



Value Recovery from Mine Water Treatment

SAIMM ESG Conference

Quinton Paulse

October 2024



Sibanye-Stillwater overview

Overview

- A leading multinational mining and metals processing group, founded in 2013
- Headquartered in Johannesburg, South Africa.

Core operations

- Major producer of precious metals, including platinum group metals (PGMs) and gold
- One of the world's largest primary producers of platinum, palladium, and rhodium
- Expanding into battery metals (e.g., lithium, nickel) to support the green economy and electric vehicle market

Sustainability focus

- Strong commitment to Environmental, Social, and Governance (ESG) principles

Workforce and impact

- Employs over 70,000 people globally
- Plays a critical role in the communities where it operates, investing in local development

Strategic vision

- Focused on creating value for stakeholders through operational excellence, sustainability, and innovation
- Vision to be a leading international precious metals and green metals producer

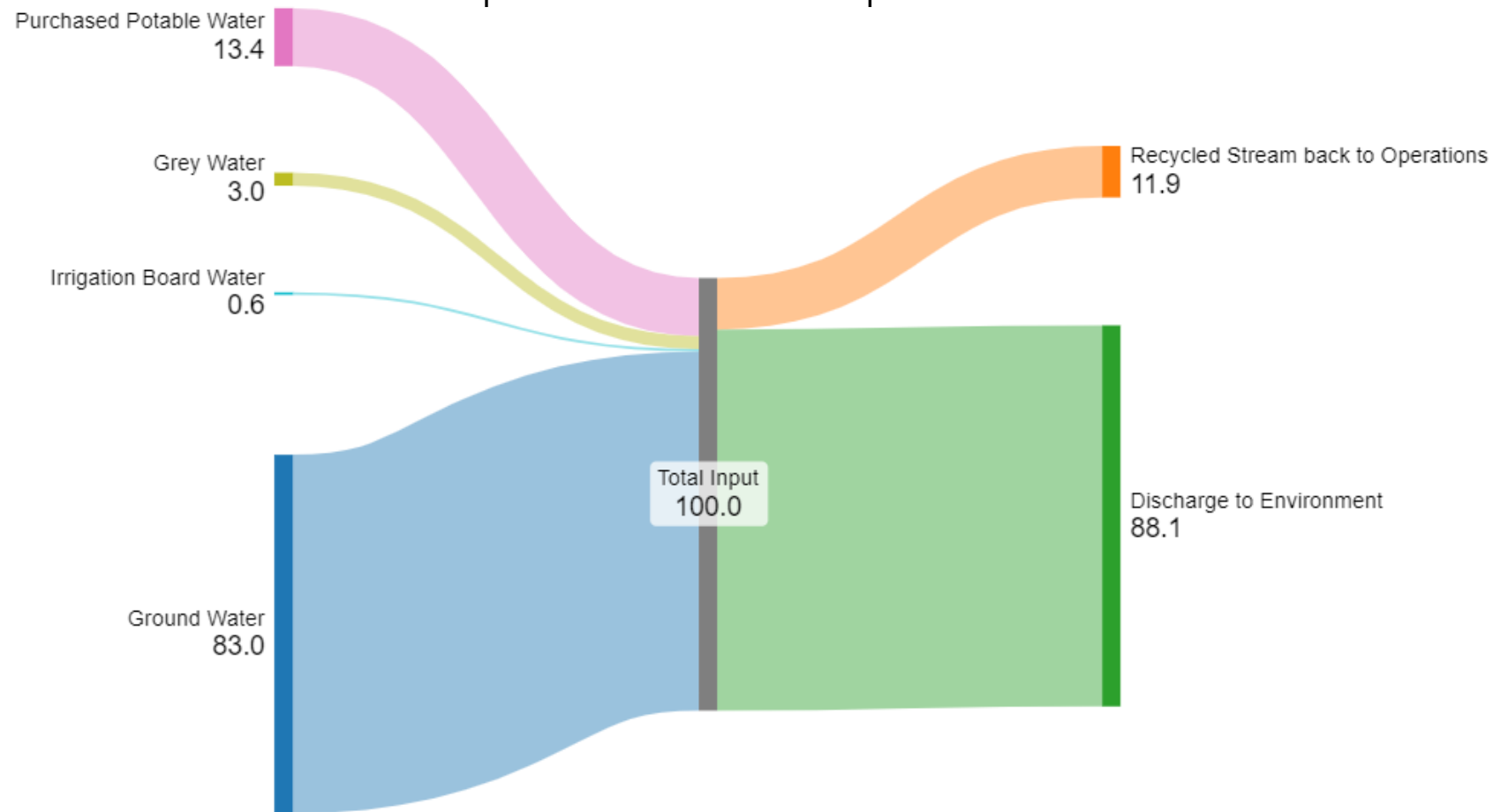


Mine water treatment at Sibanye-Stillwater

- Our mines collectively discharge 280Mℓ of treated and untreated compliant water into the environment daily
- The water bodies at our gold mining operations are completely or partially impacted by Acid Mine Drainage (AMD)
- The impacted mine water is treated to the following standards
 - Potable water (for internal consumption)
 - Fit-for-purpose industrial standards (internal users)
 - Environmental discharge
- Technologies applied at our operations:
 - Clarifiers/Thickeners
 - Ion Exchange
 - Fluidized Bed Reactors
 - Reverse Osmosis
 - Nano-Filtration
 - Various Precipitation Technologies

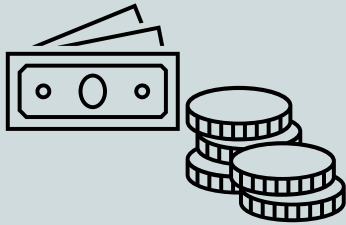


SA operations flow- Simplified



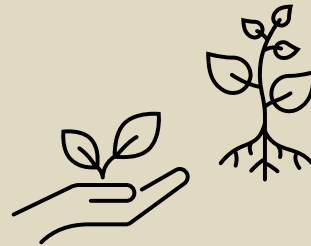
Commercially sustainable

- Projects must be commercially viable
- Project should be able to operate independently after mine closure



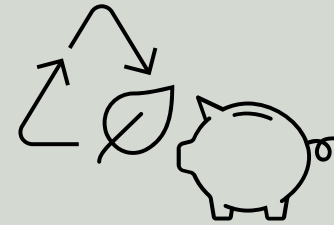
Environmental impact

- All outputs from the project must have a positive environmental impact
- The implementation of the program must improve the quality of the surrounding environment



Promote Circular economies

- Value creation from previous waste sources
- Job creation from project outputs



- Mine-impacted water poses long-term challenges.
 - Environmental liabilities
 - Significant long term financial cost – billions in some cases
- Regulatory frameworks
 - Liquid and solid waste management and disposal
 - Selling water to municipalities/water boards
- Treating mine water remains complex and costly if we follow the standard zero-value recovery approach (excluding environmental value)
- Many projects are driven by environmental compliance rather than profitability
 - Projects typically fail a few years after mine closure

Sibanye-Stillwater Value recovery initiatives

Water re-use

- Treated effluent can be safely reused for irrigation, industrial processes, and potable purposes. Water reuse reduces the demand for freshwater resources

Resource extraction

- Valuable metals or other compounds in effluent can be extracted and sold or repurposed. Techniques like precipitation, filtration, and ion exchange for recovery

Nutrient recovery

- Nitrogen and phosphorus from effluent can be used as fertilizers. Recovered nutrients reduce the need for synthetic fertilizers in agriculture

Energy Recovery (future work)

- Organic matter in effluent can be converted to biogas through anaerobic digestion. Biogas generates heat or electricity, providing a valuable energy source

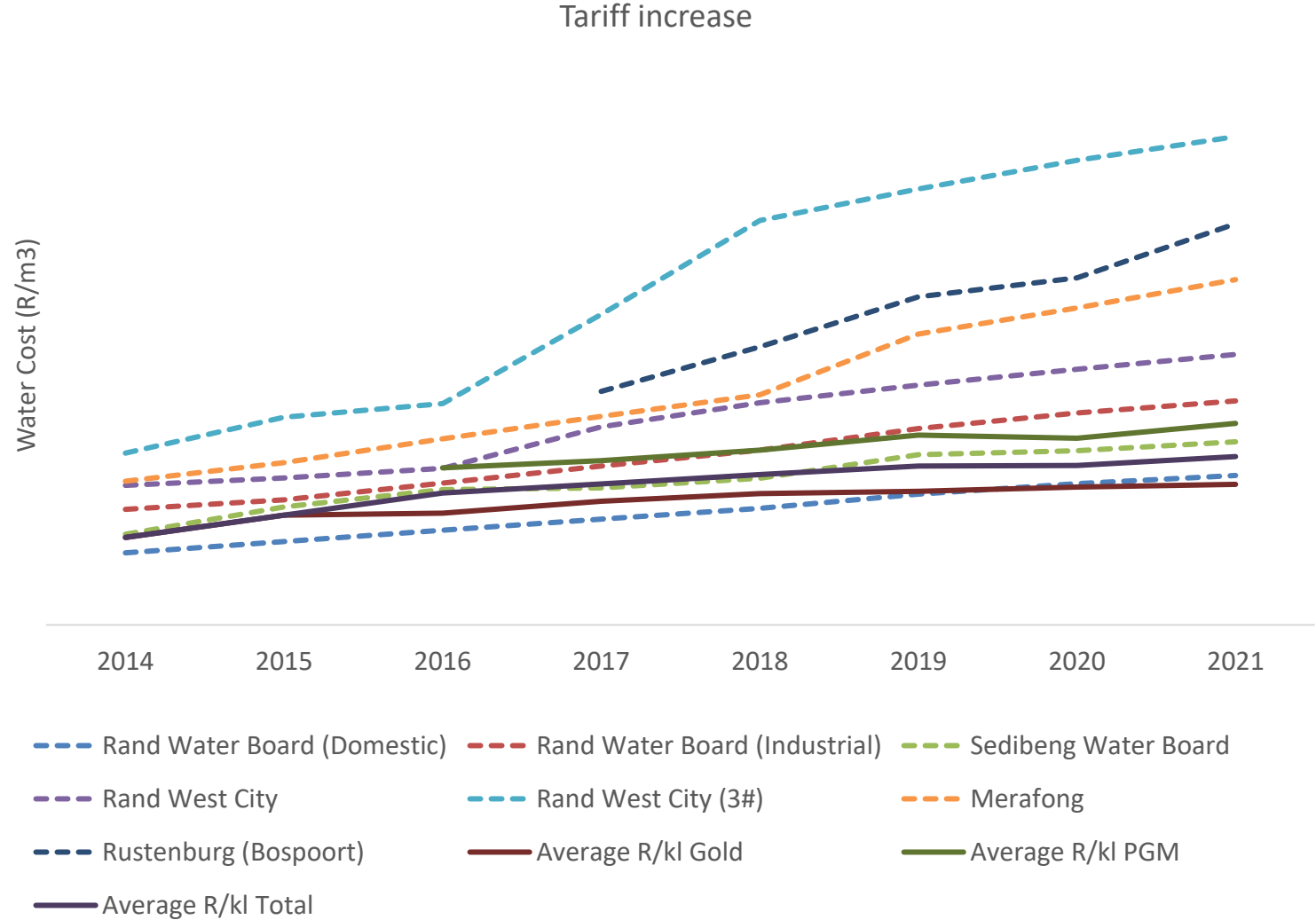


Water re-use



Water re-use

- Potable water production capacity
- 35.7 million litres/day
- Water processing cost
- R5.80 to R12.47 per m³
- Municipal water supply cost comparison
- R19.24 to R31.24 per m³



Water re-use

Gold mine

- 25 MLD Closed Circuit Ion Exchange and Nano Filtration Potable Water Plant
 - Feed- Impacted Ground Water (**Mainly solids and slightly elevated salts**)
 - Producing SANS 241:2015 Compliant Potable Water
 - Zero Liquid Discharge
 - Waste: Producing Calcium and Magnesium Carbonate solids as waste



Gold mine

- 6.2 MLD Cold Lime Softening Fluidized Bed Reactor Water Plant
 - Feed- Impacted Ground Water (**Solids, Heavy Metals, Slightly elevated salts**)
 - Producing SANS 241:2015 Compliant Potable Water
 - 98% Water Recovery
 - Waste: Solid Calcium, Magnesium and Heavy metal salts



Water re-use

Gold mine

- 4 MlD Reverse Osmosis Potable Water Plant
 - Feed- Impacted Ground Water (**Solids, High heavy metal load, Dissolved salts**)
 - Producing SANS 241:2015 Compliant Potable Water
 - 82% Water Recovery within plant boundaries (ZLD within mine boundaries)
 - Waste: Concentrated Brine



Gold mine

- 0.5 MlD Reverse Osmosis Potable Water Plant
 - Feed- Impacted Ground Water (**Solids, High heavy metal load, Dissolved salts**)
 - Producing SANS 241:2015 Compliant Potable Water
 - 91% Water Recovery within plant boundaries (ZLD within mine boundaries)
 - Waste: Concentrated Brine



Resource recovery



Resource recovery

Analysis of our waterbody shows that we can recover various minerals and metals

- Gypsum
- Carbonates
- REE's (currently being developed)
- Iron pigments

The recovery of these minerals and metals still follow our standard approach and yields the following benefits:

- Reduce overall water treatment and management cost
- Reduce waste generated from water treatment systems
- Reduce disposal cost



Resource recovery

Gold mine

- 55 tons/month of carbonate material generated
- Via precipitation from Ion Exchange Brine
- Material is currently being re-used a neutralization/precipitation aide at another Sibanye-Stillwater mine
- Net-savings: R270 000 per month
- Removes approximately 660 tons of Hazardous waste from landfill sites annually



Resource recovery

Gold mine

- 15 tons/month of Calcium, metal carbonate/sulphate solid precipitates
- Product form within the Fluidised bed and harvested when ready
- Currently being evaluated as a TSF rehabilitation aid.
- Potential Net-savings: R95 000 per month
- Removes approximately 180 tons of Hazardous waste from landfill sites annually



Nutrient recovery



- **AMD Impact Mitigation**
 - Nutrient recovery reduces harmful discharges from Acid Mine Drainage, improving water quality in impacted catchments
- **Cost Efficiency**
 - Offsets high capital and operational costs of mine water treatment projects, enhancing financial viability
- **Support for Sustainable Agriculture**
 - Provides essential nutrients for soil enhancement, contributing to food security and sustainable farming in water-scarce regions
- **Circular Economy Integration**
 - Turns waste into resources, aligning mining operations with South Africa's circular economy initiatives
- **Effluent Management**
 - Reduces effluent disposal costs and environmental impacts, complying with stringent local water-use regulations.

Nutrient recovery

First Approach

- Problem / opportunity

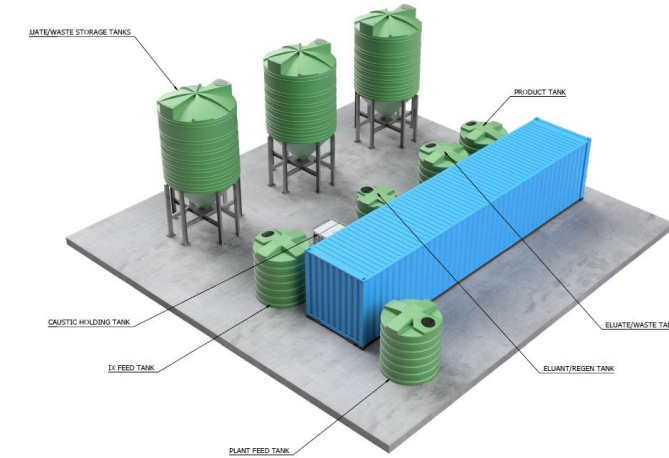
- PGM mine water within certain parts of the North-West Province is typically characterized by high ammonia and nitrate levels

- Solution / innovation

- Innovative slipstream Ion Exchange System that reduces the nitrate/ammonia load within the circulating mine water body

- Result / Value creation

- Safer underground operating conditions
- Improvement in water quality for discharge
- Potential fertilizer production from “waste” generated in the IX process



Nutrient Recovery

Second Approach

- Problem / opportunity

- High Water Treatment Costs: South Africa's Gold operations require extensive mine water pumping and treatment, a process that incurs significant costs. Optimizing this process is critical to the sustainability of operations

- Solution / Innovation

- Novel Water Treatment Technology: The environmental team is piloting an innovative technology that not only purifies water to potable standards but also recovers valuable nutrients, producing plant fertilizers. This offsets operating costs by introducing new revenue streams

- Result / Value Creation

- Cost-Effective Water Treatment: Achieves higher-quality water treatment at a reduced cost
- New Revenue Opportunities: Generates additional income from fertilizer production
- Net-Positive Financial Impact: Overall reduction in water treatment expenses, with positive financial returns
- Job Creation & Local Industry: Supports the development of a local industry, contributing to job creation



Conclusion



- **Water treatment is essential**
 - It's crucial for sustainable mining operations and should be designed with long-term goals in mind
- **Post-closure responsibility**
 - Even after closure, we will face significant costs for ongoing mine water treatment
- **Financial sustainability is critical**
 - Without financially viable solutions, water treatment systems could fail, leading to environmental risks
- **Value recovery is key**
 - By focusing on projects that recover value, we can create systems that are self-sustaining, generating profit and jobs in a post-mining era
- **Legislative support needed**
 - Certain solutions will require regulatory adjustments, especially to streamline the sale of treated water to third parties



Questions?

Email: ir@sibanyestillwater.com

James Wellsted	+27(0)83 453 4014
Henrika Ninham	+27(0)72 448 5910
Chris Law	+44(0)792 312 6200
Sarel Barnard	+27(0)82 376 9445



Tickers: JSE: SSW and NYSE: SBSW
Website: www.sibanyestillwater.com