

# BEST PRACTICE GUIDELINES FOR WATER RESOURCE PROTECTION IN THE SOUTH AFRICAN MINING INDUSTRY



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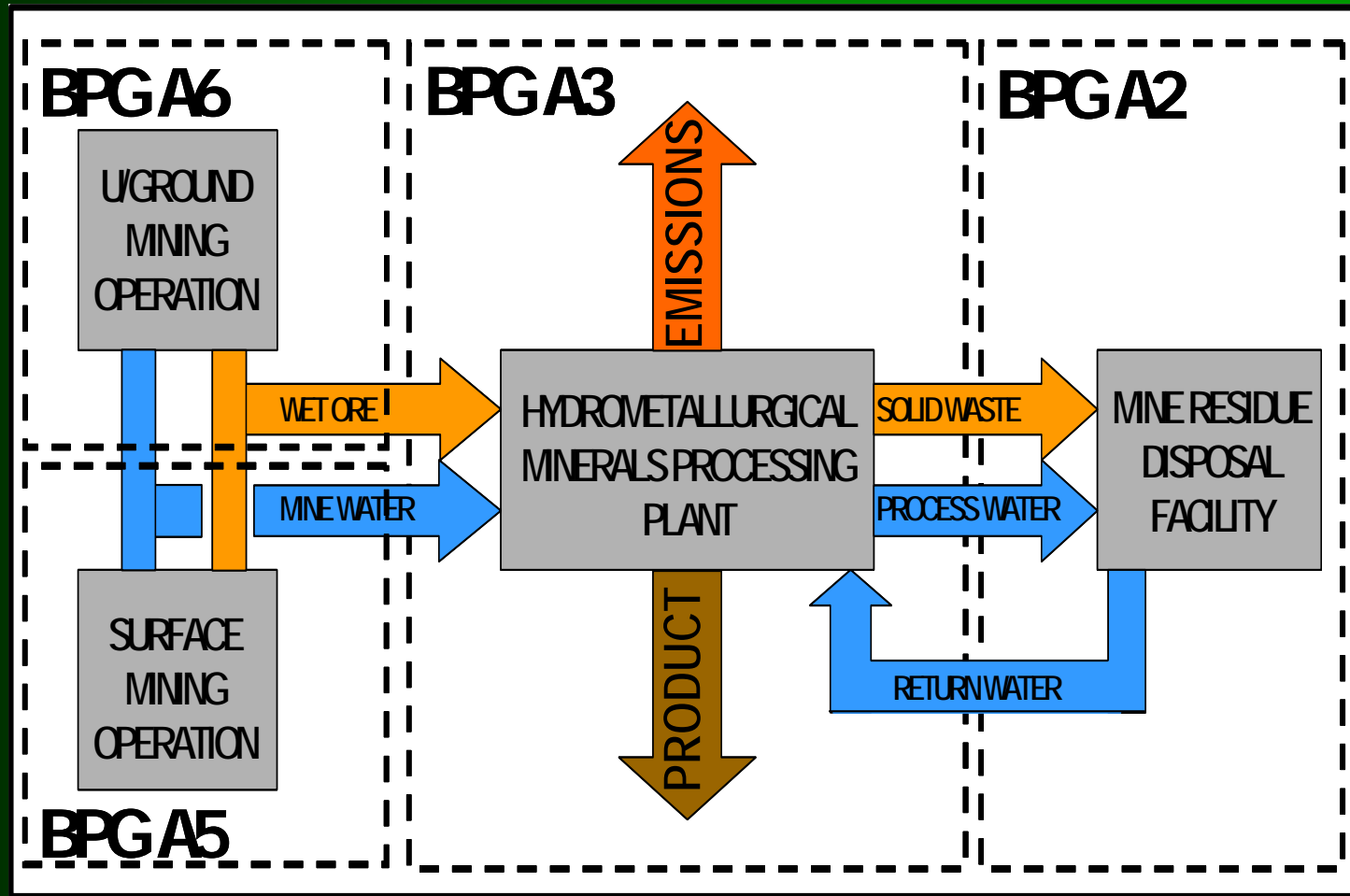
**BPG A3 :**

**WATER MANAGEMENT  
IN  
HYDROMETALLURGICAL  
PROCESSING PLANTS**



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# Hydrometallurgical processing plants

- & Milling & grinding circuits
- & Separation circuits
- & Refining circuits

Classifiers, hydrocyclones, screens, filters, thickeners, flotation processes, leaching, electro-winning, solvent extraction, metal recovery, precipitation



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# Importance of BPG

- & Significant user of water
- & Producer of water containing waste
- & Water conservation (scarce, valuable)
- & Sustainable water use (user demand)
- & Waste discharge charge system  
(economics)



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# Water management objectives

& Water reuse to reduce discharge

& Avoid / reduce effects on plant efficiency

& Avoid / reduce impact on environment  
(universal solvent)



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# Applicability of BPG

- & Aimed at water containing waste in hydrometallurgical processing plants on all types of mines
- & Simplified: Small-scale mining
- & Excluded: Pyrometallurgical & smelter operations



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# Objectives of BPG

& Promote strategic water management approach

- Water as key business asset
- Water has social, cultural, environmental & economic value

& Provide practical & logical process to optimise water management



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# Considerations

- & Understand true cost & value of water
- & Apply good housekeeping & operating practices
- & Pollution prevention & reduction at source
- & Optimise water management systems
- & Inspection, monitoring, auditing, maintenance
- & Review resource intake
- & Optimise water reuse & reclamation
- & Investigate cleaner technologies or modifications
- & Water & waste management programme



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# Legal framework

## & DWAF

- Custodian of water resources
- Responsibility: protection of water resources
- Focus: environmental impact

## & Acts – ECA, NEMA, MPRDA

## & NWA (Act 36 of 1998)

## & GN 704

## & Minimum Requirements – waste management

## & IWWM (legal: EMP & WULA)



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# Mine life cycle – exploration, prospecting, planning, design

- & Decisions at this stage : 85% of cost
- & Life-cycle assessment (cradle-to-grave)
- & EIA (acceptable levels)
- & Risk assessment & management
- & Efficiency & optimisation
- & Feasibility studies
- & Technologies (consider & evaluate)
- & Inputs (water, energy, raw material)
- & Outputs (minimise waste mass)



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# Mine life cycle

## – commissioning & operational

- & Implementation
- & Health & safety measures
- & Pollution prevention strategies
- & Good housekeeping & operating practices
- & Technologies (evaluate & modify/improve)
- & EMS (effective control)
- & Improve water management
- & Monitoring (BPG G3)
- & Water & salt balance (BPG G2)



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# Mine life cycle – decommissioning, closure & post-closure

& Residual impacts – monitoring,  
performance assessment, predictive  
modeling

& Water management – BPEO

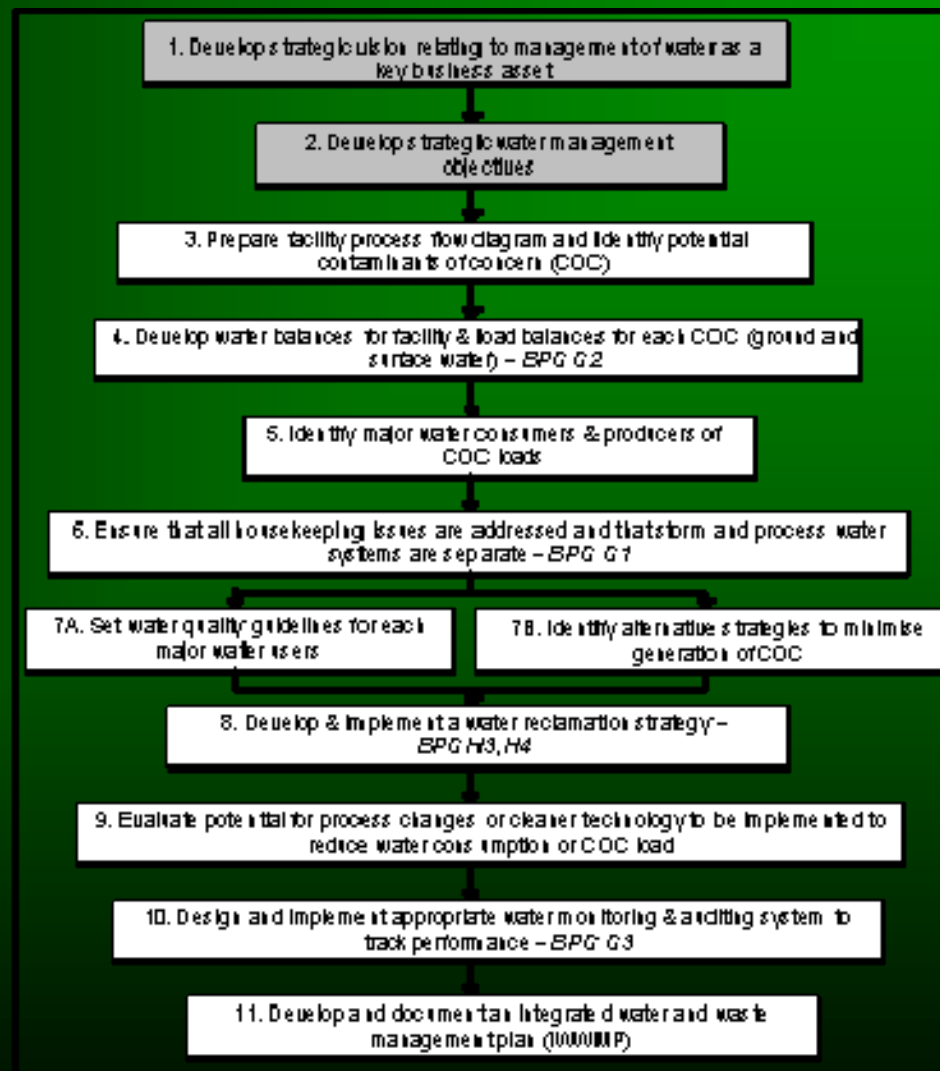
& Finances & contracts – infrastructure  
maintenance, land owner



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# Financial considerations



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# 1. Water as key business asset

- & Shared community resource
- & Scarce & valuable commodity (conserve)
- & DWAF – manage & allocate
- & Recycling VS potable use (benefit)
- & Pro-active: prevent VS mitigate
- & Reuse & reclamation (BPG H3)
- & Water management (public view, external review)



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## 2. True cost of water

- & Exploration, prospecting & planning
- & Water supply (boreholes, service provider)
- & Social, cultural, environmental & ecological
- & Economic feasibility (expenses & income)
- & Waste management & discharge
- & Operational (infrastructure & equipment)
- & Water reticulation & effluent treatment
- & Maintenance & remediation
- & Labour (skills & training)
- & Legal & risk



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## 2. Value of water

- & Cultural, social & spiritual
- & Value of ecosystem
- & Competing demands
- & Impacts on downstream users
- & Cost to operation
- & Economic production value
- & Loss of income, jobs or market share



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# Information gathering



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# 3. Site & process knowledge

## Manage what you know

- & Site – layout, locality etc
- & Environment – climate, geohydrology etc
- & Process – flow diagram, infrastructure etc
- & Inputs – characteristics, geochemistry
- & Resources – water, finance, staff
- & Mine/plant water users – quantity & quality
- & Waste – handling, hazardousness
- & Water reticulation – separate circuits etc
- & Monitoring – impacts & pollution plume



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## 4. Water & salt balances

### BPG G2 – water management tool

- & Objectives: current & future
- & Divisions: smaller management units
- & Updates: expansions or changes
- & Loads: conservative salts
- & Calculation of unknowns
- & Hydrological cycle: seasons
- & Output: level of detail, accuracy



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## 5. Mine / plant water users

- & Water quantity requirements
- & Water quality requirements
- & Sensitivity to variability / changes
- & Contaminants of concern
- & Pollution loads
- & Water reuse & reclamation (BPG H3)
- & Water treatment (BPG H4)



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## 6. Housekeeping & water management practices

Uses: dust control, transport, cooling/heating

& Water segregation – level of contamination

& Material storage – plan position, water contact

& High contamination risk areas – bund

& Storm water management – clean & dirty

& Cleaning – clean spills immediately, use of water

& Equipment & maintenance (pro-active)

& Sustainability – mine phase, plant life cycle



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# 7. Constituents of concern

## & Minimise generation of contaminants

- Significant quantity, available for uptake & potential to cause harm/impact
- Review inputs (quantity, locality, alternatives)
- Optimise pollution prevention & reduction at sources (Step 6)

## & Plant/mine water user quality requirements

- Process performance
- Product quality / yield

## & Monitoring (BPG G3), maintenance & inspections / audits



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# 8. Water reuse & reclamation (BPG H3)

- & Reason: scarcity, demand, reduce discharges
- & Opportunities: large quantities used & discharged
- & Benefits: save cost, water conservation, limit liabilities

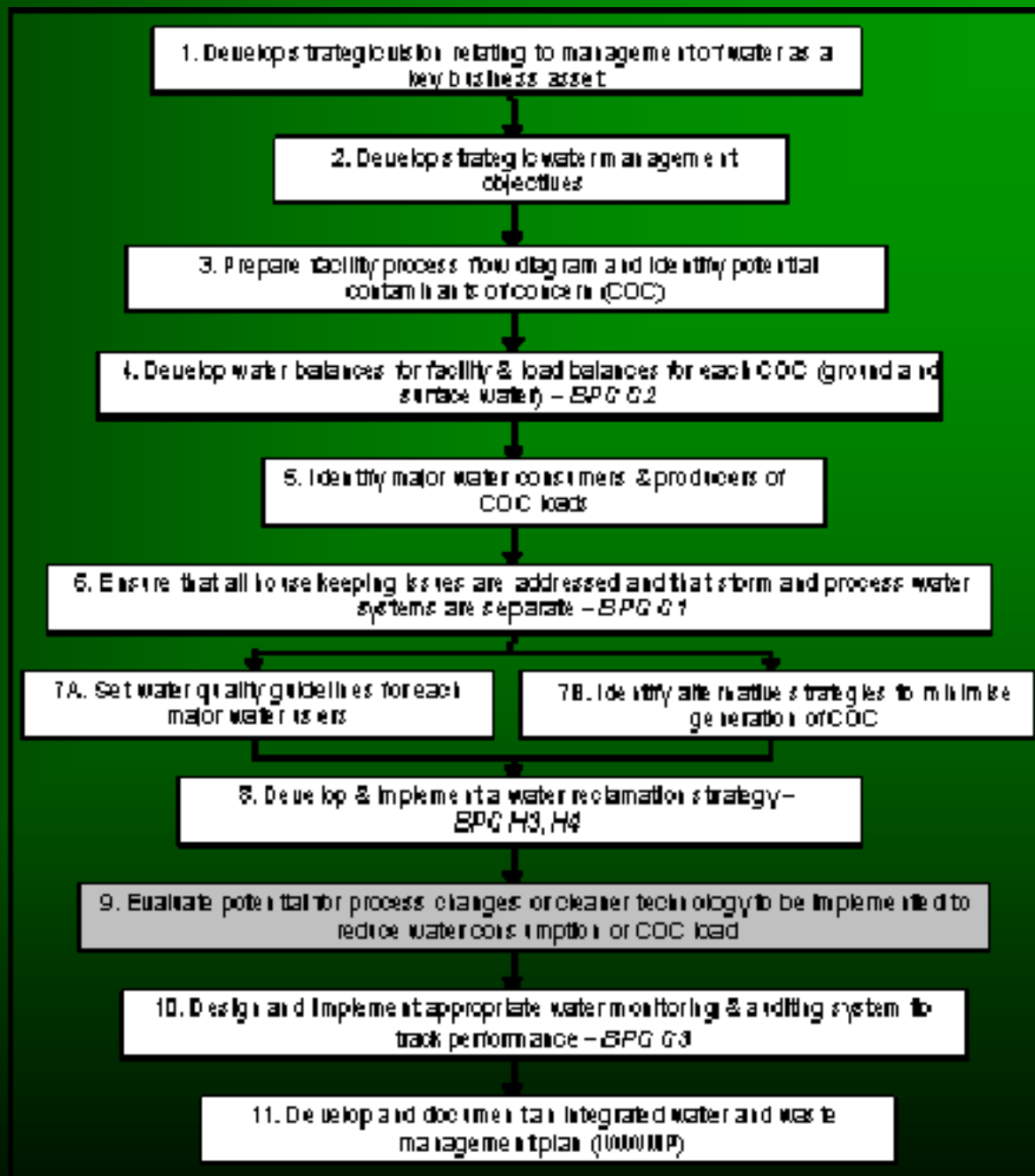
## & Considerations

Water sources	Minimise intake & losses
Water use inventory	Reticulation (link)
Discharges/disposal	Treatment (BPG H4)
Alternative uses	Monitoring
By-product recovery	Sustainability
Future projections/predictions	



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## 9. Process changes & cleaner technology

- & Pro-active & preventative approach
- & Aim: ecological & economical efficiency
- & Reduce: pollutant levels, waste, water requirements, impact
- & Implementation:
  - Identify
  - Assess applicability & practicality
  - Feasibility
  - Monitor



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# 9. Cleaner technology

## & Barriers / constraints:

- Economical (lack of resources, commodity price)
- Technological (structural, info gaps)
- Legislative (changing, lack enforcement)

## & Overcoming barriers:

- Government intervention (incentives, assist)
- Education & training (knowledge, awareness)
- Improved planning (new vs existing)



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# 10 & 11. IWWMP

& Continuous systematic improvement  
(pollution prevention, impact minimisation)

& Required for implementation

- Resources (staff, finances)
- Commitment (objectives/goals, staff)
- Monitoring (BPG G3)
- Training & awareness
- Action plans



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# 10 & 11. IWWMP Content

- & General – layout, process
- & Legislation – existing, required
- & Water environment – climate, catchment
- & Process water management (sources; users; BPG H3)
- & Storm water management (clean & dirty)
- & Groundwater management (pollution plume; impact)
- & Water treatment (BPG H4)
- & Disposal/discharge (options/alternatives, impact)
- & Waste management (classification, leaching)
- & Commitments (monitoring, management)
- & Consultation process (users, authorities)



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THANK YOU



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