Implementing Water Conservation & Water Demand Management for South Africa's mining sector

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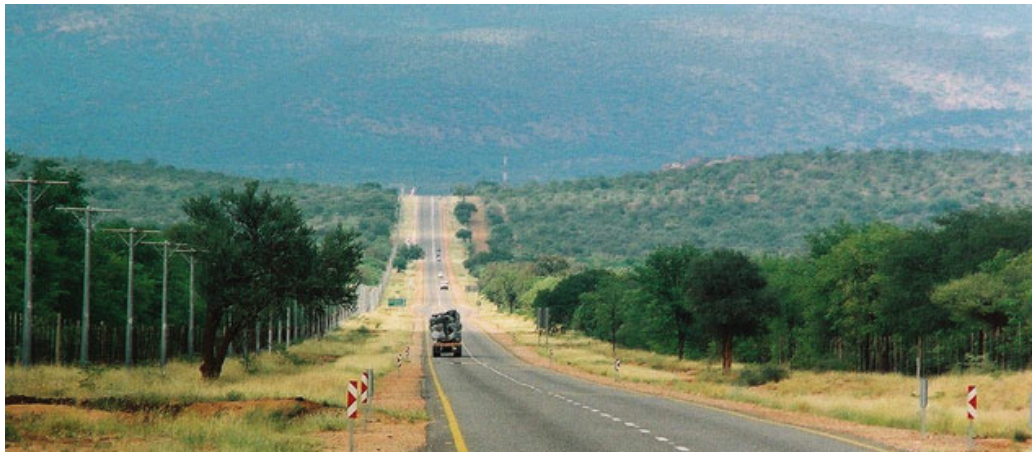
Background to WC/WDM in South Africa

- **Mining Industry Response**
  - **SA water scarcity**
  - Drought / Flash flooding
  - Climate change
  - Competing Water Demand by various sectors

    (Agriculture, Domestic, Power generation, etc)



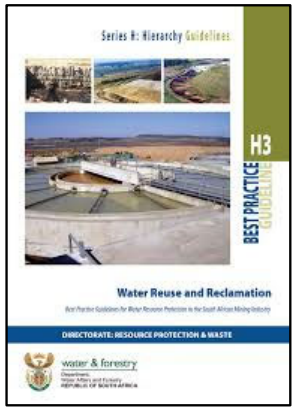
Background to WC/WDM in South Africa

- Collaboration with DWS, Minerals Council South Africa and WSP

Background to WC/WDM in South Africa

2006

- Best Practice Guideline H3: Water Reuse and Reclamation, DWS

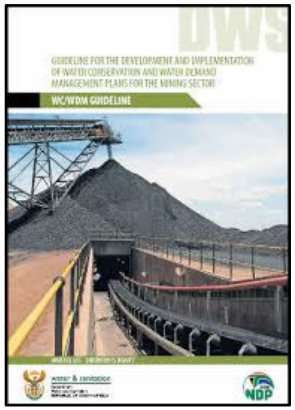


2016

- Benchmarks for Water Conservation / Water Demand Management in the Mining Sector, DWS

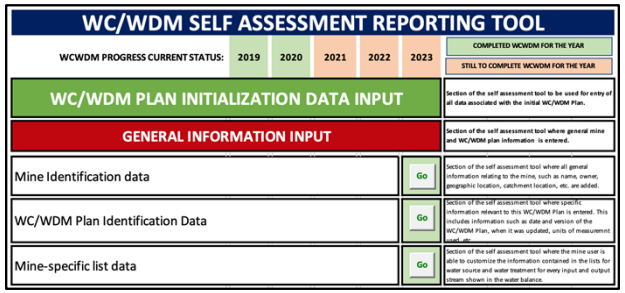
2016

- Guideline for the Development and Implementation of Water Conservation / Water Demand Management Plans for the Mining Sector, DWS



2019

- WC/WDM Self-Assessment Reporting Tool – User Manual, MCSA

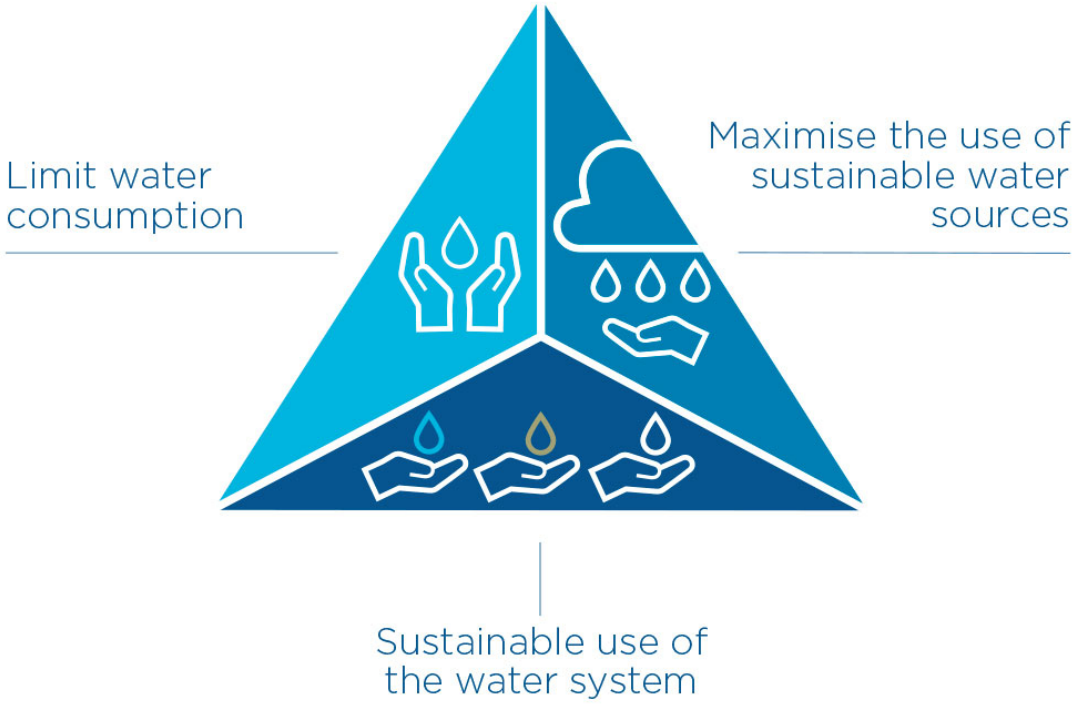


What is Water Conservation and Water Demand Management

‘water stewardship’

‘sustainability’

‘water sensitive design’



What is Water Conservation and Water Demand Management

- **WC/WDM STRATEGY**
  - Ensure sustainable water use
  - Sufficient water for present and future generations
  - Improved water management
  - Future regulatory requirement

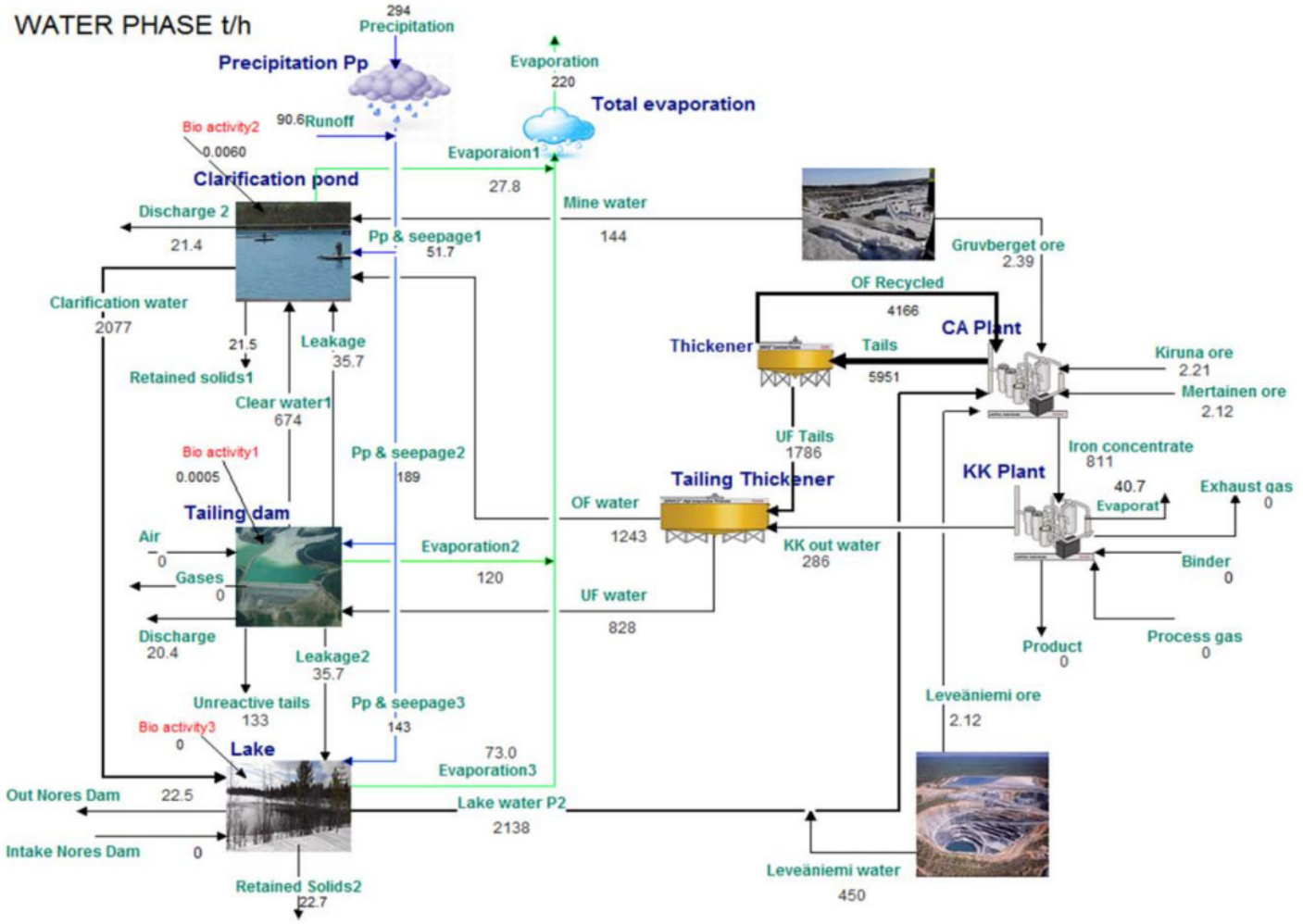
Key drivers to WC/WDM

- UN Sustainable development goals
- Drive towards sustainable mining
- Investor attraction
- Meeting ESG targets
- Community responsibility

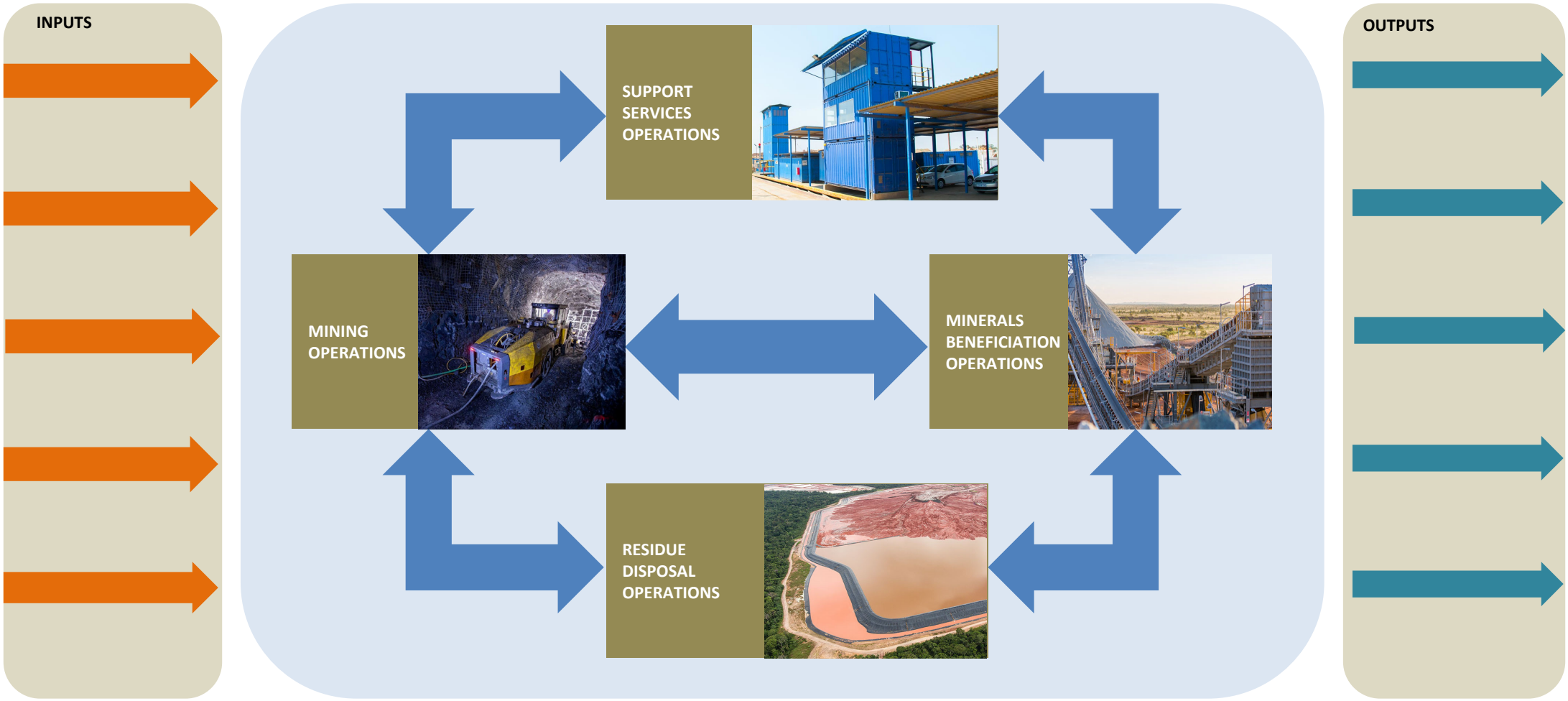
Measuring Performance

The importance of water balance modelling
'cannot control what you do not measure'

Water Balance Modelling



Water Balance Reporting Structure



Measuring Performance

Key Metrics: Water Use Efficiency (WUE) Indicators

Total water use (m^3/day)

Consumptive water use (m^3/d)

Percentage of the total volume of wastewater generated (%)

Volumes of wastewater lost (m^3/d)

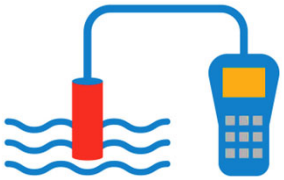
Total specific water use (m^3 per ton of ROM ore)

Water recycling ratio (%)

Measuring Performance

Accuracy

1. Measured: ~ 95%
2. Modelled: ~80%
3. Calculated: ~60%
4. Estimated: ~40%



Water Quality

Class 1: reuse without treatment

Class 2: reuse with simple treatment

Class 3: reuse with extensive/costly treatment

Setting up a WCWDM Plan

- **5-year plan to improving water management**
- **Site Specific**
  - Internal and national targets / benchmarks
  - Contextual solutions – what is reasonable
  - Cost

Example: WCWDM Plan

The Scenario

Dry climate, high evaporation rates

High water content in slurry

Pumping water from river to supply mine

'back of envelope' water balance

Discharging water to environment

Leaking water transfer pipes

Old mine: most facilities unlined – high seepage

Example: WCWDM Plan

No	Option	Basis of Calculations
1	Upgrade water balance – identify & implement opportunities	25% of unspecified sinks saved through measures identified after upgrading water balance.
2	Repair leaks	25% of unspecified sinks saved by repairing leaks.
3	Water management and awareness programme	10% of unspecified sinks saved by reducing water wastage
4	Intercept and treat all untreated discharges	80% of surplus water discharged to the river can successfully be intercepted & treated.
5	Minimise pool and surface areas of all dams	Pool on tailings facility reduced by 80%, & surface area of return water dam and other surface dams reduced by 50%.
6	Lining of all dams to reduce seepage	Seepage from all dams reduced to zero by lining.

Example: WCWDM Plan

No	Option	NPV Cost Estimate (R million)
1	Upgrade water balance – identify & implement opportunities	**3.5**
2	Repair leaks	**6.5**
3	Water management and awareness programme	**0.5**
4	Treat all untreated discharges	**50.0**
5	Minimise pool and surface areas of all dams	**15.0**
6	Lining of all dams to reduce seepage	**3.0**

Example: WCWDM Plan

MINERALS COUNCIL
SOUTH AFRICA

Description		Consumptive WUE Indicator			Capex	Cost Effectiveness	Ranking
Option		m^3/year	m^3/t	% Saving	R x 10^6	R/m^3/annum saved	
Current Situation		5,940,000	1.91				
1	Upgrade water balance – identify & implement opportunities	5,706,500	1.84	3.9%	3.5	14.99	3
2	Repair leaks	5,706,500	1.84	3.9%	6.5	27.83	4
3	Water management and awareness programme	5,804,500	1.87	2.3%	0.5	3.69	1
4	Treat all untreated discharges	5,940,000	1.91	0.0%	50.0	-	14
5	Minimise pool areas of all dams	5,702,100	1.83	4.0%	15.0	63.05	9
6	Lining of all dams to reduce seepage	5,707,800	1.84	3.9%	3.0	12.92	2

Implementation Tool

- Structured
- Standardised
- Computerised
- Reporting features

What is the Tool

Water conservation and water demand management Self-Assessment Reporting Tool: WSART

Used by the mining industry to conduct a self-assessment of the implementation of WC/WDM on the mine site.

Purpose of the Tool

Ensure consistency with the approach

Ensure consistency with the calculation

Allow for consistent reporting of WC/WDM plans

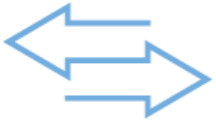
Benefits of the Tool

Assists in creating a water management strategy

Identifies initiatives for better water management

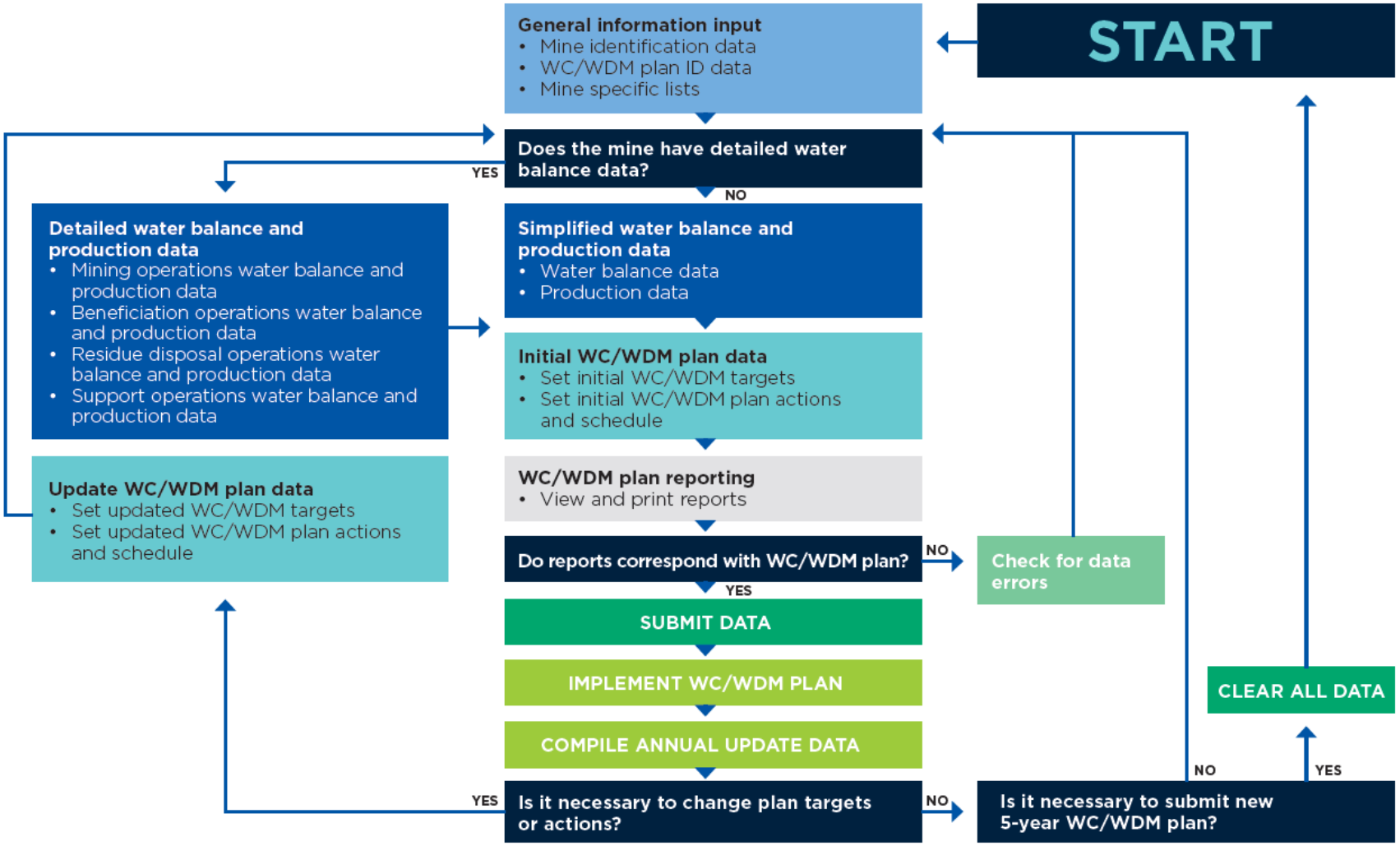
Assesses the fit-for-purpose water requirements and the level of water re-use and recycling required

Clear management reporting of the water management status on site

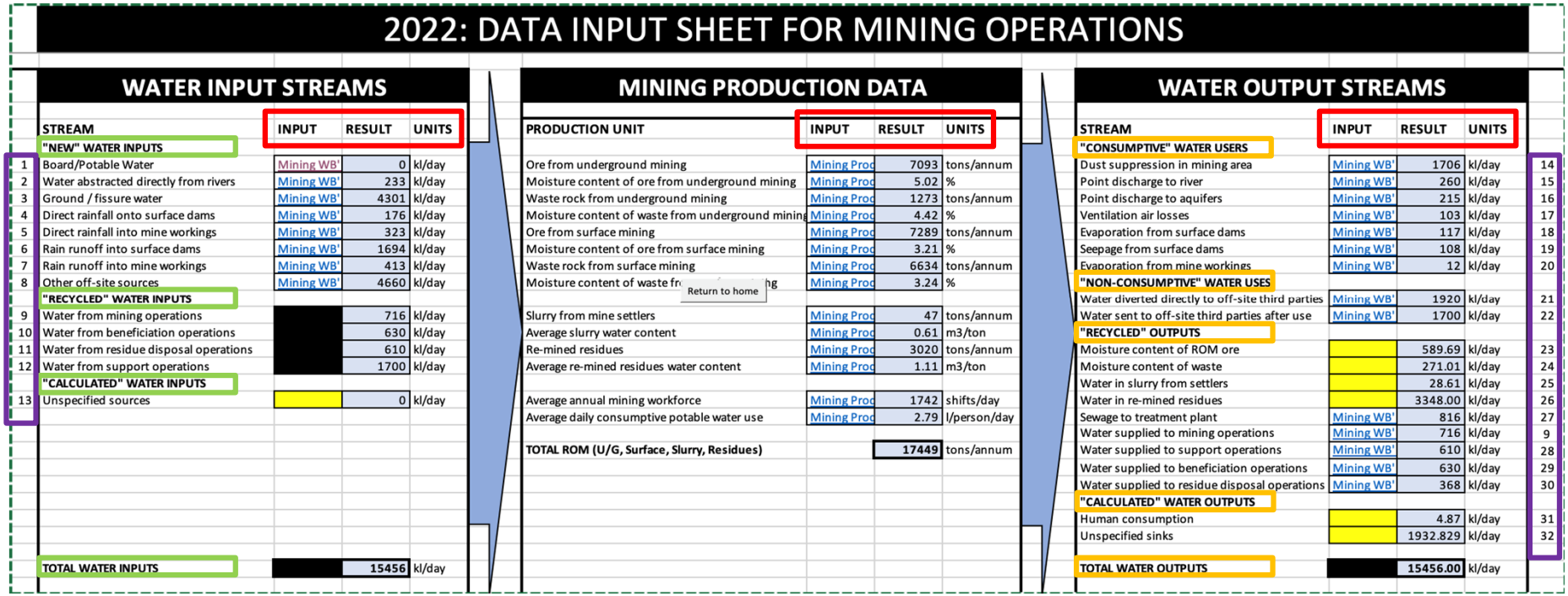


Easy to update

How to use the Tool



WSART Tool Run Through
Inputs



2022: DATA INPUT SHEET FOR MINING OPERATIONS

WATER INPUT STREAMS

	STREAM	INPUT	RESULT	UNITS
	"NEW" WATER INPUTS			
1	Board/Potable Water	Mining WB'	0	kl/day
2	Water abstracted directly from rivers	Mining WB'	233	kl/day
3	Ground / fissure water	Mining WB'	4301	kl/day
4	Direct rainfall onto surface dams	Mining WB'	176	kl/day
5	Direct rainfall into mine workings	Mining WB'	323	kl/day
6	Rain runoff into surface dams	Mining WB'	1694	kl/day
7	Rain runoff into mine workings	Mining WB'	413	kl/day
8	Other off-site sources	Mining WB'	4660	kl/day
	"RECYCLED" WATER INPUTS			
9	Water from mining operations		716	kl/day
10	Water from beneficiation operations		630	kl/day
11	Water from residue disposal operations		610	kl/day
12	Water from support operations		1700	kl/day
	"CALCULATED" WATER INPUTS			
13	Unspecified sources		0	kl/day
	TOTAL WATER INPUTS		15456	kl/day

MINING PRODUCTION DATA

PRODUCTION UNIT	INPUT	RESULT	UNITS
Ore from underground mining	Mining Prod	7093	tons/annum
Moisture content of ore from underground mining	Mining Prod	5.02	%
Waste rock from underground mining	Mining Prod	1273	tons/annum
Moisture content of waste from underground mining	Mining Prod	4.42	%
Ore from surface mining	Mining Prod	7289	tons/annum
Moisture content of ore from surface mining	Mining Prod	3.21	%
Waste rock from surface mining	Mining Prod	6634	tons/annum
Moisture content of waste fr...ng	Mining Prod	3.24	%
Slurry from mine settlers	Mining Prod	47	tons/annum
Average slurry water content	Mining Prod	0.61	m3/ton
Re-mined residues	Mining Prod	3020	tons/annum
Average re-mined residues water content	Mining Prod	1.11	m3/ton
Average annual mining workforce	Mining Prod	1742	shifts/day
Average daily consumptive potable water use	Mining Prod	2.79	l/person/day
TOTAL ROM (U/G, Surface, Slurry, Residues)		17449	tons/annum

Return to home

WATER OUTPUT STREAMS

	STREAM	INPUT	RESULT	UNITS
	"CONSUMPTIVE" WATER USERS			
14	Dust suppression in mining area	Mining WB'	1706	kl/day
15	Point discharge to river	Mining WB'	260	kl/day
16	Point discharge to aquifers	Mining WB'	215	kl/day
17	Ventilation air losses	Mining WB'	103	kl/day
18	Evaporation from surface dams	Mining WB'	117	kl/day
19	Seepage from surface dams	Mining WB'	108	kl/day
20	Evaporation from mine workings	Mining WB'	12	kl/day
	"NON-CONSUMPTIVE" WATER USES			
21	Water diverted directly to off-site third parties	Mining WB'	1920	kl/day
22	Water sent to off-site third parties after use	Mining WB'	1700	kl/day
	"RECYCLED" OUTPUTS			
23	Moisture content of ROM ore		589.69	kl/day
24	Moisture content of waste		271.01	kl/day
25	Water in slurry from settlers		28.61	kl/day
26	Water in re-mined residues		3348.00	kl/day
27	Sewage to treatment plant	Mining WB'	816	kl/day
9	Water supplied to mining operations	Mining WB'	716	kl/day
28	Water supplied to support operations	Mining WB'	610	kl/day
29	Water supplied to beneficiation operations	Mining WB'	630	kl/day
30	Water supplied to residue disposal operations	Mining WB'	368	kl/day
	"CALCULATED" WATER OUTPUTS			
31	Human consumption		4.87	kl/day
32	Unspecified sinks		1932.829	kl/day
	TOTAL WATER OUTPUTS		15456.00	kl/day

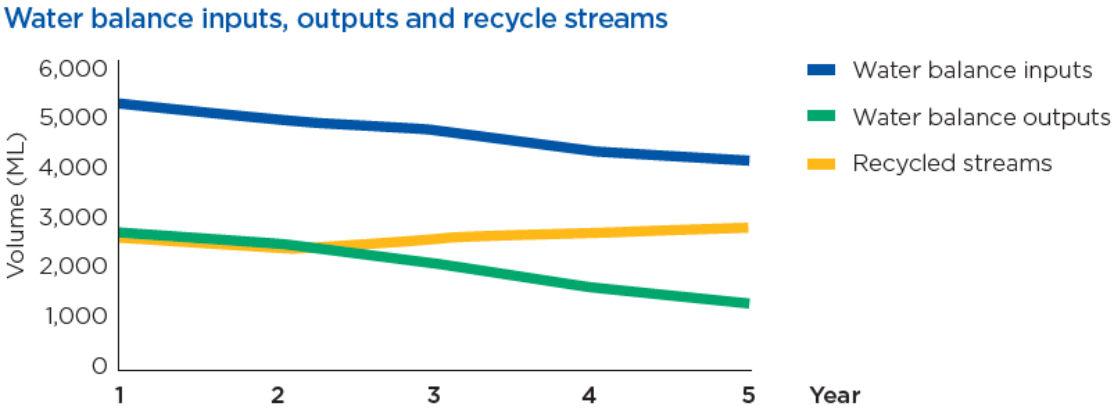
WSART Tool Run Through

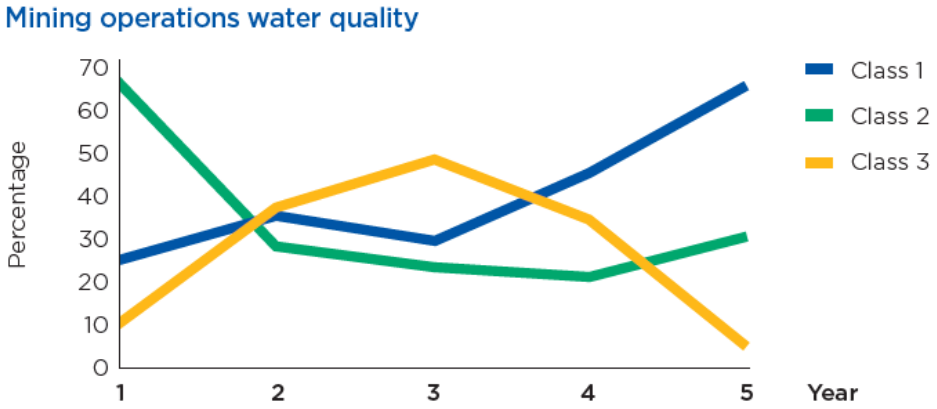
Action No	Management Action Short Name	Description	Type of action	Budget (R000's)	Estimated start date	Estimated completion date
1	PC DAM 003	Construct new pollution control dam at Shaft 9	Prevention	12000	Mar-20	Nov-20
2	RWD DAM TDF6	Construct new RWD at Tailings Disposal Facility 6 to accommodate enlargement	Prevention	144000	Jul-20	Feb-22
3	ROPLANT1	Construct new RO desalination plant at Shaft 9 to treat water from PC Dam 003	Reuse	120000	Jan-21	Dec-22
4	TDF PIPE REPLACE	Progressively replace pipelines from RWD 1 to plant with new pipelines	Prevention	30000	Jan-20	Dec-23
5						
6						

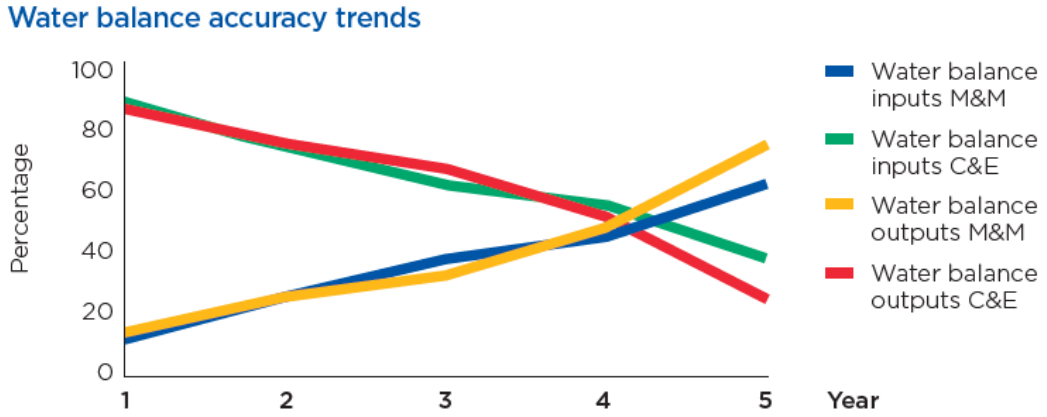
Estimated Percentage Completion														Comments
2020 Target	2020 Actual	2020 Action Status	2021 Target	2021 Actual	2021 Action Status	2022 Target	2022 Actual	2022 Action Status	2023 Target	2023 Actual	2023 Action Status	2024 Target	2024 Actual	2024 Action Status	
100															
30			90			100									
0			50			100									
25			50			75			100						

WSART Tool Run Through
Reports

- Water usage trends
- Accuracy data trends
- Water ease of reuse trends







Engagement with the industry

What would drive WC/WDM growth in the industry?

The Way Forward

- Moving towards regulation
- Implementation of the tool
- Further development
- Awareness
- Change mindset to voluntary implementation

In Concluding

- The WSART plays a pivotal role in formulating a comprehensive water management strategy for mining operations
- South Africa is at the forefront of driving sustainable water management in the mining sector
- Multi-pronged industry approach driving continuous investment in the WC/WDM

WC/WDM principles are imperative to a sustainable, resilient future in the mining industry

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