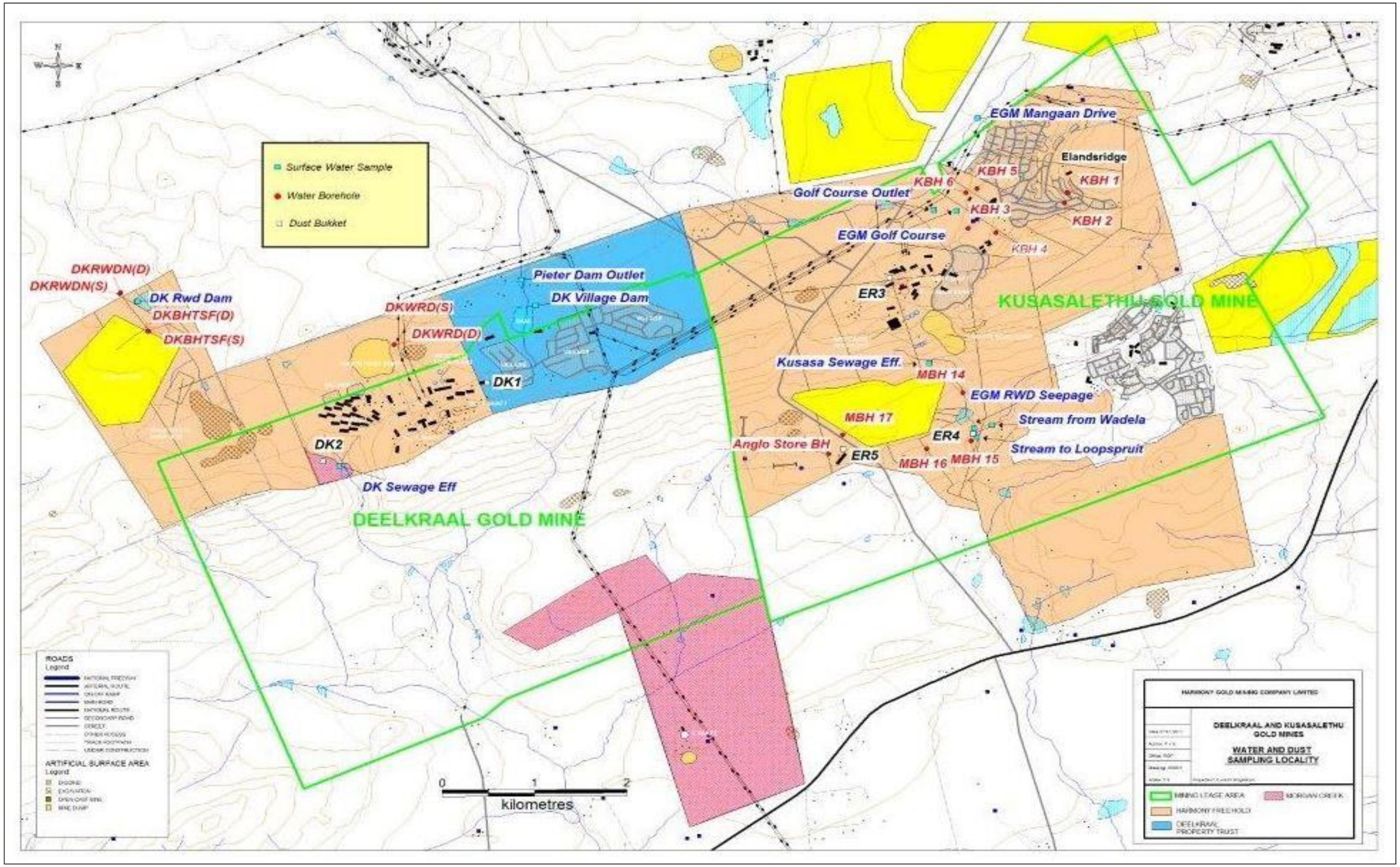

Figure 22: Surface Water Monitoring Points (Indicated in Blue)

As per Condition 4.2 of the WUL "*The Licensee must submit the result of analysis for the monitoring requirements to the Provincial Head*". Although the surface water is monitored, the mine is currently not undertaking the quarterly reporting and must ensure that this is done.

6.6.2 GROUND WATER MONITORING

The WUL includes conditions requiring groundwater monitoring. Parameters that need to be measured for the C23E quaternary catchment include the following:

- pH;
- Electrical Conductivity (EC) in mS/m;
- Sulphate (SO_4) in mg/l;
- Sodium (Na) in mg/l;
- Calcium (Ca) in mg/l;
- Magnesium (Mg) in in mg/l;
- Nitrate and Nitrite (NO_3 and NO_2) in mg/l;
- Fluoride (in mg/l); and
- Total Alkalinity ($CaCO_3$) in mg/l.
- Chloride mg/l
- Parameters that need to be measured for the C23J quaternary catchment include:
- pH;
- Electrical Conductivity (EC) in mS/m;
- Sulphate (SO_4) in mg/l;
- Sodium (Na) in mg/l;
- Calcium (Ca) in mg/l;
- Magnesium (Mg) in in mg/l;
- Nitrate and Nitrite (NO_3 and NO_2) in mg/l; and
- Fluoride (in mg/l).

The expansion of the groundwater monitoring network in 2017 provided valuable information and these boreholes should be included in the routine groundwater monitoring programme. Several of the existing monitoring boreholes are dry/blocked. These boreholes are important to the overall monitoring of the aquifers and the cleaning, deepening or replacing of the boreholes should be considered.

6.6.3 BIO-MONITORING

The WUL includes conditions requiring biomonitoring and stipulates that River Health Monitoring must be undertaken by a qualified Aquatic Specialist, including Invertebrate Habitat Assessment System (IHAS version 2.2), Invertebrate Habitat Assessment (IHAs) and Intermediate Habitat Integrity Assessment (IHIA), South African Scoring System, Version 5 (SASS5), once during summer and winter seasons, upstream and downstream of the activity on an annual basis.

6.6.4 WASTE MONITORING

As part of the waste monitoring programme the following is conducted at the mine:

- Volumes of all waste generated and disposed of (Deelkraal domestic waste disposal site) will be monitored and measured on a monthly basis and records kept;
- All contractors and disposal agents, premises and disposal sites will be inspected twice yearly to ensure that all environmental and legal requirements are adhered to, this includes the Deelkraal domestic waste disposal site; and
- Volumes of mine residue generated and disposed of by the mine will be monitored on a monthly basis and records kept. (Waste Rock disposal sites).
- The Kusasalethu operation will develop an appropriate environmental monitoring programme to ensure that the storage, disposal or effluent discharged of radio-active waste complies with the conditions of the nuclear license.
- The mine will also ensure that all areas of affected water discharge are identified and that radiological monitoring covers all such areas (e.g., Loopspruit discharge point, treated sewage discharge point, Kusasalethu plant return water dam and the TFS seepages). Furthermore, the radiological monitoring must be extended to the groundwater monitoring programme.

7 IMPACT ASSESSMENT (DIBGY 2022)

An Impact Assessment was undertaken for the Kusasalethu operations as part of the 2022 IWWMP update. The Impact Assessment was based on the various specialist studies which were conducted for the project.

This section summarises the potential impacts identified in relation to water resources. The significance of the identified potential impacts has been rated pre- and post-mitigation according to the methodology detailed in the subsection below.

The potential impacts associated with the Proposed Kusasalethu Pipelines Project are outlined on Section 8.

7.1 METHODOLOGY

Based on international guidelines and South African legislation, the following criteria are taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/ negative);
- Duration (short/medium/long-term, permanent(irreversible)/temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of impacts to water resources are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 46. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this Report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 47, which is extracted from Table 47. The description of the significance ratings is discussed in Table 48.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e., there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 46: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and/or social order.	Noticeable, on-going natural and/or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and/or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain/Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and/or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	On-going serious natural and/or social issues. Significant changes to structures/items of natural or social significance.	Average to intense natural and/or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.
3	On-going natural and/or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and/or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare/improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and/or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and/or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely/None: Expected never to happen. <1% probability.

Table 47: Probability/Consequence Matrix

Significance

7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Probability

Consequence

Table 48: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and/or social) environment	Moderate (positive) (+)
36 to 72	A positive impact. These impacts will usually result in positive medium to long-term effect on the natural and/or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and/or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and/or social environment	Negligible (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and/or social environment	Minor (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative) (-)

7.2 SIGNIFICANCE OF IMPACTS

The impact assessment, indicating the significance of impacts on water, pre and post mitigation, for the Kusasalethu Operation is indicated in the sub sections below. The below sections provide a summary of the impacts and the proposed mitigation measures to be implemented.

7.2.1 KUSASALETHU OPERATION AND DEELKRAAL OPERATION UNDERGROUND MINING AREA

Underground mining takes place at the Kusasalethu Operation. The following sections are present at the underground area:

- Oil storage and battery bays;
- Underground workshop areas;
- Waste disposal;
- Underground storage;
- Conveyor belts;
- Blasting related activities;
- Drilling;
- Backfill; and
- General.

Table 49: Potential Operational Impacts

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
Operational Phase	Operational Activities at the Oil, Diesel and Battery Bays	Spill management	• Pollution of water due to spillage/leakage of stored hazardous substances on surface; and • Pollution of water due to spillage/leakage of stored hazardous substances during transportation/loading/ off-loading on surface.	2	2	1	6	30	Negligible Negative	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded; and clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer. Spillages will be minimized by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages; in which case the procedure on handling and management of waste will be applied. In short the material will be prevented from transgressing into clean water systems or on to the soil. In the event that a spill will occur the "Procedure for Handling and Management of Waste" will be followed; and • Only properly trained personnel may work with the machinery.	2	2	-1	5	25	Negligible Negative
Operational Phase	• Operational activities undertaken at the underground workshop area	Spill management	• Pollution of water at underground workshops due to leakages and spillages during repair and maintenance; and • Decreased water quality due to pollution of water during washing of vehicles at underground workshop.	5	4	3	7	84	Moderate Negative	• Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays must be placed under drums; • Oil from drip trays must be put in containers and removed to the hazardous waste site; • Soil and water pollution can occur from leakages or spillages; in which case the procedure on handling and	3	2	2	4	28	Negligible Negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										management of waste will be applied. In short the material will be prevented from transgressing into clean water systems or on to the soil. In the event that a spill will occur the "Procedure for Handling and Management of Waste" will be followed; and • All polluted water will be separated by an oil separator and flow into the Stormwater system and into the Tailings Dam.						
Operational Phase	Operational activities: Waste generation and disposal	Waste management and disposal	• Pollution of water due to hazardous waste generation and waste disposal.	6	4	4	5	70	Minor Negative	• All material containing hazardous waste generated must be removed to the hazardous waste site; • It must be ensured that no spillage takes place to the hazardous waste site; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; and • It must be ensured that no spillage takes place to the hazardous waste site.	4	3	4	4	44	Minor Negative
Operational Phase	Operational activities: Underground storage	Underground storage	• Pollution of water due to spillage/leakage of stored hazardous substances underground; and • Cleaning and usage of refuge chamber may decrease water quantity during blasting related activities.	6	4	4	5	70	Minor Negative	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas. • All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer. Spillages will be minimized by conducting regular maintenance on equipment. Soil and water pollution can occur from leakages or spillages;	4	3	4	4	44	Minor Negative

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										• Soil and water pollution can occur from leakages or spillages; in which case the procedure on handling and management of waste will be applied. In short the material will be prevented from transgressing into clean water systems or on to the soil. In the event that a spill will occur the "Procedure for Handling and Management of Waste" will be followed; and • Only properly trained personnel may work with the machinery.						
Operational Phase	Operational activities: Blasting	Water quality	• Cleaning and usage of refuge chamber may decrease water quantity during blasting related activities.	6	4	4	6	84	Moderate Negative	• Only limited amount of water may be used for cleaning.	4	3	4	4	44	Minor (negative)
Operational Phase	Operational Activities: Drilling	Surface Water	• Drilling may result in pollution of water due to hazardous material leakages and spillages; and • Drilling may result in pollution of water due to oil mixing with water when cooling down.	6	4	4	6	84	Moderate Negative	• No hazardous material, including oil, paint, fuel and material containing hazardous substances may be • stored outside of demarcated areas; • Hazardous liquid such as oil, paint and fuel will be stored in a secured area; and • All contaminated water will flow into the underground drainage system and into the oil separator.	4	3	4	4	44	Minor (negative)
Operational Phase	Operational Activities: Backfilling	Surface Water	• Backfill may result in pollution of water due to spillage and leakages of hazardous substances during storage; • Backfill may result in pollution of water due to spillages/leakage of oil from welder during welding when grinding, cutting, welding; • Pollution of water due to hazardous waste generation at Backfill; and	5	4	5	6	84	Moderate (negative)	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas. All hazardous substances must be stored in a secured area in a container which is bunded; and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer;	3	3	3	4	36	Minor (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Backfill may result in pollution of water due to spillages when using cement							• Spillages will be minimised by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages then the spill handling procedure will be implemented. • Drip trays to be placed under drums, then disposed of at the hazardous waste site; • All hazardous waste generated at the main shaft will be put into closed drums and removed to the hazardous waste site; and • Cement will be stored in an area bunded to prevent any Stormwater from entering.						
Operational Phase	Operational Activities: Underground mining	Surface and ground Water	• Pollution of water due to spillages at electrical station; • Pollution of water due to spillages when machinery breaks down; • Decreased water quantity due to washing of surface; • Decreased water availability due to inadequate water circulation system; • Surface Water Contamination; • General use of cement may impact water due to spillage; • Pollution of water when using transformer due to spillages of lubricants; • Pollution of water when using winch due to leakages and spillages of hazardous materials; • Pollution of water due to marking off of areas using paint - hazardous material leakage and spillages;	5	4	5	6	84	Moderate (negative)	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded and Clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimised by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages. In such a case the procedure on handling and management of waste will be applied; • All vehicles and machinery will be kept in good working order; • Only limited amount of water may be used for cleaning;	4	3	4	4	44	Minor (negative}

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to marking off of areas using paint due to hazardous waste; • Pollution of water due to the general use of oil and lubricants during maintenance and service repairs as a result of spillages; and • Pollution of water due to the general use of pumps and electrical vacuum machines that may cause water pollution due to spillages of lubricants.							• Management and Maintenance programmes will be in place and form part of the operational process for the water circulation system; • Cement will be stored in an area bunded to prevent any Stormwater from entering; • All winch chambers will be equipped with storing cleaning materials. • All cleaning materials to be kept in tins at each chamber; • Old oils and cleaning agents to be removed as hazardous waste; • No hazardous material, including oil, paint, fuel and material containing hazardous substances may be stored outside of demarcated areas; • Hazardous liquid such as oil, paint and fuel must be stored in a secured area; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; and • It will be ensured that no spillage takes place to the hazardous waste site.						
Operational Phase	Operational activities: Main shaft	Surface Water	• Pollution of water due to spillages and leakages of lubricants at the Main Shaft during operation and maintenance of Main Shaft, transformer and liquid starter pack; • Pollution of water due to spillages and leakages at the Main Shaft due to the storage of lubricants; and • Pollution of water due to hazardous waste generation at the Main Shaft.	6	4	4	5	70	Minor (negative)	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas. All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimised by conducting regular	4	3	4	4	44	Minor (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										maintenance on equipment; • Should soil and water pollution occur from leakages or spillages the "Procedure for Handling and Management of Waste" will be implemented; and • All hazardous waste generated at the main shaft will be put into closed drums and removed to the hazardous waste site.						
Operational Phase	Operational activities: Ventilation Shaft	Surface Water	• Pollution of water due to spillages of lubricants at the ventilation shaft during operation and maintenance of main shaft, transformer and liquid starter pack; • Pollution of water due to spillages and leakages at the ventilation shaft due to the storage of lubricants; and • Pollution of water due to hazardous waste generation at the ventilation shaft	6	4	4	5	70	Minor (negative)	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimised by conducting regular maintenance on equipment; • Should soil and water pollution occur from leakages or spillages the "Procedure for Handling and Management of Waste" will be implemented; and • All hazardous waste generated at the main shaft will be put into closed drums and removed to the hazardous waste site.	4	3	4	4	44	Minor (negative)
Operational Phase	Operational activities: Hoist Room/Winder House	Surface Water	• Pollution of water due to spillages of lubricants at the Hoist Room during operation and maintenance of winder drum, hydraulic power back, gearboxes, filters and fans;	5	4	4	6	78	Moderate (negative)	• Spillages will be minimised by conducting regular maintenance on equipment; • Drip trays to be placed under drums, then disposed of in hazardous waste site;	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to spillages and leakages at the Hoist Room due to the storage of lubricants and other hazardous materials; • Pollution of water due to disposal of hazardous waste at the hoist room; • Pollution of water due spillage of lubricants during loading and off-loading of equipment at the Hoist Room; and • Pollution of water due to breaking of winders that contain asbestos at the Hoist Room.							• Should spillages occur then the “Procedure for Handling and Management of Waste” must be implemented; • No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimised by conducting regular maintenance on equipment; • All hazardous waste generated at the hoist room will be put into closed drums and removed to the hazardous waste site; • Review and implement measure to ensure compliance to the Asbestos Regulations as published in GN R155 of 10 February 2002, and. As a minimum the following will be complied with: • A detailed Asbestos Inventory, reflecting the locations, conditions and inspections; • Provision of adequate and comprehensive information and training on handling asbestos; • Include, the waste removal and disposal procedures during assessments on potential exposure; • Development of proper procedures on safe handling, use and disposal of asbestos work;						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										• Implement adequate measures to ensure the pant if kept clean of asbestos dust; • Control exposure to asbestos of persons other than employees by controlling release of dust into the atmosphere, prevention of dust entering water systems and installation of adequate filtration system (air and water); • Compliance with conditions relevant to asbestos forming part of the structure of the workplace, building, plant or premises; • Controlling asbestos pollutants during the erection, maintenance, alternation, etc. of asbestos cement sheeting and related products; • Provision of adequate PPE and facilities; and • Compliance with the labelling, packaging, transportation and storage requirements; and managing demolition activities as prescribed. • Undertake a survey to identify any asbestos containing material and include the management thereof in the Rehabilitation and Closure Plan to be developed.						
Operational Phase	Operational Activities: Conveyor belts	Surface and ground Water	• Pollution of water due to spillage of ore onto area under Conveyors; • Pollution of water due to incorrect disposal of Conveyor Belt; • Pollution of water due to run-off when washing of cement slabs underneath Conveyor Belt; • Pollution of water due to spillages/leakages of	6	4	4	5	70	Minor (negative)	• Regular inspections and maintenance on the belts; • Remove spillage to metallurgical plant; • All non-hazardous waste must be removed to the salvage yard; • All dirty water must be retained within the process water system; • Implement a drain maintenance programme, identifying all critical water	4	3	4	4	44	Minor (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			lubricants during the operation and maintenance of motors and gearboxes to drive Conveyor Belt; • Pollution of water due to spillages/leakages of lubricants and other hazardous materials due to storage at Conveyor Belt; • Pollution of water due to generation of hazardous materials at Conveyor Belt; and • Pollution of water due to leakage of expansion joins of Conveyor Belt.							conveyance, treatment (e.g., separators) and storage facilities, and ensure regular inspections, maintenance and clean-out of these systems are done; • No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimized by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages in which case the "Procedure for Handling and Management of Waste" must be implemented; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; and • It will be ensured that no spillage takes place to the hazardous waste site.						
Operational Phase	Operational Activities: Fridge Plant	Spill management	• Pollution of water due to hazardous materials spillages/leakages of lubricants during the storage of hazardous substances at Fridge Plant; • Pollution of water due to hazardous materials spillages/leakages of lubricants during the moving thereof	6	4	4	5	70	Minor (negative)	• Soil and water pollution can occur from spillages from the motors and gearboxes and, therefore, spillages will be minimized by conducting regular maintenance on equipment; • No hazardous material, including material containing hazardous substances may be stored	3	3	2	3	24	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			hazardous substances at Fridge Plant; • Pollution of water due to hazardous materials spillages/leakages of lubricants/gearbox oil and grease during maintenance of Fridge Plant; and • Pollution of water due to hazardous waste generation at Fridge Plant.							outside of demarcated areas; • All hazardous substances must be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Soil and water pollution can occur from leakages or spillages in which case the “Procedure for Handling and Management of Waste” must be implemented; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; and • It will be ensured that no spillage takes place to the hazardous waste site.						
Operational Phase	Operational Activities: Pre-cooling Towers	Surface water	• Pollution of water due to leakage of process water during cooling at the Pre-cooling Towers; and • Pollution of water due to hazardous waste generation at the Pre-cooling Towers.	5	4	5	5	70	Minor (negative)	• All water will be diverted to wastewater system; and • All hazardous waste generated at the hoist room must be put into closed drums and removed to the hazardous waste site.	3	3	2	3	24	Negligible (negative)
Operational Phase	Operational Activities: Compressors	Surface Water	• Pollution of water due to spillages during operation of Compressors - use of lubrication oil for bearings, motor and gearboxes; • Pollution of water due to spillages during operation of Compressors - use of chemicals in water softeners for cooling towers; • Pollution of water due to spillages of lubricants - during the use of	5	4	5	5	70	Minor (negative)	• Soil and water pollution can occur from spillages from the motors and gearboxes. Spillages will be minimized by conducting regular maintenance on equipment; • It is inevitable that spillages will occur in which case the “Procedure for Handling and Management of Waste” must be implemented; • No hazardous material, including material containing hazardous substances may be stored	3	3	2	3	24	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			transformers at Compressors; • Pollution of water due to spillages during the use of generators at Compressors; • Pollution of water due to spillages when storing material containing hazardous substances or hazardous substances at Compressors; • Pollution of water due to hazardous waste generation at Compressors; and • Pollution of water due to run-off during the use of process water - water overflow from Cooling towers at Compressors.							outside of demarcated areas; • Hazardous liquid such as oil, paint and fuel must be stored in a secured area. in a container which is bunded and Clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimized by conducting regular maintenance on equipment and • All hazardous waste generated at the hoist room must be put into closed drums and removed to the hazardous waste site.						
Operational Phase	Operational Activities: Bank Area	Surface Water	• Pollution of water due to spillages when temporarily storing fuels, lubricants, chemical before going down the shaft at the Bank Area; • Pollution of water due to temporary storage of waste coming from mining at the Bank Area; • Pollution of water due to temporary storage of radioactive material at the Bank Area; • Pollution of water due to run-off when washing the Bank Area; and • Decreased water quantity due to use of potable water for washing the Bank Area.	5	4	4	6	78	Moderate (negative)	• Soil and water pollution can occur from spillages from the motors and gearboxes. Spillages will be minimized by conducting regular maintenance on equipment; • It is inevitable that spillages will occur in which case the "Procedure for Handling and Management of Waste" must be implemented; • No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas; • Ensure that a COP is in place as according to Section 9 of the Mine Health and Safety Act, 1996. This must be in accordance with Section 42 of the Mineral and Petroleum Resource Development Act, 2002 as well as Regulation 69 and 73 of the regulations as per GN R527 of 23 April 2004 –	4	3	4	4	44	Minor (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										Mineral and Petroleum Resource Development Regulations; • Radio-active contaminated waste: • The procedure, COR 58A 0192 – Integrated waste management procedure, approved by the NNR applies to the whole of Harmony. Requirements for the release of potentially contaminated scrap and waste authorized dealers. • Develop an appropriate environmental monitoring programme to ensure that the storage, disposal or effluent discharge of radio-active waste complies with the conditions of the nuclear license – COR– 58. • Develop waste acceptance criteria as per Regulation 4 of GN 388 of 25 April 2006 – Safety standards and regulatory practices; • Ensure the “decontamination facility” referred to in COR58A0192 is used as is prescribed, clause 8; • Ensure all waste having a risk of radio-active contamination is managed in accordance with the prescribed procedures; • Ensure all information is reflected in the quarterly NNR Report; • Radio-active waste (falling outside definition under nuclear energy act, 1999): • Update procedure DH001 – Procedure for safe use of industrial gauges containing radioactive sources, to include the disposal and transportation requirements; • Ensure that for future disposals, all written authorisations from the						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										Department of Health are in place prior to disposal; • All dirty water must be retained within the process water system; and • Implement a drain maintenance programme, identifying all critical water conveyance, treatment (e.g., separators) and storage facilities, and ensure regular inspections, maintenance and clean-out of these systems are done.						
Operational Phase	Operational Activities: Lamp Room	Surface Water	• Pollution of water due to spillages while storing paint and self-rescue packages at Lamp Room; and • Pollution of water due to spillages when disposing of old batteries, paint and self-rescue at Lamp Room.	4	3	4	6	66	Minor (negative)	• Soil and water pollution can occur from spillages from the motors and gearboxes. Spillages will be minimized by conducting regular maintenance on equipment; • It is inevitable that spillages will occur in which case the “Procedure for Handling and Management of Waste” must be implemented; • Maintenance on all equipment will be done; and • All batteries, paint and Self Rescue Packs, containing hazardous material, generated at the lamp room must be removed to the hazardous waste site.	4	3	4	4	44	Minor (negative)
Operational Phase	Operational Activities: Asbestos and Radioactive material management	Surface Water	• Pollution of water due to storage and handling of material containing Asbestos and Radioactive Waste.	6	4	5	6	90	Moderate (negative)	• Review and implement measure to ensure compliance to the Asbestos Regulations as published in GN R155 of 10 February 2002. As a minimum the following must be complied with: • A detailed Asbestos Inventory, reflecting the locations, conditions and inspections; • Provision of adequate and comprehensive information and training on handling asbestos; • Include, the waste removal and disposal procedures	4	3	4	4	44	Minor (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										during assessments on potential exposure; • Control exposure to asbestos of persons other than employees by controlling release of dust into the atmosphere, prevention of dust entering water systems and installation of adequate filtration system (air and water); • Development of proper procedures on safe handling, use and disposal of asbestos work; • Implement adequate measures to ensure the plant is kept clean of asbestos dust; • Compliance with conditions relevant to asbestos forming part of the structure of the workplace, building, plant or premises; • Controlling asbestos pollutants during the erection, maintenance, alternation, etc. of asbestos cement sheeting and related products; • Provision of adequate PPE and facilities; • Compliance with the labelling, packaging, transportation and storage requirements; and managing demolition activities as prescribed; and • Undertake a survey to identify any asbestos containing material and include the management thereof in the Rehabilitation and Closure Plan to be developed. • Implement the legal requirement as per Regulation 20 of GN R155 of 10 February 2002 – Asbestos Regulations promulgated in terms of the Occupational Health						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										and Safety Act, 1993 which amongst others requires: • Cleaning of vehicles and re-usable containers and disposal of decontaminated waste on legally permitted site; • Provision of suitable PPE for all persons involved in the removal and disposal; • Adequate containers to prevent exposure during handling; • Temporary storage to comply with the waste management standard – “Minimum Requirements for the identification, handling and disposal of hazardous waste, 1998 – Second Edition”; • Proper agreements with waste removal contractors; • Safe disposal certificates for each batch to be removed; • Will form part of reconciliation to enable Kusasalethu Operation to prove safe disposal of all the asbestos waste; • Such requirements should be formalised within an operational procedure as part of the ISO 14001 implementation programme; and • Implement the waste management policy on asbestos waste as a matter of urgency – “DWA policy on asbestos waste.”						
Operational Phase	Operational Activities: Activities in the sandblasting Bay	Surface Water	• Pollution of water due to rain run-off as a result of storing sand at the Sandblasting Bay; • Pollution of water due to leakages from the painting equipment at the Sandblasting Bay; • Pollution of water due to hazardous waste at the Sandblasting Bay; and	4	3	4	5	55	Minor (negative)	• Sand will be kept away from run-off water and all wastewater must be diverted to the wastewater system; • No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas;	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Decrease in water quantity due to use of recyclable water at the Sandblasting Bay.							• Hazardous liquid such as oil, paint and fuel must be stored in a secured area and in a secured area in a container which is bunded and clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimized by conducting regular maintenance on equipment; • As soil and water pollution can occur from leakages or spillages, the "Procedure for Handling and Management of Waste" on cleaning and handling of spillages will be applied; and • All hazardous waste generated must be put into closed drums and removed to the hazardous waste site.						
Operational Phase	Operational Activities: Activities at the Shaft Workshops	Surface Water	• Pollution of water due to spillages and leakages during the use of machinery at the Shaft Workshop; • Pollution of water due to spillages and leakages of hazardous substances during the use of oil and lubricants during maintenance, service and repair at the Shaft Workshop; • Pollution of water due to spillages and leakages of hazardous substances during the use of cleaning agents, degreaser and other chemical in pressurized containers at the Shaft Workshop; • Pollution of water due to spillages and leakages of the storage	4	3	4	5	55	Minor (negative)	• Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays under drums, then disposed of in hazardous waste site; • It is inevitable that spillages will occur in which case the procedure on handling and management of waste must be implemented; • No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas. • Hazardous liquid such as oil, paint and fuel must be stored in a secured area. All hazardous substances must be stored in a secured area in a container which is	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			of hazardous substances at the Shaft Workshop; • Pollution of water due to oil mixing with water during the washing of parts and winches at the Shaft Workshop; • Pollution of water due to use of oil cooled welder and leakages thereof during grinding, cutting and welding at the Shaft Workshop; • Pollution of water due to leaking of cutting fluid and oil from workshop machinery onto workshop area thereof during grinding, cutting and welding at the Shaft Workshop; • Pollution of water due to spillages/ leakages of transformers during their use at the Shaft Workshop; • Pollution of water due to spillages/ leakages due to the usage of paint at the Shaft Workshop; • Pollution of water due to hazardous waste disposal at the Shaft Workshop; • Pollution of water due to wastewater disposal at the Shaft Workshop; and • Pollution of water due to backfill pumps leaking process water at the Shaft Workshop.							bunded and clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimized by conducting regular maintenance on equipment; • All dirty water will be retained within the process water system; • All hazardous waste generated at the hoist room must be put into closed drums and removed to the hazardous waste site; and • Wastewater flows to sump and is taken up in system.						
Operational Phase	Operational Activities: Activities at the Shaft Storage area	Surface and ground water	• Pollution of water due to spillages and leakages at the Storage Areas due to the storage of hazardous waste; • Pollution of water at the Storage Areas due to the storage of cement;	5	4	4	6	78	Moderate (negative)	• No hazardous material, including material containing hazardous substances may be stored outside of demarcated areas. • Hazardous liquid such as oil, paint and fuel must be stored in a secured area. All hazardous substances must	3	2	3	3	24	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water at the Storage Areas due to contamination because of the storage of materials containing underground active mining residue; • Pollution of water at the Storage Areas due to contamination because of the storage of materials containing underground active mining residue; • Pollution of water at the Storage Areas due to packaging removal; • Pollution of water at the Storage Areas due to spillage of hazardous substances during the operation of forklift and other handling machinery and transportation of chemistry; • Pollution of water at the Storage Areas due to temporary storage of recyclable material such as jumpers; • Pollution of water at the Storage Areas due to sandblasting of contaminated radioactive equipment; • Pollution of water at the Storage Areas due to disposal of hazardous waste; • Loss of water at the Storage Areas due to use of wastewater; • Pollution of water at the Storage Areas due to hazardous substances washed out of bunded area during the washing of the storage area; • Pollution of water due to leakages at the diesel and oil Storage Areas;							be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine must be in possession of a material safety data sheet as provided by the manufacturer; • Spillages will be minimized by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages, in which case the procedure on handling and management of waste will be applied; • Cement will be stored in an area bunded to prevent any Stormwater from entering; • Radio-active contaminated waste: • The procedure, COR 58A 0192 – Integrated waste management procedure, approved by the NNR applies to the whole of Harmony. Requirements for the release of potentially contaminated scrap and waste authorized dealers; • Develop an appropriate environmental monitoring programme to ensure that the storage, disposal or effluent discharge of radio-active waste complies with the conditions of the nuclear license – COR • – 58; • Develop waste acceptance criteria as per Regulation 4 of GN 388 of 25 April 2006 – Safety standards and regulatory practices; • Ensure the "decontamination facility" referred to in COR58A0192 is used as is prescribed, clause 8;						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to spillages during off-loading of diesel and oil at the diesel and oil Storage Areas; • Pollution of water due to vehicle and tank spillages at the diesel and oil Storage Areas; • Pollution of water due to spillages and leakages of tanks and valves during the maintenance of bunded areas at the diesel and oil Storage Areas; and • Pollution of groundwater due to spillages and leakages of tanks and valves during the maintenance of bunded areas at the diesel and oil Storage Areas.							• Ensure all waste having a risk of radio-active contamination is managed in accordance with the prescribed procedures; and • Ensure all information is reflected in the quarterly NNR Report. • Radio-active waste (falling outside definition under nuclear energy act, 1999): • Update procedure DH001 – Procedure for safe use of industrial gauges containing radioactive sources, to include the disposal and transportation requirements; • Ensure that for future disposals, all written authorisations from the Department of Health are in place prior to disposal; • All packaging will be removed to the salvage yard; • Only properly trained personnel may work with the machinery; • All recyclable material to be used again must be kept in a demarcated area. This area will be in an area where no Stormwater can enter. The area will be in a cemented area. All recyclable material not to be used again at the storage area will be removed to the salvage yard for recycling; • Sandblasting will take place in a bunded area where no Stormwater or rainwater can enter; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; • All wastewater flows to sump and is taken up in dirty water management system. All affected water						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										will be re-used within the Dirty Water Management Area; and • All dirty water will be retained within the process water system.						
Operational Phase	Operational Activities: Storage of diesel and oil	Surface and ground water	• Pollution of water due to leakages as a result of storage of diesel, oil and gas; • Pollution of water due to spillages as a result of storage of diesel, oil and gas during loading and off- loading thereof; • Pollution of water due to vehicle and tank spillages as a result of storage of diesel, oil and gas • Pollution of water due to spillages and leakages of tanks and valves during the maintenance of bunded areas as a result of storage of diesel, oil and gas; • Pollution of groundwater due to spillages and leakages of tanks and valves during the maintenance of bunded areas as a result of storage of diesel, oil and gas; and • Pollution of water due to spillages of diesel during refuelling of fork-lifts, mobi-lifts, crane, material cars and vehicles - storage of diesel, oil and gas.	5	4	4	6	78	Moderate (negative)	• Bund walls will be inspected regularly and repairs must be done if required; • Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays must be placed under drums and then disposed of in hazardous waste site; • Should spillages occur the procedure on handling and management of waste must be applied; • All vehicles should be kept in good working order to avoid spillages and the tanks will be bunded to avoid any spillages of diesel causing pollution; • Groundwater can be monitored on a quarterly basis;. • Inspections on the tanks as well as reporting of any leakages/spillages will be done on a weekly basis; and • Spillages will be minimized by conducting regular maintenance on cable trenches.	3	2	3	3	24	Negligible (negative)
Operational Phase	Operational Activities: Activities at the Plant Storage Area	Surface Water	• Pollution of water due to leaching of wet Carbon containing Cyanide and HCI at the Plant Storage Area due to the storage of fine carbon in bags for removal to facilities where gold can be removed;	6	4	6	6	96	Moderate (negative)	• All hazardous substances will be stored in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer;	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to leaching of pyrite due to the storage at the Plant Storage area; • Pollution of water due to leakage or spillage at the Plant Storage area as a result of storage of cyanide/ caustic soda and HCl; • Pollution of water due to spillages and leakages at the Plant Storage area as a result of storage of hazardous substances; • Pollution of water due to hazardous substances washed out of bunded area at the Plant Storage area as a result of washing the storage area; • Pollution of water due to contamination at the Plant Storage area as a result storage of underground radioactive mining residue; and • Pollution of water due to wastewater disposal at the Plant Storage area.							• All hazardous waste generated at the metallurgical plant must be put into closed drums and removed to the hazardous waste site; • Soil and water pollution can occur from leakages or spillages in which case the procedure on handling and management of waste will be applied; • All dirty water will be retained within the process water system; • Radio-active contaminated waste: • The procedure, COR 58A 0192 – Integrated waste management procedure, approved by the NNR applies to the whole of Harmony. Requirements for the release of potentially contaminated scrap and waste authorized dealers; • Develop an appropriate environmental monitoring programme to ensure that the storage, disposal or effluent discharge of radio-active waste complies with the conditions of the nuclear license – COR– 58; • Develop waste acceptance criteria as per Regulation 4 of GN 388 of 25 April 2006 – Safety standards and regulatory practices; • Ensure the "decontamination facility" referred to in COR58A0192 is used as is prescribed, clause 8; • Ensure all waste having a risk of radio-active contamination is managed in accordance with the prescribed procedures; • Ensure all information is reflected in the quarterly NNR Report;						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										• Radio-active waste (falling outside definition under nuclear energy act, 1999): • Update procedure DH001 – Procedure for safe use of industrial gauges containing radioactive sources, to include the disposal and transportation requirements; • Ensure that for future disposals, all written authorisations from the Department of Health are in place prior to disposal; • All hazardous waste generated at the hoist room will be put into closed drums and removed to the hazardous waste site; and • Water flows to sump and is taken up in system.						
Operational Phase	Operational Activities: Activities at the Plant workshop	Surface water	• Pollution of water due to spillages and leakages at the Plant Workshop due to the storage of hazardous substances; • Pollution of water due to spillages and leakages at the Plant Workshop due to use of machinery; • Pollution of water due to spillages and leakages of hazardous substances at the Plant Workshop due to use of oils and lubricants during maintenance, services and repairs; • Increased water consumption due to pollution of water as a result of oil mixing with water when washing parts at the Plant Workshop; • Pollution of water due to spillages and leakages at the Plant Workshop due to use of cleaning agents, degreaser and other	5	4	4	6	78	Moderate (negative)	• No hazardous material, including material containing hazardous substances will be stored outside of demarcated areas; • Hazardous liquid such as oil, paint and fuel will be stored in a secured area. All hazardous substances will be stored in a secured area in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer. Spillages will be minimized by conducting regular maintenance on equipment; • Soil and water pollution can occur from leakages or spillages in which case the procedure on handling and management of waste will be applied; • Spillages will be minimized by conducting regular	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			chemicals in pressurised containers; • Pollution of water due to oil mixing with water at the Plant Workshop due washing parts; • Pollution of water due to use of oil cooled welder and leakage of the oil from the welder at the Plant Workshop due to washing of parts; • Pollution of water due to leaking of cutting fluid and oil from workshop machinery onto workshop area at the Plant Workshop due to washing of parts; • Pollution of water due to spillage/leakages at the Plant Workshop due to usage of paint; • Pollution of water due to hazardous waste disposal at the Plant Workshop; • Pollution of water due to spillages/ leakages of transformers at the Plant Workshop when using the transformers; and • Pollution of water due to pumps leaking process water from the backfill pumps at the Plant Workshop.							maintenance on equipment; • Drip trays under drums, then disposed of in hazardous waste site; • All dirty water will be retained within the process water system; • All hazardous waste generated will be put into closed drums and removed to the hazardous waste site; and • Wastewater flows to sump and is taken up in system.						
Operational Phase	Operational Activities: Storage of diesel, oil and gas at the plant	Surface water	• Pollution of water due to leakages as a result of storage of diesel, oil and gas; • Pollution of water due to spillages as a result of storage of diesel, oil and gas during loading and off- loading thereof; • Pollution of water due to vehicle and tank spillages as a result of storage of diesel, oil and gas;	4	3	4	5	55	Moderate (negative)	• Existing bund walls are in place and must be inspected regularly and repaired when required; • Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays must be placed under drums, then disposed of in hazardous waste site; • It is inevitable that spillages will occur in which case the procedure on handling and	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to spillages and leakages of tanks and valves during the maintenance of bunded areas as a result of storage of diesel, oil and gas; • Pollution of groundwater due to spillages and leakages of tanks and valves during the maintenance of bunded areas as a result of storage of diesel, oil and gas; and • Pollution of water due to spillages of diesel during refuelling of fork-lifts, mobi-lifts, crane, material cars and vehicles - storage of diesel, oil and gas.							management of waste will be applied; • All vehicles will be kept in good working order to avoid spillages leading to soil pollution; • The tanks will be bunded to avoid any spillages of diesel causing soil pollution.; • The tank can be easily monitored for leakages/spillages; and • Groundwater can be tested on a quarterly basis. Inspections on the tanks as well as reporting of any leakages/spilling will be done on a weekly basis.						
Operational Phase	Operational Activities: Water storage and wash bay	Surface Water	• Pollution of water due to leakages or spillages of process water as a result of storage of process water at the Water Storage and Wash Bay; • Pollution of water due to water run-off while washing vehicles, equipment and machinery before leaving the plant to reduce radiation at the Water Storage and Wash Bay; and • Decrease in water quantity due to water leakages at the Water Storage and Wash Bay.	4	3	4	5	55	Moderate (negative)	• All dirty water will be diverted to wastewater system; • All dirty water will be retained within the process water system; • Ensure effective operation of all plants to minimize water use; • Undertake regular inspections on all such systems.	3	2	3	4	32	Negligible (negative)
Operational Phase	Operational Activities: Electrical substation	Surface Water	• Pollution of water due to spillages and leakages at the Electrical Substation as a result the operations and maintenance of transformers; and • Pollution of water due to hazardous waste disposal at the Electrical Substation.	5	3	4	5	60	Minor (negative)	• Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays under drums, then disposed of in hazardous waste site. • It is inevitable that spillages will occur. In such a case the procedure on handling	3	2	3	4	32	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										and management of waste will be applied.						
Operational Phase	Operational Activities: Use of hazardous substances (cyanide, caustic soda, lime and HCL)	Surface Water	• Pollution of water due to leakage or spillage of cyanide, caustic soda, lime and HCI during loading and off-loading; • Pollution of water due to leakage or spillage of mixing cyanide, caustic soda, lime and HCI during loading and off-loading; and • Pollution of water due to leakage or spillage of mixing cyanide, caustic soda, lime and HCI due to storage thereof.	5	4	4	6	78	Moderate (negative)	• Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays under drums, then disposed of in hazardous waste site and • It is inevitable that spillages will occur. In such a case the procedure on cleaning and handling of spillages will be applied.	3	2	3	4	32	Negligible (negative)
Operational Phase	Operational Activities: occurring at the Plant Area	Surface Water	• Pollution of water due to use of mills for crushing ore and spillages from motors, gearboxes and greasing of bearings of Mills during operations; • Pollution of water due to use of and spillages of grease, paint and chemicals at Mills during operations; • Pollution of water due to oil spillages from welding machines at Mills during operations; • Increased water consumption due to the pumping of water at Mills; • Loss of water due to leakages to use of transfer tank from thickeners to leach at Mills during operations; • Pollution of water due to spillages of flocculants during storage, transport and use for Thickener during operations; • Pollution of water due to grease and oil spills from gearboxes from pump during use for Leach and use for	4	3	4	5	55	Moderate (negative)	• Spillages will be minimized by conducting regular maintenance on equipment. Drip trays under drums, then disposed of in hazardous waste site. • It is inevitable that spillages will occur in which case the procedure on handling and management of waste procedure will be applied; • Maintenance of pumps will take place; • All hazardous substances will be stored in a container which is bunded and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Classify all hazardous waste as per DWS Minimum Requirements for the Identification, Handling and Disposal of Hazardous Waste. The migration of leachate or spillage into the ground and groundwater regime around all temporary storage areas will be prevented. A temporary storage site therefore requires a firm	3	2	3	3	24	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			Thickener during operations; • Pollution of water due to use of chemicals e.g., lime cyanide and pollution due to chemical spillages of Leach during operations; • Pollution of water due to grease and oil spills from gearboxes of pumps during use - Residue during operations; • Pollution of water due to pumping mud from residue tanks and spillage of mud during use - Residue during operations; • Pollution of water due to use of HCl, cyanide and caustic soda - Elution during operations; • Pollution of water due to spillages/leakages of flocculants during operations; • Pollution of water due to disposal of waste during cleaning of flocculant tanks during operations; and • Pollution of water due to leakages due to the use of Thickeners during operation.							waterproof base that is protected from the ingress of Stormwater from surrounding areas. It will also have an effective drainage system to a waterproof spillage collection area, where any spillage can be recovered and suitably treated. This area will be clearly demarcated and should not be accessible to unauthorised persons; and • Ensure effective operation of all plants to minimise water use. Undertake regular inspections on all such systems.						
Operational Phase	Operational Activities: Activities at the Salvage Yard/Stock Yard	Surface Water	• Pollution of water due to pipes bursting as a result of storage and pumping of affected water in and out of the Salvage Yard • Pollution of water due to hazardous waste storage of materials containing asbestos at Salvage Yard • /Scrap Yard; • Pollution of water due to spillages during the transportation of waste	4	3	4	5	55	Minor (negative)	• Spillages will be minimized by conducting regular maintenance on equipment; • Drip trays under drums, then disposed of in hazardous waste site; • It is inevitable that spillages will occur in which case the procedure on handling and management of waste will be applied; • Maintenance of pumps will take place;	5	2	2	2	18	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			and waste bins in and out of Salvage Yard /Scrap yard and • Pollution of water due to hazardous waste disposal Salvage Yard/Scrap Yard.							• All hazardous substances will be stored in a container which is bunded; and clearly labelled of its contents; • The mine will be in possession of a material safety data sheet as provided by the manufacturer; • Classify all hazardous waste as per DSA Minimum Requirements for the Identification, Handling and Disposal of Hazardous Waste; • The migration of leachate or spillage into the ground and groundwater regime around all temporary storage areas will be prevented; • A temporary storage site therefore requires a firm waterproof base that is protected from the ingress of Stormwater from surrounding areas; • It will also have an effective drainage system to a waterproof spillage collection area, where any spillage can be recovered and suitably treated; and • This area will be clearly demarcated and should not be accessible to unauthorised persons.						
Operational Phase	Operational Activities: Water Dams and Pump stations	Surface Water and Groundwater	• Pollution of water due to spillage of water as a result of vandalism at the water dams during operation; • Pollution of water due to seepage and run-off of hazardous minerals within affected water at the water dams during operation; • Pollution of water due to overflow at water dams into the Klipdrif Dam during operation;	6	2	4	4	48	Minor (negative)	• Security measure will be put into place to prevent theft/vandalism from taking place. Security measure will also prevent the theft/vandalism of pumps and required infrastructures. • All dirty water will be retained within the process water system. Measures to be implemented to reduce seepage; • Emphasis will be placed on the availability of pollution control equipment,	5	2	2	5	18	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to spillages/leakages of hazardous substances at pump station of water dams during operation; and • Pollution of water due to spillages/leakages of transformers at water dams during operation.							• Return Water Dam seepage is currently collected in a seepage sump. This water is pumped back into the Return Water Dam for process usage at Kusasalethu Plant - this practice is to be maintained. • Implement a drain maintenance programme, identifying all critical water conveyance, treatment (e.g., separators) and storage facilities, and ensure regular inspections, maintenance and clean-out of these systems are done; • Maintain access control and warning signage. Photographs will be taken of signage as proof; • Paddocks will be regularly inspected and maintained; • All paddocks will be cleaned as part of a maintenance programme; • Hazardous material will be prevented from transgressing into clean water systems or on to the soil. In the event that a spill will occur the “Procedure for Handling and Management of Waste” and the “Integrated Waste Management Programme” will be implemented; • Spillages will be minimised by conducting regular maintenance on equipment. • Drip trays will be placed under drums, and thereafter disposed of at hazardous waste site.						
Operational Phase	Tailings Storage Dam	Surface Water & Groundwater	• Increased sedimentation into water due to erosion at Tailings Dams during operation; • Pollution of water due to spillage of fine slimes/ tailings at	5	3	5	6	78	Moderate (negative)	• Measures to be taken to reduce erosion from Tailings Dams due to water run-off; • In the event of slimes/tailings spillages, ensure that clean-up	3	2	2	4	28	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			Tailings Dams during operation; • Pollution of water due to spillage of fine slimes/ tailings at Tailings Dams during operation as a result of vandalism/theft; • Pollution of water due to leaching of hazardous minerals at Tailings Dams during operation; • Pollution of water due to seepage from Tailings Dams through trenches and paddocks during operation; • Safety hazard to workers and community due to cyanide in dams and potential drowning from Tailings Dams; and • Safety hazard to workers and community due to flooding from Tailings Dams.							measures are implemented immediately; • Ensure adequate containment facilities are in place to minimise the risks associated (e.g., adequate paddocks); • Security measure will be put into place to prevent theft/vandalism from taking place and therefore implementing access control measures at the Tailings Storage Facility; • The condition and location of the existing boreholes will be maintained; • The establishment of basic groundwater modelling is recommended to assess the change in groundwater qualities to receptors; • Assess the trenches and paddocks if it has adequate capacity for water flow; • Assess if the flow of water in the trenches are towards the return water dam; • Maintain trenches and paddocks to keep out all vegetation and blockage that may prevent water flow to the return water dam; • Signage will be put into place to warn community of danger and regular inspections will take place to ensure signage is in place, • The Tailings Storage Facility walls and infrastructure will be inspected regularly to monitor for any probability of wall instability; • Security measure (access control measures) will be put into place to prevent people from drowning in the Tailings Storage Facility; • Assess the current holding capacity of the affected						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										water circuit, and accordingly review the adequacy of such to contain a 1:50 year flood event; and • Ensure that the dams is managed at a minimum freeboard of 0.8 m.						
Operational Phase	Spillage Ponds and Silt Trap Dams	Surface Water & Groundwater	• Pollution of water due to leakages/ spillages from Spillage Ponds; • Pollution of water due to cleaning of Spillage Ponds; and • Pollution of water due to leakages (dam has rock clad lining) of Silt Trap Dam.	5	3	5	6	78	Moderate (negative)	• Spillage ponds will be inspected and maintained on a regular basis; • Affected water from cleaning will be diverted to the affected water system; • All debris from cleaning will be disposed of at a registered hazardous waste disposal site; and • Groundwater monitoring and soil sampling will be done regularly.	3	2	3	4	32	Negligible (negative)
Operational Phase	Canals, Trenches, Pipelines	Surface Water	• Pollution of water due to process/dirty water overflow of process water into surrounding water courses of trenches and Stormwater systems; • Pollution of water due to spillages of process water due to burst pipes, pumps, leaking and thickener overflowing during the maintenance of pipes, pumps and equipment; and • Decrease in available water due to drinking water taps leaking potable water into Stormwater system.	5	3	5	6	78	Moderate (negative)	• Assess the trenches if it has adequate capacity for water flow; • Maintain trenches to keep out all vegetation and blockage that may prevent water flow to the return water dam; • Maintenance of pipes, pumps and equipment will take place on a regular basis. Instalment of meters stolen will be ongoing; • Maintenance of water taps will take place on an ongoing basis and form part of Water Management Plan; and • All personnel will be made aware of water resource preservation and will report such water wastage.	3	2	3	4	32	Negligible (negative)
Operational Phase	Sewage Treatment Plant	Surface Water and Ground Water	• Pollution of water due to sewage disposal onto mining area (Loopspruit); • Pollution of water due to sewage overflow at the sewage transfer pumps; • Pollution of water due to treated sewage discharge; and	6	4	4	5	70	Minor (negative)	• It is the duty of the mine to keep the sewage pump station in good working order to prevent any leakages or spillages; • The Sewage Treatment Plant will be fenced off so as to prevent any outside persons from entering; • In short the material will be prevented from	3	3	3	3	27	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			• Pollution of water due to disposal of screenings and sludge (hazardous waste) at Sewage Treatment Plant.							transgressing into clean water systems or on to the soil. In the event that a spill or seepage will occur the following procedure will be followed: • Immediately contain the spillage or seepage to prevent spreading to adjacent areas (clean water management area); • Once the spill has been contained use absorbent material to absorb the spilled sewage material; • Dispose of absorbent into hazardous waste bin provided at the site; • Remove contaminated soil and dispose of in hazardous waste bin provided at the site; • Prevent any sewage sludge disposal activities other than into the sewage station; • No overflow from these facilities are allowed, as this poses high risk of contamination to the nearby surface water environment; • Regular inspections will be undertaken, and ensure that the contractor is adequately trained; • Transfer station pumps are critical equipment, which will be maintained with standby facilities, available in event of failure; • The discharge of treated sewage needs to comply with the discharge quality standards as specified within Water Quality Standards; • Ensure such is disposed of as hazardous waste. Classify all hazardous waste as per DWS Minimum Requirements for the Identification, Handling and Disposal of Hazardous						

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										Waste. The migration of leachate or spillage into the ground and groundwater regime around all temporary storage areas will be prevented; • A temporary storage site requires a firm waterproof base that is protected from the ingress of Stormwater from surrounding areas. It will also have an effective drainage system to a waterproof spillage collection area, where any spillage can be recovered and suitably treated. This area will be clearly demarcated and should not be accessible to unauthorised persons; and • Ensure that records of safe disposal are available to demonstrate correct disposal of sewage sludge and screenings.						
Operational Phase	Admin Area	Surface Water	• Pollution of water due to disposal of hazardous waste at the Admin area; • Pollution of water due to disposal of hazardous waste at the Admin area; • Pollution of water due to leakage of motor oil and other hydrocarbons in the parking area of Admin area; and • Pollution of water due to soapy and oily water running into Stormwater system when washing cars in the Car Park and Admin area.	6	2	4	4	48	Minor (negative)	• All hazardous waste generated at the admin buildings will be put into closed drums and removed to the hazardous waste site; and • Stormwater run-off from road surfaces may lead to surface water siltation as well as pollution of watercourses and soil especially in areas where the slope of the roads is steeper. Stormwater run-off from road surfaces will need to be properly managed. This Stormwater run-off will flow into the Stormwater system.	3	2	2	4	28	Negligible (negative)
Operational Phase	Change houses	Surface Water	• Increased water consumption due to water usage for showers in Change Houses; • Increased water consumption due to	6	2	4	4	48	Moderate (negative)	• All pipes will be kept in a good condition to prevent leaks. All leaks will be reported and remediate as soon as possible; • Spillages or leakages will be minimised by conducting	3	2	2	3	21	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
			leakages of pipes in Change Houses; • Pollution of water due to leakages of dirty water and sewage in Change Houses; • Pollution of water due to run-off from cleaning of changing rooms in Change Houses; and • Pollution of water due to hazardous waste in Change Houses							regular maintenance on equipment. • Should spillages or leakages occur, the procedure on handling and management of waste will be applied. In short the material will be prevented from transgressing into clean water systems; • All dirty water will be retained within the process water system; and • All hazardous waste generated at the changing rooms will be put into closed drums and removed to the hazardous waste site.						
Operational Phase	Impact on water due to alien invasive vegetation	Soils and water	• Pollution of water due to mechanical removal of alien vegetation: potential oil and petrochemical spillages and leakages; • Pollution of water due to mechanical removal of alien vegetation: potential over dosage or spillage of herbicides and other chemicals; and • Pollution of water due to hazardous waste disposal of herbicides and pesticides.	4	3	4	5	55	Minor (negative)	• Vehicles and machinery will be kept in good working order to prevent leakages and spillages; • Develop an operation procedure to ensure the correct use and application of herbicides and pesticides; • Only registered herbicides and pesticides will be used; • If a contractor applies pesticides/herbicides as part of his trade/business, registration with the Department of Agriculture is required to act as “pest control operator;” • Application activities will also apply with the conditions stipulated on the label; • Pesticides/herbicide waste should be regarded as hazardous waste and will be safely and legally disposed of. • Classify all hazardous waste as per DWS Minimum Requirements for the Identification, Handling and Disposal of Hazardous Waste; • The migration of leachate or spillage into the ground	3	2	2	3	21	Negligible (negative)

Phase	Activity	Aspect	Impacts	D	E	I	P	S	Rating (Pre-Mitigation)	Mitigation Measures	D	E	I	P	S	Rating (Post Mitigation)
										and groundwater regime around all temporary storage areas will be prevented. A temporary storage site, therefore, requires a firm waterproof base that is protected from the ingress of Stormwater from surrounding areas; and • It will also have an effective drainage system to a waterproof spillage collection area, where any spillage can be recovered and suitably treated; and • This area will be clearly demarcated and should not be accessible to unauthorised persons.						
Operational Phase	Waste Rock Dumps	Surface Water	• Pollution of water due to the removal of contaminated land/soil for rehabilitation at the Waste Rock Dumps; • Pollution of water due to the removal of contaminated land/soil for rehabilitation at the Waste Rock Dump; and • Pollution of water due to the hazardous substances from using the waste rock for the construction of stores area from the Waste Rock Dump.	4	3	4	5	55	Minor (negative)	• Contaminated soil will be removed and disposed of in an appropriate manner. As the nature of the impact is positive, no additional mitigation measures are required; and • Undertake a characterisation of the waste rock dump material (e.g., leaching tests) to determine the risks of this onto the surface and groundwater environment, also in respect to the use of the material for construction purposes etc.	3	2	3	3	24	Negligible (negative)
Operational Phase	Industrial Disposal Site (Garden Refuse Site) and Landfill Site	Soil and Surface Water	• Pollution of water due to disposal of waste and other garden refuse from the Kusasalethu garden refuse site at Industrial Disposal Site/Garden refuse Site; and • Pollution of water due to waste disposal into the veld from waste generation at Mining Site (excluding the Shaft and Plant).	3	3	4	5	50	Minor (negative)	• Cease all illegal disposal activities taking place; • Undertake clean-up and rehabilitation of the area; • Identify a person to be responsible for the site; • Develop an operational procedure for the site; • Establish access control; • Undertake regular inspections; • Maintain necessary permits from DEA; and • Develop rehabilitation plan for the site.	3	2	3	2	16	Negligible (negative)

8 IMPACT ASSESSMENT FOR THE PROPOSED PIPELINES

This section deals with the identification of risks/impacts and their mitigation measures specific to the Proposed Kusasalethu Return Water and Backfill Pipelines Project. This section focuses only on water related impacts and proposed mitigation measures.

8.1 METHODOLOGY

An impact/risk assessment was undertaken for this IWWMP and the associated EIA application for the proposed project. The impact significance rating methodology is guided by the requirements of the NEMA EIA Regulations. 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, public concern, 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 significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER).

The environmental risk 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:

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

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 50.

Table 50: Criteria for determination of 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. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),

Aspect	Score	Definition
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
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),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
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 prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table 51.

Table 51: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

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

$$\boldsymbol{ER = C \times P}$$

Table 52: Determination of environmental risk

Consequence	5	5	10	15	20	25

	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 53.

Table 53: Significance classes

Environmental Risk Score	
Value	**Description**
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥ 9; < 17	Medium (i.e. where the impact could have a significant environmental risk),
≥17	High (i.e. where the impact will have a significant environmental risk).

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

In accordance with the requirements of Regulation 31 (2)(l) of the EIA Regulations (GNR 543), and further to the assessment criteria presented above it is necessary to assess each potentially significant impact in terms of:

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

In addition, it is important that the public opinion and sentiment regarding a prospective development and consequent potential impacts is considered in the decision-making process.

In an effort to ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk 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 ER score based on the assumption that relevant suggested management/ mitigation impacts are implemented.

Table 54: Criteria for the determination of prioritisation

Public response (PR)	Low (1)	Issue not raised in public response.
	Medium (2)	Issue has received a meaningful and justifiable public response.
	High (3)	Issue has received an intense meaningful and justifiable public response.

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 Table 54. The impact priority is therefore determined as follows:

Priority = PR + CI + LR

The result is a priority score which ranges from 3 to 9 and a consequent PF ranging from 1 to 2 (refer to Table 55).

Table 55: Determination of prioritisation factor

Priority	Ranking	Prioritisation Factor
3	Low	1
4	Medium	1.17
5	Medium	1.33
6	Medium	1.5
7	Medium	1.67
8	Medium	1.83
9	High	2

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is to be able to increase the post mitigation environmental risk rating by a full ranking class, if all the priority attributes are high (i.e. if an impact comes out with a medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential, significant public response, and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance). The environmental significance rating is presented in Table 56.

Table 56: Environmental Significance Rating

Environmental Significance Rating	
Value	Description
≤ -20	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
> -20 ≤ -10	Medium negative (i.e. where the impact could influence the decision to develop in the area).
> -10 < 0	Low negative (i.e., where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0 <10	Low positive (i.e., where this impact would not have a direct influence on the decision to develop in the area).
≥ 10 < 20	Medium positive (i.e., where the impact could influence the decision to develop in the area).
≥ 20	High positive (i.e., where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered.

8.1.1 DESTRIPTION AND ASSESSMENT OF IMPACTS

The following potential impacts were identified and are summarised in Table 57 below:

Table 57: Potential Impacts of the Proposed Pipelines

IMPACT DESCRIPTION			**Pre-Mitigation**							**Post Mitigation**								**Priority Factor**			
Impact	Alternative	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
Loss and degradation of wetland habitat	Alternative 1	Construction	-1	2	4	3	3	4	-12	-1	1	2	3	2	3	-6	High	1	1	1,00	-6
Erosion	Alternative 1	Construction	-1	2	2	3	3	4	-10	-1	1	1	2	2	2	-3	Medium	1	1	1,00	-3
Introduction of alien plant species	Alternative 1	Construction	-1	3	5	3	4	4	-15	-1	1	2	3	2	2	-4	High	2	1	1,13	-4,5
Displacement of wetland flora and faunal community	Alternative 1	Construction	-1	3	4	3	4	4	-14	-1	2	2	3	2	2	-4,5	Low	2	1	1,13	-5,0625
Altering surface hydrology	Alternative 1	Construction	-1	3	5	3	3	4	-14	-1	1	5	2	3	3	-8,25	Medium	1	1	1,00	-8,25
Pollution or contamination of soil	Alternative 1	Construction	-1	3	3	3	3	4	-12	-1	2	1	2	2	2	-3,5	Medium	1	1	1,00	-3,5
Pollution of surface and ground water resulting in poor water quality	Alternative 1	Construction	-1	4	2	4	3	4	-13	-1	2	1	2	2	2	-3,5	Low	1	1	1,00	-3,5
Altering surface hydrology	Alternative 1	Operation	-1	3	5	3	3	4	-14	-1	2	5	1	2	2	-5	Medium	1	1	1,00	-5
Pollution or contamination of soil	Alternative 1	Operation	-1	3	3	3	3	4	-12	-1	2	1	1	2	2	-3	Low	1	1	1,00	-3
Pollution of surface and ground water resulting in poor water quality	Alternative 1	Operation	-1	4	2	4	4	3	-10,5	-1	2	2	1	2	2	-3,5	Low	1	1	1,00	-3,5

8.1.2 MITIGATION MEASURES FOR THE POTENTIAL IMPACTS

The following general mitigation measures are recommended as good practice to reduce the potential for exacerbated risks:

- The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly;
- It is deemed important that the wetland areas be demarcated as sensitive areas; and
- Laydown yards, camps or dumping of construction material should not be permitted within the sensitive zones.

Where the proposed pipeline intersects a sensitive area:

- Only the equipment and machinery necessary for the construction and erection of the pipeline should be allowed within the wetland boundary and should be parked sufficiently out of the boundary when not in use;
- If concrete pouring is necessary to stabilise the plinths, formwork should be used to prevent spillages into the wetland and should be removed from the wetland boundary timeously;
- The number of concrete plinths used to support the pipeline should be kept to a minimum within the wetland boundary;
- During construction activities, all rubble generated must be removed from the site;
- The first 300 mm of soil must be stockpiled separate from the soil excavated deeper than 300 mm;
- Construction vehicles and machinery must make use of existing access routes as much as possible, before adjacent areas are considered for access;
- All chemicals and toxicants to be used for the construction must be stored outside the channel system and in a bunded area;
- All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Adequate sanitary facilities and ablutions on the servitude must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- All removed soil and material must not be stockpiled within the wetland system. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds;
- Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil;
- Where possible, pockets of undisturbed indigenous vegetation should be maintained in close proximity to laydown areas etc. to promote establishment during the rehabilitation phase;

- Monitoring of the pipeline should be frequent to promote early detection of spills or leaks and prevent widespread impacts;
- Alien vegetation should be manually removed and disposed of appropriately during the construction and rehabilitation phases of the project;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported and collection of waste should occur frequently.

An additional monitoring borehole at the shaft should also be considered to confirm the findings of the groundwater report and to act as an early warning device.

9 WATER AND WASTE MANAGEMENT

9.1 ISSUES AND RESPONSES FROM THE PUBLIC PARTICIPATION CONSULTATION PROCESS

A Public Participation Process (PPP) will be undertaken for the Application. I&AP's will be provided opportunities throughout the process to provide comment and thereby participate in the PPP. I&AP's will be afforded an opportunity to review and comment on the draft IWWMP. The draft IWWMP will be made available to all registered I&AP for a period of 60 days from the 16th March 2023 until the 22nd May 2023. This section will be updated post the public review period to incorporate comments received from I&APs, if any.

9.2 WATER AND WASTE MANAGEMENT

The following sections describes water and waste aspects at the Kusasalethu Operation, as well as the related operational processes.

9.3 WATER AND WASTE MANAGEMENT PHILOSOPHY

The general principle of water management is the recognition that water is a scarce resource. This in turn leads to the other principles, such as water use minimisation (water conservation) or reuse of water and pollution prevention or the limitation of pollution of water.

Water that exceeds the quality, as set by DWS shall not be released from site, with the exception of emergency conditions, but it must be reused, thus reducing the quantity of intake of clean water. The Applicant will endeavour to:

- Continually seek ways to improve its performance in terms of consumption, and water related impacts;
- Reduce consumption of clean water;
- Implement pollution prevention at source;
- Maximise, recycling and reuse of dirty Stormwater and process water;
- Implementation of process water treatment to facilitate reuse; and
- Collect, contain dirty Stormwater and process water on site for preferential use as process water.
- The hierarchical management approach comprises the implementation of best practice measures to minimise water consumption and reduce impacts on water resources, by:
- Implementing measures to ensure compliance with relevant water and waste legislation and with other standards to which the organisation subscribes;

- Proactively identifying and implement actions that are required to achieve the water and waste related objectives;
- Implement these actions in an open and transparent manner;
- Implement on-going water and waste related monitoring to support legal compliance;
- Continually seeking ways to improve the performance of water and waste management systems, process and objectives; and
- Encourage open and transparent communication with regulatory authorities and other interested and affected parties within the context of the National Water Resource Strategy and Local Catchment Management Strategies.

9.3.1 WASTE MANAGEMENT OBJECTIVES

The Kusasalethu Operation will adhere to the following:

- Reduce the possible impact of waste generation by establishing effective control of all types of waste and the removal or disposal thereof in accordance with the applicable legislative requirements, as committed to in the EMPr, dated 2008, as well as in this IWWMP;
- Determine the composition and concentration of all waste disposed of on-site to determine hazard rating and classification, including mining waste; and
- Reduce the quantity of hazardous materials by maintaining the chemical consumption to a minimum.

9.3.1.1 **MINE WASTE (RESIDUE DISPOSAL)**

Mine waste will be limited to the refuse of the mining activities as well as the slimes produced during the metallurgical process. The tailings storage facility is operated by Fraser Alexander Tailings. Table 58 below indicates the residue from the metallurgical plant at peak production.

Table 58: Residue from Metallurgical Plant

Residue	Method of disposal	Volume
Slimes from process	Tailings Storage Facility	20 % of production
Course material from process	Disposed of at the Waste Rock Dump	45 % of production

9.3.1.2 **COARSE MATERIAL**

Mine residue that accumulates from the mining activities is larger course material. The course material is currently being disposed in a silo (Kusasalethu), which is located to the south of the Kusasalethu shaft operation. The quantity of course material that is disposed of in the silo stockpile is average of approx. 20,000 tons per month, which is then processed at the gold plant. No course material is disposed of at the Old Deelkraal WRD stockpile for this waste dump is not being used any more. The surface area of the Kusasalethu WRD stockpile is approximately 20 ha and the surface area of the Old Deelkraal waste dump stockpile is approximately 5 ha. However, the Old Deelkraal waste dump stockpile will be crushed for aggregates and, therefore, will be completely removed in future.

Berms and trenches are not constructed around the two WRD stockpiles (Kusasalethu and Deelkraal) and, therefore, Stormwater runoff is entering the dirty water management areas. The berms and trenches will be constructed to contain affected water within dirty water management area and prevent the siltation of surrounding watercourses.

The Deelkraal operational area also has a solid waste dump site that is used for the disposal of general waste. The solid waste dump site is located to the south-east of the Deelkraal TFS.

9.3.1.3 TAILINGS STORAGE FACILITY (KUSASALETHU)

After slimes fills, all plant residue is pumped to the TSF. The delivery pipeline to the TSF is open end discharge and the tipping area is controlled by manual operation of the discharge valves.

Kusasalethu has one TSF divided into two compartments. The operating details are given in Table 59. At present there is no removal of material from the TSF. Final treated pulp residue from Kusasalethu gold plant is pumped to either No.1 or No. 2 compartments depending on the maintenance and pumping schedules. The side walls are constructed by the conventional hand method and mechanical ploughing. The only deposit on the dam is gold plant final pulp residue.

Recovered water will subsequently be released to the RWD, and thereafter pumped to the metallurgical plant. The recovered water from the return water dam is supplying a portion of the water requirements of the metallurgical plant. Total waste disposal at the TSF would be in the order of 70,000 tons per month. The TSF total operational area is 75 ha. Jones and Wagener Consulting Civil Engineers (J&W) undertook a TSF Life Assessment Report to determine the required footprint and final height of the TSF for the LoM to 2037. It was established that should the footprint of the TSF be unable to increase upslope of the hillside, The rate of rise (RoR) will be 2.85 m per year, which is above the 2 m per year limitation and cannot be supported. Should the RoR be limited to 2 m per year, the TSF will reach capacity in 2030, which will not sustain the Kusasalethu Operations for the LoM. Due to this, it is proposed that the TSF footprint be expanded upslope of the hillside to approximately 121.03 ha. The expansion of the footprint will reduce the RoR to 1.85 m per year which is sustainable and within recommended guidelines. A Section 102 Amendment application has been submitted to the DMRE in 2014 to amend the dimensions of the TSF.

The new proposed dimensions of the TSF will be 121.03 ha in size and have a maximum height of 74 m and 98.3 m for the upper and lower compartments respectively. Following the decommissioning of the TSF once it has reached capacity, the TSF will be capped with a clay layer and subsequently a layer of topsoil. The surface will be vegetated by appointed contractors who will ensure the stability of the TSF.

Berms and trenches are constructed around the TSF so as to prevent Stormwater runoff from entering the affected water management area. Decanting and seepage from the TSF is also collected within toe paddocks where evaporation will take place. The TSF is not fenced of so as to prevent unauthorised access to the TSF.

Table 59: Tailings Storage Facility Operating Details

	Compartment 1	Compartment 2
Number of piezometers	17	15
Piezometers above critical	None	None
Statuary freeboard requirement (m)	2.00	1.64
Minimum freeboard recorded in last year	2.41	2.16
Maximum side slope	47.5m	60m
Min factor of safety	1.52	1.47
Current area	+/-50 hectares	+/- 62 hectares
Average tpm	32481	46061

Average rate of rise (m/yr)	1.8	2.11
Area (excluding day wall)	31.3 ha	34.56 ha
Rate of rise (survey actual)	1.67	1.68
Average slurry density	1.29	1.3

The existing TSF of Deelkraal is non-operational and is currently maintained by a contractor to ensure its physical integrity.

9.3.1.4 TAILINGS STORAGE FACILITY REVEGETATION

The surfaces of all the TSF will be vegetated on mine closure or during sequential closure of the facility during the period of declining slimes production. All vegetation of the TSF on closure will be done by appointed contractors who will ensure complete stability of the dams.

9.3.2 WASTE ROCK DUMPS

There is one WRD at the Kusasalethu Operation. In 2014, the mine submitted a Section 102 Amendment to the DMRE to incorporate the maximum dimensions of the WRD, as it currently stands, for the Department's record. The WRD is currently at its maximum size and the mine intends to inform the DMRE of the current dimensions. At no point will the WRD increase in size as it has reached capacity. Stone and Allied Industries (Pty) Ltd. (Stone and Allied) will reclaim the WRD to supply the local aggregate market. The reclamation of the WRD will enable the mine to redeposit waste rock in the future if there will be a need to do so, if required, as well as removing a source of pollution and uplifting the local community through business opportunities

Kusasalethu Mine intends to incorporate the reclamation of waste rock (Kusasalethu WRD and Deelkraal WRD) for aggregate into its Mining Right. The WRD will be reclaimed using dozers and loaders and the aggregate will be crushed and utilised for sale into the local aggregate market. The WRD contains some low-grade reef. The waste rock from underground was originally routed onto the above WRD via a conveyor system and distributed by a spreader. During the reclamation of rock, the dust is suppressed by means of water sprays. As the rock is moist when deposited, there is no dust problem during deposition.

Current waste from underground passes through a washing plant from where the fines are returned to the gold plant and the coarse fractions are re-routed via the Stone Allied (Pty) Ltd. plant to the WRD.

If economically viable the waste rock dump is to be processed through the respective plants on depletion of the respective mine underground resources. The WRD will require major modification to the access of the dump for reclamation purposes and it is unlikely that this will be considered prior to underground mine closure.

There is no operational waste rock dump at the Deelkraal Operation. The Deelkraal waste rock dump has been partially reclaimed and the plan is to totally reclaim the dump and clear the footprint as part of the mine's rehabilitation strategy.

9.3.3 DOMESTIC WASTEWATER MANAGEMENT

The effluent from the Kusasalethu Operation (including the village, plant, the shaft and hostels) is pumped to the Kusasalethu sewage treatment plant, located to the south of the Kusasalethu plant on the farm Buffelsdoorn 143 IQ. All sewage sludge and screenings from the Kusasalethu sewage treatment plant is disposed of as hazardous waste. The mine will follow the "Integrated Waste Management Programme Procedure". The Kusasalethu sewage treatment plant receives an average quantity of ±88 324 m³ of raw sewage per annum, prior to be treated and used for irrigation at the golf course. In future it is proposed that the mine will re-use the treated sewage effluent within the plant operations, and therefore less water consumption from Rand Water Board.

The Kusasalethu Operation implements a water quality and quantity monitoring programme for the Kusasalethu sewage treatment plant. The Kusasalethu Operation will also conduct a risk assessment to determine the impact of such water release onto the neighbouring community. This information will be made available within reports and stored within the mine's environmental database. If sewage effluent quality is not in accordance with the wastewater limits values, the necessary management measures (quality management) will need to be implemented prior to treated sewage discharge.

The Deelkraal sewage treatment plant was sold to Morgan Creek (owner) and is, therefore, not the responsibility of Kusasalethu operation. The sewage effluent from Deelkraal offices, village and hostels are pumped to the Deelkraal sewage treatment plant, located to the south of the Village and hostel on the farm Deelkraal 142 IQ.

Table 60: Sewage Treatment Plant at Kusasalethu Operation

Sewage Facilities	Co-ordinates	Total volumes received per annum
Sewage Treatment Plant (Kusasalethu Operation)	S 26o 27'36.23" E 27o 21'40.48"	±88 324 m³

The following management measures are adhered to by the Kusasalethu Operations:

- Prevent surface water pollution due to spillage, seepage and/or discharge of untreated or insufficiently treated domestic wastewater from the domestic wastewater systems;
- Prevent the leakage of untreated domestic wastewater from the containment systems by ensuring the reliability of the system through regular inspection and maintenance;
- Implement a maintenance programme for all sewage and grey water conveyance systems which include pipelines and treatment plants;
- Review the operational/contract conditions as set out with the contractor currently responsible for the STP, and perform regular inspections on the sewage conveyance systems to confirm correct operation;
- Kusasalethu sewage treatment plant and Deelkraal sewage treatment plant – verify if the STP is operational and if an upgrade of this system is required, and
- Undertake clean-up and rehabilitation at contaminated areas due to sewage spillages. Sewage spills will be cleaned-up by removing any excess sewerage, where practicably possible with suction into a holding tank, or with long handled shovels into a watertight container.

9.4 STRATEGIES

The primary objective of the Kusasalethu Operations water management strategy is to recycle as much water as possible, to minimise losses as far as possible, to prevent spillage and wastage of water and to minimise the volumes of raw water intake.

The water management system is based on the principles of pollution prevention, management of affected water at source, optimal re-use/recycling of affected water as well as zero discharge of affected water to the natural surface water environment.

9.4.1 POLLUTED WATER MANAGEMENT

No discharges from the dirty water management system to natural water resources/the environment will take place in future without an approved WUL.

Some of the affected Stormwater runoff within the demarcated dirty water management system will be captured within the affected water facilities (RWDs) to be re-used within the process.

A full review will be done on the current Stormwater/affected water management of the Kusasalethu and Deelkraal mining area. A comprehensive surface water monitoring and data interpretation programme will support such identification. Areas with potential risk to Stormwater/external Stormwater environmental pollution will be identified, and measures of affected water containment identified. Areas of specific focus include:

- Waste rock dump disposal sites;
- Deelkraal domestic waste disposal site;
- Two emergency dams/spillage ponds;
- Return water dams;
- The tailings storage facilities;
- Poor maintenance of all water conveyance structures; and
- Sewage treatment plants.

9.4.2 RECYCLING OF POLLUTED WATER

It will be considered essential that affected water in surface water holding structures (TSF, RWD and the two emergency dams/spillage ponds (in future possibly the sewage treatment plant) be optimally re-used for process water make-up.

A drain maintenance programme has been implemented, which identifies all critical water conveyance, treatment (e.g., separators) and storage facilities. The drain maintenance programme will ensure regular inspections, maintenance and clean-out of drainage systems.

Specific areas of unauthorised releases, e.g., from the mine Stormwater drain, sewage treatment plants, the return water dams and seepage from the TFS pose a high risk to the environment. The mine will inform the DWS of such release (in accordance with Section 20 of the NWA) and all dirty water storage facilities and the IWULA.

9.4.3 WATER MANAGEMENT PROJECTS

To minimise the mine's impact on water and as part of the mine's commitment to continual improvement, the Kusasalethu Operations have initiated several projects. A summary of these is provided below and has been divided into the DWS hierarchy of water management.

9.4.3.1 **POLLUTION PREVENTION**

Several water management measures aimed at preventing the contamination of clean water with mine affected water are implemented by the mine. These include the following:

- The separation of clean and affected water through diversion canals and an affected water management system that collects affected runoff from dirty management areas and draining towards the process water storage facilities (i.e., TSF, RWD and two emergency storage dam/spillage ponds). Affected water is then re-used in the Process Plant as process water;
- The affected runoff from the Kusasalethu waste rock dump stockpile is contained and managed, through the berms, diversion canals and an affected water management system that collects affected runoff and drains affected runoff towards the affected water storage facilities of Kusasalethu Operation. All affected Stormwater from the Kusasalethu waste rock dump drain to the existing return water dam;

- The Deelkraal WRD stockpile is currently being reworked and course material is taken to the Kusasalethu plant. Affected Stormwater from the Deelkraal waste rock dump stockpile is contained within the Deelkraal Village dam;
- Minimisation of affected water management areas and the separation of clean and affected water management areas; and
- Minimising the intake of potable water from the Rand Water Board for process application at the metallurgical plant and as make-up water for underground activities (drilling and chilling). This minimises the potential volume of potable water that will be polluted during the process.

9.4.3.2 WATER RE-USE AND RECLAMATION

Affected water from affected water management areas is contained in the mine's dirty water management system and re-used optimally to limit the risk of spillage to the environment, and the latest policy of the DWS, as contained in the relevant draft Best Practice Guideline, will be reflected in the annual review of the water re-use and reclamation strategies.

9.4.3.3 TREATMENT

Treatment of process water is currently taking place at a smaller scale, where water is being conditioned to suit running of mining equipment, in future the mine will consider treatment of process water for use in domestic activities or discharge to recharge resource closer by.

9.5 PERFORMANCE OBJECTIVES/GOALS

Harmony Gold has a Health and Safety Policy, as well as an Environmental Policy in place, which outlines the mine's commitment towards environmental management and which provides the framework for all environmental activities on the mine. The policy is aimed at achieving excellence and ensuring continual improvement in the mine's endeavour to create a sustainable environment. There is a continual process of reviewing to assess the impacts of the mine's activities on the environment. The performance objectives are summarised in Table 61 below.

Table 61: Performance Objectives

Item	Performance Objective
Process water	• To monitor required water quality standard; • To re-use and recycle process water; • To update the water balance as per WUL requirements in terms of applicability, changes in mine planning, evaluation of new projects, evaluation of Closure strategies, changes in mine water management, availability of new technology and changes in regulatory and legislative requirements; • To use the water balance on a frequent basis to assess the quantity, quality and source of all water at the mine. • The water balance will be used to focus on key performance areas and to achieve the desired targets, such as (DWA, 2004): • To audit water usage from various source areas; • To identify areas of high water consumption and wastage; • To identify and quantify imbalances; • To locate and quantify sources of seepage and leakage; • To identify and quantify pollution sources; • To assist with the design and verification of storage requirements and minimising the risk of spillage; • To assist in decision-making; and

Item	Performance Objective
	• To use the water balance as a tool in long-term water and waste management strategies.
Groundwater	• To prevent deterioration of ground water quality; • To prevent aquifer contamination; • To rehabilitate the disturbed land use areas to meet the anticipated end of life land capability requirements as committed to in the EMPr, dated 2009; • To commence with the implementation of the necessary rehabilitation measures to ensure the restoration of biodiversity to self-sustainable levels on all disturbed land use areas available for rehabilitation during the Operational Phase; • To ensure that the water management system will be continually improved aiming at the objective to achieve a policy of zero discharge of water containing waste; • To investigate and quantify the residual impacts associated with the mining and related activities so as to ensure the identification, investigation and implementation of suitable mitigation and management strategies; • To minimise water pollution by working on the principle of no release of dirty water (being affected runoff or seepage) to any area other than the dirty water management system; • To monitor, maintain and constantly aim at improving water re-use and conservation measures to reduce the volume of raw water needed for consumption; • To monitor infiltration into groundwater from surface pollution sources, by monitoring current levels of groundwater in relevant boreholes monthly as well as the quality in the relevant boreholes on a quarterly basis; • To contain contaminated water in the affected water storage facilities and maintain the water level in these facilities below the legal requirement to cater for a 1:50 year storm event as well as to provide for a 0.8 m freeboard (refer to Regulations GN 704, dated June 1999, under the NWA, 1998) by optimisation of the re-using of the dirty water; • To investigate and implement measures to limit excessive infiltration of affected water from the dirty water management system to the groundwater; • To rehabilitate areas of spillage and place systems so as to prevent re- occurrence of spillage; • To investigate and implement measures to limit hydrocarbon spillages at all workshop areas; and • To ensure the rehabilitation strategy complies with the requirements of Regulation R.527, dated April 2004, and the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002).
Storm/surface water	• To ensure clean and dirty water separation; • To isolate and minimise the size of the dirty water management areas from which affected runoff water will be retained; • To ensure diversion of clean Stormwater runoff around the mine area; • To ensure the collection and containment of contaminated water; • To prevent the discharge of affected water to the environment; • To ensure that the containment facilities' capacities comply with legislative requirements, specifically referring to Regulations GN 704, dated 1999, or apply for Exemption where compliance are not feasible; • To ensure that the Stormwater management will take aspects such as the life cycle of the mine, the different hydrological cycles, principles of risk management and local hydrology of the catchment into account;

Item	Performance Objective
	• To ensure that rehabilitated areas are given raised contours in order to direct Stormwater into the Stormwater management system, and to limit ponding; and • To ensure that the latest policy of the DWS, as contained in the relevant Best Practice Guideline, will be reflected in the Stormwater Management Plan, as well as the Stormwater management measures implemented on-site in future. • The Kusasalethu Operation will investigate and assess the need for the following Stormwater management measures: • To ensure that the principle of keeping clean and dirty water separate will be applied by the Kusasalethu Operations at all water use activities (e.g., TSF, RWD, two emergency storage dams/spillage ponds); • To ensure that the mine will prevent affected water from the TSF, the RWD from entering the surrounding environment by means of seepage or overflow; • To ensure clean Stormwater cut off berms to prevent clean water runoff from entering the dirty water management areas; and • To maintain Stormwater diversion berms to minimise the size of dirty water management areas and to increase clean and dirty water separation. • As part of the strive for continual improvement of the Stormwater management practices, the following additional measures/strategies will be investigated for implementation: • To ensure that the sufficiency of the Stormwater management measures associated with the TSF in terms of a long-term/closure water management strategy will be assessed by a suitably qualified person; • To ensure that a suitably qualified person will be used to assess whether any additional clean water diversions are possible and necessary; and • To ensure that the effective training of employees and clarification of their roles and responsibilities in terms of the stormwater component of the IWWMP is the key to the success or failure of the plan and should be appropriately developed for implementation.
Waste	• To ensure proper legal disposal of waste at registered sites; • To minimize waste generation; • To re-use or recycle if possible; and • To ensure proper storage before disposal to prevent pollution of environment.

9.6 MEASURES TO ACHIEVE AND SUSTAIN PERFORMANCE OBJECTIVES

The IWWMP action plan identifies measures to achieve the water and waste related objectives. Refer to Section 9.11 below.

9.7 INTEGRATED WATER AND WASTE MANAGEMENT ACTION PLAN

There are various relevant acts and principles governing water and waste management, namely: NEMA, NWA, NEM:WA as well as BPG prescribed by the DWS. The subsections below provide an overview of the project specific water and waste management plan. Refer to Section 9.11 for the integrated water and waste management action plan.

9.8 WATER AND WASTE MANAGEMENT PHILOSOPHY

All the relevant principles contained in DWS's BPG will be utilised for all designs and management practises. The mine will also ensure compliance with GN 704 of the NWA.

9.8.1 WATER MANAGEMENT

Harmony recognises water as a vital environmental resource. The general principle of water management is the recognition that water is a scarce resource. Water and waste management systems have been introduced at the Kusasalethu Operations to ensure that potential pollution of the water resources will be minimised.

Harmony should endeavour to ensure the sustainability of the water resources by:

- Minimising the impact of its operations on the quantity and quality of water resources within the sphere of influence of those operations;
- Recognising the rights of beneficial use of water within the sphere of influence, both during and after cessation of those operations;
- Continuously seeking ways to improve their performance in terms of consumption, efficiency, discharge reduction and other water related impacts;
- Leaving the water resources in a state capable of supporting a sustainable post- closure land use, after cessation Ixia's operations;
- Water Policy Principles:

In pursuit of its water policy objectives, Harmony will endeavour to implement a hierarchical management approach which will strive to:

- Reduce consumption and contamination of water at source;
- Maximise recycling and reuse;
- Treat water to render it useable; and
- Storage and disposal.
- Comply with relevant water legislation and with other standards to which the organisation subscribes;
- Proactively identify and implement actions that are required to achieve the policy objectives;
- Implement these actions in an open and transparent manner;
- Follow a knowledge-based approach based on a thorough understanding of the relationship between Harmony's activities and its effect on the water resource;
- Integrate water consumption and water quality objectives into line management responsibilities;
- Monitor and timeously report to all interested and affected parties on performance in relation to measurable water consumption and quality objectives;
- Periodically review and audit the performance of water management systems, processes and objectives; and
- Form partnerships with regulatory authorities and other interested and affected parties within the context of the National Water Strategy and Local Catchment Management Strategy.

9.8.2 WASTE MANAGEMENT

The waste management philosophy is the core strategy of waste prevention, minimization, reuse, recycling, energy recovery and final disposal. This is firmly established as a driving principle nationally and globally.

According to NEM:WA, the following measures should be implemented:

- Avoid the generation of waste and where such generation cannot be avoided to minimise the toxicity and amounts of waste that are generated;
- Reduce, re-use, recycle and recover waste;
- Where it must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
- 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;
- Prevent any employee or any person under his or her supervision from contravening the Act (NEM:WA); and
- Prevent the waste from being used for an unauthorised purpose.

9.9 STRATEGIES

These strategies are structured into a hierarchical management approach to ensure effective implementation. The hierarchical management approach comprises the implementation of best affordable technology as a minimum to minimise water consumption and reduce impacts on the water environment. The strategies are equally applicable to the management of process and service water, Stormwater, surface water, groundwater and waste. A summary of the Harmony's Mine's strategies relating to water is presented in Table 62.

Table 62: Summary of the Harmony Operations Water and Waste Management Strategy

Key Aspect	Description of the strategy
Water Consumption	Integrate water consumption and water quality objectives in line with management responsibilities; Reduce consumption and contamination of water at source; and Maximise recycling and reuse of service and process water where practical possible.
Surface and groundwater resources	Minimising the impacts of Harmony's Mine's operations on the quantity and quality of water resources within the sphere of influence of those operations; Recognising the rights of beneficial use of water within the sphere of influence, both during and after cessation of the operations at the Harmony Mine; Continuously seeking ways to improve the Harmony Mine's performance in terms of consumption, efficiency, discharge reduction and other water related impacts; and Leaving the water resources in a state capable of supporting a sustainable post-closure land use, after cessation of the Harmony Mine Operations.
Water balance and Salt balance	Implement a hierarchical management approach which will strive to: Reduce consumption and contamination of water at source; Maximise recycling and reuse; Treat water to render it useable; and Storage and disposal.

Key Aspect	Description of the strategy
Stormwater management	The necessary mitigation measures will be implemented to comply with GN R704 or where this is not possible the necessary exemption has been applied for; Optimisation of clean and dirty water systems; Good housekeeping measures will be implemented to prevent unnecessary spillages and storage of waste which will result in the contamination of Stormwater; Scheduling of all Stormwater infrastructure on preventative maintenance; and Implementation of a Stormwater management plan.
Waste management	Implement a hierarchical management approach which will strive to: Reduce waste as far as practical possible; Separate waste into different streams which will allow for recycling and reuse of waste materials; Recycle and reuse waste; Dispose of waste which cannot be used or recycled; and Dispose of hazardous waste to an appropriate licenced facility.

9.10 KEY PERFORMANCE AREAS AN INDICATORS

The overall objective is the prevention or minimisation of potential impacts on the surrounding water resources, as a result of activities, by actively practicing adequate water management programmes. To ensure this, key performance areas and indicators have been established as detailed in Table 63 below.

Table 63: Key Performance Indicators

Key Performance Area	Objective	Indicator
Legislation		
Compliance with the waste and water legislation	To ensure that the project activities comply with: NEM:WA NWA; GN 704; and Conditions of the WUL.	Compliance audits must be undertaken annually to determine compliance to the applicable legislation.
Surface Water		
Process water	Ensure that process water is used optimally.	Monitor all process volumes to inform the water balance. Optimise the re-use of contaminated water into the mining process.
Stormwater	To ensure the separation of clean and dirty Stormwater throughout the operational area.	Separation of clean and dirty water in the operational area where relevant, which is measurable against GN R704 requirements. Prevent the leaking of clean Stormwater into the dirty water systems. All leaks should be addressed as a matter of urgency. No spillages from the in-pit sump, Pollution Control Dam (PCD) or any Stormwater management structures.
Erosion	To prevent erosion at the rehabilitated areas.	Monitor erosion gullies to ensure that they are filled. Monitor vegetation establishment of the rehabilitated areas.
Water and Salt balance	To maintain the zero- discharge water balance and reduce risk of uncontrolled spillages into the natural environment with adequate Stormwater management measures.	Monitor all necessary flow parameters to calibrate the water balance; and Update water balance annually.
Surface water quality	To ensure that contamination of the surface water resources of the	Conduct monthly surface water quality inspections and monitoring.

Key Performance Area	Objective	Indicator
	catchment is prevented, minimised or mitigated as far as possible.	
Siltation of all silt traps and PCD	To ensure sufficient storage capacity is available within the PCD and silt traps by regularly removing silt and ensure the PCD and silt traps are able to contain the runoff during storm events.	Ensure PCD and silt traps are maintained and cleaned regularly to prevent siltation of the dams/silt traps. This should be done during the dry season.
Catchment yield	Keep footprint as small as possible and divert clean water away from dirty water areas.	To maintain the clean and dirty water systems to ensure that clean water is released to the catchment and to contain the contaminated footprint of the facility to the smallest possible area. Rehabilitation of disturbed areas as soon as possible.
Groundwater		
Dewatering	To prevent significant drawdowns to surrounding farms and nearby watercourses as a result of dewatering activities.	Conduct regular groundwater levels monitoring. Establish compensation measure in the event that an impact is confirmed through monitoring.
Groundwater contamination	To prevent the contamination of the groundwater environment.	Monitor groundwater quality around the potential pollution sources for changes in the water quality. Monthly site inspections should be undertaken to identify any potential contamination sources such as runoff from dirty water areas. Monitor groundwater levels and quality for changes in groundwater that is available to downstream water users and to the nearby surface water sources. Update the numerical model every five years to monitor the pollution plume and potential draw down from the dewatering process
Aquatics		
Present Ecological Status	Maintain and where possible improve the current ecological status of the river reaches.	The control of contaminated surface and groundwater will allow for the maintenance of the downstream ecological structures.

Key Performance Area	Objective	Indicator
		Bi-annual aquatic biomonitoring must be conducted to ensure that temporary pollution events and diffuse pollutants not included in the surface water assessments are not negatively affecting the condition of the river downstream of the project.
Waste Management		
Waste Management	To implement the hierarchy of waste management: Prevent; Reuse; Recycle; and Dispose of (last resort).	Measure and record waste generated, disposed and recycled. Maintain waste disposal certificates for record purposes. Comply to applicable norms and standard for waste.
	Prevention of pollution due to the storage and/or management of waste on site.	Separate clean and dirty Stormwater. Contain any dirty water originating on the site.
Communication with external parties		
Stakeholder Engagement	To ensure effective and transparent communication with stakeholders	Implement a grievance mechanism to address any concerns raised by the public. Attend water forums. Communicate project progress and determined closure objectives at regular intervals (at least every quarter) with all stakeholders and surrounding communities.

9.11 INTEGRATED WATER AND WASTE MANAGEMENT ACTION PLAN

The water and waste action plan applicable to the operation is detailed in Table 64 below.

Table 64: Integrated Water and Waste Management Action Plan

Infrastructure area	Specific Goals	Management Plan	Responsibility
Roads, Railways and Pipelines	• All the roads, railways, pipelines and powerlines may be required to service the residential communities. • After mine closure, the services not required to sustain the residential communities (e.g., villages) will be removed.	• The redundant infrastructure services will be removed as soon as the various mining sections they serve close.	• The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Sewage Treatment Plant	• The sewage works forms part of the infrastructure servicing the residential community. • Upon mine closure, the ownership of the sewage works will be transferred from the mine to the responsible municipality when the residential areas are proclaimed.	• The sewage works and their surrounds will be maintained in good working order until the transfer of ownership.	• The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Decommissioning of Mineral Processing Plant	• To remove all gold plant buildings, associated structures and any debris arising from the demolition, or removal, from the gold plants in the most cost-effective manner. In addition, to ensure that in the removal of the materials the effect on the environment is minimised, and rehabilitated areas are sustainable into the future.	• During the decline of the plant tonnages all non-operational structures and associated infrastructure will be demolished. • The debris is to be reprocessed through the plant and all steel structures to be washed before removal for sale. (Any associated offices that have been declared for sale are to be inspected and cleared of any possible mineral concentrates). • All non-operational roads will be graded and the debris processed through the plants. • Operating units will be dismantled as the tonnages declines and will be washed or processed. • All equipment that cannot be reprocessed through the plant (electrical motors, etc.) will be disposed of. • All concrete foundations and contaminated underlying soil will be managed in terms of the closure plan. • On the removal of all buildings and plant infrastructures, the surface will be rehabilitated to a pre-determined standard as agreed to by the various stakeholders. A rehabilitation programme, as part of the closure plan, is to be implemented to ensure that the area is completely rehabilitated.	• The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Workshops, Administration and other Buildings	• There is a possibility that these buildings will not be demolished but disposed of or transferred to a third party in line with the SLP.	• The ownership of this infrastructure will be transferred from the mine to the responsible municipality or other third party when the areas are proclaimed.	• The party responsible for removal of infrastructure and implementation of management actions will be determined during the closure plan development.
Housing, Recreation and other Buildings	• The mine villages will be proclaimed as townships. The housing, recreation and other buildings will form part of this township.	• Application to have Kusasalethu village a proclaimed township will be made. • The hostels will be sold to a developer to develop as flat accommodation within the Kusasalethu Township.	• The manager engineering is responsible for the proclamation of the townships. • The townships will be sold to a third party.
Mine Residue Deposits			
Disposal Facilities (Pipes, Solution Trenches, Return Water Dams etc.)	• To ensure that all the TSF's are removed, and any remaining facilities are converted to a permanent topographical feature with no adverse environmental impacts and have low maintenance costs. All dams will be maintained until final closure.	• The toe trenches and outlets to the filter drains will remain open to allow free flow of solution out of the dams. The outer slopes of the trenches are to be flattened to about 1:3 and the trenches grassed and vegetated. This is to prevent any collapse along the slopes. Any trenches that may constitute a hazard will be fenced off and signposted. • Catchment paddocks and surrounding areas will be cleaned out and their walls raised if necessary to contain any solids from the dam within their boundaries. • The penstocks on the dams will be blocked with concrete plugs of safely sealed, and the catwalks to and from theses penstocks will be removed. • Any associated pipework shall also be removed.	• The plant manager and appointed contractor's personnel shall be responsible for the complete rehabilitation of the Tailings dams. • Personnel training and financial actions. • The plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructure. He will be responsible for the provision of funds until the closure of mine, thereafter funds will be made available from and environmental trust fund.

Infrastructure area	Specific Goals	Management Plan	Responsibility
		• The return water dams will be retained as natural water run-off retention dams with adequately designed spillways to safely discharge excessive storms. • The access roads will remain open to allow access for maintenance and inspections. Any roads that do not require usage will be ploughed and vegetated. • The pump station buildings will be stripped and all pumps and associated equipment removed, once these facilities are no longer of use to the rehabilitation programme. All overland pipelines and plinth will be removed. • All the fences and access gates around the dam will remain and be adequately signposted.	
Ongoing Seepage, Control of Rainwater	• On mine closure the Tailings dams will be rehabilitated to prevent any harmful seepage or dam run-off that could have an adverse environmental impact.	• All water dams will be retained to control the run-off of any water caused by rainstorms. • Toe trenches will also stay open to allow the flow of seepage from the dams. • The fate of any water will be determined by the quality and if suitable will be allowed to enter the existing water and boundary dams. • The establishment of vegetation will result in evapotranspiration of most (65%-85%) of rainfall, reducing the groundwater pollution potential, plus the introduction of hydrophilic trees to ameliorate groundwater pollution. • The catchment paddocks capacities will be confirmed and reconstructed to contain a 1:100-year 24 hour duration flood.	• The gold plant manager will be responsible for the complete rehabilitation of the tailings dams. • The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructure. He will be responsible for the provision of funds until the closure of the mine, thereafter the funds will be made available from an environmental trust fund created for environmental rehabilitation.
Long-term Stability	• The gold plant manager will ensure that the stability of the dams will be maintained after mine closure.	• Long term stability of the dams will be achieved with the vegetation of the side slopes and surface area by grassing or vegetating.	• The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructures. He will be responsible for the provision of funds until the closure of the mine, thereafter funds will be made available from and environmental trust fund created for environmental rehabilitation.
Final Rehabilitation with Respect to Erosion and Dust Control: Tailings dams	• To ensure that the tailings dams and infrastructures are rehabilitated in a way that no dust can be allowed into the atmosphere and that no erosion may occur on the dam walls to be of any damaging effect to the environment.	• Final rehabilitation would be done by the stabilising of the dam by vegetation (grassing). The surface areas would be allowed to dry for access by agricultural equipment for vegetation of the areas. The top will be divided into a number of small paddocks. These paddocks will prevent the movement of water, reducing the possibility of erosion. • The surface would be seeded and irrigated. Similar paddocking would be done on any un-stabilised or exposed levels. • The planting of hydrophilic trees is to be introduced around the dams and paddocks to ameliorate groundwater pollution and act as wind breaks preventing dust dissemination.	• The gold plant manager will ensure his appointed personnel are trained in the rehabilitation of Tailings dams and associated infrastructures to prevent any dissemination of dust or possible erosion. He will ensure there are sufficient funds made available during the mines operation. An environmental trust fund will be made available after mine closure for further rehabilitation.
Final Rehabilitation with Respect to Erosion and Dust Control: Waste Rock Dumps	• All rock dumps will be reprocessed prior to final closure of the mine if economically viable. However, should re-treatment of the dumps prove to be inappropriate a revised management plan will be developed approximately 5 years prior to mine closure. • Maintain plant production by the re-treatment of the waste rock dump as the underground mining activities are reduced/cease. • Preparation of the rock dump site area for the rehabilitation on the complete removal of all gold bearing ore, sand, soil and material.	• Preparation of the area to begin with the removal of the underlying surface to depth of 2m to ensure the complete removal of all economic gold bearing material followed by covering the excavated site with topsoil for revegetation. • Rehabilitation of the entire area to be achieved by the reintroduction of natural flora that was removed/damaged during the construction phase of the waste rock dump. • In conjunction with the DWS ensure a complete rehabilitation phase has taken place and the area returned to a self-perpetuating ecosystem.	• Reclamation and production of the waste rock dump to fall under the authority of the gold plant manager. • The manager metallurgy will be responsible for all metallurgical environmental issues who will appoint designated personnel to ensure complete rehabilitation of the metallurgical plant areas on closure.

Infrastructure area	Specific Goals	Management Plan	Responsibility
	• Rehabilitation of the area by grassing and planting local flora. • Maintenance and monitoring of the area until self-sustaining.		
Revise the Water Monitoring Programme			
Groundwater monitoring	• The expansion of the groundwater monitoring network in 2017 provided valuable information and these boreholes should be included in the routine groundwater monitoring programme.	• Several of the existing monitoring boreholes are dry/blocked. These boreholes are important to the overall monitoring of the aquifers and the cleaning, deepening or replacing of the boreholes should be considered.	• The Environmental Officer together with the mine manager are responsible for ensuring that the groundwater monitoring programme is adequate and in line with the WUL and should ensure that the monitoring boreholes are cleaned, deepened or replaced within 8 months.
Stormwater Management and Water Management Infrastructure			
Management of Stormwater and water management infrastructure.	• The maintenance programme of Stormwater and water management infrastructure should be improved.	• Increase the frequency of inspections and the subsequent maintenance of infrastructure. • Note cracks and damage observed in these maintenance inspections and make provision for rectification during maintenance times. • Certainty should be gained on whether the entire Stormwater system can handle a 1:50 year flood. • Remove vegetation found in the various systems on a regular basis and the inspection thereof included into the regular maintenance programme. • Remove all obstructions and litter from Stormwater systems to ensure the unimpeded flow of water through these systems. • As per GNR 704: prevent water containing waste or any substance which causes or is likely to cause pollution of a water resource from entering any water resource, either by natural flow or by seepage, and must retain or collect such substance or water containing waste for use, re-use, evaporation or for purification and disposal in terms of the Act. • Maintenance all water and Stormwater infrastructure should be improved. The frequency of inspections should be improved.	• The Environmental Officer together with the mine manager are responsible for ensuring that the maintenance programme of Stormwater and water management infrastructure is improved.
Sealing of Underground Workings and Rehabilitation of Dangerous Excavations			
Shafts	• All the shafts will be capped in accordance with the DMR requirements	• A concrete cap will cover the open shaft	• The mine managers are responsible for the shaft capping. This capping will form part of the mine manager's closure plan.
Submission of Information after Decommissioning up to Closure	• Relevant data and information as identified during the compilation of the decommissioning and closure plan will be submitted to the relevant authority at agreed intervals.	• Compilation of the relevant data and information identified during the compilation of the decommissioning and closure plan.	• The mine manager is responsible for the compilation and submission of the data to the relevant authority as per the agreed intervals.
Maintenance			
Maintenance of rehabilitated areas	• All rehabilitated land, tailings dams and infrastructures will be maintained as described in the previous sections for a period of three years after operations in that particular area have ceased	• For each facility, the maintenance on vegetation will be maintained for 18 months after germination. • Once rehabilitation has been completed, a three-year period will be allowed to ensure that this vegetation is self-sustaining. • If so, a partial closure certificate will be applied for. • If not, a contingency sum will be allowed for in the trust fund to bring the vegetation to this self-sustaining level.	• The mine manager is responsible for the maintenance of rehabilitated areas.

9.12 CONTROL AND MONITORING

9.13 AUDIT AND REPORTING ON PERFORMANCE MEASURES

The mine is committed to continual improvement and prevention of pollution. This is demonstrated by constant maintenance and implementation of ISO 14001 system its applicable procedures. The applicant undertakes annual EMP audit performance assessments. The last EMP Performance Assessment was conducted in August 2016.

9.14 AUDIT AND REPORTING ON RELEVANCE OF THE IWWMP ACTION PLAN

An external IWUL Compliance Audit was conducted in 2015 in accordance with the conditions laid out in the IWUL and the provisions of the NWA, specifically in fulfilment of IWUL Appendix V, Condition 11. A copy of the IWUL audit is attached in Appendix A.

The main findings of the WUL audit report were the following:

- Storing Water: The Kusasalethu Operations is exceeding the allowable storage limits at both the East and West Reservoirs. It was recommended that Harmony re-evaluate the volumes received from the Water Board. An IWUL Amendment Application should be submitted with accurate water consumption and storage figures (Appendix III, Condition 1.1);

- Discharging of Waste: The mine reported that it has not been involved in an initiative such as Direct Estimation of Ecological Effect Potential (DEEEP). It was further reported that only biomonitoring is occurring; this monitoring includes hydrochemistry but not toxicity testing. It is recommended that the mine should develop and implement toxicity testing, and investigate and involve mine representatives in initiatives such as DEEEP (or similar) (Appendix V, Condition 2.6); and

- Disposing of waste: The IWUL requires quality testing of waste streams enter wastewater facilities. The mine reported that a waste classification was completed on the sewage sludge but that sampling of the wastewater streams entering the storage facilities is not completed (as it is not practical) but conduct sampling in the RWDs. The mine should submit an IWUL Amendment Application to DWS regarding the waste quality sampling as this is not possible, and request that if sampling is to be completed in the waste water facilities that the 'range' referred to be provided (Appendix VI, Condition 3).

10 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 WUL amendments.

10.1 REGULATORY STATUS OF ACTIVITY

The Kusasalethu Operation has an approved Mining Right (GP/30/5/1/2/3/2/1/08EM), as well as existing WUL (License No.: 08/C23J/AJFG/10192).

10.2 SECTION 27 MOTIVATION

The NWA includes considerations set out in Section 27(1) that must be applied in the assessment of licence applications for water use. The objective of this section is to provide the necessary information required in terms of Section 27(1) to allow the DWS to evaluate this application.

10.2.1 SECTION 27 (1)(A): EXISTING LAWFUL WATER USES

The current WUL (License No.: 08/C23J/AJFG/10192) authorises various water uses in terms of Section 21 (a), (f), (g) and (j) of the NWA. The applicant may require that some conditions be amended.

10.2.2 SECTION 27 (1)(B): THE NEED TO REDRESS RESULTS OF PAST RACIAL AND GENDER DISCRIMINATION

One objective of the NWA is to address past racial and gender discrimination and to alleviate poverty in South Africa; therefore, it is of utmost importance to support and stimulate economic development in order to realise the upliftment of previously disadvantaged groups and/or individuals.

The Kusasalethu operation has created a significant number of employment opportunities, not only during the construction phase, but also during the operational phase of the project. The mine will also create a significant number of employment opportunities during the decommissioning phase of the project. The Kusasalethu operation has provided employment opportunities for the surrounding residential areas, which are Carletonville, Westonaria, Fochville, Potchefstroom and Randfontein. These residential areas do house many historically Disadvantaged South Africans that required employment. Elandsridge and Wedela residential areas were developed as part of the Mine's housing development and are located on the farm Buffelsdoorn 143 IO.

10.2.3 SECTION 27 (1)(C): EFFICIENT AND BENEFICIAL USE OF WATER IN THE PUBLIC INTEREST

The IWWMP of the mine has been developed in accordance with the DWS's hierarchy of water use. Recommendations stemming from this IWWMP document have been incorporated in setting the relevant objective, targets and management plans steering towards a goal of efficient and beneficial use of water in the public interest.

10.2.4 SECTION 27 (1)(D): SOCIO-ECONOMIC IMPACT

The mine provides the following socio-economic benefits:

- During the operational and decommissioning phase, the Kusasalethu and operation provides work for a large number of contractors and employees;
- Permanent employment opportunities during the operational phase are estimated at ± 5,870 employees at the Kusasalethu operation, subsequently ensuring that at least 5,000 families can sustain themselves. Similarly the multiplication factor is applicable to the local Merafong City Municipality;
- A large number of jobs are created for Historically Disadvantaged South Africans;
- Job creation at Kusasalethu operation benefits relatives of the people employed through the increased household income;
- The benefit of increased income is realised in the local economy as there will be more money available for households to purchase essential and possible additional luxury items; and
- The generation of additional business sales and employment opportunities has initiated an ongoing ripple effect through the sub-region, resulting in an increase in product and service value measured in Gross Geographical Product (GGP).
- The Socio-Economic impact of the failure to authorise the water use or uses
- Kusasalethu/Deelkraal Mine will not be able to proceed unless the indicated water use activities are authorised. Kusasalethu/Deelkraal mine is an existing operation, which includes the appointment of contractors and employees. Without the necessary authorisation contractors and employees will be without a job and therefore further increase in poverty of this region.
- It must be noted that Randfontein Estates Limited: Kusasalethu/Deelkraal Operation has already invested significantly in the mine over the years. The investments made include the construction and maintenance of all infrastructures, obtaining authorisation from the local government for mining and water use activities.

10.2.5 SECTION 27 (1)(E): CATCHMENT MANAGEMENT STRATEGY APPLICABLE TO THE RELEVANT WATER RESOURCES

The catchment management agency for the Vaal River System was established on 29 January 2016, through the promulgation of GNR 81 in terms of the NWA and is called the Vaal River Catchment Management Agency. This notice specified the following amongst others:

- The Vaal Water Management Area (WMA) is the result of the consolidation of the Upper, Middle and Lower Vaal catchments. The Vaal Water Management Area occupies the Central North-eastern area of South Africa. It extends to Ermelo in Mpumalanga, just west of Swaziland in the east across to Kuruman in the Northern Cape to the West. To the northwest, the WMA borders Botswana and the Crocodile (West) and Olifants Catchments. Johannesburg sits on the boundary of the CMA. To the south east it is bounded by Lesotho;
- The major water uses in the water management area include industrial, mining sectors, power generation, commercial agriculture (including stock watering, small and large irrigation schemes, dry land farming and forestry), nature conservation, as well as urban and rural human settlements;
- The business case of the Vaal River Catchment Management Agency has been approved;
- All initial, inherent and delegated functions will be performed in the Vaal River CMA; and
- A Water Resource Management charge will be billed by the Vaal River CMA in accordance with Section 57(2) of the NWA.
- The following impacts have been considered for this IWWMP:
- The direct impact of physical structures (environmental constraints to construction e.g., of weirs or dams);
- The allocation of water for equity. will include approaches towards the application of Schedule 1 Use, General Authorisations, the revitalisation of irrigation schemes, etc.;
- Failure to support equity, or appropriate development – noting the consequential impacts of poverty;
- Sanitation systems and the impacts on groundwater quality;
- The implementation of the Reserve; and
- The ability to monitor and manage compliance, thus protecting the resource and with it the environment.
- All decisions regarding water are critical to the environment. Decisions must be made on a balance of social, economic and ecological costs and benefits, considering both the immediate and the long-term, and always with an eye out for the unintended consequence. It is the intention of the Internal Strategic Perspective (ISP) (DWS, 2004) to provide the basis for integrated decision-making. The principles of environmental management underpin every strategy developed in this document.

There are a number of strategic areas with a particularly strong biophysical/ ecological emphasis. These include:

- The Reserve (groundwater, rivers, wetlands and estuaries);
- Water quality - surface and groundwater;
- The approach towards the clearing of Invasive Alien Plants;
- The management of wetlands;

- Land degradation. Erosion and sedimentation (land care); and
- Land use and especially how this is impacted by land reform and the re-allocation of water.
- The roles of co-operative governance and the need for awareness raising and capacity building are key strategic elements of many strategies. In reality all strategies and all aspects of management have a strong interaction with the biophysical environment. This ISP captures these concerns in discussion and through a strategic approach emphasises the will of the DWS to manage the environment to the best benefit of the country and its people (DWS, 2004).

10.2.6 SECTION 27 (1)(F): THE LIKELY EFFECT OF THE WATER USES TO BE AUTHORISED ON THE WATER RESOURCES AND ON THE WATER USERS

The economy of the Upper Vaal Management area consists of widespread urbanisation, mining and industrial activity, which relate to gold and coal deposits in the area occur in the northern part of the water management area. Collectively, mining and industrial development in the Upper Vaal River water management area produce a total of 45 % of South Africa's Gross Domestic Product (GDP). Economic activity in the rest of the Upper Vaal water management area mostly relates to livestock farming and rain fed cultivation (Hall and Jennings, 2007; NWRS, 2004). Due to ongoing economic growth and continued urbanisation, further growth in water demand is expected in the area. It is therefore paramount that water allocation decisions are made, taking cognisance of only marginal potential for further resource development. The main water use in the Upper Vaal is, therefore, shared by the industrial, urban and mining sectors, which account for 80% of water usage. Irrigation accounts for 9% of water usage and power generation accounts for 7%. The remainder is used for supply to rural areas. These percentages do not include water transfer in and out of the management areas. Aside from these usages, water is also transferred in and out of the Management areas. The Upper Vaal area transfers water out to the Crocodile, Marico and Olifants Management areas and transfers water in from the Thukela, Usutu & Mhlatuze Management areas as well as from Lesotho as per the agreement between South Africa and Lesotho via the Lesotho Highlands Water Project. The Upper Vaal area has an impact on Botswana, Lesotho, Namibia, Zimbabwe, Mozambique and Swaziland (DWA, 2014).

The mine has an existing WUL. It is not likely that changes to the WUL conditions would alter the impact of the mine on the receiving environment, significantly. The proposed changes are driven by:

- Incorrect information included in the WUL i.e., stream names;
- Changes in limits to be measured for monitoring water quality to include additional rivers or increase limits as Harmony is exceeding the limits provided; and
- Exceedance of the allowable storage limits in storage dams.
- Water is re-cycled and re-used by the Applicant.

10.2.7 SECTION 27 (1)(G): THE CLASS AND RESOURCE QUALITY OBJECTIVES OF THE WATER RESOURCES

The Vaal River downstream of Vaal Dam to the outlet of C23J (Integrated Unit of Analysis (IUA) UM) includes the urban areas of Vereeniging, Vanderbijlpark, Sasolburg and Parys. In the reach between Vaal Dam and the Vaal Barrage the three main tributaries (Suikerbosrand, Klip and Rietspruit rivers) discharge into the Vaal Barrage, each conveying significant volumes of treated wastewater and mine discharge water. Management of the flow entering this reach is from Vaal Dam and is influenced by the water users in and downstream of the Vaal Barrage, the urban return flows and mine dewatering discharges as well as the releases form Vaal Dam to maintain the TDS concentration at 600 mg/l (DWA, 2012).

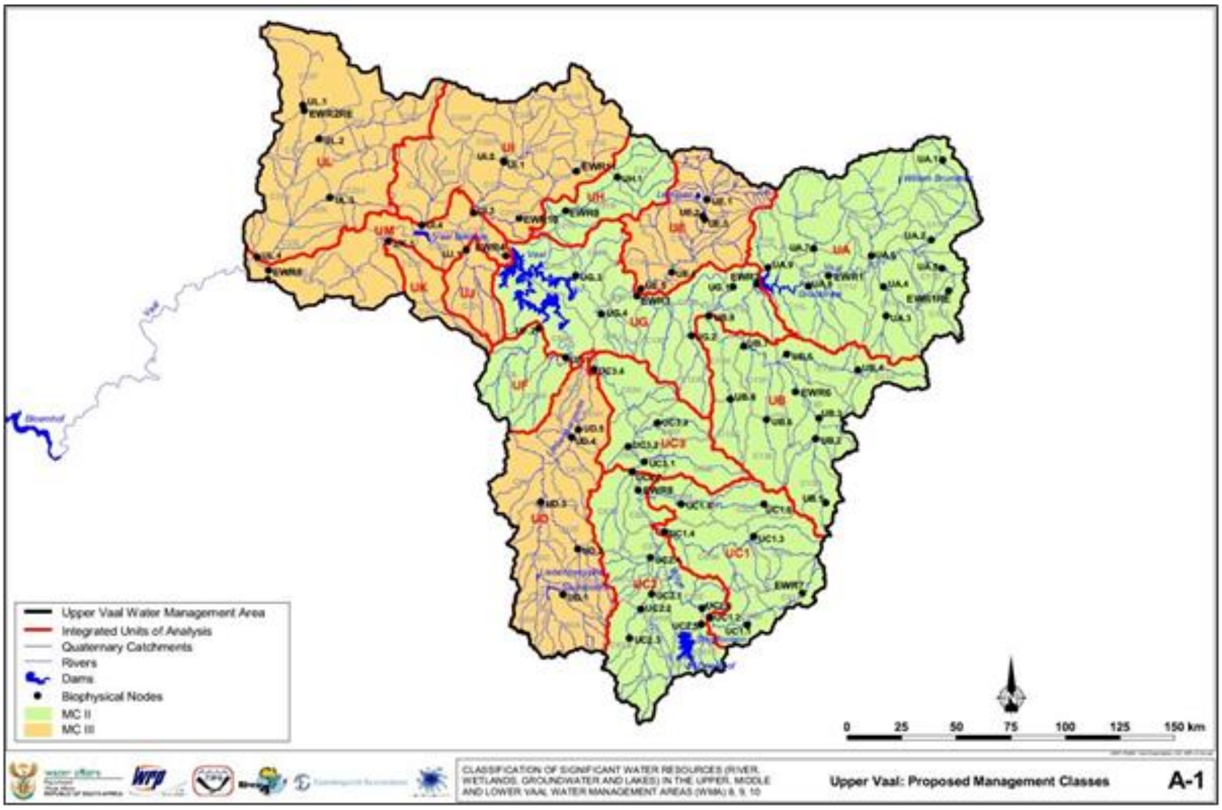

Figure 23: Classification of Significant Water Resources in the Vaal Water Management Area

Two EWR sites were defined in this IUA, one with a C Ecological Categories (EC) and the other a C/D EC state, both with a HIGH EI providing motivation that the Recommended Ecological Category (REC) should be an improvement of the Present Ecological Status (PES). However, the assessment of this scenario as part of the Reserve study indicated that the implications of this improvement have significant impacts on the economy. The operational scenario accepted for the purpose of defining the Reserve was therefore to maintain the PES. The scenarios evaluated during this study still do not achieve the REC and for that reason the PES was used in the catchment configuration for this IUA (DWA, 2012).

10.2.8 SECTION 27 (1)(H): INVESTMENTS ALREADY MADE AND TO BE MADE BY THE WATER USER IN RESPECT OF THE WATER USE IN QUESTION

The Applicant has made several investments in respect of applying for the existing WUL, including:

- Performed and Lawfulness Review of the status of water use activities;
- Conducted a GN 704 Audit to identify any shortcomings in respect to compliance with the said Regulations;
- Developed an Integrated Water and Waste Management Plan detailing specific alterations required;
- Developed a Water balance as a management tool for all water use activities taking place at Kusasalethu Operation;
- The construction and operation of all water use activities as part of the Kusasalethu Operations; and
- Water use optimisation strategies, which include improved monitoring and control.

In terms of this IWWMP, the Applicant has made investments in terms of the following:

- Updating of the IWWMP; and
- Updating of the water balance.

10.2.9 SECTION 27 (1)(I): THE STRATEGIC IMPORTANCE OF THE WATER USE TO BE AUTHORISED

As demonstrated from the mining and Kusasalethu plant activities, the mine would not be able to proceed without the existing WUL. The mine provides important socio-economic advantages to the community and to South Africa.

10.2.10 SECTION 27 (1)(J): THE QUALITY OF WATER IN THE WATER RESOURCE

The following reservations apply with respect to the transfer of water into and out of the water management area, and the provision of water for future growth:

- The existing transfer of 491 million m^3/a from Lesotho, which is to be increased to 835 million m^3/a after the commissioning of Mohale Dam in Lesotho. – reserved by international agreement for use in and transfer from the Upper Vaal water management area;
- Existing transfers from the Thukela water management area up to the installed capacity of 630 million m^3/a. The yield benefit in the Vaal System is 736 million m^3/a – reserved in the Thukela water management area;
- Future large-scale water resources development on the Thukela River is reserved mainly for transfer to the Upper Vaal water management area. Current planning allows for an additional transfer of 475 million m3/a – reserved in the Thukela water management area;
- Existing transfer of 55 million m3/a from the Buffalo River in the Thukela water management area to the Upper Vaal water management area – reserved in the Thukela water management area;
- Transfers from the Usutu to Mhlatuze water management area at the current capacity of 63 million m^3/a – reserved in the Usutu to Mhlatuze water management area;
- Existing transfers from the Upper Vaal water management area to the Olifants water management area of 36 million m^3/ a for power generation, plus an allowance of 38 million m3/a for future growth. (Included in Tables D8.3 to D8.6.) – reserved in the Upper Vaal water management area;
- Transfers from the Upper Vaal water management area through the Rand Water distribution system to meet requirements in the Crocodile (West) and Marico water management area which are in excess of the capacity of the local resources in the Crocodile (West) and Marico water management area. Currently this amounts to 514 million m^3/a and is projected to increase to 723 million m^3/a. As an upper high growth scenario, transfers may need to increase to 1 125 million m^3/a. (Figures included in Tables D 8.5 and D 8.6.) – reserved in the Upper Vaal water management area;
- Releases from the Upper Vaal water management area along the Vaal River to users in the Middle Vaal and Lower Vaal water management areas to meet their realistic needs that cannot be supplied from own resources. Little change is expected from the current transfer of 828 million m^3/a, although it may increase to about 910 million m3/a in 2025 under the high growth scenario – reserved in the Upper Vaal water management area;
- Current surplus transfer capacity into the Upper Vaal water management area is to be reserved for growth in urban, industrial and mining water requirements in the Upper Vaal and Crocodile (West) and Marico water management areas, and is not to be used for commercial irrigation;

- The allocation of surplus yield in the Upper Vaal water management area will be subject to national authorisation as it can be allocated to users in the Upper, Middle, Lower Vaal as well as Crocodile (West) and Marico and Olifants water management areas; and
- The Upper Vaal water management area forms the central component of the Vaal River System, which extends over several water management areas. As water resources management in the Vaal River System impacts to some degree on the water quantity and quality in all the interlinked water management areas, management of the Vaal River System is to be controlled at a national level.

10.2.11 SECTION 27 (1)(K): THE PROBABLE DURATION OF ANY UNDERTAKING FOR WHICH WATER IS TO BE AUTHORISED

It is anticipated that the project would have a lifespan of 35- 40 years, (up until 2055), before it would be decommissioned.

11 REFERENCES

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