



**Surface Water Impact Assessment for  
Klipspruit Colliery Proposed Nwabu Project –  
Pit BD and Pit H Underground Mining  
Expansion Project  
WU36905**

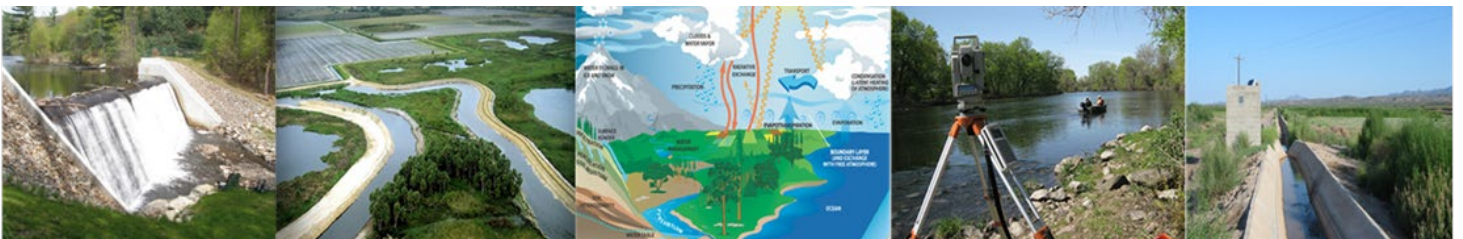
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**18 December 2025**




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# Surface Water Impact Assessment Klipspruit Colliery: Pits BD and H Underground Mining Expansion Project - WU36905

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Author	Sbongiseni Mazibuko (Hydrologist) <i>Pr. Sci. Nat</i>		18 December 2025

### Prepared By:



Altra Watech (Pty) Ltd.  
11 Van Der Merwe Street  
HQ Centre, Nelspruit  
1240  
[info@altrawatech.co.za](mailto:info@altrawatech.co.za)

### Prepared For:



Niara Environmental Consultants (Pty) Ltd.  
Office 1 Palm Place Office Park  
22 Bram Fischer Drive, Linden, Johannesburg,  
2195  
[info@niara.co.za](mailto:info@niara.co.za)

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## **Specialist Details and Declaration**

### ***Specialist Details***

Sbongiseni Mazibuko is a hydrologist focusing on hydrological perspectives of land use management and climate change. Sbongiseni has – over the past nine years – worked on numerous projects for a variety of clients, including mining, agriculture, and public entities, which included hydrological assessments, water balances, stormwater planning and management, floodlines modelling, catchment yield assessments, and water conservation and water demand management plans.

### ***Declaration***

This report has been prepared in accordance with Section 13: General Requirements for Environmental Assessment Practitioners (EAPs) and Specialists, as well as per Appendix 6 of GNR 982 – Environmental Impact Assessment Regulations and the National Environmental Management Act (NEMA No. 107 of 1998 as amended 2017) and Government Notice 704 (GN 704). It has been prepared independently of influence or prejudice by any parties.

I, *Sbongiseni Christian Mazibuko*, declare that –

- I act as the independent specialist in this application,
- I regard the information and data contained in this report to be accurate and correct as per the provision of data from the client,
- I do not have any vested interest (i.e., business, financial, personal, or other) in the project other than remuneration for the professional work performed and
- I conducted the work relating to the project objectively in line with my profession and regulatory body and within the confines of the applicable legislation.



Mr. Sbongiseni Christian Mazibuko

MSc Hydrology, (*Pr.Sci.Nat.* Reg number: 011204)

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## EXECUTIVE SUMMARY

Niara Environmental Consultants (Pty) Ltd (Niara) appointed Altra Watech (Pty) Ltd to undertake a surface water impact assessment study for the proposed expansion of the underground mining of Pits BD and H of Klipspruit Colliery (KPS). Seriti Power (Pty) Ltd (Seriti) is the holder of a Mining Right for KPS operations issued by the Department of Mineral Resources and Energy (“DMRE”) (No. MP 30/5/1/2/2/125 MR). KPS intends to apply for an amendment of the existing Environmental Authorisation (EA) and an Integrated Water Use License (IWUL) for the proposed additional changes in mining methods and infrastructure for Klipspruit Extension Weltevreden (KPSX) by changing from Open Cast (OC) to underground mining (UG) methods at Pits BD and H. Currently, UG mining has commenced at Pit BD. As such, Niara, as an independent Environmental Assessment Practitioner (EAP), was appointed to ensure compliance by undertaking the required environmental regulatory process in accordance with relevant legislation and guidelines. This included the expected changes to the overall mine water balance at KPSX operations, identifying potential surface water impacts, developing mitigation measures for the identified impacts, and drafting a surface water monitoring plan to protect water resources in areas surrounding the mine.

The site's average annual, monthly, and daily water balances were calculated using the updated water Process Flow Diagram (PFD) and the water requirement/demand estimates for KPSX operations throughout the Life of Mine (LoM). The water PFD presents the site's current and proposed infrastructure, the derived mining philosophy, and the future plans incorporated into the water balance calculations. The mining philosophy accounted for the phases in which the mine will operate, including UG mining of coal seams (2 and 4) through Pits BD and H, where Run-of-Mine (RoM) will be accessed via audits and transported to conveyor belts for processing at the Phola Coal Processing Plant (PCPP). In-pit sumps will collect all dirty water (i.e., groundwater ingress, entrenched runoff, and dewatering). Dirty water from these pits will be collected by sumps and be pumped to Pollution Control Dams (PCD 1 for Pit H and PCD 4 for Pit BD) through pipelines that will be installed (for Pit H operations) while other volumes will be lost through evaporation. Water from these PCDs will be used to supplement dust suppression on haul roads and to provide additional mine water by pumping it to the Raw Water Reservoir (RWR) and the KPS Balancing Dam. All dirty catchment areas will divert runoff into these pits, as outlined in the proposed stormwater management plan.

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Pits BD and H are within the 500 m buffer line from the river and wetlands in the area. It was also concluded that the pit's surface area would reduce naturalised surface runoff into the streams downstream of the KPS mining area. However, the overall mine rehabilitation program was deemed adequate for restoring flow regimes in downstream areas. Deteriorating surface water quality due to accidental spillages of hydrocarbons, grease and oil, together with the accumulation of suspended sediments from exposed surfaces and alteration of natural flow and drainage patterns resulting from surface compaction during the construction of the mining infrastructure, were identified as the primary impacts that might affect the quantity of the surface water resources in the mine surrounding areas. The local surface water resources are low in sensitivity due to their shallow nature and intermittent flow. The proposed mitigation measures should be regularly reviewed as best practice and to ensure compliance with the various on-site licenses issued by authorities. The mitigation measures aim to ensure that the pre-mining/current water resource status does not deteriorate due to mining activities.

Clearing the surface and site preparations for the development and construction of the mine infrastructure (haul roads, conveyor loading area, box cut for Pit H) will expose soil surfaces to erosion factors – particularly during the wet season. When a large spatial area of vegetation cover is cleared and topsoil is disturbed, a large area of loose material is exposed and susceptible to erosion. During rainfall events, runoff from the exposed site will transport the eroded soil material into the nearby water resources. Monitoring and inspection of stormwater channels, silt traps, dam walls, and dams for signs of erosion, cracking, silting and blockages of inflows is recommended to ensure the performance of the stormwater infrastructure. After a heavy storm event, removing accumulated silt from the lined stormwater channels and PCD silt traps is recommended to prevent spillages and improve stormwater system efficiency. General monitoring should be undertaken monthly during the wet season, after storm events, or per the site management schedule.

The impacts of the proposed activities and the infrastructure were identified and then assessed based on the impact's magnitude, duration, probability, extent, severity and consequences and the receptor's sensitivity. This analysis culminated in determining the impact's significance, identifying the most significant impacts and those requiring stringent management. The local surface water resources were considered low in sensitivity. Mitigation and monitoring measures were specified throughout the report.

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During site preparation and construction of mining support infrastructure associated with Pit H, it is recommended that vegetation clearing, including the construction site, be kept to a minimum to reduce sedimentation that might introduce additional sediments into surface water resources downstream. Keeping the construction site footprint and heavy machinery pathways to a minimum is also recommended. Installation of silt traps in the downslope areas as well as bunding of any oil and hydrocarbon-spill-prone areas. Any hydrocarbon or oil spills must be removed from the construction site in accordance with the relevant waste management procedures.

During the operational phase of the project, it is recommended that the proposed Stormwater Management Plan principles be adhered to, implement dust suppression procedures, and servicing of heavy machinery be done in bundled areas (e.g., Workshop) to ensure that water quality does not deteriorate due to mixing of clean and dirty water systems, oil and hydrocarbon spills and saltation. Regular monitoring of potential spills along the conveyor belt route and immediate remedial action should be taken to reduce the risk of pollution.

A surface water monitoring plan was proposed to account for the additional activities and infrastructure supporting mining in the KPSX area. Based on the existing KPSX plan, two in-stream points were proposed downstream of the unnamed tributary draining surface runoff from Pit H areas to serve as receptors for any surface water quality changes due to mining, while the other proposed point is on the unnamed tributary in the eastern part of Pit H. In addition, sampling of in-pit sumps at the two pits is proposed, together with cumulative inflows, for representation in PCD 2 and PCD 4. Monthly sampling is recommended for the in-pit sumps and PCD 2 and 4, while quarterly sampling is proposed for Wel SW15 and Wel SW16 points due to the stream's dryness during the dry season. Surface water samples from these points should be sampled in accordance with the sampling guidelines and analysis must be carried out by a SANAS-accredited laboratory. Water quality changes and compliance of the proposed surface water sampling are to be evaluated against parameters stipulated in the conditions of KPSX IWUL (Licence No. 03/B11F/ACGIJ/4740) and against Resource Quality Objectives (RQOs) for the Olifants Catchments to ensure that water resource quality in the larger region is protected and improved. Non-compliance observed from any of the proposed surface water sampling points for KPSX must be reported and addressed per the stipulations in General Notices 704 throughout the phases of the UG mining activities associated with Pits BD and H.

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## LIST OF ACRONYMS

BPG	Best Practice Guidelines
CA	Competent Authority
DEM	Digital Elevation Models
DMRE	Department of Mineral Resources and Energy
DRE	Design Rainfall Estimation
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EC	Electrical Conductivity
GA	General Authorisation
GN	Government Notice
ha	Hectare
HDPE	High-Density Polyethylene
IWULA	Integrated Water Use License Application
IWUL	Integrated Water Use License
IWWMP	Integrated Water and Waste Management Plan
ISO	International Standard Organisation
KPS	Klipspruit Colliery
KPSX	Klipspruit Extension Weltevreden
LoM	Life of Mine
NWA	National Water Act
m <sup>2</sup>	Square metre
m <sup>3</sup>	Cubic metre
MAE	Mean Annual Evaporation
mamsl	meters above mean sea level
MAP	Mean Annual Precipitation

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MI	Megalitre
nMAR	Mean Annual Runoff
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act 36 of 1998)
WMA	Water Management Area
PES	Present Ecological State
PCD	Pollution Control Dam
PCPP	Phola Coal Processing Plant
PES	Present Ecological Status
PFD	Process Flow Diagram
RoM	Run-off-Mine
RQO	Resource Quality Objectives
RWR	Raw Water Reservoir
SABS	South African Bureau of Standards
SANAS	South African National Accreditation System
SANBI	South African National Biodiversity Institute
SANS	South African National Standard
SAWS	South African Weather Services
SAWQG	South African Water Quality Guidelines
STWP	Sewage Treatment Plan
SWMP	Storm Water Management Plan
TDS	Total Dissolved Solids
WMA	Water Management Area
WTP	Water Treatment Plant
WUL	Water Use License Application
WWTP	Waste Water Treatment Plant

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## 1 Introduction

Niara Environmental Consultants (Pty) Ltd (hereafter Niara) commissioned Altra Watech (Pty) Ltd to undertake a surface water impact assessment study for changing mining methods from Open Cast (OP) to Underground (UG) of Pit BD and Pit H of the Klipspruit Extension Weltevreden (KPSX) mining area of Klipspruit Colliery (KPS) – termed Nwabu Project. The mine site is located on the consolidated farms, which include Grootpan 7 IS, Hartebeestlaagte 325 JS, Tweefontein 328 JS, Weltevreden 324 JS and Wildebeestfontein 327 JS, roughly 6 km north of Ogies Town, within the eMalahleni Local Municipality in the Mpumalanga Province, within quaternary catchments B20G (Figure 1.1) of the Limpopo-Olifants Water Management Area (WMA). Proposed Pit BD and its associated UG workings include open-cast mining on Farm Portions 9, 10, 11 and 15 of Farm Weltevreden 324 JS, while Pit H and its UG workings are located on the Remaining extent of Portion 41 of Oogiesfontein 4 IS Farm and Farm Portions 10, 11 and 22 of Farm Weltevreden 324 JS (Figure 1.2).

KPS is owned and operated by Seriti Power (Pty) Ltd (Seriti) and intends to apply for the amendment of its Environmental Authorisation (EA) and Integrated Water Use Licence (IWUL) issued by the Department of Mineral Resources and Energy (DMRE) and the Department of Water and Sanitation (DWS), respectively, for the proposed expansion to UG mining methods of via Pits BD and H and their associated infrastructure to support mining operations. As part of the best practice in the mining sector, changes in the mining activities are likely to affect (negatively or positively) surface water resources in the mining right area and its surroundings. These changes (for both pits) include the addition of in-pit sumps, overburden dumps, and topsoil stockpiles; the construction and operation of pipelines to a wastewater storage facility; stormwater management infrastructure; and the construction and maintenance of additional haul roads from the two pits to connect with the existing haul roads.

Therefore, a surface water impact assessment study is required to identify and evaluate how the proposed expansion and changes in mining methods activities will impact the surface water-related elements on the mine site and the surrounding environment. This is aimed at ensuring that the change in mining activities will not negatively impact the mine site's water management, and thus the surrounding water resources or the environment. Results from this specialist study will contribute to the submission of a Water Use Licence Application (IWULA) process in terms of Section 21 of the National Water Act, 1998 (Act No. 36 of 1998) (NWA, 1998) and an EA process, as per Regulation 31 of the National Environmental Management Act, Act 107 of 1998, as amended (NEMA) for submission to DMRE.

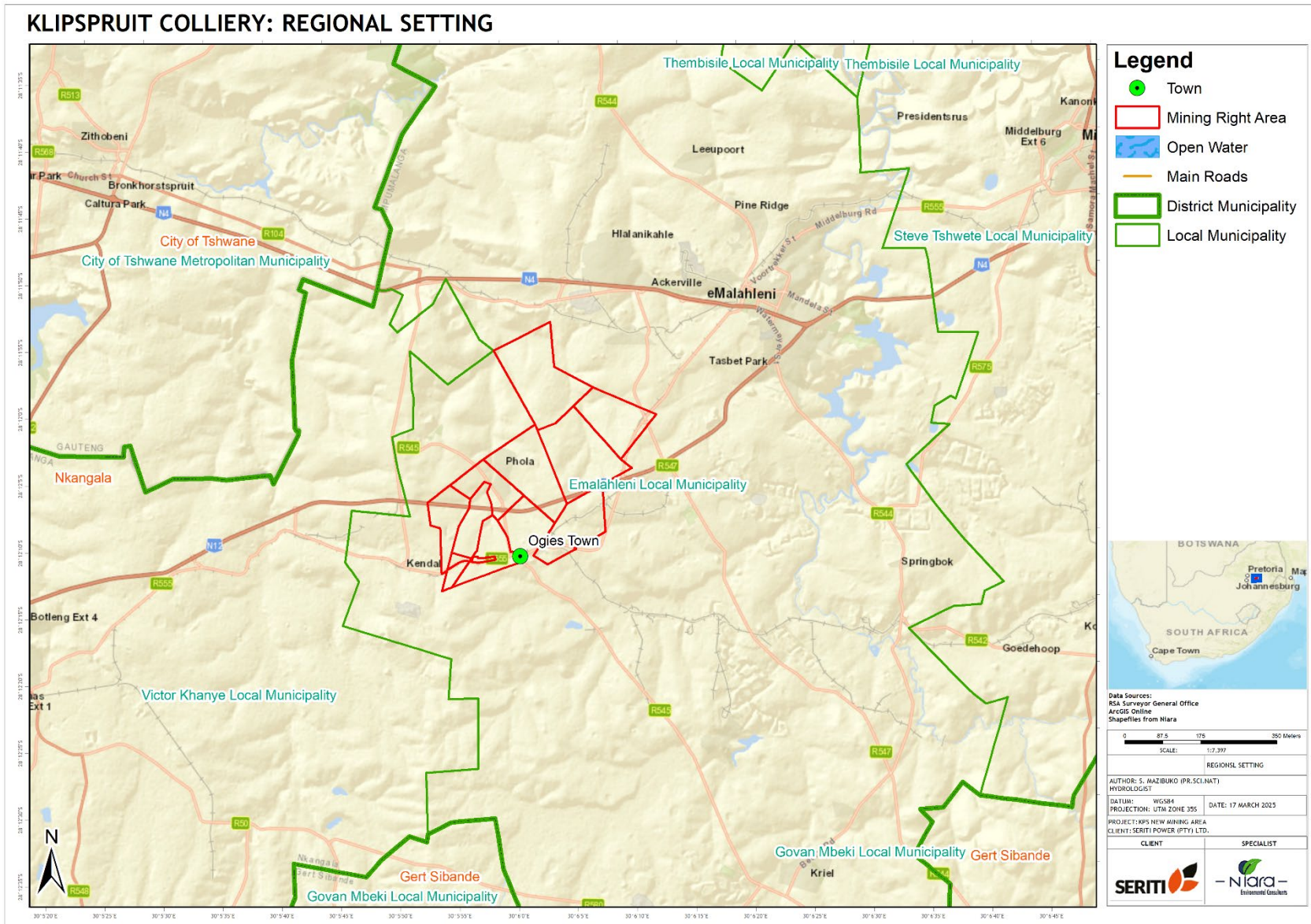


Figure 1.1: Location of the study site

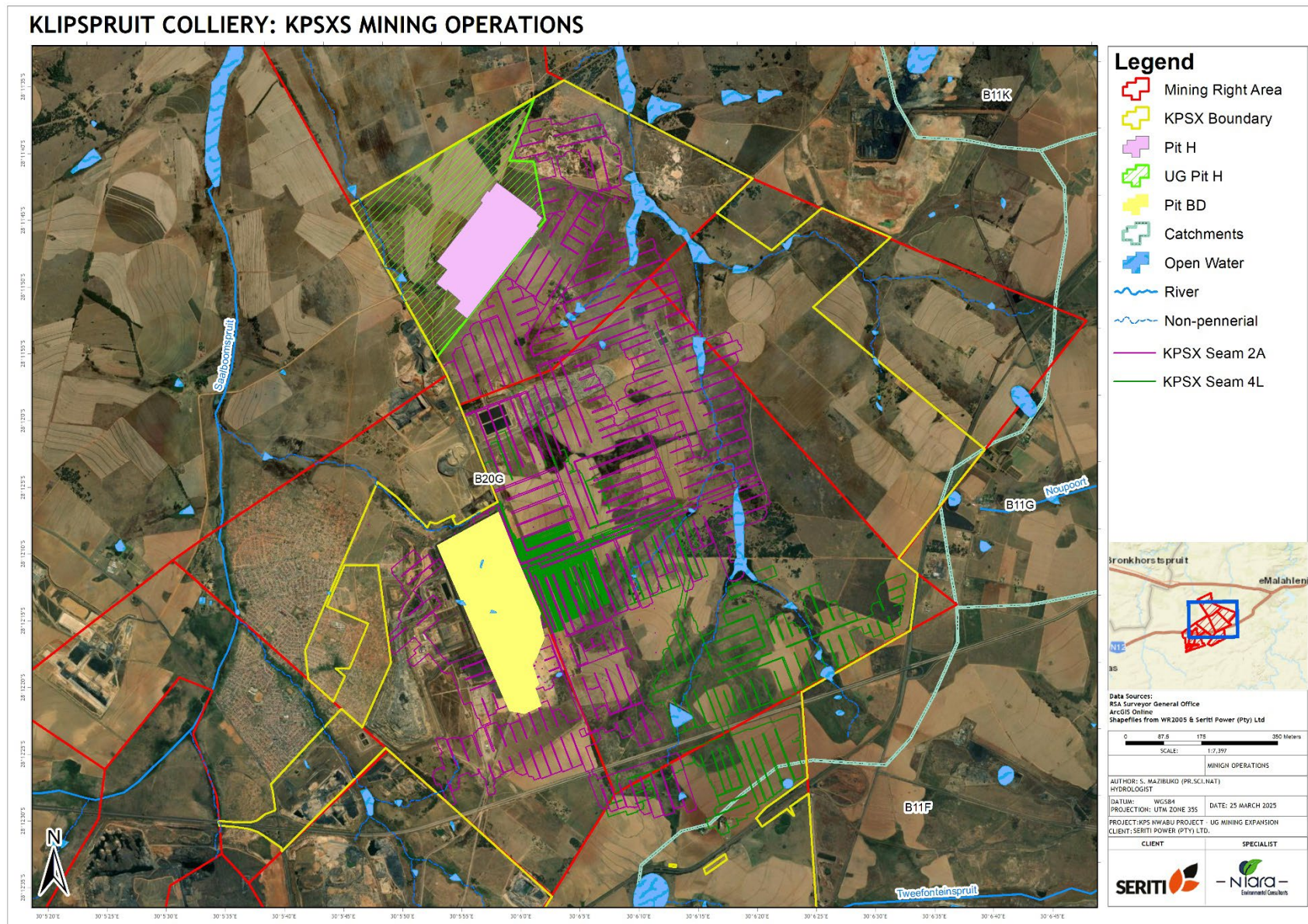


Figure 1.2: Spatial extent of KPSXs Pits BD and H

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## 2 Scope of Work

The scope of work for the study is defined as follows:

1. Information Sourcing and Data Collection:
  - Acquisition and review of relevant information and data relating to the study and
  - Review the applicable regulations and guidelines concerning water use licensing and environmental authorisation for the mine site's expansion projects.
2. Receiving Environment, Hydrological Setting and Water Quality:
  - Baseline description of the receiving environment and the climate pertinent to the hydrological impact assessment,
  - Determine naturalised hydrological response and
  - Baseline water quality analysis.
3. Water and Salt Balance Synthesis:
  - Summary of the simulation of annual, monthly, and daily water balances study for the mine site, including Pits BD and H.
4. Surface Water Impact Assessment:
  - Identify, evaluate and quantify surface water impact elements related to the construction, operation and decommissioning of the proposed mining activities, and
  - Derive a range of mitigation measures to minimise the impacts and recommendations on the monitoring required.
5. Surface Water Monitoring Plan:
  - Develop a surface water monitoring plan to incorporate the proposed activities associated with UG mining via Pits BD and H, and
  - Indicate the variables to be analysed, frequency of analyses, data management and reporting
6. Reporting:
  - Reporting on the study's findings, including the conclusions and recommendations.

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## **3 Methodology**

### **3.1 Desktop Study and Information Sourcing**

A review of previous surface water impact assessments and the first draft of the hydrological assessment report were conducted to gain insights into the proposed activities of the mining operations and plans for KPSX's Pits BD and H. This was reviewed with national legislation and guideline documents governing water management on the mine sites in South Africa. These included the National Water Act (Act 36 of 1998), the Department of Water and Sanitation (DWS) Best Practice Guidelines (BPGs), Salt and Water Balances, and the mining program for the mine site. Up-to-date survey data and imagery for the mine site were interpreted alongside the infrastructure layout to identify areas that will undergo rehabilitation for the placement of surface infrastructure (Pits, pipelines, and SWMP). Hydroclimatic data for the study site were collected and analysed to understand rainfall patterns and to compute expected peak flow volumes.

### **3.2 Baseline Hydrology**

The general catchment, climate and hydrology setting of the study site were summarised using data derived from the previous studies, the 2012 South African Water Resources Study database (WR2012) (Bailey & Pitman, 2015), as well as the rainfall data from the South African Weather Services (SAWS) rain gauge station located in Ogies town. These were used to derive the Mean Annual Precipitation (MAP) and the Mean Annual Evaporation (MAE) expected in the areas. The naturalised Mean Annual Runoff (MAR) for the mine site was based on downscaled runoff from the quaternary catchment to encompass the mine area of influence, primarily derived from the Pitman model simulation compiled in the WR2012 study. These analyses provided insight into the general rainfall-runoff and evaporation dynamics for the area and enabled the calculation of potential evaporation on the open water storage facilities within the mine.

### **3.3 Applicable Legislation**

The NWA (Act No. 36 of 1998) was developed to ensure the protection of water resources in South Africa. The NWA recognises that water resource management aims to achieve the sustainable use of water for the benefit of all users. In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all "water uses" must be licensed by the Competent Authority (CA), i.e., the regional DWS. DWS – the custodian of South Africa's water resources – is responsible for the effective and efficient management of water resources to ensure sustainable economic and social development while also protecting water resources in accordance with the NWA. DWS is also responsible for evaluating and issuing licenses pertaining to water use (i.e., Water Use Licenses (WULs)) in the mining industry.

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Regarding mining activities, Sections 19(1) and 19 (2) of the NWA address pollution prevention. Part 4 addresses pollution prevention, particularly when water resource pollution occurs or may occur from land-based activities. This section indicates that “*the person who owns, controls, occupies or uses the land in question is responsible for taking reasonable measures to prevent water resources from being polluted*”. If the measures are not taken, the CA concerned may do whatever is necessary to prevent the pollution, remedy its effects, and recover all reasonable costs from the persons responsible.

The ‘reasonable measures’ which have to be taken may include measures to:

- Cease, modify or control any act or process causing the pollution;
- Comply with any prescribed waste standard or management practice;
- Contain or prevent the movement of pollutants;
- Eliminate any source of pollution;
- Remedy the effects of pollution; and
- Remedy the effect of any disturbance to the bed and banks of a watercourse.

The NWA also describes the actions the CA can take to enforce the Act's requirements. Part of Section 26 (1) of the NWA provides for:

- Monitoring, measurement and recording of incoming and discharged water from a water resource, and
- Regulate or prohibit any activity to protect a water resource or in-stream or riparian habitat.

Prescribe the outcome or effect that must be achieved through management practices to treat waste, or any class of waste, before it is discharged, deposited into, or allowed to enter a water resource.

Section 28 of the NEMA (Act 107 of 1998) (NEMA), deals with the “duty of care and remediation of environmental damage”, and stipulates that *every person who causes has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring or in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*. The National Environmental Management: Protected Areas Act, 2003 (NEMPAA) ensures that mining is not authorised in areas critical for ensuring water security, such as those in the Strategic Water Resources Areas and wetlands.

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### 3.4 Best Practice Guidelines

WULs for most mines include conditions that include detailed and accurate water balances that meet the then Department of Water Affairs and Forestry (DWAF) Best Practice Guidelines: G2 Water and Salt Balances (BPGs) (DWAF, 2006a). Mine water and salt balances should be dynamic, considering seasonal changes and incorporating changes in – among other things – water storage levels for the period of the Life of Mine (LoM). Principles used in calculating the average water and salt balances included:

- Dynamic water balances based on variable climate inputs should include all inflows and outflows from any mining activity.
- Reflected surface and groundwater interconnections with the water resource in the location of the mine area.
- Incorporating accurately measured volumes of water abstracted, used, or discharged at any point in the mine.
- Water uses included mine process water intake for coal washing, outflows to and return water from wastewater storage facilities and water abstracted from mine workings.
- Average water balances incorporated accurate values determined from flow meter measurements and modelled runoff, groundwater seepage, and evaporation estimates. Some of the mine mass balance calculations were conducted when measurement data were unavailable.
- Measures taken to manage the fluxes of mine water accounted for current, future and post-closure mining conditions.

### 3.5 Surface Water Quality and Monitoring Programme

A site visit was conducted to identify elements that could affect the surrounding surface water features of the proposed mining activities site. In the proposed mine site, there were no flowing streams from which baseline surface water quality could be obtained. Other relevant site information was collected to guide the study and interpret the results related to the potential impact of surface water.

Seriti commissioned Aquatico (Pty) Ltd (Aquatico) to collect, analyse and interpret the surface water samples for KPS. The locations of surface water sampling points are recorded in the water quality database, and these points were assumed to be representative of identified upstream activities affecting the surface water resources surrounding the proposed expansion sites.

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Surface water sampling is conducted in accordance with the South African Bureau of Standards (SABS) International Standard Organisation (ISO) 5667-1: 2006 Part 1: Guidance on the design of sampling programs and sampling techniques, ISO 5667-6: 2005 Part 6: Guidance on sampling of rivers and streams, and ISO 5667-3: 2003 Part 3: Guidance on preservation and handling of water samples.

These samples are submitted to a South African National Accreditation System (SANAS) accredited laboratory for analysis in accordance with SANAS 241-1:2011 for the surrounding environment. Analyses are carried out using methods prescribed by the SABS under the Standards Act, Act 30 of 1982. Surface water quality results are compared against the baseline water quality results reported by Digby Wells (2014) and stipulated in the KPS IWUL (Licence No. 24075037) as well as gazetted RQOs for significant water resources of the Olifants and Letaba river catchments (DWS, 2017).

### **3.6 Average Water Balances**

The 2024 Water and Salt Balance update study for the entire KPS operations was conducted by WSP (2024a) and provided baseline information to guide water flow quantities that could be affected in this study. Source of water to support mining operations, wastewater storage facilities such as PCDs, fluxes (rainfall, groundwater ingress, evaporation, mine water demands, make-up water) and flow links within the mine site were derived from this report. This also included the mining philosophy that will be adopted throughout the LoM. Results presented in the water and salt balance study were calculated in accordance with DWS's BPG G2 (DWAf, 2006a).

The hydrogeological study by Niara (2024) presented potential estimates of groundwater ingress into the mining areas (Pits) for all phases of the mine activity, and these volumes were incorporated into the overall average site water and salt balances. Three dynamic average water balances (annual, monthly, and daily) were developed in the present scenarios, covering the entire LoM period. Average water balance simulations utilised results from the hydrological assessment to provide hydrological inputs, such as rainfall, overland runoff, and evaporation, for modelling calculations of the open-water storages used to support the mining operations.

The attached spreadsheet indicates the flow of water quantities of different components and accounts for all estimates of losses within the mine site, which is treated as a closed water system. While no actual water use volumes were available—indicating gaps – reasonable assumptions were made in line with the mine's operational philosophy and generic practices used in the industry.

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### **3.7 Surface Water Impact Assessment**

Informed by the approved layout of Pits BD and H and their associated UG workings extent, mining philosophy, baseline physical and hydrological characteristics, and the potential impacts of the proposed activities on surface water receptors, the potential impacts of the proposed activities on surface water receptors were identified for the LoM, including the construction, operation, decommissioning, and post-closure phases. Before these impacts were assessed, the sensitivity of surface water resources and surface water impact methodologies was discussed below. Areas likely to impact surface water receptors due to the proposed UG mining activities via Pits BD and H were identified based on baseline information from sensitive wetland features (100m, 200m, 500m buffer layers) developed by the South African National Biodiversity Institute (SANBI) wetland protection status. This also included the desktop mapping of these features.

#### **3.7.1 Surface Water Impact Assessment**

An impact assessment of on-site, local and regional sensitive water receptors resulting from the construction, operation, closure and decommissioning phases of the mine site was undertaken using the impact assessment methodology guideline derived from the EIA Regulations of the NEMA (Act No. 107 of 1998) and adopted by DWS for Section 21 (c) and 21 (i) of the NWA.

#### **3.7.2 Impacts on the Water Resource Quality**

This assessment comprises the elements that deal with the direct impact on the status of the quality of a water resource based on the Present Ecological Status (PES) of the major river (DWS, 2017) and the related intensity of the impact on the resources. The latter is defined by the direct impact (negative or positive) on the hydrology, water quality, geomorphology, vegetation, and fauna and is defined and scaled based on the rating presented in Table 3.1.

**Table 3.1: Impact on the water resource quality (hydrology, water quality, geomorphology, biota)**

Negative Impacts	
Negligible / non-harmful; no change in PES	0
Very low / potentially harmful; negligible deterioration in PES (<5% change)	+1
Low / slightly harmful; minor deterioration in PES (<10% change)	+2
Medium / moderately harmful; moderate deterioration in PES (>10% change)	+3
High / severely harmful; large deterioration in PES (by one class or more)	+4
Very high / critically harmful; critical deterioration in PES (to E/F or F class)	+5
Positive Impacts	
Negligible; no change in PES	0
Very low / potentially beneficial; negligible improvement in PES (<5% change)	-1
Low / slightly beneficial; minor improvement in PES (<10% change)	-2
Medium / moderately beneficial; moderate improvement in PES (>10% change)	-3
Highly beneficial; large improvement in PES (by one class or more) and/or increase in protection	-4
Very highly beneficial; improvement to near-natural state (A or A/B class) and/or major increase in protection status	-5

The *likelihood* of an impact is determined by assessing the frequency of the identified activity, the frequency of the impact, the extent to which the activity is regulated, and the ability to detect the impact. These range from a very small scale to areas beyond the proposed activity's footprint. The *duration* of the identified impact can be classified as permanent to a one-day time scale. The *probability* of impact is scaled into five classes, with the unknown set to 100% and the unlikely set to 20%. These three components are summarised in Table 3.2.

The cumulative factors presented in Table 3.2 were used to derive the intensity, severity, consequence and risk the identified activity will have on the natural resource. The calculation and their matrix scores are given in Table 3.3.

**Table 3.2: Scale, duration and likelihood components of the impact assessment**

SPATIAL SCALE (EXTENT) OF IMPACT	
Very small portion of watercourse/s impacted (<10% of extent)	1
Moderate portion of watercourse/s impacted (10-60% of extent)	2
Large portion of watercourse/s impacted (60-80%)	3
Most or all of watercourse/s impacted (>80%)	4
Impacts extend into watercourses located well beyond the footprint of the activities	5
DURATION OF IMPACT	
Transient (One day to one month)	1
Short-term (a few months to 5 years) OR repeated infrequently (e.g. annually) for one day to one month	2
Medium-term (5 – 15 years)	3
Long-term (ceases with operational life)	4
Permanent	5
LIKELIHOOD OF THE IMPACT	
Improbable / Unlikely	20%
Low probability	40%
Medium probability	60%
Highly probable	80%
Definite / Unknown	100%

**Table 3.3: Consequences components of the impact assessment**

<b>CALCULATIONS AND MAXIMUM VALUES</b>	
Intensity = Maximum Intensity Score (negative value for positive impact) X 2	MAX = 10
Severity = Intensity + Spatial Scale + Duration (<Intensity - Spatial Scale - Duration> for positive impact)	MAX = 20 (MIN = -20 for +ve impacts)
Consequence = Severity X Importance rating	MAX = 100
Significance\Risk = Consequence X (Likelihood / 100)	MAX = 100

The final step was to calculate the significance rating (Table 3.4) based on the calculations presented above for the intensity, severity, and consequence (in Table 3.3 above). Risk is rated as Low, Moderate, or High based on cumulative scores. The low-risk class indicates that the impact is acceptable as is or with the proposed mitigation measures, whereas the high-risk class suggests that the impact will have negative long-term effects.

**Table 3.4: Significance ratings, classification and applicable management actions**

<b>RISK RATING CLASSES</b>		
<b>RATING</b>	<b>CLASS</b>	<b>MANAGEMENT DESCRIPTION</b>
<b>1 – 29</b>	<b>(L) Low Risk OR (+) Positive (+ +) Highly positive</b>	Acceptable as is or with proposed mitigation measures. Impact to watercourses and resource quality small and easily mitigated, or positive.
<b>30 – 60</b>	<b>(M) Moderate Risk</b>	Risk and impact on watercourses are notable and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
<b>61 – 100</b>	<b>(H) High Risk</b>	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

### 3.8 Surface Water Monitoring Plan

A surface water monitoring plan for expanding the mining activities to include UG mining via Pits BD and H was drafted and recommended for implementation during the construction, operation, decommissioning and post-closure phases of the KPSX mining area. The monitoring plan aims to ensure that KPS mine operations comply with regulations to protect surface water resources and other downstream receptors. Also, this plan was drafted to account for cumulative impacts that might be introduced into downstream receptors, particularly the environment and surface water components. Baseline water quality and RQOs for the area provided the baseline for water quality used for compliance and water resources protection.

### 3.9 Desktop Tools

The summary and the description of the datasets utilised in the desktop assessment are presented in Table 3.5.

**Table 3.5: Summary of the dataset and information used**

DATASET/TOOL	SOURCE	RELEVANCE
Hydrological Data	WR2012 (Bailey & Pitman, 2015), DRE	Determine the local rainfall, evaporation and runoff regimes for the mine site.
Mine infrastructure layout, including Pits BD and H.  The draft version of the Surface Water Impact Assessment study	Niara	Identify the mine site setting and layout to understand the mining extent and guide the water balance development.  Baseline information related to the study
2023/4 Water Balance Update Study	WSP (2024a)	Identify groundwater yield values and pit ingress, measured water flow quantities, mine operational philosophy and annual water balance scenarios for KPS.
Wetland buffer lines	Niara	Determine appropriate buffer zones for rivers, wetlands, and estuaries, and ensure they comply with resource-quality objectives.

### 3.10 Limitations and Assumptions

The assumptions guiding this study were based on applicable guidelines and practices in the South African mining industry. The following constraints may have affected this study:

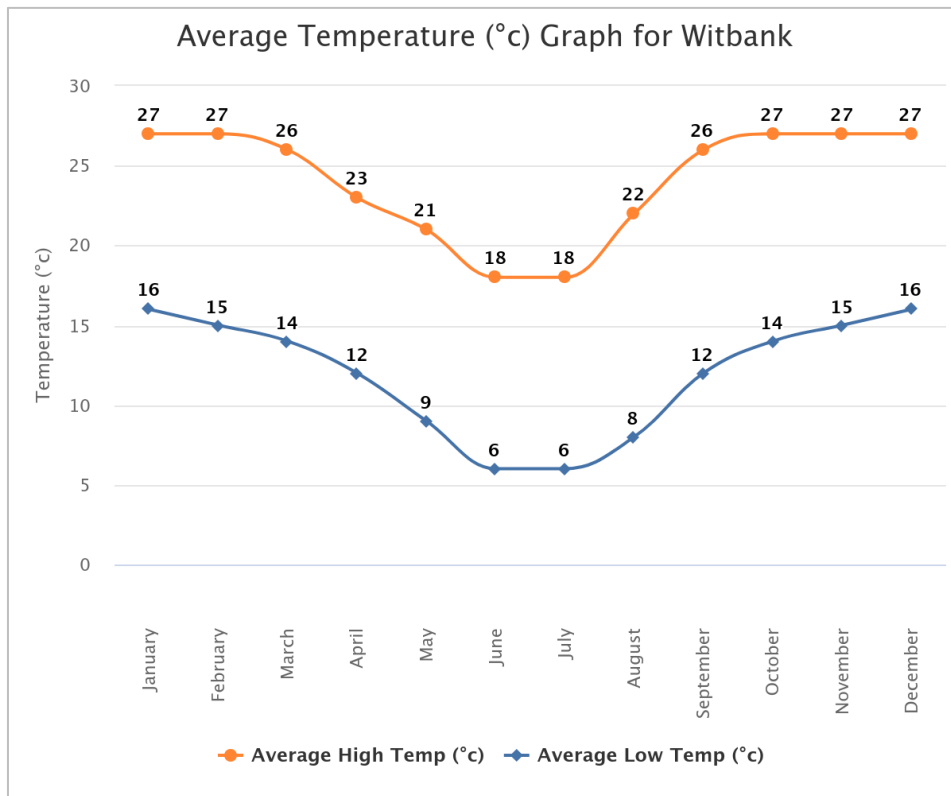
- This assessment was based on the project description, proposed mining activities, and their relationship with the overall KPS operations. Therefore, this report has been prepared for the purpose outlined in the Introduction and Scope of Work (SoW) above. No responsibility is accepted for the use of this report, in whole or in part, in any other context or for any other purpose.
- Seasonal changes in the hydrological regimes affecting the area's water quality were not accounted for in the analysis. However, the static water-quality sampling values from 2022 were compared with the recommended RQOs for the mine-site catchments and the IWUL limits.

- 
- It was assumed that the mine rehabilitation program would ensure that the mining footprint remains within the same size as a means of ensuring that (during the wet season) the characteristics of the sub-drainage areas are not changed, which might result in increased runoff that will subsequently result in more water flowing to the storage facilities that may not hold all the dirty water.
  - The expected peak flow volumes generated in the dirty water areas did not account for the expected hydroclimatic changes that might be attributed to climate change. Thus, the hydrological and site layout conditions were assumed to be stationary, albeit non-stationary, a widely acknowledged condition in the hydrology community.
  - Routine maintenance of the mine site was assumed to be implemented to ensure that the stormwater management system remains efficient throughout the mine operation. Therefore, it is essential to keep the dirty water areas as small as possible and divert clean water around and away from them.

## 4 Desktop Assessment

### 4.1 Hydrometeorological Analysis

The dominant climatic conditions at the KPSX site are warm-temperate, classified as Cwb (Köppen et al., 2006). The area experiences hot, wet summers (October to March) and dry, cold winters (June to August), with average maximum and minimum temperatures of 25°C and 3°C, respectively. Figure 4.1 shows Witbank’s long-term average minimum and maximum temperatures roughly 24 km southwest of the mine site.



**Figure 4.1: Average temperatures for the study site represented by Witbank station (source: WorldWeatherOnline, 2024)**

### 4.2 Topographic and Hydrologic Setting

KPSXs Pits BD and H are located in the headwater reaches of a predominantly rural quaternary catchment B20G (522 km<sup>2</sup>), draining its runoff with a series of unnamed tributaries of the Saalboomspruit that joins the Wilge River of the Limpopo-Olifants WMA (Figure 4.2). Undulating hilltops are characterised by relatively gentle slopes (4°), with the landscape covered by dry and irrigated cultivated land and grassland. The topographic nature of the area gives rise to a series of depression storages in the form of wetlands dominating the area (Figure 4.3). A series of unnamed tributaries arises from an elevation of about 1 612 meters above mean sea level (mamsl) and the lowest point of the KPSX boundary at 1 482 mamsl, as shown on the elevation distribution maps presented in Figure 4.4.

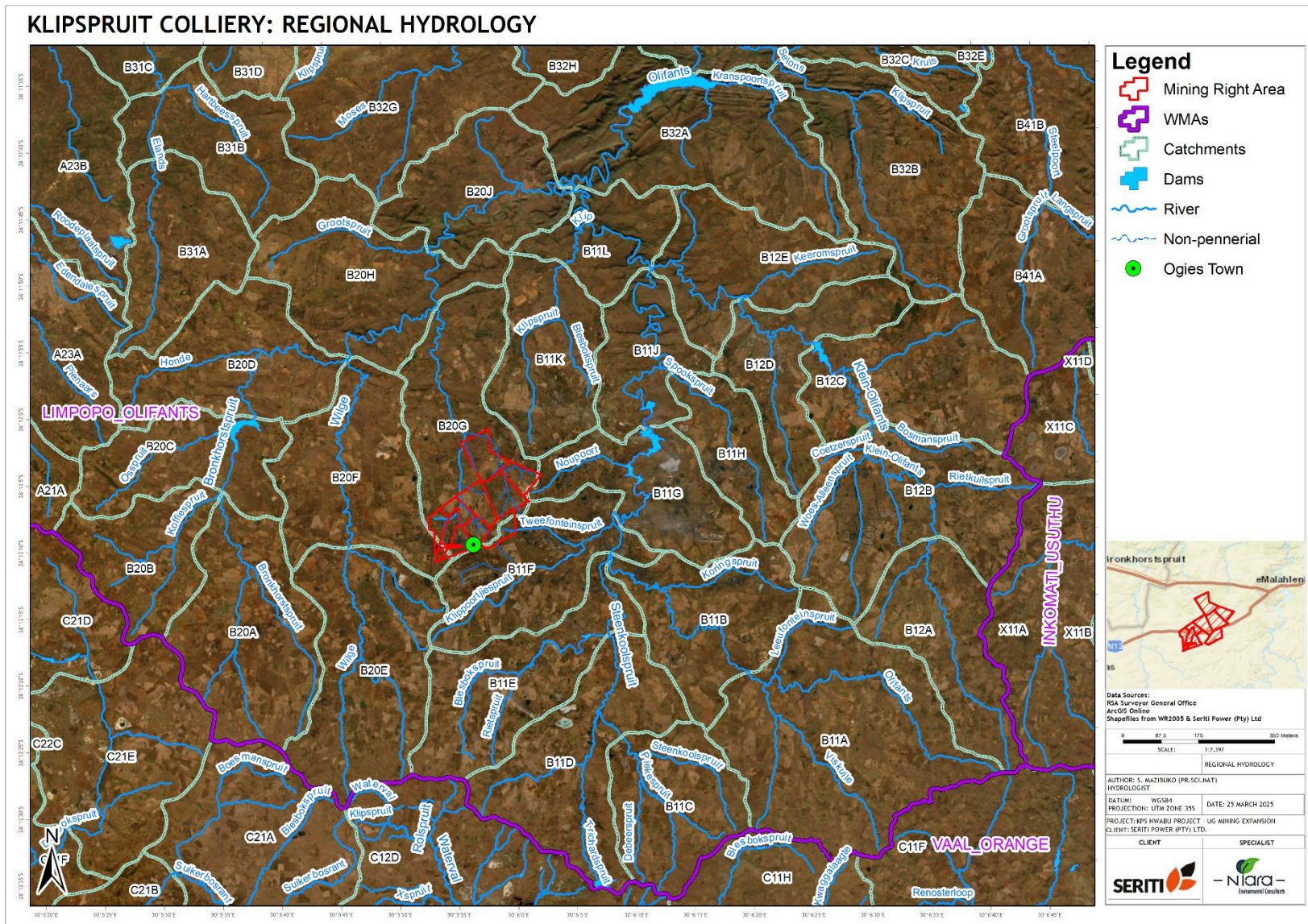


Figure 4.2: Regional hydrological setting of the KPS

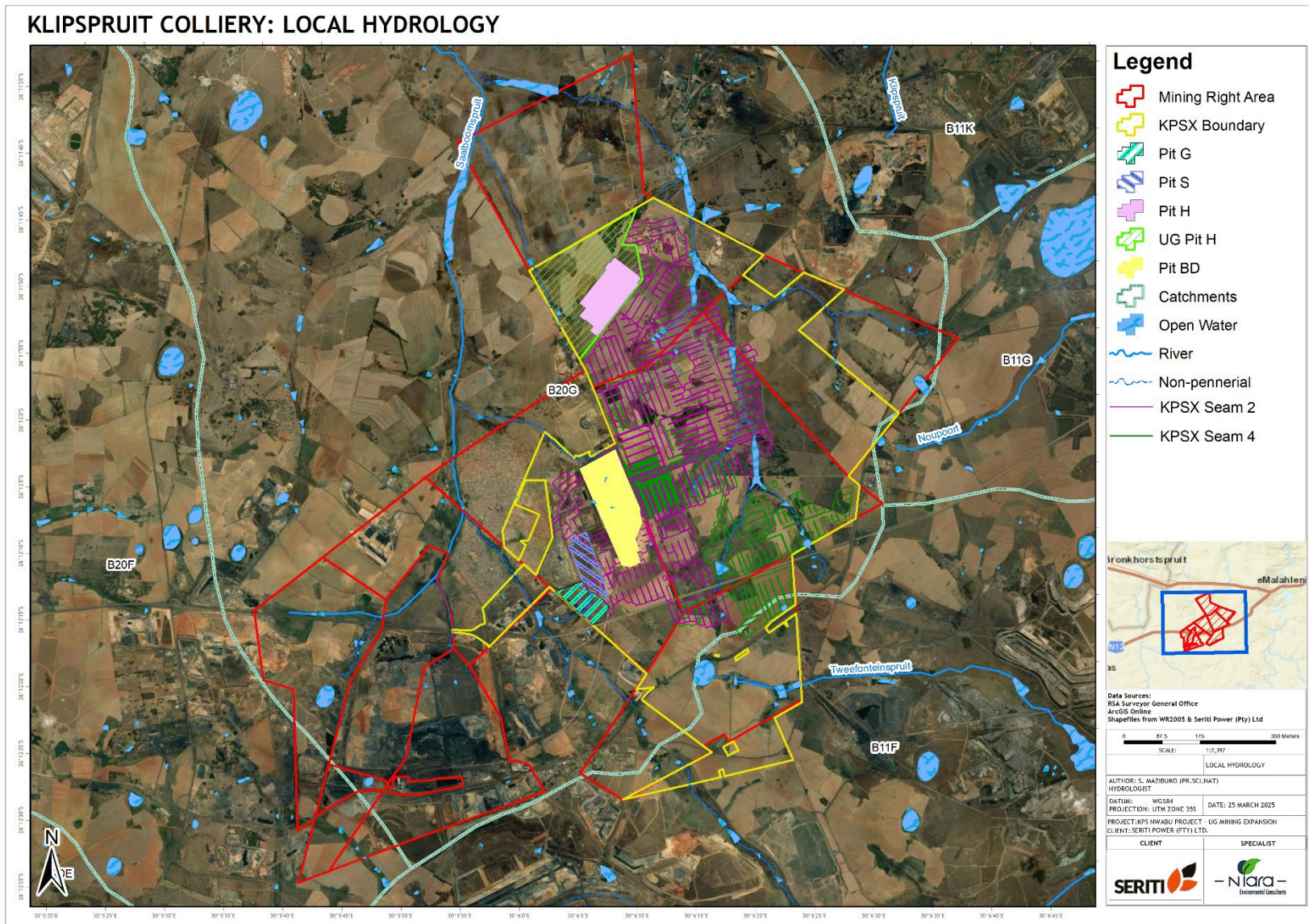


Figure 4.3: Local hydrological setting of the KPS mining area

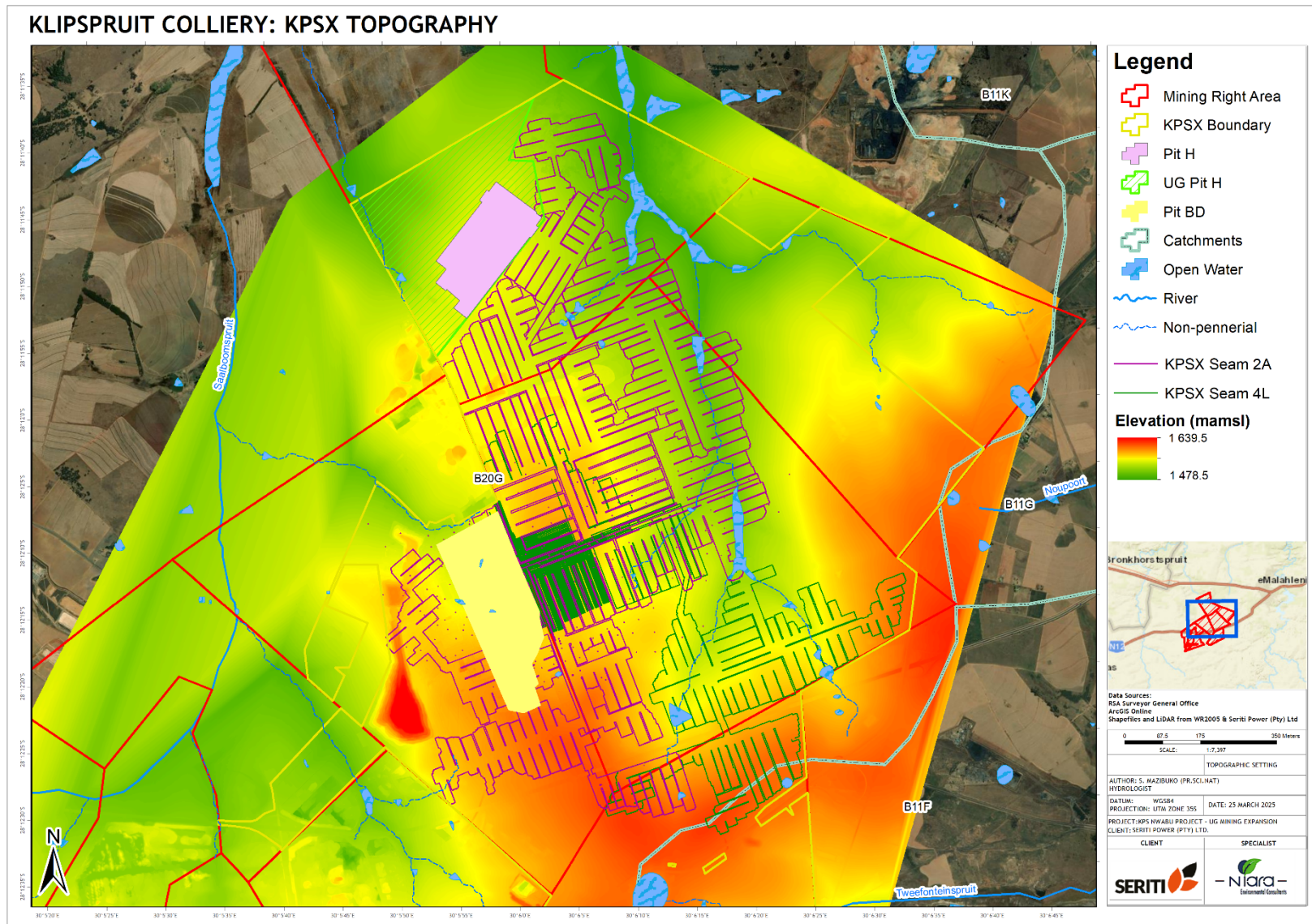
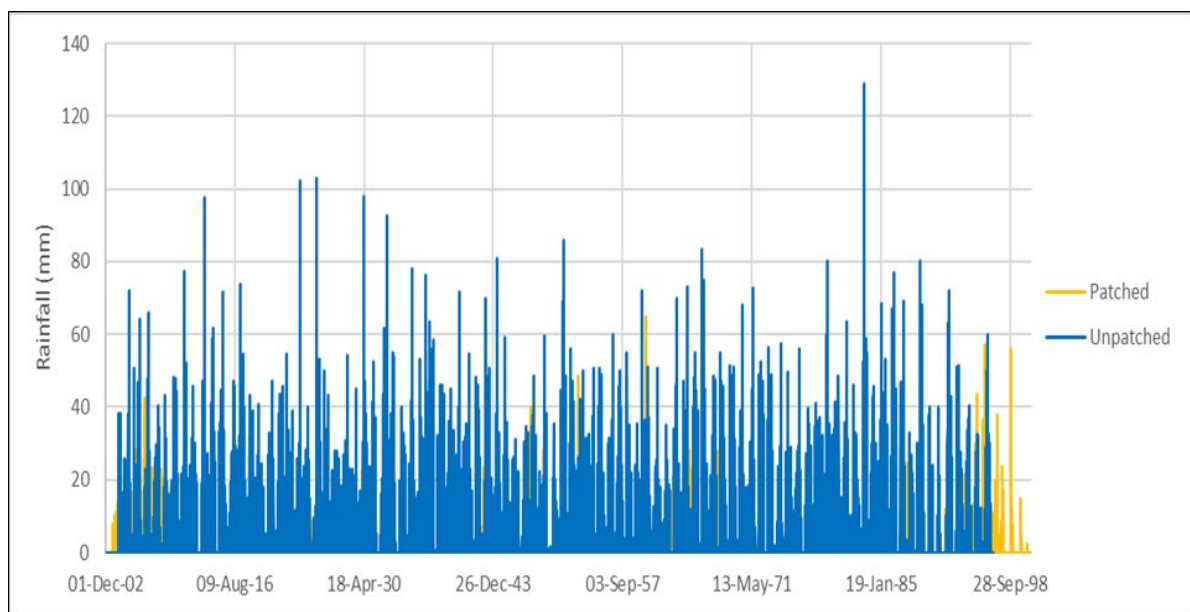


Figure 4.4: Topographic setting of the KPSX mining area

Catchment average-based rainfall record from the South African Water Resources Study (WR2012) (Bailey & Pitman, 2015) indicates that the mine area experiences a Mean Annual Precipitation (MAP) of 686 mm while site-specific rainfall recorded (96 years) from the South African Weather Services (SAWS) Ogies (Pol) station (26°03'S, 29°03'E) – located roughly 6 km from the mine site – indicated MAP of 743 mm. The 96-year long record of the Ogies (Pol) station rain gauge is plotted in the time series given in Figure 4.5. The figure also includes the patched records for periods with no recorded data. Expanding the record addressed the issue with rainfall measurements in the Main Pit area of KPS, which had limited records. Having a site-representative localised record can enhance understanding of rainfall patterns in the area, thereby increasing confidence in the results.



**Figure 4.5: Daily Rainfall from the Ogies (Pol) weather station**

Within the KPS boundary, no available hydrometeorological station provides all the parameters required for a detailed hydrological study. Under these conditions, regionalised data are often used to give the area's baseline hydroclimatic conditions. This case was true for representative evaporation data that could be used to represent evaporation patterns for the KPS. The calculated Mean Annual Evaporation (MAE) for the study area, based on Symons Pan (S-Pan) converted to open water, is 1 700 mm.

The statistical distribution of monthly rainfall and evaporation is presented in Figure 4.6, indicating these variables' high seasonality, while the monthly average values are given in Table 4.1. Regular rain (90% of the events) for the wettest months (December and January) will likely be at most 67 mm, while extreme rainfall (10% of the events) will likely not exceed 199 mm. The dry season runs from May to September, while October to April is wet.

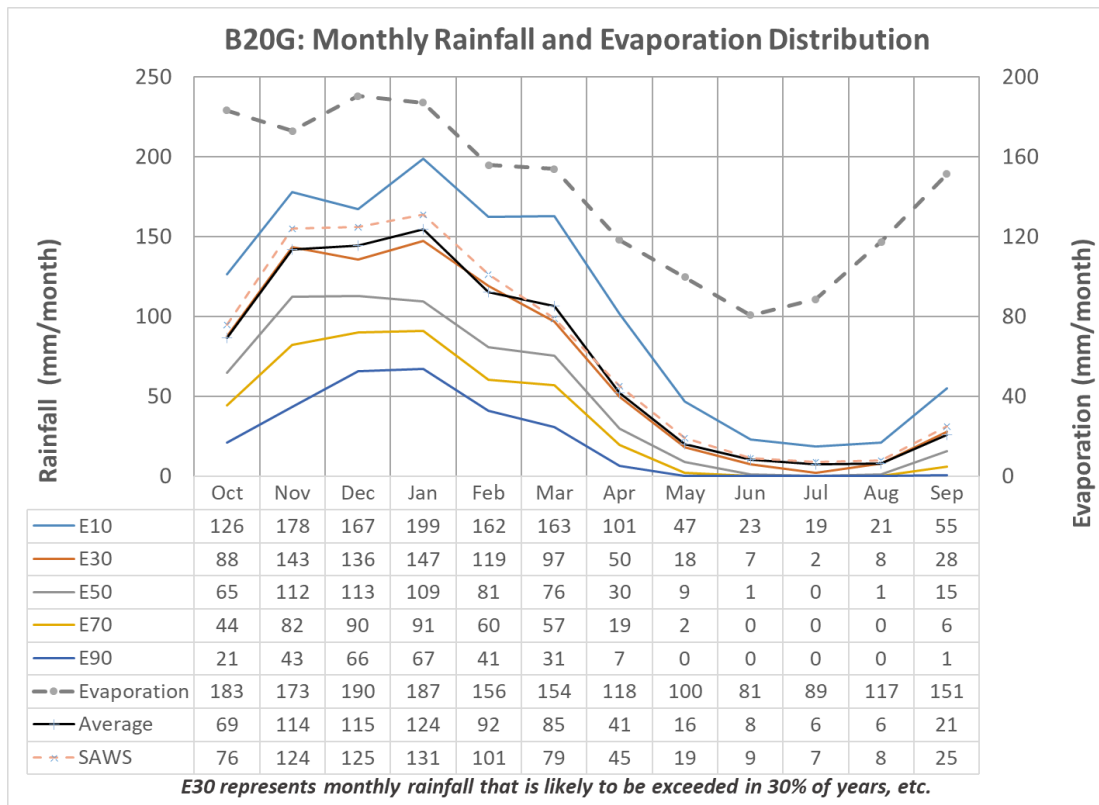
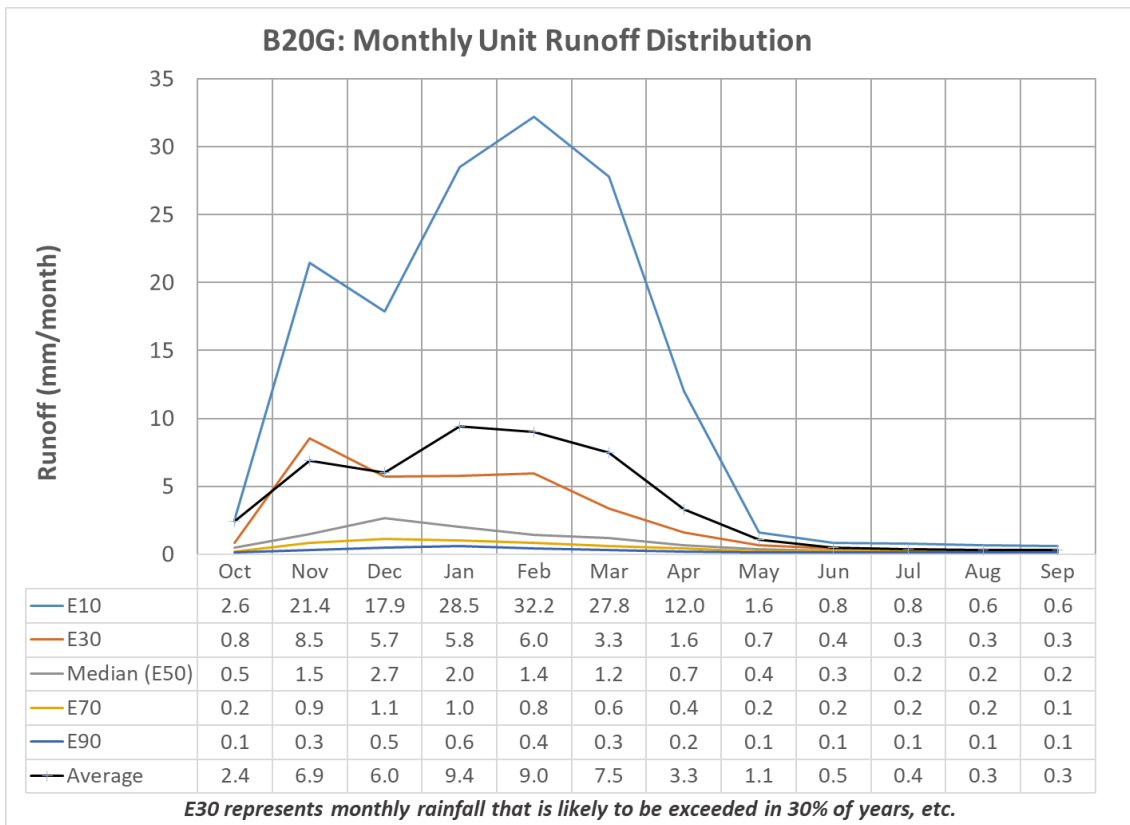


Figure 4.6: Monthly rainfall and evaporation distributions (source: Bailey & Pitman, 2015)

Table 4.1: Summary of the monthly evaporation and rainfall dataset for the study site

Months	Evaporation (S-Pan) (mm)	% of MAE	Lake Evaporation Factors	Lake Evaporation (mm)	Average Monthly Rainfall (mm)	Catchment Rainfall
	4A		-	B20G	Pol (0478093W)	B20G
October	183	11	0,81	148	76	69
November	173	11	0,82	141	124	114
December	190	12	0,83	157	125	115
January	187	11	0,84	156	131	124
February	156	10	0,88	136	101	92
March	154	9	0,88	135	79	85
April	118	7	0,88	103	45	41
May	100	6	0,87	86	19	16
June	81	4	0,85	68	9	8
July	89	5	0,83	73	7	6
August	117	7	0,81	94	8	6
September	151	9	0,81	122	25	20
<b>Total</b>	<b>1 700</b>	<b>100</b>	<b>-</b>	<b>1 420</b>	<b>749</b>	<b>698</b>

The natural Mean Annual Runoff (MAR) depth for the quaternary catchment B20G was downscaled to obtain representative runoff for the mine site, which was calculated to be 50 mm. This runoff accounts for approximately 7.2% of the area's MAP. The monthly distribution of unit runoff hydrological response is presented in Figure 4.7.



**Figure 4.7: Unit hydrograph for catchment B20G (derived from (Bailey & Pitman, 2015))**

### 4.3 Baseline Water Quality Analysis

The presence of defunct coal mines across the Upper Olifants River catchment has been attributed to the deterioration of surface water quality due to high Total Dissolved Solids (TDS) and calls for more comprehensive management of surface water resources to ensure these conditions don't deteriorate the surface water resources of the area have been made by DWS. One of DWS's interventions was the development of the Integrated Water Resource Management Plan (IWRMP) for the Upper and Middle Olifants Catchment in 2009 (DWAf, 2009), aimed at addressing water quality issues in the area.

#### 4.3.1 Surface Water Quality

Surface water monitoring and sampling in KPS – including KPSX – are conducted by Aquatico using the prescribed method described in section 3.5. For KPSX, surface water sampling was done for February – April 2022 (Term 1) and May – June 2022 (Term 2). The selection of the surface water sampling points was guided by the principles and guidelines stipulated in BPGs (DWAf, 2006c). These principles recommend identifying a point in a river course unlikely to be affected by KPSX mining activities, as well as downstream points that may reflect potential mining effects on surface water resources.

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Figure 4.8 shows the location of surface water sampling points considered for evaluating surface water quality conditions before the commencement of UG mining activities at Pits BD and H. During the site visit, the upper reaches of the unnamed tributaries of the Saalboomspruit were dry. Thus, it was not sampled. Therefore, the results of surface water samples collected in 2022 were interpreted by comparing KPSX IWUL (Licence No. 24075037) limits and recommended values provided in RQOs for the area (DWS, 2017).

Results show that Term 1 had most parameters within the IWUL limits, except for a few points that indicated upstream pollution sources, as indicated by increased SO<sub>4</sub>, salinity, and Mn. Parameters of concern included low pH and elevated EC, TDS, SO<sub>4</sub>, Cl, Ca, Mg, Fe, Mn and TSS concentrations. Similar patterns were observed for Term 2; however, there was increased concentration, which may be attributed to low rainfall. Aquatico recommended that the source of these exceedances be investigated and contained. This pollution emanates from possible discharge or seepage at or near KPS and should be investigated, contained, and remediated.

#### **4.3.2 Open Bodies Water Quality**

The water quality data for the KPSX PCDs (except PCD 3) are compared with the limits specified in Table 5, based on the KPSX IWUL of 2016 (Licence No. 03/B11F/ACGIJ/4740). This water quality data is also evaluated against the General Authorisation Limit (GN 665 of 2013) for disposing of wastewater in a natural watercourse for comparative purposes, as well as the RQO values for the Olifants Catchments (DWS, 2017). Other PCDs not affected by the proposed extension within the KPS, from Term 1 and Term 2, such as the KPSS PCD, indicated elevated pH and high NO<sub>3</sub>N concentration. Such water quality would be expected from wastewater containment facilities; however, these exceeded the IWUL limits for wastewater. Aquatico recommended that this water be kept in a closed-circuit system and that discharge into the environment and seepage into the groundwater resource be prevented, where possible.

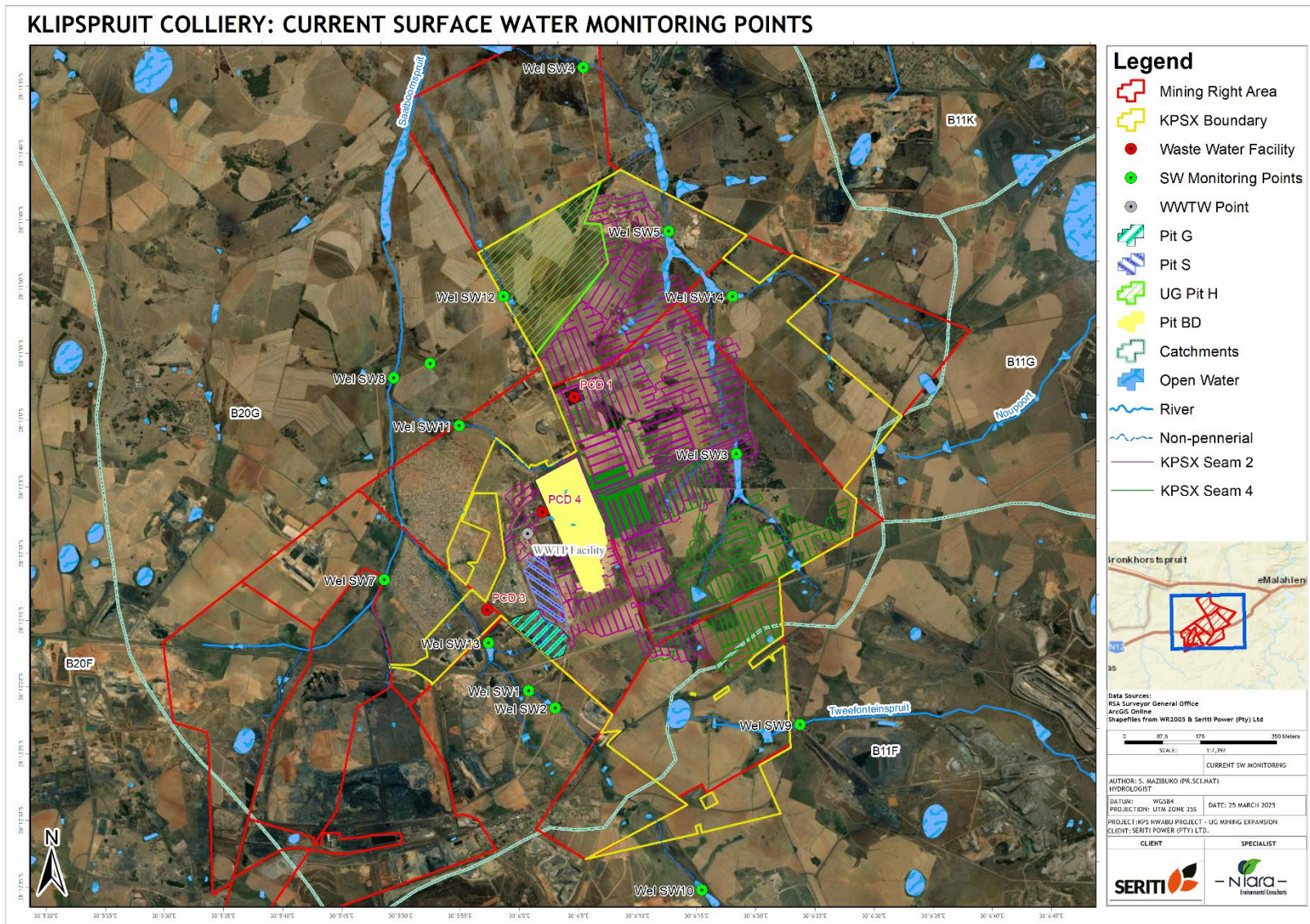


Figure 4.8: KPSX current surface water sampling points

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## 5 AVERAGE WATER BALANCES

In line with the DWS's G2 BPG (DWAF, 2006a), understanding the water systems' boundaries and the layout of the water circuits is essential when developing and updating a site-wide average water balance. This is primarily because it serves as a tool for decision-making, simulating different water-use scenarios and evaluating the risk of mine water management. This section of the report, therefore, presents the general mine infrastructure related to water use (inflows, outflows, and storage) based on the current and future plans of the KPS mine, including UG mining via Pits BD and H. A water balance approach accounted for the dynamics of monthly rainfall, runoff, evaporation, and water reuse for KPSX over the LoM. These dynamics accounted for normal (95<sup>th</sup> percentile) and worst (10<sup>th</sup> percentile) conditions possible within the KPS mine site.

The updated water flow processes for the wider KPS are presented in a Process Flow Diagram (PFD) to provide insights into all water-linked flows within KPS, including the proposed addition of KPSX mining methods, their supporting infrastructure, and assumed water requirements and fluxes throughout the LoM. The following assumptions and information were used to update KPS's PFD.

### 5.1 Water Balance Assumptions and Limitations

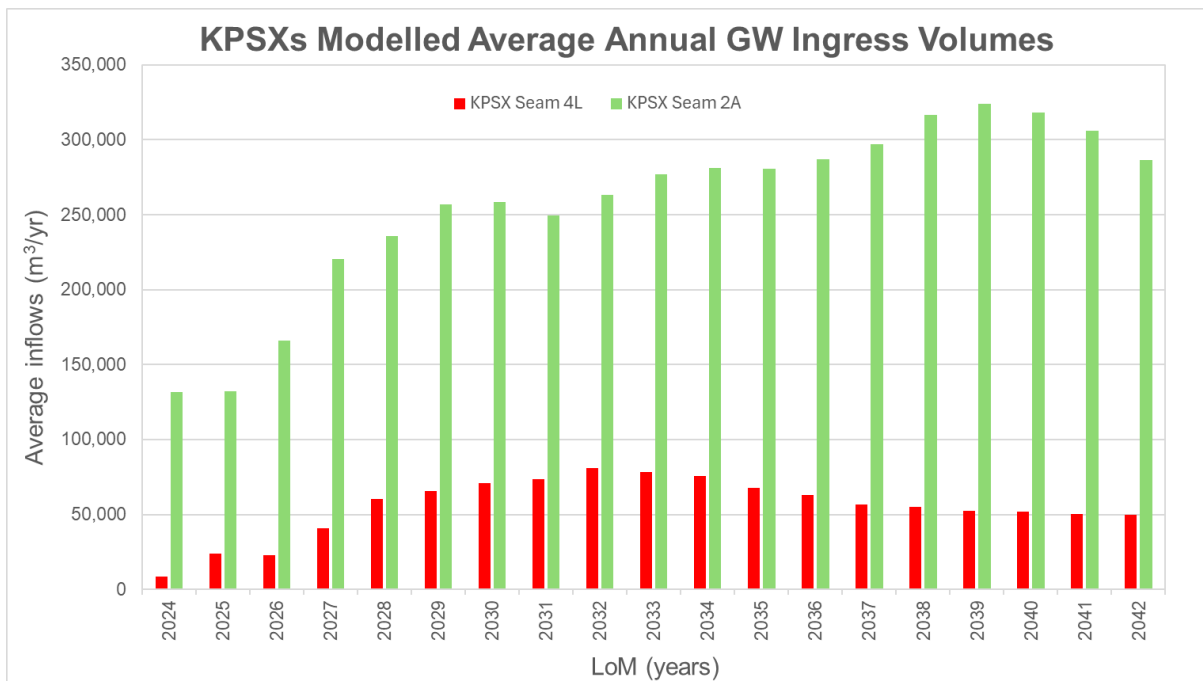
The baseline information used to guide the development and computation of KPSX's water balances was sourced from various reports on the study and from best practices applicable to calculating water balances for the coal mine sites. Surface water runoff from the mine infrastructure and natural (grassed) areas was estimated to be 80% and 50% of the mine site MAP, respectively. These factors were used in the calculation of the expected unit hydrograph for the naturalised flows, which are likely to be impacted by the construction of pits (particularly Pit H), and additional haul roads connecting the mining areas with the coal conveyance and processing within the KPS area.

The daily, monthly and annual average groundwater ingress volumes into Pits BD and H were based on the groundwater model simulations for KPS's LoM and are given in Table 5.1 and their relative annual average volumes are graphically represented in Figure 5.1. Simulations show that KPSX is estimated to reach a maximum ingress of 324 120 m<sup>3</sup>/yr (888 m<sup>3</sup>/d) for Seam 4L in year 2032 and 81 030 m<sup>3</sup>/yr (222 m<sup>3</sup>/d) for Seam 2A in year 2039. After the peak periods, it was calculated that these volumes will reduce gradually.

Evaporation from the pit sumps assumes that these sumps (in the pits) will have a fixed surface area: their size will not change. This therefore suggests that high uncertainty is associated with fluxes in and out of these storage facilities.

**Table 5.1: Average daily, monthly and annual groundwater ingress volumes for KPSXs Seam 2 and 4**

Years	KPSX Seam 4L			KPSX Seam 2A		
	Daily (m <sup>3</sup> /day)	Monthly (m <sup>3</sup> /month)	Yearly (m <sup>3</sup> /yr)	Daily (m <sup>3</sup> /day)	Monthly (m <sup>3</sup> /month)	Yearly (m <sup>3</sup> /yr)
2024	23	690	8,395	360.1	10,803	131,437
2025	64.8	1,944	23,652	362.6	10,878	132,349
2026	62.5	1,875	22,813	454.6	13,638	165,929
2027	112.1	3,363	40,917	603.4	18,102	220,241
2028	165.8	4,974	60,517	645.8	19,374	235,717
2029	180.4	5,412	65,846	703.2	21,096	256,668
2030	193.7	5,811	70,701	708	21,240	258,420
2031	201.3	6,039	73,475	684	20,520	249,660
2032	221.6	6,648	80,884	720.8	21,624	263,092
2033	215.1	6,453	78,512	758.3	22,749	276,780
2034	207	6,210	75,555	770.7	23,121	281,306
2035	185	5,550	67,525	769.2	23,076	280,758
2036	172.9	5,187	63,109	785.8	23,574	286,817
2037	155	4,650	56,575	814.2	24,426	297,183
2038	150.6	4,518	54,969	866.9	26,007	316,419
2039	144.2	4,326	52,633	888.1	26,643	324,157
2040	141.4	4,242	51,611	872.5	26,175	318,463
2041	137.5	4,125	50,188	838.6	25,158	306,089
2042	136.9	4,107	49,969	785.1	23,553	286,562



**Figure 5.1: Modelled average annual groundwater ingress for KPSXs Seams 2 and 4**

## 5.2 Water Process Flow Diagram

The main components of the mine infrastructure are (i) the Main Pit Area, (ii) Klipspruit South Pit (KPSS), (iii) mined Bankfontein Void, and (iv) Klipspruit Extension Weltevreden (KPSX). The latter is relevant to this study, including water operations at Pits BD and H based on UG mining methods. The two pits were integrated into the KPS mining operations, and their effect on water operations was represented in the 2024 water and salt balance update study conducted by WSP (2004a). Based on the understanding of the proposed operations of Pits BD and H and their associated mine infrastructure, the water process flow diagrams for the main components of KPS are presented in Figure 5.2 (for Main Pit and Bankfontein Void) and Figure 5.3 for KPSX amendments relevant to this study.

### 5.2.1 Main Pit Area Operations

Figure 5.2 shows the mine water reticulation diagram for the Main Pit area and its operations. Water in the Main Pit is collected in the Ramp 1 area (Ramp 1 sump), and “In-pit” water seeps into the Ramp 1 Void. Dirty water from Ramp 1 is pumped to Ramp 4 (plus Discard Dump seepage) and Ramp 4 Booster station. Ramp 4 Booster station receives water from Ramp 3 (via the dirty water channel) and water from the Discard Bin (RoM sump) collecting sump. The Balancing Dam receives water from Ramp 4, Ramp 4 Booster Water, and reject water from the Water Treatment Plan (WTP), dirty runoff from the Refuel Bay, and overflows from the Rubber and South Dams – the latter, which was reported to have not been active for a while (WSP, 2024a). Water from this dam is used for dust suppression, supplied to the Zibulo Colliery (after treatment) and exported to the Mzimkhulu Mine Water Treatment Plant (WTP). The WTP supplies potable water to mine support operations, and some of it is discharged into the environment via a river. Rubber Dam supplies water for dust suppression and coal processing at the Phola Coal Processing Plant (PCPP), as well as water for washbays, workshops, offices, and firewater via the Concrete Reservoir. This dam also receives water from Zibulo UG Workings. Dirty runoff from the coal product stockpile area and treated effluent from PCPP are recovered at the South Dam and Discard Bin, respectively.

Dirty runoff generated in the Run-of-Mine (RoM) stockpile areas flows into Wayne’s Sump, which also receives treated water from the Sewage Treatment Plan (STP), and this water is used to suppress dust on haul roads and in the administrative areas. Water pumped directly from the Balancing Dam to the filling point near Wayne's Sump still needs to be confirmed, together with treated effluent from the Sewage Treatment Plant (STP) and dirty runoff upstream of this sump, which is assumed to be routed to Ramp 4. KPS, Zibulo Colliery and NLC operations supply RoM for processing at PCPP. Generated slurry from coal processing and, through a filter press, is discarded to the KPS Discard Dump.

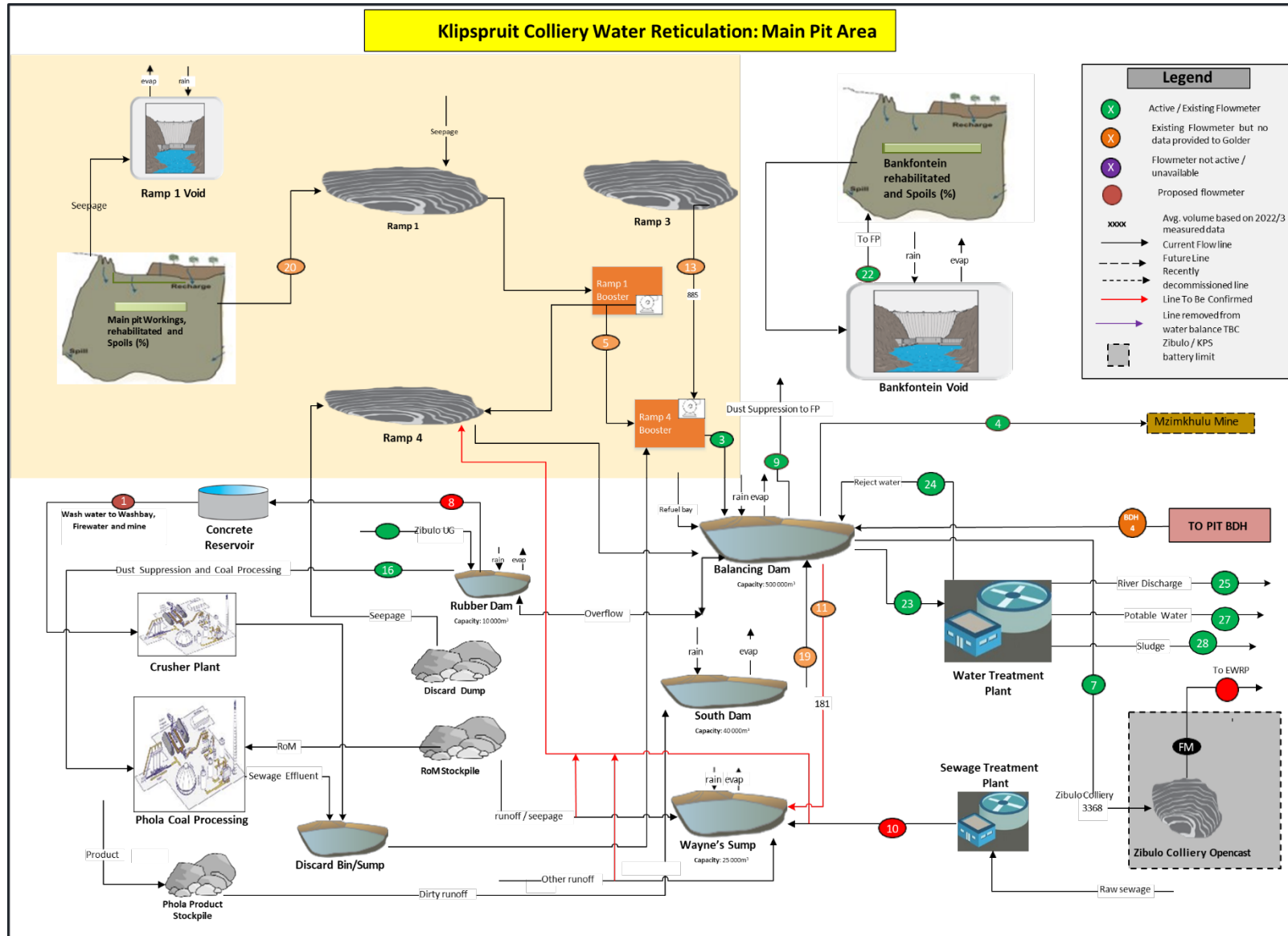


Figure 5.2: KPS Water Reticulation System in the Main Pit area

### **5.2.2 Bankfontein Void Area Operations**

Bankfontein Void has undergone 100% rehabilitation since mining ceased. It is envisaged that backfilling of the void will be completed within 3 years (WSP, 2024a). The void receives only rainfall, runoff, recharge, and seepage from the backfilled spoils.

### **5.2.3 Klipspruit South Pit Area Operations**

KPSS is currently open-cast mined and underground mining is also planned. The water flow circuit within this operation is presented in Figure 5.3. Dirty runoff and seepage from the Box Cut Waste stockpile, KPSS, and ingress are pumped to the KPSS PCD and will be used for dewatering the underground Klipspruit southwest mine in the near future. Dirty water from this PCD is also used for dust suppression on haul roads and pumped to the KPS Balancing Dam. This dam also has a feedback line to this PCD in the event of water overflow or as needed.

### **5.2.4 Klipspruit Extension Weltevreden Area Operations**

KPSX area mining operations (Figure 5.3) will include UG mining of the main seams (1 seam, 2 seam, 2A seam, 4 lower seam, 4 upper seam, 4 upper A seam, and 5 seam) via adits at Pit BD and H. At Pit BD (which is already operational), rainfall, dirty runoff, dewatering, seepage and groundwater ingress are collected by sumps from the two seams (seams 2 and 4) and pumped into PCD 4. This PCD also receives treated effluent from STP, dirty stormwater from the workshop and the proposed sump downslope of this PCD, RoM stockpile and coal conveyor belt loading areas. Water from PCD 4 will be pumped to PCD 1 or returned to the water system through the Raw Water Reservoir (RWR) to supplement dust suppression. If PCD 1 reaches its full capacity, it will overflow into PCD 2.

PCD 2 will receive dirty runoff water pumped (via pipeline) from Pit H overburden stockpile and its sump. Pit H sump will receive rainfall, dirty runoff within the pit, dewatering, seepage and groundwater ingress. It is also envisaged that water from PCD 2 will be pumped back to PCD 1 to supplement mining operations. Operations at PCD 1 will involve supplying the RWR and KPS Balancing Dam, provided the dam has sufficient capacity. Additional water from the Balancing Dam will be returned to the PCD 1 to supplement the supply to the RWR. RWS will receive water from KPS Balancing Dam, PCD 1, 3, and 4, and will be used to supply the fire tank, BHM, conveyor dust suppression, HDV wash water, and Conveyor belt wash water (RoM Tip, Transfer bin, and Overland feed bin).

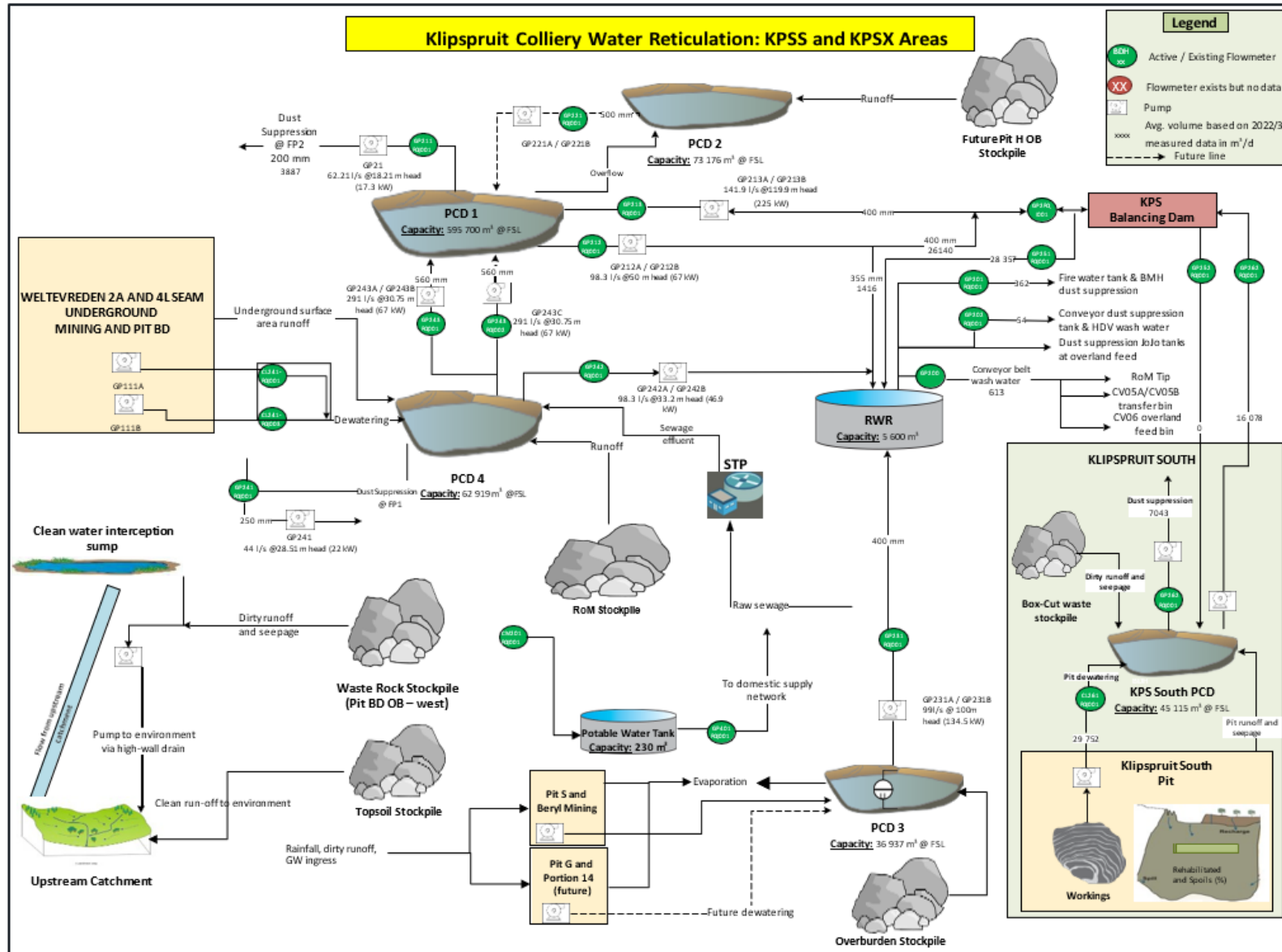


Figure 5.3: KPS Water Reticulation in KPSS and KPSX areas - including Pits BD and H

### 5.3 Water-Related Infrastructure

#### *Balancing Dam*

The Balancing Dam, with a design capacity of 500 000 m<sup>3</sup>, is the main water-collection facility on the mine site and supports mining and PCPP operations. The facility is a clay-lined homogeneous earth embankment dam covering an area of 8.5ha (Jones and Wagener, 2017). It operates at 50% under normal conditions and 70% during the wet season. The dam is currently experiencing siltation, which only allows for the 400 000 m<sup>3</sup> maximum operational capacity. Inflows into this facility include water from the Pits BD (via RWR), KPS South Pit (via KPSS PCD), Booster Tank 2, Rubber and South Dams, RoM and Discard Bin sumps, and PCD 1. The dam receives water from the Pit BD and KPSS mining area dams. Water abstractions include dust suppression on haul roads and mining operations, the Rubber Dam, the Zibulo Colliery Dam, the Mzimkhulu Mine, and water for the WTP.

#### *Wayne's Sump*

This 1.1ha High-Density Polyethylene-lined (HDPE) sump has a storage capacity of 25 00 m<sup>3</sup> and is generally used to collect stormwater from the administration buildings, dirty runoff from the workshop areas, and overflows from the Balancing Dam. Water from this facility is used to suppress dust on haul roads, while the other volume is pumped to the Balancing Dam.

#### *Discard Bin Sump*

This earth-lined sump has a storage capacity of 9 000 m<sup>3</sup> and covers an area of 0.1ha. It receives dirty runoff generated from the crusher plant and treated effluent from PCPP operations. Outflows from this facility are directed to Ramp 4 Booster.

#### *Rubber Dam*

Rubber Dam (HDPE-lined and 0.45ha area) receives external water from Zibulo Colliery, with a full storage capacity of 10 000 m<sup>3</sup>. During reporting, this dam was operated at a low volume due to the dam wall failure, and water was diverted to the Balancing Dam. Under normal operational conditions, water from this dam is directly supplied to PCPP operations, while overflows are directed to the Balancing Dam.

#### *South Dam*

South Dam covers a surface area of 3.93ha and has a maximum storage capacity of 40 000 m<sup>3</sup> on a clay-lined surface. This dam receives dirty runoff generated by the coal product stockpile area from the PCPP, which has resulted in 2 000 m<sup>3</sup> of silt accumulation. Dirty water from this facility is pumped to the Balancing Dam.

### Pollution Control Dams

There are five PCDs which support mining operations at KPS and the summary of their characteristics, inflows and outflows is presented in Table 5.2. The wastewater storage facilities relevant to Pits BD and H are PCDs 1, 2 and 4. These PCDs will collect all accumulated dirty water from the in-pit sumps of Pits BD and H via pipelines. This also includes the expected future dewatering of Pit BD. Central to the operation of PCD 1 is the pumping of water to and from the KPS Balancing Dam, while PCD 4 will be pumping to PCD 1 and RWR.

**Table 5.2: Summary of the KPS PCDs**

Facility	Construction Date	Closure Date	Capacity (m <sup>3</sup> )	Water Sources	Water Outflows	Areas @ FSL (m <sup>2</sup> )
PCD 1	2018 Commissioned in 2019 & 2020	2044	571,931	<ul style="list-style-type: none"> <li>Pit H dewatering (future source)</li> <li>Rainfall</li> <li>PCD 4 and PCD 2 (in future)</li> <li>Raw Water Reservoir</li> </ul>	<ul style="list-style-type: none"> <li>Evaporation</li> <li>Dust suppression / Filling Point</li> <li>Raw Water Reservoir</li> <li>Balancing Dam</li> </ul>	205,047
PCD 2	2021	2046	73,176	<ul style="list-style-type: none"> <li>Pit H contaminated seepage and runoff (future source)</li> <li>Rainfall</li> <li>Overflow from PCD 1</li> </ul>	<ul style="list-style-type: none"> <li>Evaporation</li> <li>Pumping to PCD 1 (in future)</li> </ul>	126,903
PCD 3	2018	2044	36,937	<ul style="list-style-type: none"> <li>Wash water return</li> <li>Rainfall</li> <li>Dirty runoff from overburden and RoM stockpile</li> <li>Pit S in-pit sump (rainfall, GW ingress &amp; dirty runoff)</li> <li>Pit G in-pit sump (rainfall, GW ingress &amp; runoff)</li> <li>Pit G future dewatering</li> </ul>	<ul style="list-style-type: none"> <li>Evaporation</li> <li>Dust suppression</li> <li>Raw Water Reservoir</li> </ul>	19,239
PCD 4	2019	2045	62,919	<ul style="list-style-type: none"> <li>RoM Tip sump</li> <li>Pit BD seepage</li> <li>Rainfall</li> <li>Dirty stormwater &amp; runoff</li> <li>Pit BD's Seam 2 &amp; 4 UG Workings Dewatering</li> <li>Treated Effluent</li> </ul>	<ul style="list-style-type: none"> <li>Raw Water Reservoir</li> <li>Evaporation</li> <li>PCD 1</li> <li>Filling Point</li> <li>Dust Suppression</li> </ul>	19,239
KPSS PCD	2019	2045	45,115	<ul style="list-style-type: none"> <li>KPSS dewatering</li> <li>Rainfall</li> <li>KPSS dirty seepage and runoff</li> </ul>	<ul style="list-style-type: none"> <li>Balancing Dam</li> <li>Evaporation</li> </ul>	-

### 5.3.1 Water Flow Monitoring Points

Records of storage facility levels, inflows, and outflows are vital for calibrating a dynamic water balance for a mine. These data are used to calibrate and verify key assumptions made when setting up a model. The model calibration assumptions pertained to rainfall, recharge, and runoff. Flowmeter records used in the calibration were taken from January 2022 to December 2023 flow rate data and presented in Table 5.3. The records show periods with outliers that need to be addressed by Seriti, and the dewatering volumes are also noted as higher in 2022 than in 2023 for the KPSX area.

**Table 5.3: 2022 and 2023 average flowmeter data for KPS used in the model**

Flow No.	Flowmeter Name	Source	Destination	Average Flow (m <sup>3</sup> /d)	
				2022	2023
3	Ramp 4 (Main Pit)-Balancing Dam	Ramp 4 (Main Pit)	Balancing Dam	TBC	3,062
4	Balancing Dam to Mzimkhulu	Balancing Dam	Mzimkhulu Mine	655	852
9	Balancing Dam to Filling Point	Balancing Dam	Dust suppression near the Filling point	269	156
16	Rubber Dam to Phola	Rubber Dam	PCPP (Dust suppression and coal processing)	2,571	4,692
18	Zibulo to Rubber Dam	Zibulo Colliery	Rubber Dam	0	628
22	Bankfontein to Filling Point	Bankfontein	Filling point	461	3,386
23	Balancing Dam to WTP	Balancing Dam	WTP	2,491	2 101
24	WTP Reject water	WTP	Balancing Dam	882	848
25	River discharge	WTP	River	1 838	1 376
28	Sludge	WTP	Discharge	105	368
CL261_FQI_001	South Pit dewatering	South Pit	KPSS PCD	15	87
GP262_FQI_001	KPSS Pit to Balancing Dam	KPSS PCD	Balancing Dam	264	109
CM401_FQI_001	Potable water tank inlet			176	39
GP200_FQI_001	-	Raw Water	Wash water system	690	80
GP201_FQI_001	-	Dust suppression	Fire water tank	420	56
GP211_FQI_001	-	PCD 1	Filling Point 2	2,058	523
GP212_FQI_001	-	PCD 1	Raw Water Reservoir	1,416	560
GP213_FQI_001	-	PCD 1	Balancing Dam	26,140	20,472
GP221_FQI_001	-	PCD 2	PCD 1		6,719
CL241_FQI_001	-	Pit	PCD 4	26,455	1,938
GP241_FQI_001	-	PCD 4	Filling Point 1	9,552	820
GP243_FQI_001	-	PCD 4	PCD 1 Supply line 1	18,312	9,503
GP243_FQI_002	-	PCD 4	PCD 1 Supply line 2	118,529	8,394

Note: Seriti Personnel is verifying values highlighted in yellow

### 5.3.2 System Operating Rules for KPSX Water Storage Infrastructure

The management of dirty water levels at the Balancing Dam, PCDs 1, 2, 3, and 4 (inflows and outflows) was simulated to maintain minimum levels and prevent over-spilling, while ensuring supply meets demand. The adopted dam operation rules for all water infrastructure to support UG mining operations at Pits BD and H are summarised in Table 5.4 and were confirmed by Seriti personnel for 2024 operations. These simulations include the expected additional inflows and stormwater runoff associated with Pits BD and H operations for the KPS LoM duration.

**Table 5.4: KPSX water storage facility operating rules relevant to Pits BD and H**

From	To	Operating Rule
<b>Balancing Dam</b>	Dust Suppression	Pump out only if the dam level is above 60% and stop pumping as soon as the dam level is below 40%
	PCD 1	Start pumping to PCD1 when the level in the Balancing Dam is greater than or equal to 90%
<b>PCD 1</b>	Balancing Dam	Pump to Balancing Dam when PCD 1 level is above 90%.
	RWS	Pump to the RWS only if the PCD 4 volume is greater than 5 000 m <sup>3</sup> .
<b>PCD 2</b>	PCD 1	Pump to PCD 1 when the PCD2 level is greater than 70%, but first check whether the PCD1 level is less than 85%. Stop pumping when the PCD 2 level gets below 40%.
<b>PCD 4</b>	PCD 1	Pump to PCD 1 when PCD 4 volume exceeds 5 000 m <sup>3</sup> . but first check whether the PCD 1 level is less than 60%.
	RWS	Pump to the RWS only if PCD4 volume is greater than 1 000 m <sup>3</sup> .
<b>Pit BD Workings</b>	PCD 4	Pump first to PCD 4 to keep the working level as low as possible. Ensure that the dam level is below 90%.
<b>PCD 4</b>	PCD 1	Stop pumping when PCD 4 reaches 90%
	RWR	If the PCD 4 level is above 50%, then pump to PCD 1 until the PCD 4 level reaches 45%; thereafter, start pumping to RWR when the PCD 4 level is greater than or equal to 21% and to the filling point when the PCD 4 level is greater than or equal to 10%.
	Filling Point	Stop pumping from PCD 4 if the level is less than or equal to 4%
<b>Pit BD Spoils</b>	PCDs 1 & 4	Pump first to PCD 4 to manage to decant from the spoils. Ensure that the dam level is below 80%. If the PCD 4 level is above 80%, then pump to PCD 1.
<b>Pit H Workings</b>	PCD 1	Pump to PCD 1 to ensure the workings level remains as low as possible. Ensure that the dam level is below 85%.
<b>Pit H Spoils</b>	PCD 1	Pump to PCD 1 to manage to decant from the spoils. Ensure that the dam level is below 85%.
<b>PCD 3</b>	PCD 4	Start pumping when the level in PCD 3 is at or above 70%. Stop when PCD 3 level reaches 3%.
	Buffer Tank	Only pump for supply when the PCD 3 level is at or above 45%. Stop when PCD 3 level reaches 3%.
	RWR	Only pump for supply when PCD 3 level is greater than or equal to 7.5%. Stop when PCD 3 level reaches 3%.
	RWR (Buffer Tank)	Only pump for supply when the PCD 3 level is greater than or equal to 45%

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### 5.3.3 KPS Water Demands

The average water demand for coal processing at the PCPP and for dust suppression within the plant area in 2023 was estimated at 3.6 MI/d (1 314 MI/yr) based on monitoring data from inflows to the wash plant. Dust suppression on haul roads from the Filling Point sump averages 0.8 MI/d to 1.5 MI/d. A value of 1.5 MI/d was used and accounted for an estimated yearly average of 548 MI. Dust suppression water required at the RoM stockpile area, fire hydrants and workshops from the concrete reservoir was recorded at 0.8 MI/d (292 MI/yr). Dust suppression at the PCPP from the Balancing/Rubber Dam: 1.25 MI/d. The current total area requiring dust suppression on haul roads is 42.01ha, and an additional 624 m<sup>3</sup>/day will be required to include additional haul roads connecting Pit H to the existing mine haul road network.

### 5.4 Average Water Balances

Site-wide water balance calculations were simulated for annual, monthly, and daily scenarios (i.e., 95<sup>th</sup>, 10<sup>th</sup> percentiles, and average) of water flow within KPSX. These calculations were informed by the site-wide KPS water operations as the proposed UG workings at both pits and incorporated their direct impact not only on mine operations but also on the overall mine water management, as shown in the KPSX PFD in Figure 5.3. An assumption about the size of Pit H's sump was made because this information was unavailable at the time of reporting. The average expected rainfall and runoff into the Pit H's box cut were calculated based on the area's average rainfall and the runoff factors (provided in the assumptions), which will be collected by a sump for pumping to PCD 1.

The results of the computed annual, monthly and daily water balances based on the incorporation of UG workings in the KPSX operations, with the inclusion of the two pits, are presented in Tables 5.5 to 5.6. Results show that the inclusion of UG mining will bring an additional volume of 818 m<sup>3</sup>/day (equivalent to 298 486 m<sup>3</sup>/yr) for Pit H, of which 631 m<sup>3</sup>/day (equivalent to 230 136 m<sup>3</sup>/yr) will be pumped to PCD 1. For Pit BD, an annual volume of 8 317 m<sup>3</sup>/yr (23 m<sup>3</sup>/day) will be from inflows, while outflows to the PCD 4 will account for 7 025 m<sup>3</sup>/yr (19.2 m<sup>3</sup>/day). The two wastewater storage facilities (PCD 1 & 4) have adequate capacity to store the volumes of dirty water generated by mining operations. It is, however, worth noting that the expected groundwater ingress volumes will vary over a period and these estimates need to be refined in future water balance updates.

**Table 5.5: Average annual water balance calculation for PSXS's Pits BD and H**

KPS WATER BALANCE					
AVERAGE ANNUAL					
Water In	Quantity	WATER USE FACILITY NAME		Water Out	Quantity
<b>KPSX AREA</b>					
From: Rainfall	18 m <sup>3</sup> /a		To: Evaporation	24 m <sup>3</sup> /a	
From: Runoff	4,253 m <sup>3</sup> /a		To: Decant	0 m <sup>3</sup> /a	
From: GW Ingress	1,391 m <sup>3</sup> /a		To: UG Losses	468 m <sup>3</sup> /a	
From: Recharge	1,155 m <sup>3</sup> /a		To: PCD 4	7,025 m <sup>3</sup> /a	
From: UG Water Supply	1,500 m <sup>3</sup> /a				
<b>TOTAL</b>	<b>8,317 m<sup>3</sup>/a</b>	<b>800</b>	<b>TOTAL</b>	<b>7,517 m<sup>3</sup>/a</b>	
From: Rainfall	458 m <sup>3</sup> /a		To: Evaporation	617 m <sup>3</sup> /a	
From: Runoff	247 m <sup>3</sup> /a		To: Dust Suppression	5,534 m <sup>3</sup> /a	
From: PCD 2	1,071 m <sup>3</sup> /a		To: RWR	908 m <sup>3</sup> /a	
From: PCD 4	2,729 m <sup>3</sup> /a		To: Spill	164 m <sup>3</sup> /a	
From: KPS Balancing Dam	3,708 m <sup>3</sup> /a		To: KPS Balancing Dam	1,050 m <sup>3</sup> /a	
From: Pit H	230,136 m <sup>3</sup> /a				
<b>TOTAL</b>	<b>238,349 m<sup>3</sup>/a</b>	<b>230,076</b>	<b>TOTAL</b>	<b>8,273 m<sup>3</sup>/a</b>	
From: Rainfall	237 m <sup>3</sup> /a		To: Evaporation	240 m <sup>3</sup> /a	
From: Pit H OB Stockpile Runoff	1,078 m <sup>3</sup> /a		To: PCD 1	1,071 m <sup>3</sup> /a	
			To: Spill	5 m <sup>3</sup> /a	
<b>TOTAL</b>	<b>1,315 m<sup>3</sup>/a</b>	<b>-1</b>	<b>TOTAL</b>	<b>1,316 m<sup>3</sup>/a</b>	
From: Rainfall	17 m <sup>3</sup> /a		To: Evaporation	26,064 m <sup>3</sup> /a	
From: Runoff	0 m <sup>3</sup> /a		To: Buffer Dam	193,500 m <sup>3</sup> /a	
From: Pit G	113,364 m <sup>3</sup> /a		To: RWS	41,052 m <sup>3</sup> /a	
From: Pit S	120,240 m <sup>3</sup> /a				
<b>TOTAL</b>	<b>233,621 m<sup>3</sup>/a</b>	<b>-3</b>	<b>TOTAL</b>	<b>260,616 m<sup>3</sup>/a</b>	
From: Rainfall	36 m <sup>3</sup> /a		To: Evaporation	58 m <sup>3</sup> /a	
From: RoM Stockpile Runoff	134 m <sup>3</sup> /a		To: Dust Suppression	664 m <sup>3</sup> /a	
From: WW Return	38 m <sup>3</sup> /a		To: RWS	100 m <sup>3</sup> /a	
From: Pit BD	7,025 m <sup>3</sup> /a		To: PCD 1	2,729 m <sup>3</sup> /a	
From: SWMP Sump	0 m <sup>3</sup> /a		To: Spill	3,934 m <sup>3</sup> /a	
<b>TOTAL</b>	<b>7,233 m<sup>3</sup>/a</b>	<b>-252</b>	<b>TOTAL</b>	<b>7,485 m<sup>3</sup>/a</b>	
From: PCD 1	908 m <sup>3</sup> /a		To: BMH Dust Suppression	362 m <sup>3</sup> /a	
From: PCD 3	41,052 m <sup>3</sup> /a		To: Conveyor Dust Suppression	54 m <sup>3</sup> /a	
From: PCD 4	100 m <sup>3</sup> /a		To: Conveyor Wash Water	613 m <sup>3</sup> /a	
From: KPS Balancing Dam	247 m <sup>3</sup> /a				
<b>TOTAL</b>	<b>42,307 m<sup>3</sup>/a</b>	<b>41,278</b>	<b>TOTAL</b>	<b>1,029 m<sup>3</sup>/a</b>	
From: GW Ingress	192,156 m <sup>3</sup> /a		To: Evaporation	1,700 m <sup>3</sup> /a	
From: Seepage	0 m <sup>3</sup> /a		To: PCD 1	230,136 m <sup>3</sup> /a	
From: Rainfall	68,600 m <sup>3</sup> /a		To: Decant	66,650 m <sup>3</sup> /a	
From: Runoff	37,730 m <sup>3</sup> /a				
<b>TOTAL</b>	<b>298,486 m<sup>3</sup>/a</b>	<b>0</b>	<b>TOTAL</b>	<b>298,486 m<sup>3</sup>/a</b>	
<b>TOTAL INFLOWS</b>	<b>829,628 m<sup>3</sup>/a</b>	<b>244,906</b>	<b>TOTAL OUTFLOWS</b>	<b>584,722 m<sup>3</sup>/a</b>	
KEY					
Dirty Water		Clean Water		Grey Water	

**Table 5.6: Average monthly water balance calculation for PSXS's Pits BD and H**

KPS WATER BALANCE					
AVERAGE MONTHLY					
Water In	Quantity	WATER USE FACILITY NAME		Water Out	Quantity
<b>KPSX AREA</b>					
From: Rainfall	2 m <sup>3</sup> /month		PIT BD	To: Evaporation	2 m <sup>3</sup> /month
From: Runoff	354 m <sup>3</sup> /month			To: Decant	0 m <sup>3</sup> /month
From: GW Ingress	116 m <sup>3</sup> /month			To: UG Losses	39 m <sup>3</sup> /month
From: Recharge	96 m <sup>3</sup> /month			To: PCD 4	585 m <sup>3</sup> /month
From: UG Water Supply	125 m <sup>3</sup> /month				
<b>TOTAL</b>	<b>693 m<sup>3</sup>/month</b>		<b>67</b>	<b>TOTAL</b>	<b>626 m<sup>3</sup>/month</b>
From: Rainfall	38 m <sup>3</sup> /month		PCD 1	To: Evaporation	51 m <sup>3</sup> /month
From: Runoff	21 m <sup>3</sup> /month			To: Dust Suppression	461 m <sup>3</sup> /month
From: PCD 2	89 m <sup>3</sup> /month			To: RWR	76 m <sup>3</sup> /month
From: PCD 4	227 m <sup>3</sup> /month			To: Spill	14 m <sup>3</sup> /month
From: KPS Balancing Dam	309 m <sup>3</sup> /month			To: KPS Balancing Dam	88 m <sup>3</sup> /month
From: Pit H	19,178 m <sup>3</sup> /month				
<b>TOTAL</b>	<b>19,862 m<sup>3</sup>/month</b>		<b>19,173</b>	<b>TOTAL</b>	<b>689 m<sup>3</sup>/month</b>
From: Rainfall	20 m <sup>3</sup> /month		PCD 2	To: Evaporation	20 m <sup>3</sup> /month
From: Pit H OB Stockpile Runoff	90 m <sup>3</sup> /month			To: PCD 1	89 m <sup>3</sup> /month
				To: Spill	0 m <sup>3</sup> /month
<b>TOTAL</b>	<b>110 m<sup>3</sup>/month</b>		<b>0</b>	<b>TOTAL</b>	<b>110 m<sup>3</sup>/month</b>
From: Rainfall	1 m <sup>3</sup> /month		PCD 3	To: Evaporation	2,172 m <sup>3</sup> /month
From: Runoff	0 m <sup>3</sup> /month			To: Buffer Dam	16,125 m <sup>3</sup> /month
From: Pit G	9,447 m <sup>3</sup> /month			To: RWS	3,421 m <sup>3</sup> /month
From: Pit S	10,020 m <sup>3</sup> /month				
<b>TOTAL</b>	<b>19,468 m<sup>3</sup>/month</b>		<b>-3</b>	<b>TOTAL</b>	<b>21,718 m<sup>3</sup>/month</b>
From: Rainfall	3 m <sup>3</sup> /month		PCD 4	To: Evaporation	5 m <sup>3</sup> /month
From: RoM Stockpile Runoff	11 m <sup>3</sup> /month			To: Dust Suppression	55 m <sup>3</sup> /month
From: WW Return	3 m <sup>3</sup> /month			To: RWS	8 m <sup>3</sup> /month
From: Pit BD	585 m <sup>3</sup> /month			To: PCD 1	227 m <sup>3</sup> /month
From: SWMP Sump	0 m <sup>3</sup> /month			To: Spill	328 m <sup>3</sup> /month
<b>TOTAL</b>	<b>603 m<sup>3</sup>/month</b>		<b>-21</b>	<b>TOTAL</b>	<b>624 m<sup>3</sup>/month</b>
From: PCD 1	76 m <sup>3</sup> /month		RWR	To: BMH Dust Suppression	30 m <sup>3</sup> /month
From: PCD 3	3,421 m <sup>3</sup> /month			To: Conveyor Dust Suppression	5 m <sup>3</sup> /month
From: PCD 4	8 m <sup>3</sup> /month			To: Conveyor Wash Water	51 m <sup>3</sup> /month
From: KPS Balancing Dam	21 m <sup>3</sup> /month				
<b>TOTAL</b>	<b>3,526 m<sup>3</sup>/month</b>		<b>3,440</b>	<b>TOTAL</b>	<b>86 m<sup>3</sup>/month</b>
From: GW Ingress	16,013 m <sup>3</sup> /month		Pit H	To: Evaporation	142 m <sup>3</sup> /month
From: Seepage	0 m <sup>3</sup> /month			To: PCD 1	19,178 m <sup>3</sup> /month
From: Rainfall	5,717 m <sup>3</sup> /month			To: Decant	5,554 m <sup>3</sup> /month
From: Runoff	3,144 m <sup>3</sup> /month				
<b>TOTAL</b>	<b>24,874 m<sup>3</sup>/month</b>		<b>0</b>	<b>TOTAL</b>	<b>24,874 m<sup>3</sup>/month</b>
<b>TOTAL INFLOWS</b>	<b>69,136 m<sup>3</sup>/month</b>		<b>20,409</b>	<b>TOTAL OUTFLOWS</b>	<b>48,727 m<sup>3</sup>/month</b>
KEY					
Dirty Water		Clean Water		Grey Water	

**Table 5.7: Average daily water balance calculation for PSXS's Pits BD and H**

KPS WATER BALANCE					
AVERAGE DAILY					
Water In	Quantity	WATER USE FACILITY NAME		Water Out	Quantity
KPSX AREA					
From: Rainfall	0.0 m <sup>3</sup> /day		PIT BD	To: Evaporation	0.1 m <sup>3</sup> /day
From: Runoff	11.7 m <sup>3</sup> /day			To: Decant	0.0 m <sup>3</sup> /day
From: GW Ingress	3.8 m <sup>3</sup> /day			To: UG Losses	1.3 m <sup>3</sup> /day
From: Recharge	3.2 m <sup>3</sup> /day			To: PCD 4	19.2 m <sup>3</sup> /day
From: UG Water Supply	4.1 m <sup>3</sup> /day				
<b>TOTAL</b>	<b>23 m<sup>3</sup>/day</b>		<b>2</b>	<b>TOTAL</b>	<b>21 m<sup>3</sup>/day</b>
From: Rainfall	1.3 m <sup>3</sup> /day		PCD 1	To: Evaporation	1.7 m <sup>3</sup> /day
From: Runoff	0.7 m <sup>3</sup> /day			To: Dust Suppression	15.2 m <sup>3</sup> /day
From: PCD 2	2.9 m <sup>3</sup> /day			To: RWR	2.5 m <sup>3</sup> /day
From: PCD 4	7.5 m <sup>3</sup> /day			To: Spill	0.4 m <sup>3</sup> /day
From: KPS Balancing Dam	10.2 m <sup>3</sup> /day			To: KPS Balancing Dam	2.9 m <sup>3</sup> /day
From: Pit H	630.5 m <sup>3</sup> /day				
<b>TOTAL</b>	<b>653 m<sup>3</sup>/day</b>		<b>630</b>	<b>TOTAL</b>	<b>23 m<sup>3</sup>/day</b>
From: Rainfall	1 m <sup>3</sup> /day		PCD 2	To: Evaporation	0.7 m <sup>3</sup> /day
From: Pit H OB Stockpile Runoff	3 m <sup>3</sup> /day			To: PCD 1	2.9 m <sup>3</sup> /day
				To: Spill	0.0 m <sup>3</sup> /day
<b>TOTAL</b>	<b>4 m<sup>3</sup>/day</b>		<b>0</b>	<b>TOTAL</b>	<b>4 m<sup>3</sup>/day</b>
From: Rainfall	0.0 m <sup>3</sup> /day		PCD 3	To: Evaporation	71 m <sup>3</sup> /day
From: Runoff	0.0 m <sup>3</sup> /day			To: Buffer Dam	530 m <sup>3</sup> /day
From: Pit G	310.6 m <sup>3</sup> /day			To: RWS	112 m <sup>3</sup> /day
From: Pit S	329.4 m <sup>3</sup> /day				
<b>TOTAL</b>	<b>640 m<sup>3</sup>/day</b>		<b>-3</b>	<b>TOTAL</b>	<b>714 m<sup>3</sup>/day</b>
From: Rainfall	0.1 m <sup>3</sup> /day		PCD 4	To: Evaporation	0.2 m <sup>3</sup> /day
From: RoM Stockpile Runoff	0.4 m <sup>3</sup> /day			To: Dust Suppression	1.8 m <sup>3</sup> /day
From: WW Return	0.1 m <sup>3</sup> /day			To: RWS	0.3 m <sup>3</sup> /day
From: Pit BD	19.2 m <sup>3</sup> /day			To: PCD 1	7.5 m <sup>3</sup> /day
From: SWMP Sump	0.0 m <sup>3</sup> /day			To: Spill	10.8 m <sup>3</sup> /day
<b>TOTAL</b>	<b>20 m<sup>3</sup>/day</b>		<b>-1</b>	<b>TOTAL</b>	<b>21 m<sup>3</sup>/day</b>
From: PCD 1	2.5 m <sup>3</sup> /day		RWR	To: BMH Dust Suppression	1.0 m <sup>3</sup> /day
From: PCD 3	112.5 m <sup>3</sup> /day			To: Conveyor Dust Suppression	0.1 m <sup>3</sup> /day
From: PCD 4	0.3 m <sup>3</sup> /day			To: Conveyor Wash Water	1.7 m <sup>3</sup> /day
From: KPS Balancing Dam	0.7 m <sup>3</sup> /day				
<b>TOTAL</b>	<b>116 m<sup>3</sup>/day</b>		<b>113</b>	<b>TOTAL</b>	<b>3 m<sup>3</sup>/day</b>
From: GW Ingress	526.5 m <sup>3</sup> /day		Pit H	To: Evaporation	5 m <sup>3</sup> /day
From: Seepage	0.0 m <sup>3</sup> /day			To: PCD 1	631 m <sup>3</sup> /day
From: Rainfall	187.9 m <sup>3</sup> /day			To: Decant	183 m <sup>3</sup> /day
From: Runoff	103.4 m <sup>3</sup> /day				
<b>TOTAL</b>	<b>818 m<sup>3</sup>/day</b>		<b>0</b>	<b>TOTAL</b>	<b>818 m<sup>3</sup>/day</b>
<b>TOTAL INFLOWS</b>	<b>2,273 m<sup>3</sup>/day</b>		<b>671</b>	<b>TOTAL OUTFLOWS</b>	<b>1,602 m<sup>3</sup>/day</b>
KEY					
Dirty Water		Clean Water		Grey Water	

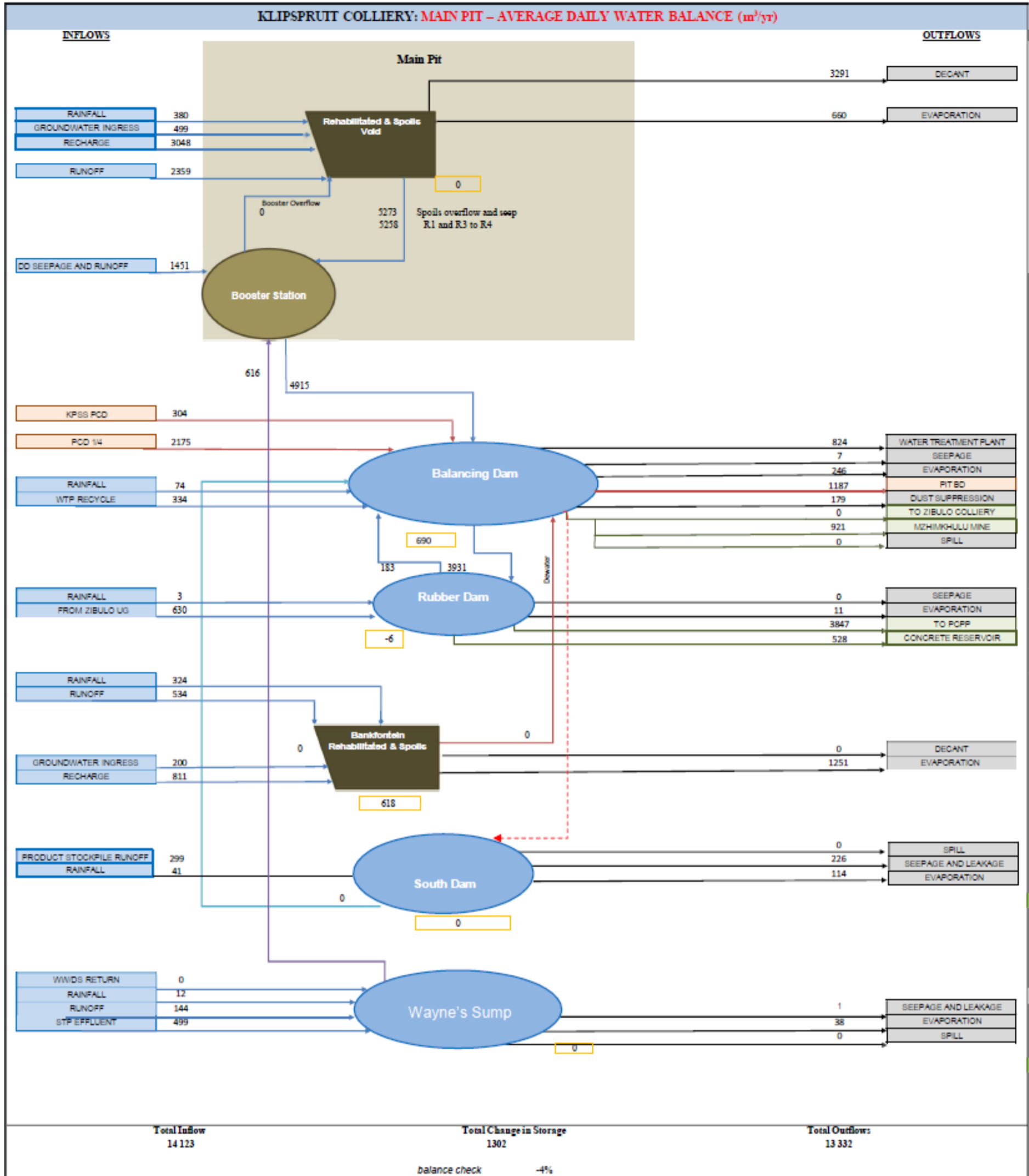


Figure 54: Daily average water balance for the Main Pit area of KPS

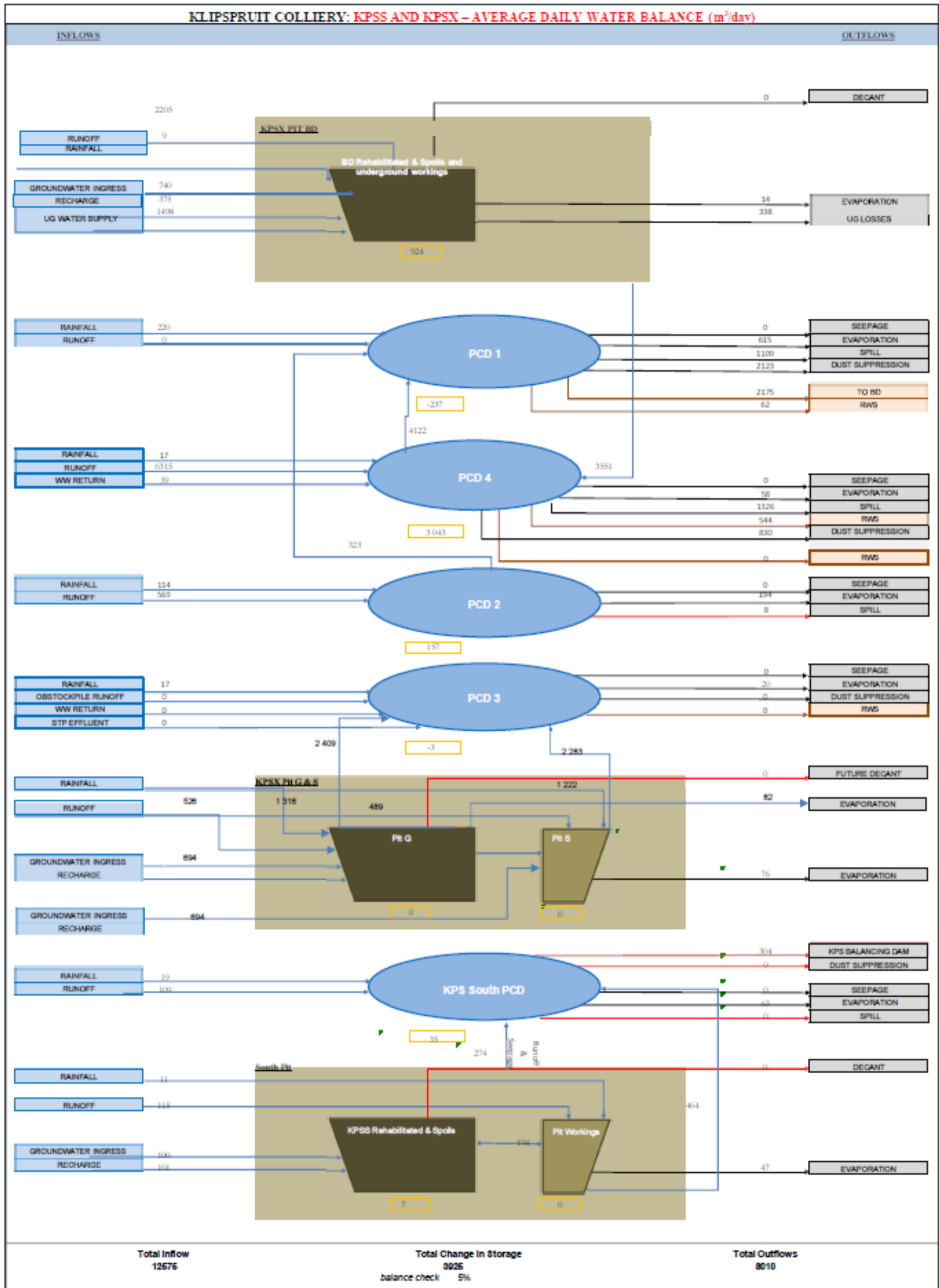


Figure 5.5: Daily average water balance for KPSX, including Pits ED and H

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## 6 Surface Water Impact Assessment

The potential impacts of the proposed mining-related activities on surface water receptors and the sensitivity of surface water resources in the surrounding areas of Pits BD and H are discussed and summarised, along with the mitigation measures that have been drawn. The mine site layout plan, distribution of coal seams, baseline hydrology, proposed stormwater management plans and updated water and salt balance studies guided this report's findings. This assessment primarily focuses on the areas surrounding Pits BD and H to assess the receptors identified in the surface water sensitivity assessment.

### 6.1 Surface Water Sensitivity

The local surface water resources are of medium sensitivity; the rationale for this sensitivity assessment is as follows:

- The proposed infrastructure changes on KPSX are within quaternary catchment B20G and are in the headwater reaches of Saalboomspruit, a tributary of the Wilge River. The catchment is mainly rural, with flows through preferential flow and natural drainage, so the probability of self-rehabilitation is high. Wetlands characterise the riparian reaches of the Saalboomspruit.
- Based on a review of the project description and listed activities in the previous section, Pit BD has an estimated total surface area of 70ha (0.7 km<sup>2</sup>), while 65ha (0.65 km<sup>2</sup>) characterises Pit H. These areas will modify the natural hydrological response to the downstream area. Based on the calculated unit runoff for the quaternary catchment, runoff will be reduced by 14.2 mm and 13.1 mm from the Pits BD and H areas.
- The extension of Pits BD and H within the 500 m buffer lines of the surrounding wetlands and river lines, as shown in Figure 6.1. A larger proportion of Pit H will be on the highly elevated area, and only a north-flowing tributary on the western edge of the pit is within the 500 m buffer line.

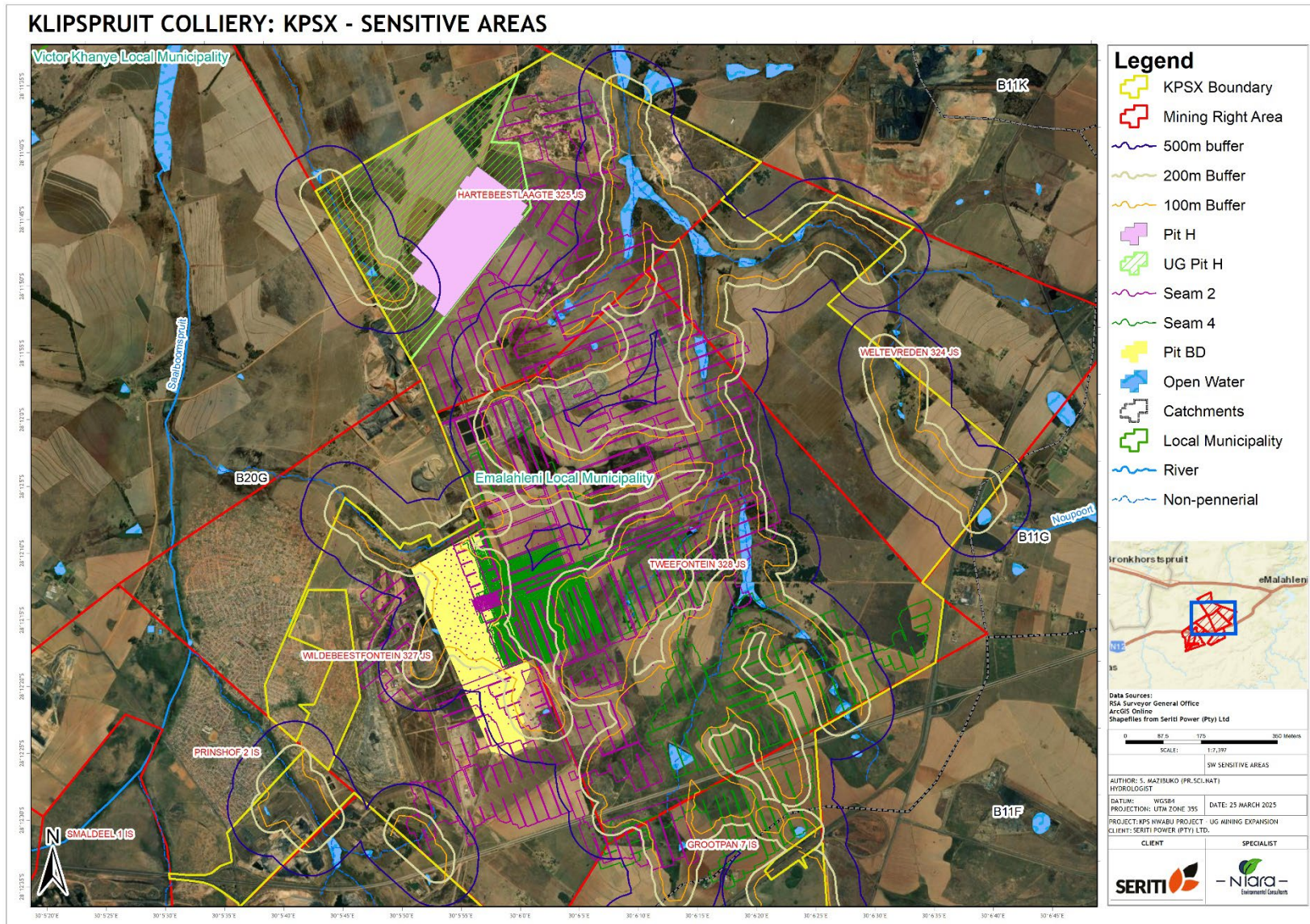


Figure 6.1: Surface water-sensitive areas

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## 6.2 Impact Assessment

The surface water impact methodology used in this study assesses the impacts of the proposed mining activities related to surface water management that were developed to comply with the risk matrix for WULA Section 21 (c) and (i) of NWA.

An assessment of each identified potentially significant impact, including –

- i. cumulative impacts;
- ii. the nature of the impact;
- iii. the extent and duration of the impact;
- iv. the probability of the impact occurring;
- v. the degree to which the impact can be reversed;
- vi. the degree to which the impact may cause irreplaceable loss of resources; and
- vii. the degree to which the impact can be mitigated.

This impact assessment is divided into three stages.

- *Issue identification* – evaluation of issues arising from diverting, channelling or concentrating the flow of surface water resources;
- *Impact definition* – positive and negative impacts associated with these issues (and any others not included) then need to be defined – the definition statement should consist of the activity (source of impact), aspect and receptor, as well as whether the impact is direct, indirect, or cumulative. Fatal flaws should also be identified at this stage, and
- *Impact evaluation* – this is not a purely objective and quantitative exercise. It has a subjective element, often relying on judgment and values as much as on science-based criteria and standards. The need, therefore, exists to clearly explain how impacts have been interpreted so that others can see the weight attached to different factors and understand the assessment's rationale.

Impacts on potential surface water receptors within and surrounding the mine pit area and its associated mining support infrastructure were quantified, and mitigation measures were proposed based on mining activities during the construction, operation, decommissioning, and post-closure phases of mining at KPSX areas.

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### **6.3 Impacts Description**

The impacts of the significant activities associated with various phases of the proposed changes in mining activities within the KPSX area were identified. These impacts were related to the potential positive or negative effects they can have on the surrounding environment, particularly on surface water resources.

#### **6.3.1 Impacts During Construction**

During the project's construction phase, the mining activities synopsis, as well as the description of their identified impacts on the surrounding surface water resources, are presented in Table 6.1. The main impacts given in the table are related to the potential deterioration of the downstream and surrounding surface water quality, changes in the naturalised flow regimes and natural drainage patterns of the surrounding landscape (including a wetland through conveyor belt crossing), soil erosion and sedimentation brought on by the development of the box-cut mining Pit H, the construction of new infrastructure (i.e., haul roads, stormwater system, water pipelines, conveyor system, stockpiles, overburden dump) – to support mining operations.

The construction of box-cut infrastructure to support mine operations may modify the natural hydrological regimes of surface water by reducing the catchment yields of natural flow. The two pits' footprint areas have surface drainage pathways that collect and convey overland runoff generated after rainfall events towards an unnamed tributary that drains to the Saalboomspruit on the western part of the pits. These pathways are typically dry during winter due to the lack of rainfall in the mine area. An increase in sediment loads resulting from suspended soil particles from cleared vegetated areas, topsoil stockpiles and haul roads areas can occur during storm events that have the potential to generate increased overland runoff. Larger exposed surfaces could increase sedimentation in downstream areas and, in turn, affect downstream water resources – particularly during the wet season.

Localised accidental spills and discharges of hydrocarbons (diesel, oil, grease, etc.) could contaminate and alter the chemistry of surface water resources in downstream and downslope areas. These spillages could arise from earthmoving and construction equipment, hazardous substances, and other potentially polluting materials, including human waste, that are not contained or removed when inadequate emergency control measures are in place to deal with the contaminants. This could indirectly contaminate downslope surface water resources on the contractor site and eventually affect the integrity of the surrounding streams, including the wetland that the conveyor belt will cross.

**Table 6.1: Summary of the identified impacts during the construction phase of Pits BD and H**

Construction Phase		
Project Activities	Impact	Impact description
Initial earthworks associated with site clearing, stripping and stockpiling of topsoil, preparations and construction of new mine surface infrastructure (Pit H, haul roads, conveyor belt crossing a stream and a wetland, water pipelines, stockpiles) and box cut and access ramps at the two pits	Water quality deterioration	<ul style="list-style-type: none"> <li>• Clearing the topsoil and site preparations for the mine infrastructure will expose soil surfaces to erosion.</li> <li>• When a large area of vegetation is cleared and topsoil is disturbed, loose material is exposed, resulting in erosion.</li> <li>• During rainfall events, runoff from the exposed site will transport the eroded soil material into the streams.</li> <li>• Uncontrolled spills of contaminants such as fuel, lubricants and oils and subsequent washing away of these into the surface water resources.</li> </ul>
	Alteration of flow, drainage patterns and wetland deterioration	<ul style="list-style-type: none"> <li>• A reduction in runoff water quantity in the downstream surface water resources system due to the construction of additional mining infrastructure.</li> <li>• Initial stormwater management measures are constructed on-site, reducing the catchment area for runoff (MAR).</li> <li>• Potential effects on the wetland’s integrity and its aquatic life.</li> </ul>
	Soil erosion and sedimentation	<ul style="list-style-type: none"> <li>• Site clearing, digging of trenches, and topsoil removal will be undertaken during the construction of additional mine infrastructure, which might lead to erosion and, consequently, siltation of watercourses.</li> <li>• The project could cause water resource pollution through sediment transport and other chemical parameters from runoff from the surface operations.</li> <li>• The risk of sedimentation is directly linked to erosion risk, as eroded soil particles will end up in nearby watercourses as sedimentation.</li> </ul>

**6.3.2 Impacts During Operation**

Table 6.2 shows the identified surface-water impacts during the mine's operational phase. Managing UG mining activities at Pits BD and H, stockpiles, and mine support equipment can result in accidental spillages that contaminate clean water areas through seepage, direct runoff, or oil and hydrocarbon spills, which may eventually pollute the surrounding surface water resources. Movement of heavy machinery and vehicles will result in the disturbance of the topsoil which could increase erosion and sedimentation if dust suppression is not applied adequately. Disturbed surfaces that are not rehabilitated are also likely to contribute to increased sedimentation in the downstream water resources. The conveyor belt's operation of loading the extracted RoM from the pits to the crusher plant has the potential to result in dust development and the expansion of the open pits and connecting haul roads in the landscape, thereby increasing modification of the national landscape setting. This affects rainfall-runoff mechanisms and, in turn, the expected runoff regimes in downstream areas. The need to capture and contain dirty water generated during operations may reduce water availability for less-impacted surrounding water users.

**Table 6.2: Summary of the identified impacts during the operational phase of Pits BD and H**

Operational Phase		
Project Activities	Impact	Impact description
Coal extraction through heavy machinery movement, RoM stockpiling and conveyance, and operation and maintenance of surface infrastructure (pits, PCDs, SWMP, stockpiles, workshops & mobile offices).	Water quality deterioration	<ul style="list-style-type: none"> <li>• Dirty stormwater runoff from operational areas containing potential pollutants such as oils, lubricants, fuels and waste materials, RoM and Discard may mix with clean water catchment areas when extreme events occur.</li> <li>• The project could cause water resources to be polluted through sediment transport and other chemical parameters due to overland runoff from haul roads.</li> <li>• Discharge of excess water into PCDs would also present risks to water quality in the downstream areas.</li> <li>• Increased siltation of PCDs, reducing their storage capacity</li> <li>• Blockage of SWMP infrastructure resulting in overspill to the clean areas.</li> <li>• Seepage from the overburden stockpile areas to the clean water areas.</li> <li>• Increased soil erosion emerging from uncompacted soils around the hardened area and stockpiles.</li> </ul>
	Water quantity	<ul style="list-style-type: none"> <li>• Reduced natural runoff availability of water to downstream water users due to changes in land use to mining.</li> <li>• The excess water discharged into PCDs could result in an overspill to the streams in the environment.</li> <li>• Reduces runoff paths resulting from the construction of a river and wetland crossing.</li> <li>• Increase surface runoff due to the compaction of the surface areas.</li> </ul>
Subsidence of the mine.	Alteration of natural drainage patterns	<ul style="list-style-type: none"> <li>• Mine failure could result in lateral or vertical ground movement, changing the land morphology and topography and interrupting the hydrologic environment.</li> <li>• The nature of these impacts on the hydrologic environment may be massive.</li> <li>• Subsides affect the water table, which, in consequence, will affect the surface water resources with which it interacts through baseflow and recharge.</li> </ul>

### 6.3.1 Impacts During Closure and Decommissioning

The erosion and water-quality effects addressed during the construction phase are likely comparable to those during closure and rehabilitation. Only four impacts associated with the mine closure and rehabilitation were identified, summarised in Table 6.3. Preventing and handling accidental spillages during demolition of the mine infrastructure poses a potential risk to surface water quality due to oils and other mine rubble that may be contaminated. Other consequences are anticipated since this activity should be limited to the affected regions.

**Table 6.3: Summary of the identified impacts during the decommissioning phase Pits BD and H**

Decommissioning Phase		
Project Activities	Impact	Impact description
Cessation of the mining at Pits BD & H, removal (waste, fuel, oil, explosives, lubricants) and demolition of surface infrastructure (conveyor belt, haul roads, pipelines), backfilling and compacting the void, and rehabilitation.	Water quality deterioration	<ul style="list-style-type: none"> <li>Removal and handling of hazardous waste offsite and waste storage facilities, damage to waste handling facilities resulting in water quality deterioration.</li> </ul>
	Water quantity	<ul style="list-style-type: none"> <li>With adequate rehabilitation and closure, some catchment is returned to a self-sustaining system.</li> <li>Return of natural drainage patterns as a result of freely draining topography.</li> </ul>
	Soil erosion and sedimentation	<ul style="list-style-type: none"> <li>Increased soil erosion emerging from uncompact soils around the demolished mine.</li> <li>Increasing uncompact areas due to moving maintenance vehicles could lead to increased soil erosion and sedimentation.</li> </ul>
	Alteration of flow and drainage patterns	<ul style="list-style-type: none"> <li>The open pits in situ and associated mine infrastructure will modify the areas' natural drainage patterns and influence the rainfall-runoff generation processes.</li> </ul>

### 6.3.2 Impacts During Post-Closure

Dust, erosion, water quality, and quantity effects addressed during construction are probably comparable to those in closure and rehabilitation (summary in Table 6.4). These will likely affect the quality and quantity of surface water resources and the local hydrology.

**Table 6.4: Summary of the identified impacts during post-closure for Pits BD and H**

Post-Closure Phase		
Project Activities	Impact	Impact description
Rehabilitation	Water quality deterioration and water quantity changes	<ul style="list-style-type: none"> <li>Removal and handling of hazardous waste offsite and waste storage facilities, damage to waste handling facilities resulting in water quality deterioration.</li> <li>Increased dust and soil erosion emerge from the uncompacted soils around the demolished mine and the discard dumps.</li> <li>Infestation of alien invasive plants could arise due to poor vegetation in the rehabilitated areas, which could result in reduced erosion.</li> </ul>
	Poor monitoring	<ul style="list-style-type: none"> <li>With adequate rehabilitation and closure, the catchment processes will be restored to a self-sustaining system.</li> <li>Implementation of necessary measures to ensure the success of the rehabilitation in terms of surface water quality.</li> </ul>
	Alteration of flow and drainage patterns	<ul style="list-style-type: none"> <li>The open pits in-situ and associated mine infrastructure will modify the areas' natural drainage patterns, influence rainfall-runoff generation processes, and freely drain topography.</li> </ul>

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## 6.4 Impact Rating

The results of the identified surface water impact significance ratings for the activities associated with the UG mining through Pits BD and H are presented in Table 6.5. These ratings include the construction, operations, decommissioning, and post-closure phases of mining. As explained in the methodology section presented in Section 3.7.1, this section assesses the significance of potential impacts and their residual before and after the recommended mitigation measures are implemented. These recommendations are informed by the best practices in the mining industry, as well as the principles recommended by the mine water management policy (DWS, 2022a). Based on the RQOs for the Olifants Catchments, Saalboomspruit has a PES in category C, indicating it is moderately modified. The impact assessment includes the elements associated with the aquatic biota and habitat.

The table shows that most identified impacts had medium to low significance before mitigations were imposed. When mitigation measures are incorporated into the matrix through re-rating, most impacts are downgraded to low risk. This, therefore, suggests that KPSX activities associated with UG mining at Pits BD and H must adhere to the derived mitigation measures to ensure that the proposed and active mining activities remain compliant and ensure that the best practices applicable within the mining industry are followed and that water resources in the area are developed, used efficiently and protected as per the preamble of the NWA (NWA, 1998) as well as the targets of the National Water Resources Strategy (DWS, 2022b).

The mitigation measures are recommended to be implemented by incorporating them into KPS's procedures and plans, as they have the potential to reduce risks associated with UG mining activities at Pits BD and H to the surrounding surface water resources.

Table 6.5: Impact rating during the construction, operation, decommissioning and post-closure with and without the relevant mitigation measures

Activities	Impact	Mitigation Measures	Affected River		Intensity of Impact on Resource Quality					Mitigation Measures	Likelihood	Significance	Risk Rating	Confidence level		
			Name	PES	Abiotic Habitat			Biota								
					H	W	G	V	F							
<b>CONSTRUCTION PHASE</b>																
Initial earthworks associated with site clearing, stripping and stockpiling of topsoil, preparations and construction of new mine surface infrastructure (haul roads, conveyor belt loading and crossing a stream and a wetland, water pipelines, stockpiles) and box cut and access ramps at the two pits	Water Quality Deterioration	Nb	Saalklappspruit	C	Moderate to High	3	4	3	4	3	<ul style="list-style-type: none"> <li>Keep the construction site footprint minimal, including access roads used to supply materials, which must be kept minimal.</li> <li>Service heavy machinery in waste-demarcated areas and any spillage of oils, grease and hydrocarbons must be removed immediately per the waste handling protocols applicable to the mining industry.</li> <li>Wetland and river crossing of the conveyor belts must ensure that there are no spillages and disturbance of baseline soils.</li> </ul>	60%	27	L	Low	
		Yes				3	2	3	4	3		20%	8	L	Low	
	Alteration of flow, drainage patterns and wetland deterioration	Nb				2	1	5	4	3		<ul style="list-style-type: none"> <li>Construction must maintain the natural landscape to reduce surface water ponding, the development of gullies, and erosion.</li> <li>The scheduling of earthworks should be implemented with a minimal footprint at risk of gully formation.</li> </ul>	80%	43	M	Medium
		Yes				2	1	4	4	3			20%	9	L	Low
	Soil erosion and sedimentation	Nb				2	4	3	3	2		<ul style="list-style-type: none"> <li>Earthworks during the dry season to reduce chances of dirty runoff washing away sediments, contaminated soils and water to the surrounding environment</li> <li>Dust suppression measures must be implemented on the construction sites if mining supports infrastructure to reduce siltation of the water resources surrounding the wetlands.</li> </ul>	60%	27	L	Low
		Yes				2	3	2	3	2			40%	14	L	Low
<b>OPERATIONAL PHASE</b>																
Coal extraction, RdM stockpiling and conveyance, and operation and maintenance of surface infrastructure (pits, PODs, conveyor belt stockpiles, workshops and mobile offices).	Water quality deterioration	Nb	Saalklappspruit	C	Moderate	0	3	0	1	2	<ul style="list-style-type: none"> <li>Mining operations must ensure no spillages of contaminated water mixed with clean water.</li> <li>To reduce accidental oil, grease, and hydrocarbon spillage, servicing and refuelling heavy machinery used to support mining operations must be done in bunded areas.</li> <li>Operations of the PODs must align with the recommendation for its operational philosophy to ensure it does not spill into the environment.</li> <li>Regular maintenance of SWMP infrastructure to prevent blockages and overflow</li> <li>Regular monitoring and servicing of the conveyor belt to prevent RdM spillages to the river crossing and the surrounding wetlands.</li> <li>Implementation of surface water monitoring plan to ensure that any pollutants related to the UG mining activities of Pits BD and H are addressed as per GN704 regulations.</li> </ul>	40%	14	L	Low	
		Yes				0	2	0	1	1		20%	5	L	Low	
	Water quantity	Nb				0	5	1	2	3		<ul style="list-style-type: none"> <li>In-pit sumps must be pumped regularly to ensure that water storage capacity in the PODs is adequate to allow for any unexpected fluxes from the pits during heavy storm events</li> <li>SWMP sizing volumes must be incorporated into the operation related to dewatering and pumping out water from pits and PODs.</li> </ul>	60%	32	M	Medium
		Yes				0	0	1	2	2			40%	11	L	Low
Subsidence of the mine.	Alteration of natural drainage patterns	Nb	Saalklappspruit	C	Moderate	3	4	5	4	3	<ul style="list-style-type: none"> <li>Continuously dewater the pits and pump dirty water to POD 1, 2 and 4.</li> </ul>	80%	41	M	Medium	
		Yes				2	3	3	3	3		60%	22	L	Low	
<b>DECOMMISSIONING PHASE</b>																
Cessation of the mining, the removal and demolition of surface infrastructure, and rehabilitation. Removal of surface infrastructure and rehabilitation.	Water quality deterioration	Nb	Saalklappspruit	C	High to Moderate	2	5	4	5	4	<ul style="list-style-type: none"> <li>The removal and demolition of the mining infrastructure must be done in such a manner that contaminants do not wash down into the clean environment</li> <li>Oil, grease and hydrocarbon spillages must be contained and disposed of per the relevant waste management guidelines.</li> </ul>	60%	31	M	Medium	
		Yes				2	1	4	2	3		40%	17	L	Low	
	Water quantity	Nb				4	4	3	2	2	<ul style="list-style-type: none"> <li>Top soil backfilling and compaction on the pit area must ensure that it allows for natural infiltration to reduce erosion and siltation.</li> <li>Pits must be rehabilitated sequentially to allow for a reduced footprint.</li> </ul>	80%	38	M	Medium	
		Yes				3	2	2	2	2		40%	13	L	Low	
	Soil erosion and sedimentation	Nb				3	5	4	5	4	<ul style="list-style-type: none"> <li>Schedule demolition during the dry season to ensure less erosion of the contaminated soils that may increase siltation and contaminate the downstream water resources.</li> <li>Dust suppression measures must be implemented to prevent dust particles from being disposed of in clean areas.</li> </ul>	80%	43	M	Medium	
		Yes				2	4	4	4	3		40%	17	L	Low	
	Alteration of flow and	Nb				4	4	3	3	3	<ul style="list-style-type: none"> <li>Backfilling pits and contour landscaping will allow for the recovery of the landscape and the processes that affect runoff generation.</li> </ul>	60%	29	L	Low	
		Yes				3	2	2	2	2		40%	14	L	Low	

drainage patterns																	
										<ul style="list-style-type: none"> <li>Infrastructure demolition should be done in a scheduled manner to ensure that the heavy machinery track is kept minimal.</li> </ul>							
<b>POST-CLOSURE PHASE</b>																	
Rehabilitation	Water quality deterioration and water quantity changes	Nb	Saalklappspuit	C	High to Moderate	3	1	4	5	4	<ul style="list-style-type: none"> <li>Implement a rehabilitation plan to reduce dust and excessive overland flow resulting in erosion.</li> <li>The recommended surface water monitoring plan should be implemented until the ambient surface water quality is restored to align with the relevant targets set in the RCOs for the catchment.</li> </ul>	60%	43	M	Medium		
		Yes				-4	-2	-5	-4	-4		80%	-38	+	Low		
	Poor monitoring	Nb				4	3	3	0	0	<ul style="list-style-type: none"> <li>Routine monitoring of all landscape features affecting local hydrology and surface water quality must be conducted routinely.</li> <li>Proper landscape rehabilitation and preventing alien invasive plants from infestation after the discard dumps and pit areas are closed must be prioritised to protect and restore local hydrological conditions.</li> <li>Anomalies arising from monitoring must be addressed in line with the remediation measures.</li> </ul>	60%	25	L	Low		
		Yes				-2	-1	-4	0	0		80%	14	L	Low		
	Water Quantity	Nb				3	2	3	3	1	<ul style="list-style-type: none"> <li>Surface water quality must be implemented until water quality conditions are at ambient conditions or in line with the water quality.</li> <li>Proper rehabilitation can improve the catchment's natural hydrological response to the downstream area by resulting in normal runoff patterns.</li> </ul>	60%	31	M	Medium		
		Yes				-3	-3	-3	-3	-2		80%	-36	+	Low		

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## 6.5 Mitigation Measures

Below is a summary of the mitigation measures recommended to reduce residual impacts on the surface water quality in the area surrounding the KPSX addition for Pits BD and H UG mining:

### *Construction Phase*

- In case of accidental spillages of oils, hydrocarbons, and hazardous waste, emergency response procedures (e.g., spillage control kits) should be implemented to contain and dispose of the spillage immediately.
- Servicing and refuelling station areas must be bunded with completely contained compact surfaces to contain all waste in the storage facility, like sumps, for proper disposal per waste handling protocols.
- The scheduling of earthworks should be implemented to minimise the footprint at risk of erosion at any given time, or schedule works according to the season. Earthworks during the dry season have less impact on the contamination of surface water resources due to reduced chances of runoff washing away sediments, contaminated soils and water to the surrounding environment.
- Construction material on site and removed topsoil must be stored in minimally designated areas to reduce contamination of the clean stream areas.

### *Operational Phase*

- Heavy machinery used in mining activities must be serviced and refuelled in designated areas that are compacted and bunded with a proper containment facility for contaminated water for legislated disposal procedures.
- Implementing the proposed surface water monitoring program will reduce the potential of the identified negative impacts on the surrounding surface water receptors through early detection and formulation of remediation measures. This includes ensuring that any water discharged to the environment meets the minimum RQO standards for the area.
- Regular monitoring and maintenance of stormwater management infrastructure, pipelines to PCDs and conveyor belt to ensure efficiency and reduce environmental spillages to the clean environment.

- 
- Dewater pit sumps (at both pits) regularly and implement the recommended water operational philosophy of the PCDs associated with KPSX mining activities to ensure that there is no accidental overspilling of the facility by pumping additional water to supplement the dust suppression storage tank facility. Regular PCD silt-trap maintenance reduces siltation, thereby reducing the wastewater dam's storage capacity.

#### *Decommissioning Phase*

- A post-rehabilitation audit should be undertaken during the closure of Pits BD and H to ascertain whether the landscape and surface water quality rehabilitation has been successful. If not, further measures should be recommended and implemented.
- Designated areas for demolition vehicles must have adequate pollutant storage such that any accidental oil, fuel, and grease spillages are contained and disposed of accordingly before further contaminating the environment through contact with areas susceptible to overland runoff.
- Schedule demolition during the dry season to ensure less erosion of the contaminated soils that may increase siltation and contaminate the downstream water resources. Also, dust suppression measures must be implemented to prevent dust particles from being disposed of in clean areas.
- To minimise the flow alteration, the infrastructure's demolition should be done in a scheduled manner to ensure that the heavy machinery track is kept minimal.
- Rehabilitation must ensure that indigenous vegetation is restored and that natural preferential flow into the environment is restored. This will help the catchment restore its hydrological processes and other environmental dynamics.

#### *Post-Closure Phase*

- Proper landscape rehabilitation and prevention of alien invasive plants from materialising after the closure of the discard dumps and pits areas need to be prioritised to protect and restore local hydrological conditions of the site to reduce dust and excessive overland flow resulting in erosion and reduce catchment natural hydrological response to the downstream area.
- Monitor and inspect the rehabilitation footprint for signs of erosion, soil cracking, and silting to ensure the landscape and its associated processes perform efficiently. Monitoring should be undertaken monthly during the wet season, after storm events, or per the site management schedule.

- 
- The recommended surface water monitoring plan should be implemented until the ambient surface water quality is restored to align with the relevant targets set in the RQOs for the catchment. In the event of decanting sites, these areas must be monitored. If necessary, remediation measures should be drafted and implemented to ensure adequate restoration of the landscape and its associated surface-water functions.

## 6.6 Cumulative Impacts

Cumulative impacts associated with UG mining activities in both pits were based on environmental effects from current active mining in the surrounding area and from previous mining activities within the area. The likelihood that infrastructure will affect surface water resources is significant. While the current project presents a relatively low risk to the quality of the nearest surface water resources, failure to address this issue could exacerbate the cumulative impacts.

Prevalent water quality problems in the Upper Olifants are associated with operational coal mines along the Grootspuit and Saalklapspruit. These issues are primarily due to mining activities in the KPSS mining area. Additionally, other mining operations in the upstream catchments of the Wilge River have further contributed to the decline in water quality in the larger Upper Olifants River. As mining continues to expand in these upstream areas, pollution levels are anticipated to increase. The recommended mitigation measures and remediation plans should be designed and implemented to address any issues arising from activities that directly affect the surrounding surface water quality.

## 7 Surface Water Monitoring Plan

The proposed monitoring points were based on targeted areas that could reflect changes in water quality in the surrounding area resulting from KPSX's proposed mining activities. This program aims to ensure that the principles of IWRM are implemented to address the broader water resource challenges in the area.

### 7.1 Monitoring Network

This includes two additional points (Wel SW15 and Wel SW16) located on an unnamed tributary draining towards the northwestern part of Pit H, and the other point is in the eastern downstream of this pit (Figure 7.1). This point aims to intercept any downstream potential effects (and changes from Wel SW13) resulting from the activities within the two pits. Sampling of dirty water from the in-pit sumps from both pits is also proposed, together with PCD 2 and 3. These points will help improve the modelling of salt balances for KPS in the future. The locality description of the proposed surface water monitoring points is given in Table 7.1.

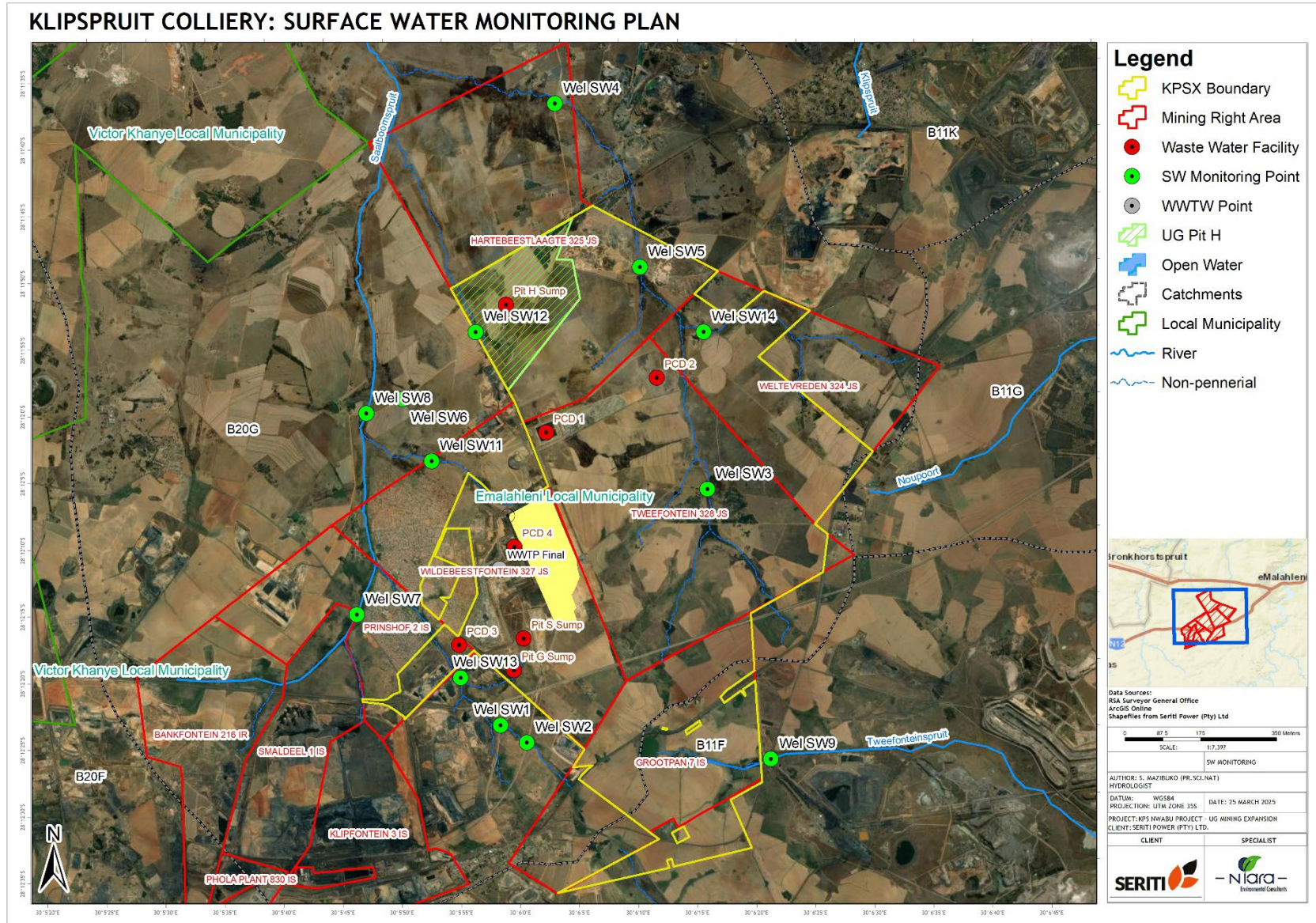
**Table 7.1: Description of the proposed surface water monitoring points for Pits BD and H**

Sampling Point	Description	Latitude	Longitude
Wel SW15	Evaluate impacts downstream of pits	-26.004851°	29.038553°
PCD 3	Cumulative dirty water from pits	-26.010757°	29.047198°
Pit BD Sump	Opencast Pit BD	-26.015340°	29.058691°
Pit H Sump	Opencast Pit H	-26.009381°	29.060644°

All surface water monitoring parameters will be continually assessed to meet legislative requirements set out in the IWUL and to provide an indication of water quality management and potential impacts associated with the proposed additional mining activities. Any non-compliance with the parameters from the proposed surface water monitoring points must be reported as outlined in Regulation 704 of the NWA and annually with the Integrated Water and Waste Management Plan (IWWMP) performance assessments for the KPS mine.

### 7.2 Monitoring Parameters

While the monitoring plan should be reviewed periodically to ensure the appropriateness of selected sites for sampling and sampling frequency during the operation of the mine, surface water parameters of concern to be monitored include all those listed in the KPSX IWUL (Licence No. 24075037). Water quality parameters listed in the IWUL must also be assessed against the RQOs measures for the Olifants catchments to ensure that DWS regional IWRM plans are monitored for potential improvements in water quality in the area. Monthly surface water samples must be collected and analysed by a SANAS-accredited laboratory.



**Figure 7.1: Proposed surface water monitoring plan amendments with the inclusion of Pits BD and H UG workings**  
 18 December 2025

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## 8 CONCLUSIONS AND RECOMMENDATIONS

### 8.1 Conclusions

The following conclusions and recommendations were derived from this study:

- Klipspruit Colliery (KPS) proposes to amend the existing Environmental Authorisation (EA) and Integrated Water Use Licence (IWUL) issued by the Department of Mineral Resources and Energy (DMRE) and the Department of Water and Sanitation (DWS), respectively, for Klipspruit Extension Weltevreden (KPSX), changing the mining methods from Open Cast (OC) to underground (UG) through Pits BD and H and their associated mining support infrastructure. The authorisation of activities related to Pits BD and H, and their associated support infrastructure, can potentially affect the surrounding environment, mining operations, water management, and other surface water receptors, all of which need to be evaluated.
- KPSX is located on relatively flat terrain with undulating hills that drain the sources of the Saalboomspruit in quaternary B20G of the Olifants Water Management Area (WMA). Rainfall, evaporation and runoff vary seasonally in this area, as the WR2012 analysis indicates Mean Annual Precipitation (MAP) of 689 mm, Mean Annual Evaporation (MAE) of 1 700 mm, and naturalised Mean Annual Runoff (MAR) of 50 mm.
- Pit BD UG operations are currently the mining of coal from seams 2 and 4, which is transported to the conveyor loading area. A plan for extending the conveyor belt to the edges of Pit BD is in place, along with construction of Pit H and its supporting infrastructure (in-pit sump, pipelines, and haul roads). Mined coal from these pits will be transported to the conveyor belt connected to the Phola Coal Processing Plant (PCPP).
- Dirty water (groundwater ingress, seepage, runoff) from these pits will be collected by sumps (already existing in Pit BD) and pumped to PCD 1 from Pit H and PCD 4 for Pit BD. Groundwater simulation shows that groundwater ingress from these pits will reach the maximum flow rate of 80 884 m<sup>3</sup>/yr (222 m<sup>3</sup>/day) in year 2032 for seam 4, while seam 2 will have a maximum of 263 093 m<sup>3</sup>/yr by 2043. Estimated annual volumes from the two pits will be used to support mining operations at KPSX through the distribution and management of its associated PCDs.

- 
- Dirty water from PCD 4 will be pumped into the Raw Water Reservoir (RWR), supplementing dust suppression water on haul roads and for coal processing at the conveyor load point. This water will be sourced from pumping PCDs 1, 3, and 4, together with additional inflows from the KPS Balancing Dam, if needed.
  - Average water balance simulations for inflows into PCD 1 (with the inclusion of Pit H) were not computed (explicitly) in the dynamic model due to the lack of observation data. Expected rainfall patterns from the Main Pit area were assumed to have a similar magnitude and were, therefore, used to estimate the expected annual volume of water to be received by each pit based on the total surface area of their box cut. Similarly, evaporation from the in-pit sumps was assumed based on the relative water losses from the dirty water collecting sump from the main pit area.
  - Identified impacts related to surface water show a medium risk of siltation and contamination of the downstream resources during the three phases of the mine. The removal of topsoil and vegetation, heavy machinery and vehicle movement, fuel or chemical mishandling and spillage, and washing down of construction materials pose a risk of water quality deterioration during construction and mining.
  - During the mining phase, routine checking and maintenance of the SWMP infrastructure in the mining areas of KPSX must be done to ensure that the system does not accumulate silts and debris, which can result in overflow. Also, regular cleaning of PCD silt traps must be conducted to increase the operational efficiency in support of mining operations. Appropriate application of dust suppression at conveyor load points and haul roads, together with a smaller operational footprint for the pits, can potentially reduce the risk of contaminating water resources in areas surrounding the mine site.
  - A rehabilitation program with defined monitoring areas indicated that the mine site could reduce the risk of increased erosion of the pits, topsoil and overburdened areas, as well as failure to restore landscape topographic settings. A successful rehabilitation will have positive impacts by restoring hydrological regimes and associated processes, ensuring that natural runoff in streams and surrounding wetlands returns to ambient conditions.

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- Cumulative impacts arising from the current and historical mining activities in the area surrounding KPSX were identified as the potential source of additional water quality threats in the area, which can be addressed by the implementation of the derived mitigation measures together with the proposed surface water monitoring plan and sustainable rehabilitation programme, which are all aimed at preventing water quality deterioration and improving quality.
  - The proposed surface water monitoring plan will ensure that mining activities associated with Pits BD and H are adequately monitored for changes in the water quality throughout the mine phases of KPSX. Remediation plans to address water-quality issues that may arise must align with relevant regulations and legislation, including the WUL conditions and the broader scope of the NWRS and Mine Water Management Policy (DWS, 2022a,b).

## 8.2 Recommendations

The following recommendations derived from this study are outlined as follows:

- Dirty water (groundwater ingress, runoff, seepage) in both sumps from both pits must be pumped to the PCDs for reuse to support mine operations. Water levels in the PCDs should be maintained at 55% to ensure efficient operations.
- Proper stormwater management plan, infrastructure maintenance to enhance efficiency and prevent spillages to the clean water catchment areas.
- A monitoring programme is an essential tool to identify any risks of potential impacts as they arise and to assist in impact management plans by assessing if mitigation measures are operating effectively. It is recommended that surface water monitoring be implemented throughout the life of the mine.
- It is recommended that all measures implemented to mitigate impacts should be regularly reviewed against best practice guidelines to achieve compliance with the regulations. These include keeping the construction footprint minimal and servicing heavy machinery in bunded areas to prevent accidental spills of oils, grease, and hydrocarbons that might affect surface water quality in the surrounding environment.
- Installing flowmeters on the pipelines from both pits to PCDs is recommended to improve site-wide water management and simulation of the water and salt for the KPS mine site in the future.

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- In line with the main recommendations and targets set out in the NWRS v3 (DWS 2022a), a mine site Water Conservation and Water Demand Management Plan needs to be updated as soon as the mining activities at Pits BD and H resume to ensure the efficient and effective use of water resources within the KPS mine.
  - The surface water monitoring programme must be reviewed and revised regularly if there are water quality issues in support of the Water Management Programme annually.

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# SBONGISENI MAZIBUKO

Hydrologist

(Pr.Sci.Nat – Registration No: 011204)

[sbongiseniczibuko@gmail.com](mailto:sbongiseniczibuko@gmail.com) | 083 623 2156

## PROFILE

Technically proficient hydrologist specializing in surface water resources with emphasis on flood hydrology, water resources assessments, stormwater planning, water balances, geospatial analytics and modelling.

## QUALIFICATIONS

- MSc (Hydrology)  
Rhodes University, 2017
- BSc Honours (Hydrology)  
University of Zululand, 2011
- BSc Hydrosiences  
University of Zululand, 2009

## ACADEMICS

- Supervised 1 MSc & 9 BSc Hons  
University of Zululand 2017
- 9 BSc Honours (Hydrology)  
University of Zululand, 2011
- Hughes, D.A and Mazibuko, S.C.  
(2018). Simulating saturation-excess surface runoff in a semi-distributed hydrological model. Hydrological Processes, doi.org/10.1002/hyp.13182

## TRAINING

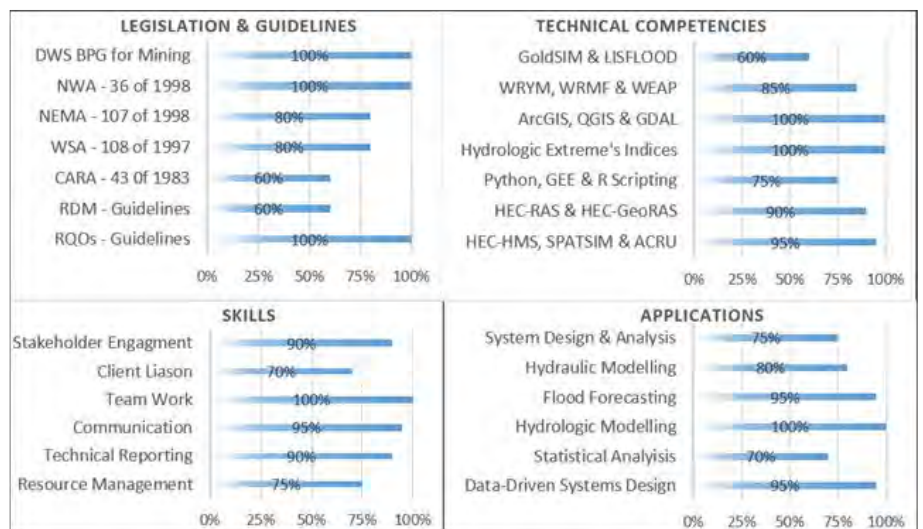
- PCRaster Python Framework for Hydrological Applications
- QGIS for Hydrological Applications
- Structures with HEC-RAS
- Dam Breach Analysis with HEC-RAS
- Flood Hydrology
- Sediment Transport with HEC-RAS
- HEC-RAS 1D&2D Essentials
- Revised Desktop Reserve Model

## KEY EXPERIENCE

### Hydrologist Associate at Altra Watech (Pty) Ltd

- Peak Flow Determination & Flood Frequency Analysis.
- Surface Water Impact Assessments.
- Floodline Modelling using HEC-RAS and GeoHEC-RAS.
- Rainfall-Runoff Modelling using ACRU and Pitman Models.
- Water Resources Planning and Development using WRMF.
- Storm Water Management Plans using PCSWMM.
- Geospatial Analysis using GlobalMapper, QGIS and ArcGIS.
- Water Conservation Water Demand Management Plans.
- Surface and Groundwater Monitoring Database Development.
- Static and Dynamic Water and Salt Balance using Excel & GoldSIM.
- Writing Project Proposals and Technical Reports.
- Field Data Collection (water quality, quantity and soil sampling).
- Geospatial Data Analytics with Google Earth Engine.

## COMPETENCIES MATRIX



## AUTHORED RELEVANT PROJECTS

PROJECT
Water Balance Study for Burnside Coal, Glencoe
N'komati Anthracite Mine – Water Conservation and Demand Management Plan
Hydrological Assessments for Lichtenburg, Coligny, Itekeng, Itsoseng and Ipelegeng WWTWs
Construction of Gauging Weir in the Valsriver at Bothaville – Hydrological Assessment
Lindley WWTW – Hydrological Assessment
Hydrological Assessment for Olifantsdrift 10-KP Farm
Kroonvaal Engen 1-Stop Filling Station - Water Balance Study
Tugela and North Coast Engen 1-Stop Filling Stations - Water Balance Study
Kariboo Colliery - Water Balance & Salt Update
Vlakvarkfontein Colliery – Salt & Water Balance Update
Douglas and Willem Brummer Dam – Hydrological Assessment
Idwala Coal - Water Balance Study
Water Conservation and Demand Management Plan for Dingwell Quarry Mine
Kelvin Power Station – Salt & Water Balance Update Study
N'komati Anthracite Mine – Salt & Water Balance Update Study
Selkatkop Mine – Hydrological Assessment & Water Balance
Seriti Klipspruit Colliery – Hydrological Assessment, Salt & Water Balance Update Synthesis
Mbali Colliery – Salt & Water Balance Update Study

herewith certifies that  
**Sbongiseni Christian Mazibuko**

Registration Number: 011204

**is a registered scientist**

in terms of section 20(3) of the Natural Scientific Professions Act, 2003  
(Act 27 of 2003)

in the following field(s) of practice (Schedule 1 of the Act)

Water Resources Science: Hydrological Science (Professional Natural Scientist)

Effective **19 November 2014**

Expires **31 March 2026**



A handwritten signature in black ink, appearing to read 'S. Mazibuko'.

Chairperson

A handwritten signature in black ink, appearing to read 'N. Maseko'.

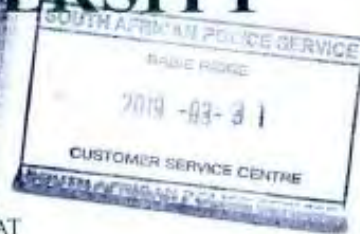
Chief Executive Officer



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# RHODES UNIVERSITY



THIS IS TO CERTIFY THAT

**SBONGISENI CHRISTIAN MAZIBUKO**

WAS THIS DAY AT A CONGREGATION OF THE UNIVERSITY  
ADMITTED TO THE DEGREE OF

**MASTER OF SCIENCE**

IN  
**HYDROLOGY**



VICE CHANCELLOR

DEAN OF THE FACULTY OF SCIENCE

REGISTRAR

GRAHAMSTOWN  
21 APRIL 2017



# University of Zululand

This is to certify that the degree of  
**Honours Bachelor of Science**  
**(Hydrology)**

has been awarded to

**Mazibuko, S bongiseni Christian**  
**20054556**

who satisfied all the requirements in the year

**2010**

**UZ 00969**



*[Faint, mirrored text from the reverse side of the diploma, including the name 'Mazibuko, S bongiseni Christian' and the number 'UZ 00969']*



*[Signature]*  
Vice-Chancellor

*[Signature]*  
Registrar

*[Signature]*  
Dean

**27 May 2011**





# University of Zululand

This is to certify that the degree of  
**Bachelor of Science**  
**(Hydrosciences)**  
First Class



has been awarded to

**Mazibuko, Sbongiseni Christian**  
**20054556**

who satisfied all the requirements in the year

2008



Chancellor

Registrar

Dean

**22-May-2009**