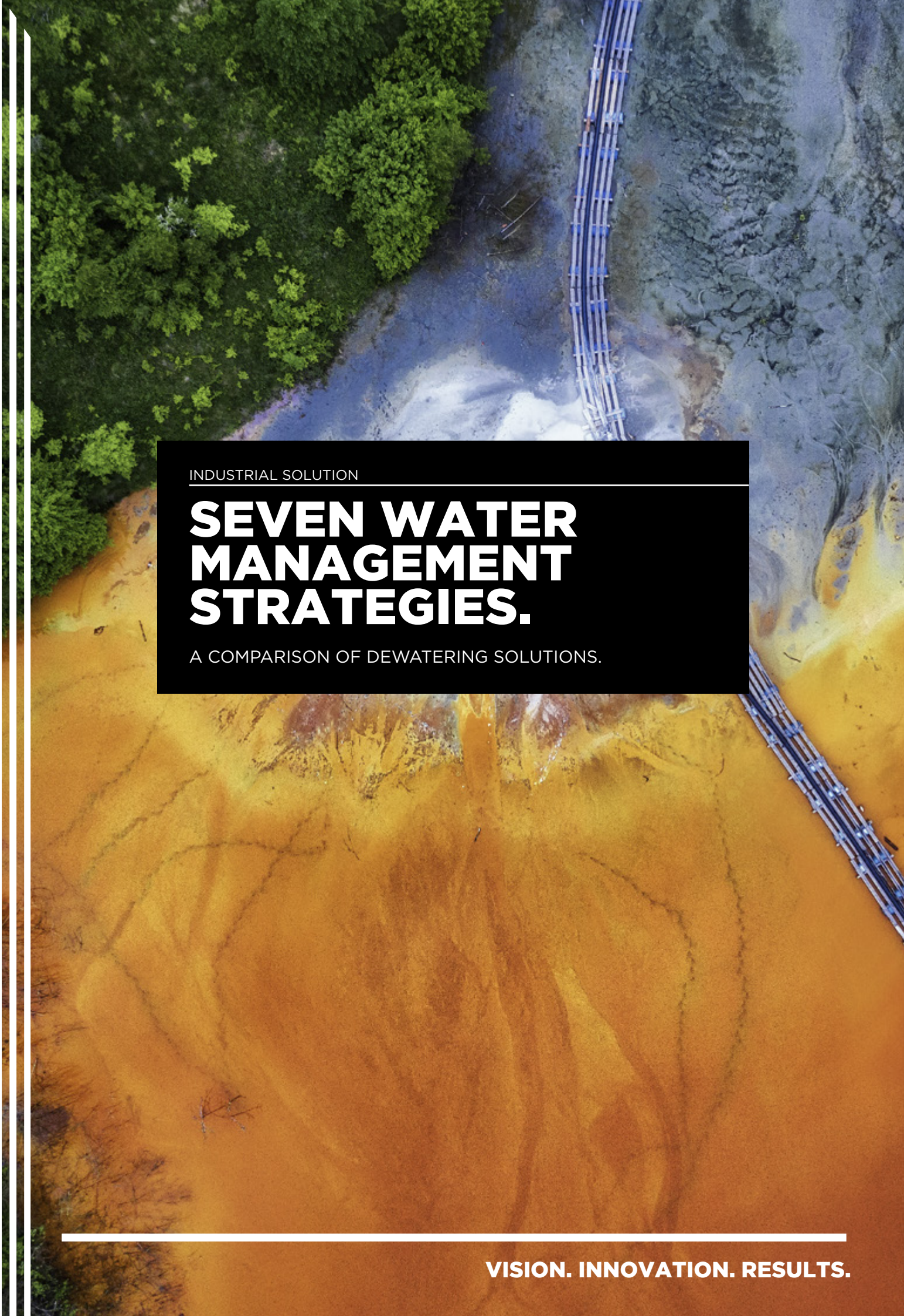


INDUSTRIAL SOLUTION

SEVEN WATER MANAGEMENT STRATEGIES.

A COMPARISON OF DEWATERING SOLUTIONS.

VISION. INNOVATION. RESULTS.

DEWATERING SOLUTIONS FOR MINING.

MINETEK WATER

Mine water management is crucial for mine sites to maintain operational efficiency and compliance. However the removal of water can be costly and complex with high risk and little payoff if not correctly managed.

Underground and open pit mining often requires dewatering solutions to recover valuable resources below. Mine dewatering is needed when a mine extends below the water table, resulting in excess water infiltrating the production site.

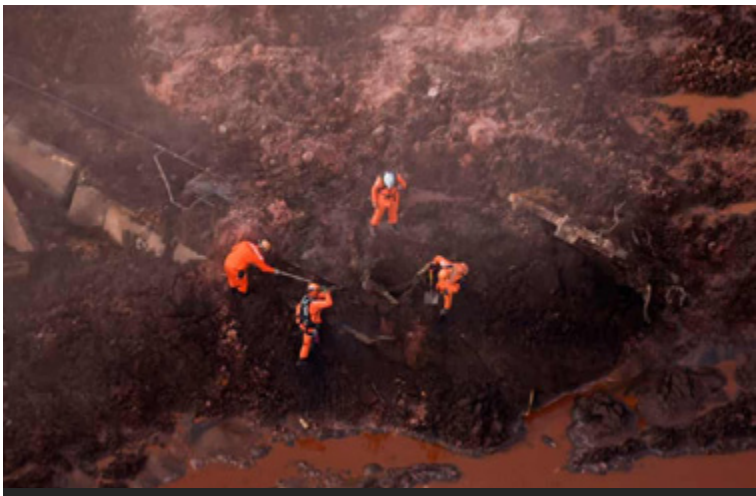
Excess water can halt production, particularly if it is dispersed where mining activity is occurring. Production stoppages can impact bottom line figures, which is why a mine water management plan is essential. Keep reading to discover the most efficient dewatering methods and techniques.

REPERCUSSIONS OF FAILURES IN MINE WATER MANAGEMENT

Mine water management plans are essential in maintaining regulatory water requirements. Companies who fail to adhere to environmental regulations or breach compliance may result in the following.

- Hefty fines or infringement notices
- Mandatory environmental audit
- Tailings dam failure
- Potential loss of life
- Criminal lawsuit due to negligence

The repercussions of a failed mine water management plan are exponential. Therefore, it is in the companies and environments best interest to have a secure strategy and plan to effectively manage mine water levels.



CASE STUDY: THE COST OF FAILED WATER MANAGEMENT, VALE TAILINGS DAM COLLAPSE, BRAZIL 2019.

In February 2021, Vale agreed to pay $7 billion in compensation for the 86-meter dam collapse in the state of Minas Gerais, Brazil. The financial blow to the mining company also came in the form of a massive stock plunge immediately after the disaster. Shares fell 24 per cent, wiping out $18.96 billion US in January 2019.

The environmental impact was immense, with 1.2 square km of forest impacted, and 320km of a river that supplies water to the state polluted. Toxic elements were found in the drinking water supply for 5 additional states. Further compensation may have been made “behind closed doors” to the families of the 272 people that died in the accident.

16 people - including the former CEO of Vale - were charged with homicide and other environmental crimes.

The dependency on tailings dams in Brazil and other parts of the world remains problematic with climate change leading to increased severe and unpredictable weather events.

WATER MANAGEMENT: FUTURE PROOFING.

MINETEK WATER

In 2013, 500 water scientists from the Cooperative Remote Sensing Science and Technology Centre warned that the majority of people on Earth will be forced to live with severe pressure on fresh water supply within the space of two generations, due to over-use, climate change and pollution.

Today's mining operations must compete with increased pressures for environmental management, the effects of climate change, and population growth in nearby areas.

The heavy dependency on tailings dams demonstrates an inability to adapt that will only lead to increased operational costs, fines, shutdown or disaster.

Deep well injection and sprinklers / irrigation systems are just some of the techniques commonly used for water management. They both come with their different pros and cons.

ENVIRONMENTAL CONCERNS

THE PRINCIPLES OF WASTE MINIMISATION

Sustainable management ensures long-term cost reduction, efficiency, and future-proofs mining for long term scaling. Mine water management proposals should promote wastewater in order of priority:

1. Avoidance
2. Reduction
3. Reuse
4. Recycling
5. Recovery of energy
6. Treatment
7. Containment
8. Disposal

VISION. INNOVATION. RESULTS.

WATER MANAGEMENT: THE RIGHT SOLUTION.

MINETEK WATER

Mine water management plans include strategies to deal with both surface and ground water. Through modeling, hydrologists can predict the expected ground or surface water distribution. This is used to inform and guide the mine dewatering method to best suit their application.

SEVEN COMMON OPEN CUT AND UNDERGROUND MINE DEWATERING TECHNIQUES:

1. **Water transfer or haulage**
2. **Sprinkler / misting systems**
3. **Dam wall construction**
4. **Water evaporators**
5. **Water treatment plants**
6. **Constructing new storage ponds or dams**
7. **Deep well injection**

A combination of these seven methods can be used successfully to create a holistic water management strategy. Minetek can optimise or replace existing strategies, based on the individual project, budget, environmental assessment and client needs.

WATER EVAPORATORS

- MINETEK's evaporator systems presents immense value, especially when compared to traditional water treatment or construction of new dams.
- No waste stream or chemical pretreatment required.
- Broad range of volume capacity with systems operating more than 2160m3/ hour (9600 GPM).
- Automated system with no operator required – fully integrated environmental management system.
- Minetek units Will perform even in humid environments.
- Unique ability to process water with high TDS and high TSS.
- Not susceptible to changes in feed water quality.
- Minimal footprint and power required.

MINETEK's water evaporator is versatile in application and can be used for any of the following.

- Brine/Wastewater Disposal
- High TDS – Saline Water Evaporation
- Acid/Contaminated Water Disposal
- Pit Dewatering
- Process & Produced Water Disposal
- Extreme Rainfall Events Causing Flooding
- Tailings Water Removal & Dewatering
- Storage Dam Overloading increasing Risk of Failure
- Legacy & Mine Closure Site Wastewater
- Mine Dewatering
- Coal Ash Pond Dewatering
- Leachate Water Management

WATER MANAGEMENT: THE RIGHT SOLUTION.

MINETEK WATER

WATER TREATMENT PLANTS

- Reverse osmosis water treatment to remove acidity, high metal concentrations and any other pollutants.
- Treating wastewater through a combination of chemicals and mechanical filtrations – PH adjusters, coagulants & flocculants.
- On site treatment plant – expensive set up costs.

SPRINKLER & MISTING SYSTEMS

- Pump water into evaporation pond into sprinkler and misting systems.
- Slow and inefficient dewatering method.
- Large surface area required.
- Reliant on favourable climate conditions for operation.
- Maintenance heavy infrastructure.
- You may as well just rely on solar evaporation.
- Ultimately inefficient.

DEEP WELL INJECTION

- Deep well injection is a dewatering method pumping water deep into the well until there is little to no water remaining.
- It is a simple, inexpensive method
- However, can present new risks with leakage into groundwater.

VISION. INNOVATION. RESULTS.

WATER MANAGEMENT: THE RIGHT SOLUTION.

MINETEK WATER

WATER TRANSFER

- Transport off site to dispose of excess water.
- Hauling waste sludge off site.
- Outsource water management to third party companies.
- Labour heavy and expensive.
- Cannot transport copious quantities of water at a quick rate.
- As the name suggests, this method simply transfers the problem from one location to another.

DAM WALL CONSTRUCTION

- Constructing a new dam wall to hold extracted water can be expensive.
- Sometimes it is only a short-term solution as aquifers may be dispersed in various locations.

NEW CONSTRUCTION OF A DAM OR STORAGE POND

- New construction needs a lot of approval from environment regulators as we know the cost.
- Extremely capital intensive and expensive.
- Creates a long term, legacy issue to be managed over many years.
- Displaces often useful land parcels.
- Low OPEX, high CAPEX.

COMPARING MINETEK TO COMMON SOLUTIONS.

MINETEK WATER

WATER MANAGEMENT COMPARISON CHART

	MINETEK WATER EVAPORATION	STANDARD WATER TREATMENT	SPRINKLERS / IRRIGATORS	DEEP WELL INJECTION	NEW DAMS OR PONDS
VOLUME	1 ML/ DAY EVAPORATED	1 ML/DAY TREATED	HIGHLY VARIABLE	HIGHLY VARIABLE	HIGHLY VARIABLE
APPROX. CAPEX	$220,000	$1,000,000	TYPICALLY LOW TECH, LOW COST DEPENDING ON SCALE	HIGH COST	HIGH COST
OPEX	$0.20/$m^3$ EVAPORATED	$2.00/$m^3$	HIGHLY VARIABLE	HIGHLY VARIABLE	LOW
WASTE STREAM	NO	YES	NO	NO	LARGE LEGACY FOOTPRINT
ABILITY TO TREAT FOR RE-USE	NO	YES	NO	NO	NO
CHEMICAL ADDITIVES / DOSING	NO	YES	NO	NO	NO
OPERATOR REQUIRED	NO, SYSTEM IS AUTOMATED	YES	YES	YES	YES
MOBILITY	YES, SYSTEM CAN BE RELOCATED EASILY	TYPICALLY FIXED INSTALLATIONS	SOMEWHAT, DEPENDING ON FOOTPRINT	FIXED	FIXED
ABILITY TO MANAGE CHANGE IN WATER QUALITY INPUT	YES	TYPICALLY NO	NO	YES, IF PUMPS AND INFRASTRUCTURE ARE DESIGNED CORRECTLY	YES
LEAD TIME	FAST DEPLOYMENT 6 - 8 WEEKS	3 - 4 MONTHS	LOW TECH, TYPICALLY AVAILABLE	HIGHLY VARIABLE	SIGNIFICANT LEAD TIMES
MAINTENANCE	LOW MAINTENANCE	CONSTANT CLEANING AND REPLACEMENT OF PARTS	HIGH MAINTENANCE, NOZZLE BLOCKING AND CORROSION	HIGHLY VARIABLE	HIGHLY VARIABLE
INFRASTRUCTURE FOOTPRINT	MINIMAL	MINIMAL	SIGNIFICANT CREATES GROUNDWATER ISSUES AND STABILITY ISSUES BECAUSE EVAPORATION IS SO LOW (4%)	PUMPING INFRASTRUCTURE CAN BE ELABORATE	PUMPING INFRASTRUCTURE CAN BE ELABORATE

VISION. INNOVATION. RESULTS.

FURTHER READING.

MINETEK WATER

LAND BASED.

CLICK HERE

FLOATING.

CLICK HERE

BOOK A 15 MINUTE DISCOVERY CALL.

CLICK HERE TO MEET WITH OUR SALES TEAM.

SOURCES.

GUIDELINES FOR MANAGEMENT OF WATER IN MINES

- https://earthresources.vic.gov.au/legislation-and-regulations/guidelines-and-codes-of-practice/guidelines-management-of-water-in-mines-and-quarries

VALE DAM DISTASTER

- https://www.bbc.com/news/business-55924743
- https://news.mongabay.com/2021/06/after-two-collapses-a-third-vale-dam-at-imminent-risk-of-rupture/
- https://www.abc.net.au/news/2019-02-12/iron-ore-price-explainer-after-mining-dam-collapse/10800698?nw=0&r=HtmlFragment
- https://www.geoengineer.org/news/2019-brazilian-dam-collapse-vale-fined-7-billion-in-compensation
- https://www.bnamericas.com/en/news/brumadinho-mining-disaster-compensation-cost-reaches-us366bn-for-brazils-vale
- https://www.theguardian.com/world/2021/feb/04/brazil-mining-collapse-vale-agrees-compensation
- https://www.theguardian.com/world/2020/jan/21/brazil-dam-collapse-mining-disaster-charges
- https://www.mining.com/web/ex-vale-ceo-charged-with-homicide-for-brazil-dam-disaster/

ATTRIBUTING EXTREME WEATHER TO CLIMATE CHANGE

- https://www.carbonbrief.org/mapped-how-climate-change-affects-extreme-weather-around-the-world

WATER IN MINING AND INDUSTRY

- https://www.publish.csiro.au/ebook/chapter/9780643103283_Chapter_10#:~:text=Water%20is%20used%20by%20the,generation%20%E2%9C%BD%20suppression%20of%20dust