Water Ecosystem Mapping in Mining and Mineral Industry

Pre-Study

SprintlyWorks©

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About SprintlyWorks

About

SprintlyWorks©

SPRINTS-AS-A-SERVICE

Answer Big Questions &
Deliver Sustainable Impacts

Visit Our Website

- Established in 2018
- Headquartered in Helsinki
- Headcount: 15
- 100+ projects delivered

We advise top management across industries...

Industrials	Metals & Mining	Chemicals
Healthcare	Oil & Gas	Automotive
Consumer Goods	Pulp & Paper	Utilities

...on most pressing & complex problems in:

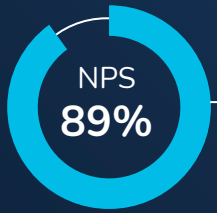
Manufacturing	Corporate Finance & Strategy
Supply Chain	People & Organisation
AI & Technology	Business Development
Operations	Sustainability

Recognition & Awards

Featured on World Economic Forum for being a trailblazer in Future of Work

One of The Top 8% Achievers in 2024 ranked by Kauppalehti – Finland's largest economic publication

Customers appreciate our impact



ABB

> *"**The work of the team was important** in increasing the level of awareness and urgency on the selected subject internally.*
>
> ***Director, ABB***

Kemira

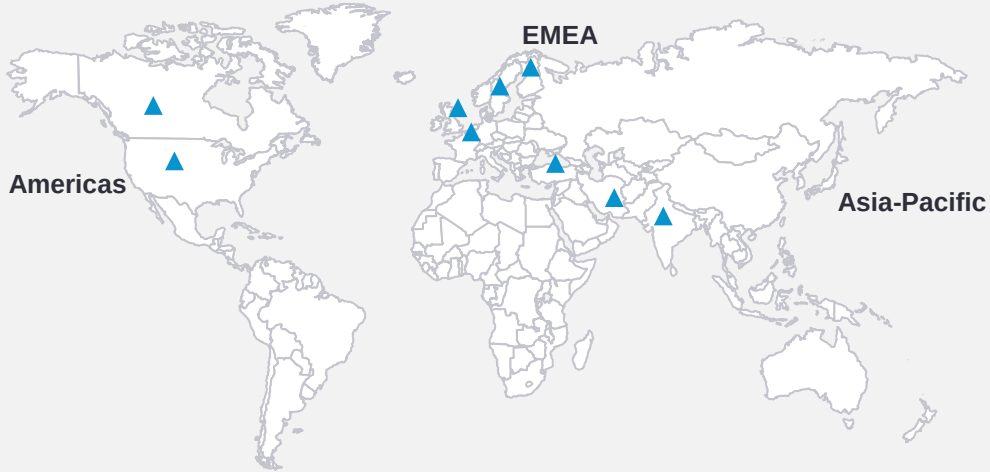
> *"I have to say that from quality perspective team exceeded all targets. **Fast, intense – "Sprint Manner"** way of working showed well its power.*
>
> ***Senior Vice President, Kemira***

TOYOTA

> *"I have completed 23 years in the industry and I'm not that easily impressed but I must **say astonished by the result** you have here.*
>
> ***Director Strategic Innovation, Toyota - Material Handling***

We have 50+ country research experience, with sector knowledge in Chemical, Industrial Equipment, Paper & Pulp to name a few

- Deep geographic coverage, we have conducted market interviews in 50+ countries namely.
  - **Americas** – US, Canada
  - **Asia** – India, UAE
  - **EMEA** – Finland, Sweden, UK, Germany
- This help customers in building comprehensive knowledge of their business worldwide with strategic decision-making.



Our Notable Customers:

NOKIA SIEMENS GE TOYOTA ABB Fazer UPM storaenso ANDRITZ VATTENFALL
kemira SANDVIK FINNAIR Metsä fortum Alko Danfoss NESTE essity st1
L&T Valmet Huhtamaki outokumpu elisa PAULIG Orkla VAISALA posti

Our in-house capability

Team to lead, supervise, and drive the project

Partner

Rahul Abhisek

- **Background:** MSc Business and Design from Aalto University, Finland
- **Notable references:** Bill & Melinda Gates Foundation, Kemira, ABB, GE, Stora Enso, UPM

Director

Tuomas Marttila

- **Background:** MBA from IMD
- **Previous experience:** Bain & Company and private equity across multiple industries, with a focus on industrial goods and services and energy.

Senior Consultant

Quy Pham

- **Background:** MSc. in Finance & CEMS from Aalto University
- **Previous experience:** Lead and delivered 30+ projects across multiple industries, like Energy, Pulp & Paper, Consumer Goods

Consultant

Jongsuk Hyun

- **Background:** MSc. in Management from London Business School
- **Previous experience:** Lead & delivered 10+ projects across a variety of sectors, like Chemical, Industrial Equipment and Food & Beverage

Knowledge Analysts

Lam Nguyen

- **Background:** BA, Economics at Foreign Trade University of Vietnam
- **Previous experience:** Designed market strategies & opportunity diagnosis in APAC region for 10+ European clients

Nanak Moolchandani

- **Background:** BCom Honors at Delhi University
- **Previous Experience:** Led & executed more than 20+ projects for clients across Sustainability, FMCG, Digitalization in EMEA and APAC

We built a strong pipeline of rockstar talents!

Global Talent Pool

... From Top-tier Universities

... Across 10 European Countries

... In Different Specialisations

Finance	Supply Chain
Strategy	Data Analytics
Sustainability	Industrial Engineering
Marketing	Business Law

Available associates for 2025

Talent's University		*Experiences*
	***Ni*** MSc in Finance Aalto University	BAIN & COMPANY
	***Meriem*** MSc in Marketing Stockholm School of Economics	McKinsey & Company
	***Dario*** MSc in Business Bocconi School of Management	Husqvarna
	***Simon*** MSc in Finance and Economics London School of Economics	LEK
	***Haytham*** MSc in Strategic Management HEC Paris	BCG

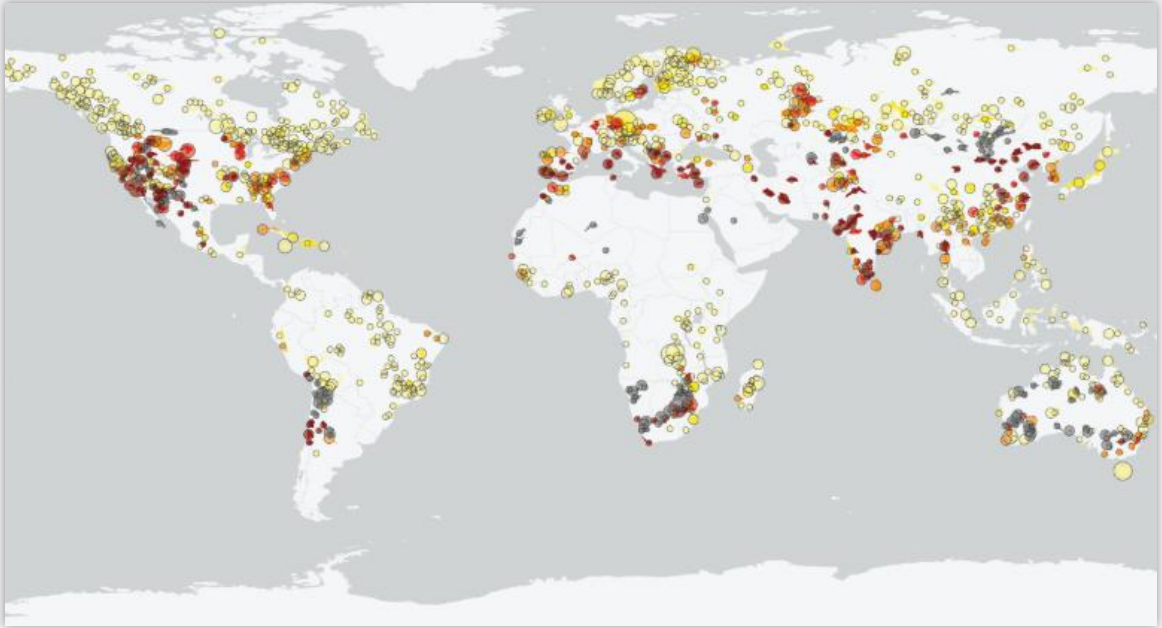
2000+
Talents...

Our Perspectives

Global Overview

- High Demands for Efficient Water Management
- Water’s Pivotal Roles in the Mining & Mineral Industry
- Water Ecosystem Value Chain

16% of critical mineral mines and deposits are located in water-stressed areas...



Source: World Resource Institute

...efficient water management is essential

Water Management Techniques

Explore New Technologies

Developments like Direct Lithium Extraction (DLE) and microbial solutions reduce water use

Assess Risks Across Value Chains

Companies are setting water targets, analyzing water usage value chain & improving technologies by priorities

Improve Governance & Compliance

Governments strengthen mining regulations and collaborate with communities in water management

Expand Access To Data

Increased transparency on water use & mining data is needed to improve policies and supply chain visibility

Water plays an indispensable role in the mining and mineral industry, across all stages from extraction to disposal

EXPLORATION AND DEVELOPMENT

MINE OPERATIONS

MINERAL PROCESSING

LOGISTICS

HEALTH, SAFETY & ENVIRONMENT

Mining & Minerals Key Activities

Survey and Drilling	Planning, Development & Infra	Mine Planning	Drilling and Blasting and Hauling	Plant Processing	Stockyard/ Tailing Management	Railroad Transport	Port Operations	Asset Safety	Process and People Safety
• Cools drilling machines • Stored for drinking • Reduces dust in road & infra. construction		• Dewater from pits, etc. • Dust dispersion on haul road & maintenance • Cleans HEMM, etc.		• Crushes & grinds rocks • Metal extraction • Ore slurry transport • Tailing ponds storage		• Material transport via pipelines & barges • Dust control at sites • Washes railcars & ships		• Fire emergency storage • Land restoration • Tree planting • Recycled before discharge	

Water Value Chain Supporting Mining & Minerals Industry

- **Water Sourcing**
- **Water Storages, Treatment & Use**
- **Water Sourcing**
- **Water Storages, Treatment & Use**
- **Wastewater Recycling & Discharge**

Source: Infosys

Value Chain of Water Ecosystem

Water ecosystem sustainability emphasizes innovative solutions in treatment, usage, recycling, and discharge phases

WATER SOURCING	WATER STORAGES	TREATMENT & USES	WASTEWATER RECYCLING	WATER DISCHARGE
				
• Sourced locally from rivers, etc. • Pumped via pipelines • Used for cooling, mineral processing, dust control, etc.	• Stored in tanks or reservoirs • Ensures a steady supply for mining operations	Vast Rooms for Innovative Solutions in Water Ecosystem Sustainability **Focus of this Report** • Treated to remove impurities • Treatment involve filtration, pH adjustment, etc. • Ensure safety in ore washing, etc.	• Treated after use to meet environmental standards • Recycled for reuse, reducing fresh water's demand & waste	• Discharged into local systems • Must meet quality standards before release • Ensure compliance & prevent harms

Source: Infosys

Challenges & Innovative Solutions

- Major Water Management Challenges
- Cutting-Edge Innovations in Water Technology
- In-Depth Analysis of Leading Technological Solutions

Water management challenges in mining & mineral industry arise from operational inefficiency and societal conflicts

Major Challenges

WATER TREATMENT & USES

WASTEWATER RECYCLING

WATER DISCHARGE

- Water Contamination
- Low Recycling Efficiency
- Acid Mine Drainage
- Constant Needs for Scaling & Equipment Maintenance
- High Energy Costs
- Unoptimized Data Management System
- Unstandardized & Poor Governance
- Local Community Conflicts
- Harmful Impact on Ecosystems
- Legal Constraints

Operational Inefficiency | Societal Conflicts

Source: SprintlyWorks Analysis

Innovative Solutions

State-of-the-art technology and processes have been leveraged for sustainable water management

★ Deep-dived in next slides

Innovative Technology

ADVANCED WATER TREATMENT TECHNOLOGY

★Membrane Filtration Systems
RO[1] and UF[2] effectively remove contaminants from process water

★Ion Exchange Technology
Systems are used to remove dissolved ions from mining water

Electrocoagulation
Uses electric current to destabilize contaminants to be coagulated & settled

WASTEWATER RECYCLING & RESOURCE RECOVERY

★SAVMIN Technology
Selective removal of heavy metals, sulfates, etc. from acidic mine water

★SPARRO Technology
Membrane desalination using seeded precipitation & RO to treat wastewater

Biogenic Sulfide Technology
Not only focus only on water treatment but also focuses on metal recovery

Nanotechnology Applications
Precise removal of specific contaminants from mining wastewater

SUSTAINABLE WATER DISCHARGE

★Zero Liquid Discharge Systems
Eliminate liquid waste by recovering all water within the mining process

Constructed Wetlands
Facilitates the natural treatment of mining effluents via biological processes

Algae-Based Bioremediation
Certain algae species absorb heavy metals and nutrients

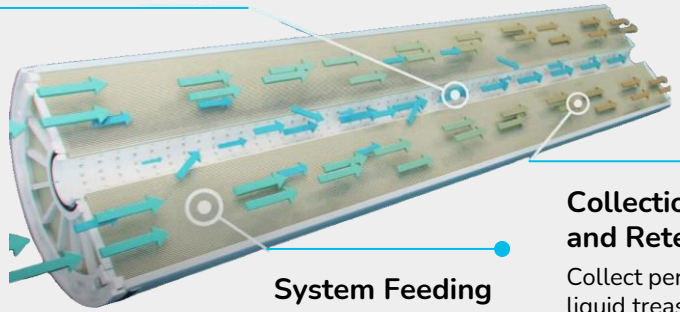
Enabler for Operational Efficiency & Societal Harmony
Integrated data management system streamlines the operational process and facilitates legal compliances

Source: Scient Direct, SprintlyWorks Analysis
Note: 1. RO = Reverse Osmosis; 2. UF = Ultrafiltration

Deep-dive | Membrane Filtration Process

Separation at the Membrane

Allow smaller molecules and desirable ions dart through the pores, leaving larger ones behind



System Feeding

Introduce the liquid mixture, or feed stream, into the membrane module under pressure

Collection of Permeate and Retentate

Collect permeate (i.e., purified liquid treasure) and retentate (i.e., concentrated undesirables) is either cycled back or discarded

Source: Scient Direct, Company Websites & Public Reports, SprintlyWorks Analysis

Leading Practices

BHP

Adopt for desalination in mining operations, particularly in Chile and Australia, where freshwater is scarce

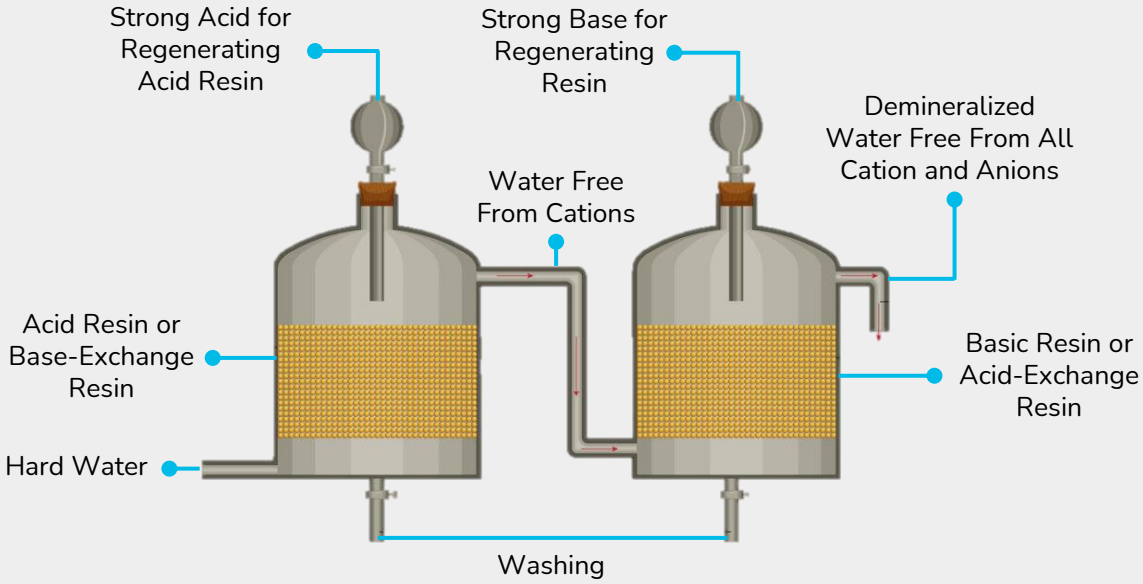
Teck

Adopt for water quality at mining operation for both efficiency and environmental compliances

Vale

Adopt for water desalination and treatment at mining operations, especially in Brazil and Canada

Deep-dive | Ion Exchange Resins in Water Purification



Source: Scient Direct, Company Websites & Public Reports, SprintlyWorks Analysis

Leading Practices

Anglo American

Adopt for uranium mining operations, particularly at the Mossel Bay and Rustenburg operations

Freeport-McMoRan

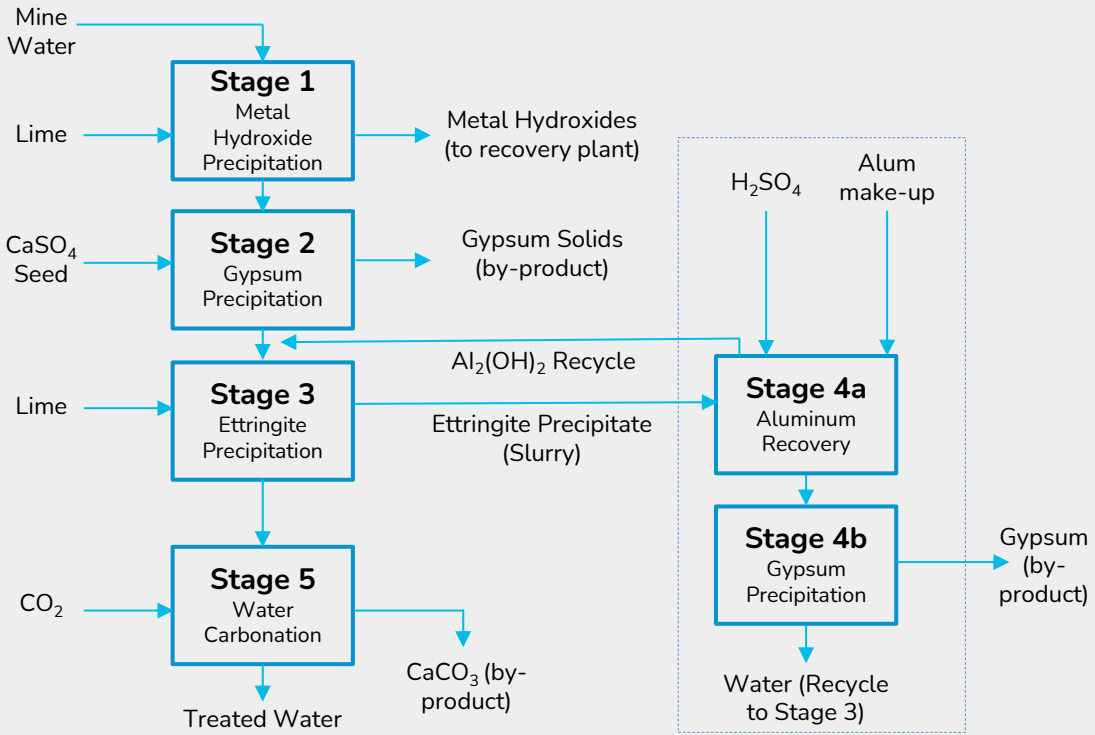
Adopt in its Morenci Copper Mine in Arizona, USA, recovering copper from leach solutions

Rio Tinto

Adopt in its Río Tinto Borax mining operation in California, recovering lithium from brine solutions

In-depth Innovative Solutions

Deep-dive | SAVMIN Process



Source: Scient Direct, Company Websites & Public Reports, SprintlyWorks Analysis
Note: 1. AMD = Acid Mine Drainage

Leading Practices

Mintek

Develop the technology to tackle AMD[1] and sulfate removal from contaminated mining wastewater

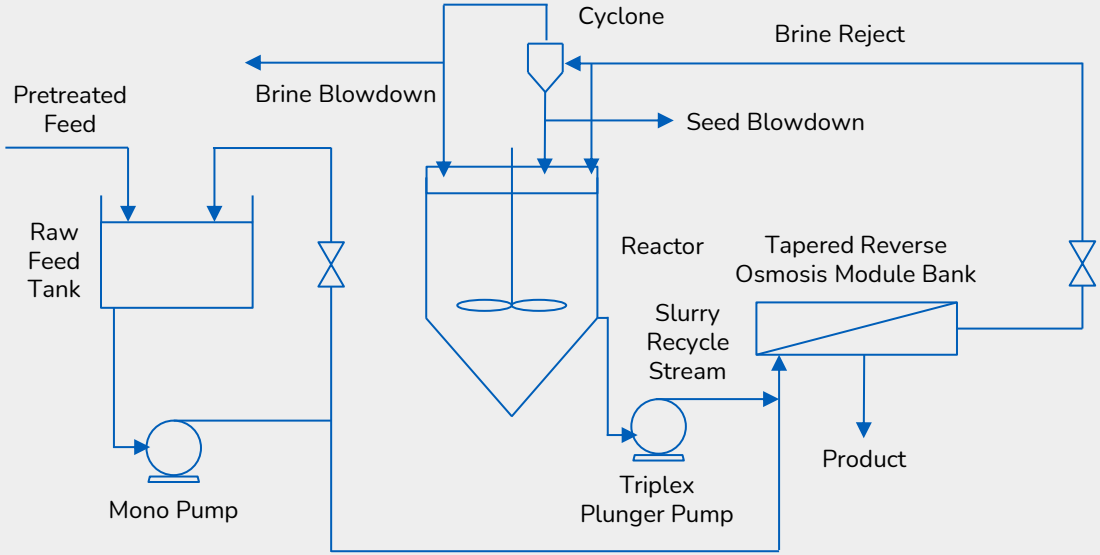
Anglo American

Adopt in coal and gold mines to treat AMD & comply with sulfate discharge regulation

Sibanye-Stillwater

Adopt in legacy gold mining sites to mitigate AMD effects on the local water ecosystem

Deep-dive | SPARRO Process



Source: Scient Direct, Company Websites & Public Reports, SprintlyWorks Analysis

Leading Practices

Anglo American

Adopt in coal and platinum mining operations to manage high sulfate concentrations in wastewater

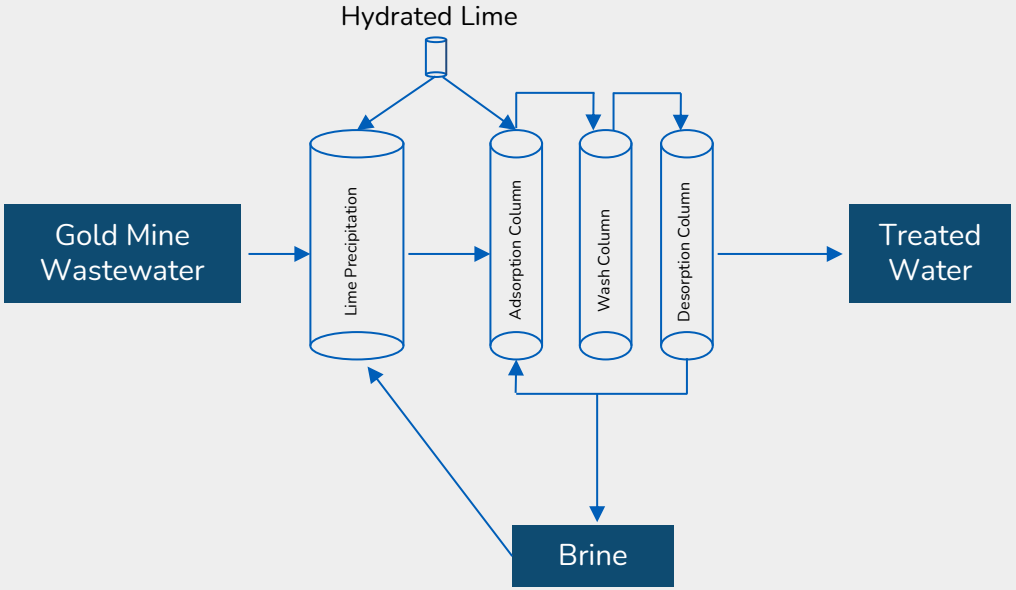
Glencore

Adopt in the Tweefontein mine in the Mpumalanga region to recover clean water from mining effluent

Sibanye-Stillwater

Adopt in gold & platinum mining sites to treat contaminated water & reduce sulfate level before discharge

Deep-dive | Zero Liquid Discharge (ZLD) Process



Source: Scient Direct, Company Websites & Public Reports, SprintlyWorks Analysis

Leading Practices

Anglo American

Adopt in Mogalakwena Platinum Mine to recover water from wastewater & reduce liquid waste

Rio Tinto

Adopt in Rincon Lithium Project, managing brine waste and recover lithium from evaporated salts

Teck

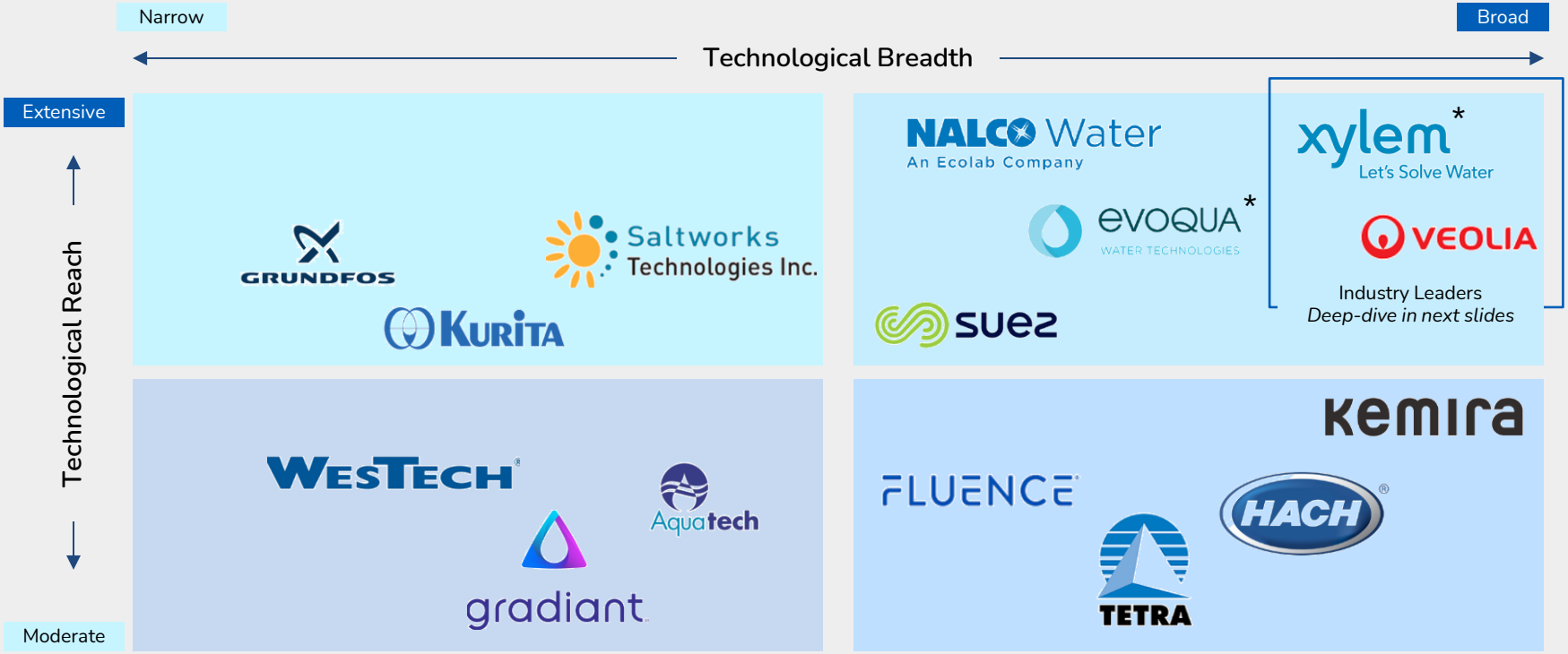
Adopt in Elk Valley coal mines to control selenium and sulfate contamination in mining wastewater

Key Solutions Providers

- Key Solution Providers’ Matrix by Technological Capabilities
- Comprehensive Insight into Industry Leaders

Key Solution Providers Matrix

Xylem & Veolia lead the industry with superior technological capabilities



Source: SprintlyWorks Analysis

Notes: *Xylem acquired Evoqua in May 2023 for 7.5 billion USD, making Evoqua a subsidiary of Xylem

xylem Let's Solve Water | Xylem delivers tailored solutions for industrial needs

2011
Washington, D.C., USA

$8.6 billion
in revenue (2024)

23,000
Employees worldwide (2024)

+25.6%
Net Profit Margin (2024 vs 2023)

150+
Presence in countries

20+
Distinct Brand Categories

Source: Company Website

xylem Let's Solve Water | Xylem specializes in water pumping & wastewater treatment

Xylem provides cutting-edge technological solutions tailored for diverse industries

Mining | Aquaculture | Commercial Buildings | Construction | Energy & Power | Food & Beverage | Healthcare | Life Sciences

Applications

Wastewater and Resue

	Multi-Stage Pumps
	Pressurization sets
	Automatic Self-Priming Pumps
	Biological Wastewater Treatment

Mine Dewatering Pumps

	Submersible Dewatering Pumps
	Automatic Self-Priming Pumps
	Submersible Pumps
	Pump Control & Monitoring Systems

Water Pumps & Treatment

	Split Case & Double Suction Pumps
	UV Disinfection Systems
	Portable Handheld Sampling Equipment
	Flowmeters & Velocimeters

Process Water

	Pressure Booster Sets
	Water Heat Exchangers
	Flow Meters
	Ozone Water & Wastewater Treatment Systems

Source: Company Website
Notes: These solutions are not exhaustive and only provides an overview

xylem Let's Solve Water | Xylem's VFD technology helped the client save energy, reduce costs, enhance safety, and lay a foundation for future expansion

DELTA SAND & GRAVEL CO.

The client was the Delta Sand and Gravel Co.

The Project

- Delta Sand & Gravel, a mining company in Eugene, Oregon, needed an efficient surface water management system
- Xylem, a global water technology provider, supported in upgrading pumping infrastructure

The Challenge

- Old existing pumps needs frequent maintenance
- High in-rush currents at startup caused power surges, increasing operational risks
- Future expansion required a solution adaptable to a deeper pit

The Solution

- Installed Goulds Water Technology vertical turbine pumps with VFDs
- Added floating barge system & suction screen for flexibility & efficiency
- Introduced soft start controller to address power surge issues

The Results

- Saved energy by 25%
- Reduced maintenance costs
- Improved safety by eliminating crane-dependent repairs
- Had future-proof solution to increased pit depth

Source: Company Website
Note: VFD = Variable Frequency Drives

VEOLIA | Veolia leads in sustainable water solutions, tailoring services for industrial clients

1853
Established in Paris, France

€1.65B
in revenue (2023)

6,516
Employees worldwide (2023)

11,450
Customers signed in 2023*

116
Countries covered in 2023**

1,667
Technology patents***

Source: Company Website
Notes: * All unique external client accounts with a closed win record in 2023; ** All figures per business unit contracts signed in 2023; *** Including pending patents

VEOLIA | Veolia specializes in desalination, recovery, recycling & wastewater treatment

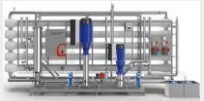
Veolia provides cutting-edge technological solutions tailored for diverse industries

Mining | Food and Beverage | Healthcare | Chemicals | Municipal | Oil and Gas | Power | Pulp and Paper

Applications

Desalination

Barrel™ – Compact digital RO desalination with remote monitoring



CaptuRO™ – High-recovery RO for industrial and wastewater purification

Hydrotech™ Disc Filters – Provides reliable suspended solids removal

Whittier® L'eau Claire – Deep-bed filtration for fine solids and color removal

Reuse, Recovery and Recycle

Evaled™: Evaporation technologies for wastewater treatment, water reuse, and zero liquid discharge

Multiflo™: A clarification process for a wide range of water treatment applications

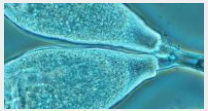
Opus™: Multi-step treatment for high-fouling industrial wastewater, including filtration and reverse osmosis

Rapide Strata™: Ion exchange deionizers for producing high-purity water

Wastewater Treatment

Actiflo®: High-rate, compact clarification using microsand for efficient water treatment.

Aquilair™: Chemical scrubber for transferring odorous molecules to an aqueous solution



BAS™: Combination of biofilm & activated sludge solution for organics removal & reduced sludge production

eXeno™: MBBR technology for treating micropollutants like pharmaceuticals in wastewater

Source: Company Website
Notes: These solutions are not exhaustive and only provides an overview

VEOLIA | Veolia's compact & efficient technology helped the client's system to comply with all heavy metals discharge criteria

Yukon The client was the Yukon Government, acting on behalf of the Government of Canada

The Project

- Veolia designed a flexible water treatment system for rising contamination in the Faro Pit
- Veolia proposed a treatment strategy to ensure effective remediation & environmental compliance

The Challenge

- Faro Mine was one of Canada's most complex abandoned mine remediation projects
- Rising pit water levels and the deteriorating treatment facility posed an environmental risk

The Solution

Veolia designed & built temporary treatment facility to remove heavy metals with

- Modular Reactors for iron oxidation, pH control, etc.
- ACTIFLO High-Rate Clarification for TSS & metals removal

The Results

The system successfully met all heavy metals discharge criteria, allowing:

- Extended treatment seasons for continuous water management
- Larger water drawdowns to prevent overflow risks

Source: Company Website

Our Expertise & Offerings

Methodology & Framework

- Water Sustainability Offerings
- Methodology to Solve Water Management Challenges
- High-level Frameworks

SprintlyWorks support businesses tackle every water challenge

Business Challenges	Solutions We Provide		
Water Scarcity Disrupting Operations	**Water Risk Assessments** *Deep dive in next slide*	Water Efficiency Strategies	Alternative Sourcing Models
Poor Water Quality Impacting Production Processes	Water Treatment Optimization	Process Adaptation Consulting	Supplier Diversification
Floods Causing Plant Shutdowns	Flood Risk Modelling	Business Continuity Planning (BCP)	Infrastructure Resilience
High Dependence on Water for Production	Water Footprint Analysis	Closed-loop Water Systems	Alternative Water Sourcing
Ecosystem Degradation Leading to Water Shortage	Ecosystem Impact Assessment	Sustainable Manufacturing Practices	Stakeholder Collaboration

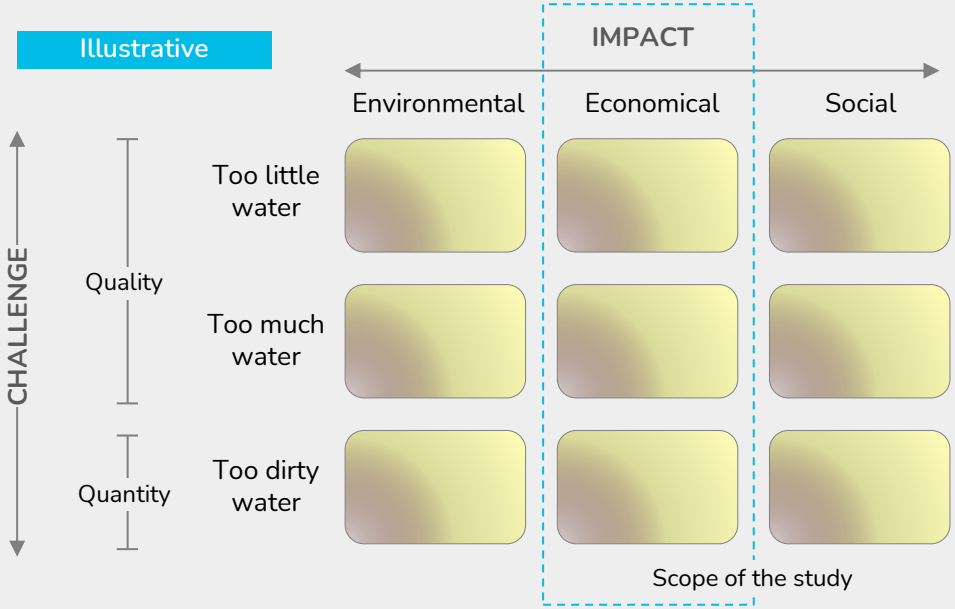
Our methodology for emerging topics under water risk assessment

	ASSESS	DEVELOP	IMPLEMENT	MONITOR
1 Water Resource Dependency (Operations)	Assess water usage, source dependency, and water intensity in operations.	Recommend water reduction targets and efficiency strategies. Provide benchmarking insights for similar industries/companies	Implement water efficiency measures.	Track reduction progress through data insights and operational benchmarks.
2 Physical & Climate Water Risks	Identify water-stressed areas, climate change impact, and physical water risks.	Develop water risk mitigation strategies. Recommend alternate sourcing, water storage solutions, and impact analysis.	Deploy mitigation measures.	Evaluate risk reduction impact using data models. Provide forward-looking insights.
3 Community Water Impact	Analyze shared water challenges in the community (e.g., depletion, contamination). Identify social water risks.	Recommend social water stewardship strategies (e.g., community access, conservation projects).	Execute community water conservation projects.	Measure community water availability improvement. Provide social impact assessment.
4 Water Governance & Compliance	Assess current governance frameworks, regulatory risks, and reporting gaps.	Develop a water governance roadmap (reporting standards, policy frameworks).	Implement internal governance measures.	Track governance performance through audits. Provide benchmarking.

Our Framework

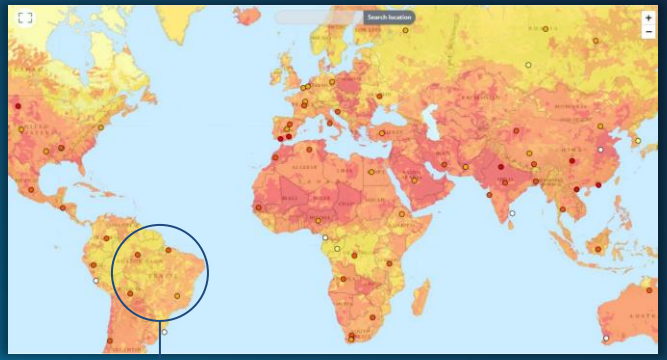
The Water Impact Matrix consolidates key water challenges...

Illustrative

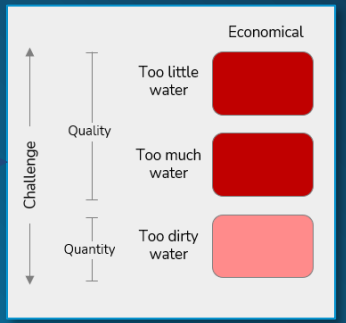


Source: WWF Risk Filter, SprintlyWorks Analysis
Note: The matrix shown here is a template version, with risk values not filled in. Water challenges can be acute (such as flash droughts) or chronic (such as long-term water scarcity). Both types are considered here.

...to analyse the impact on businesses in key hotspots



*Data presented is only for representation purposes



Best Practices

- Executive Summary of Client Previous Case
- Sample In-depth Analysis

Executive Summary

We helped MiningCo. analyse water scarcity in key mining sites and map out the water value chain to identify innovations to optimise water in mining process

ABOUT OUR CLIENT

- Water scarcity has been identified as a key theme for customers
- MiningCo. would like to better understand the state of water scarcity in key mining sites & map out the value chain of water management for mining and mineral processing

OUR CLIENT NEEDS

UNDERSTAND WATER INTENSITY IN KEY MINING SITES

- Understand the water usage on specific customer mining sites in different regions and pinpoint the regions where customer face water scarcity most (e.g., South America)

MAP OUT THE WATER VALUE CHAIN AND ECOSYSTEM

- Map out the value chain of using & managing water during the minerals mining process and map the key technologies and services used during each stage.

OUR APPROACH

Analyse water consumption at key mining sites

- Understand the historical and projected water consumption in key customer sites across main mineral groups: iron, copper, nickel, lead, zinc, aluminum, etc. Analysed social, economical and environmental impacts of water scarcity on customer operations

Map value chain and ecosystem of water management

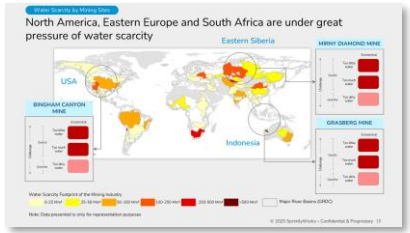
- Interview experts to map out the end-to-end value chain of water in mineral processing & detail how water is extracted, used & managed
- Identify key players in the water management ecosystem for potential partnerships for product innovations

Recommend water technologies for mining operations

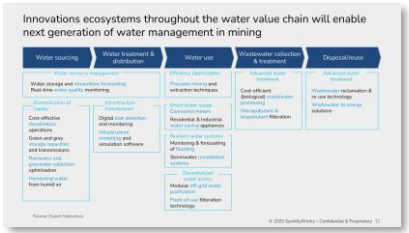
- Review current water-related offerings and identify gaps with customer needs
- Conduct a competitive analysis of existing water management solutions in the mining sector

OUR DELIVERED VALUE

1 12+ mining sites analysed and 50+ risks impacts derived



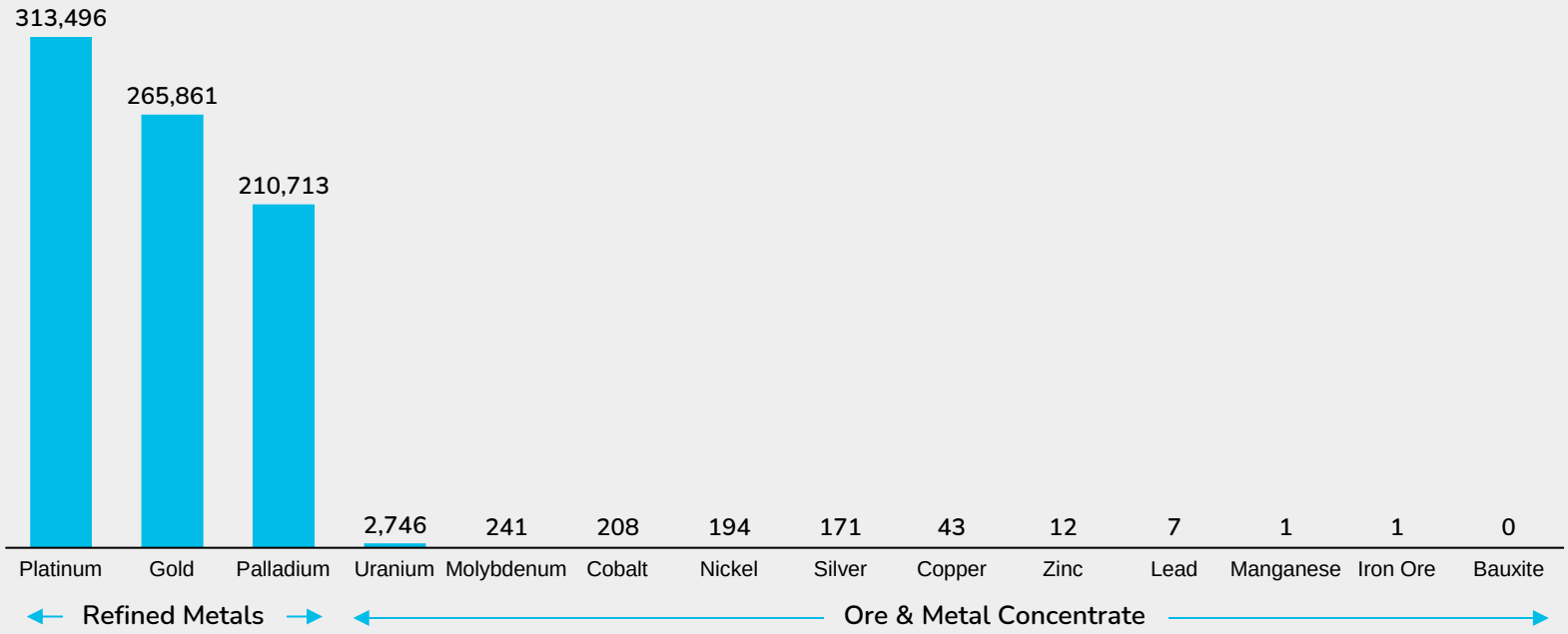
2 Water management value chain mapped and 40+ solutions identified



Sample In-depth Analysis

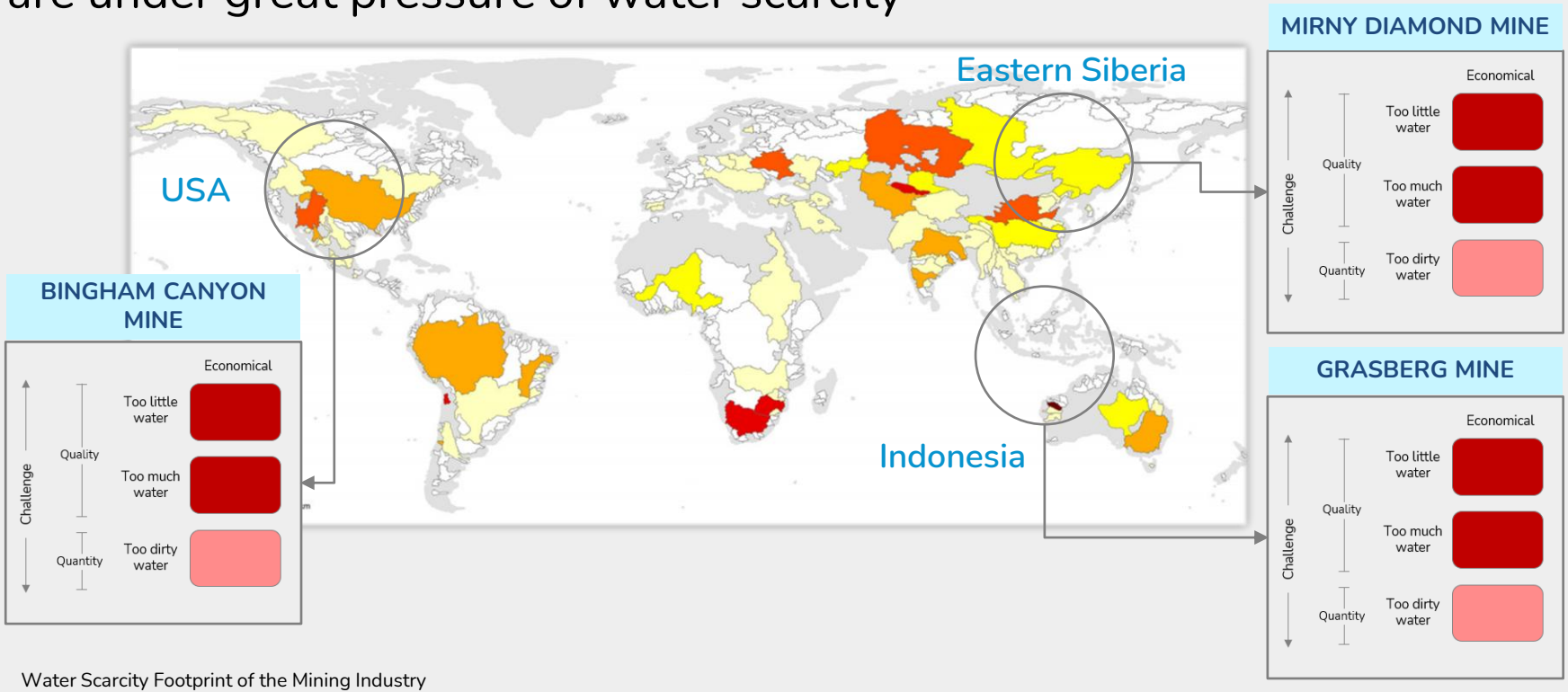
Water Intensity Varies Enormously by Metal & Mineral Commodity

Global average water footprint of metals & minerals (cubic meters per ton)



Source: IEA, Simon Meißner (2021)

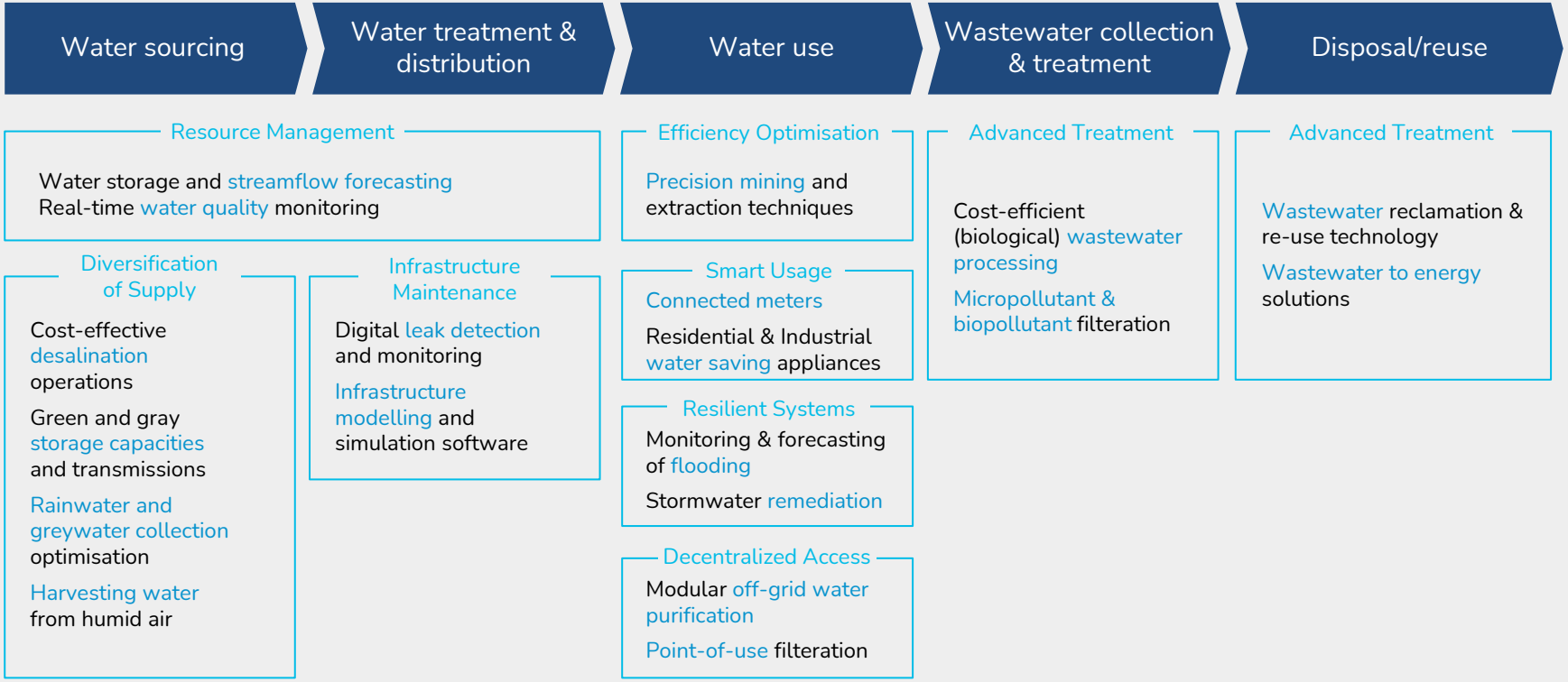
Mining sites in North & South America, Eastern Europe and South Africa are under great pressure of water scarcity



Source: Literature Review, SprintlyWorks Modelling
Note: Data presented is only for representation purposes

Sample In-depth Analysis : Water Value Chain

Innovations ecosystems throughout the water value chain will enable next generation of water management in mining & minerals



Source: Expert Interviews

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Faster Progress on Strategic Topics

> *Same project internally would have been taken 4-6 months calendar time when running it beside all the other tasks*

Let’s be in touch!

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