

The following is a summary of a paper prepared by the Centre for Water in the Minerals Industry (CWiMi) from the Sustainable Minerals Institute at the University of Queensland.

Summary of
International Water Issues for Mining

A scoping paper prepared for the
International Council for Mining and Metals



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This paper does not present the views of ICMM or its members.

1 Introduction

Water use, water quality, impacts on groundwater and access to water are issues that can all have ‘bottom-line’ impacts on mining operations. In recent years concern over water issues has increased worldwide driven by ongoing severe drought conditions in many countries; increased global concern over the provision of fresh water to a growing population; and climate change related risks around water.

This paper was written for ICMM as a scoping exercise to formally assess the priority water issues relating to mining at an international level. Even though water is not mentioned directly in any of the 10 Principles of the ICMM Sustainable Development Framework, water issues relate to:

- Principle 4 to ‘implement risk management strategies based on valid data and sound science’;
- Principle 6 to ‘seek continual improvement of our environmental performance’;
- Principle 7 to ‘contribute to conservation of biodiversity and integrated approaches to land use planning’;
- Principle 9 to ‘contribute to the social, economic and institutional development of the communities in which we operate’; and
- Principle 10 to ‘implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders’.

Issues around water tend to impact most sectors of a business, and may have both direct and wide-reaching indirect impacts. Addressing water issues requires an integrated approach that recognises both risks and opportunities inherent in any given solution. Considerable work is being undertaken at the local and national level to address water issues. For example, many documents have been produced that describe the water-related challenges, risks and opportunities for individual mines or minerals processing sites. At a country level, the Australian government has recently published a Leading Practice Handbook to guide water management in the Australian Minerals Industry (Commonwealth of Australia, 2008). A number of South African Best Practice Guideline documents have also been developed to improve water resource protection within the South African mining industry (Department of Water Affairs and Forestry, 2006).

However few studies, if any, have distilled water related issues in the mining industry at an international level. The aim of this paper is to attempt to catalogue and describe the main water issues impacting the minerals industry globally. It summarises information derived from a range of sources, including corporate/association literature from the minerals industry and other industries as well as interviews with water management professionals from a number of different countries.

2 Why is minerals water management special?

Given the huge global investment in managing and understanding water issues, it is first important to answer the question: *What is special about the minerals industry*

when it comes to water issues compared to other water users? There are a number of features of minerals industry water use that distinguishes it from the three main users of water, i.e., irrigation, urban and ecosystem uses.

1. Mining operations can use water of a quality that is unacceptable for other uses but have limited capacity to deal with variable water supply.
2. In many cases, water needs to be brought to mining operations which means companies manage their own water supply.
3. Mines are generally land custodians and therefore have special water responsibilities that exist beyond the time that mining ceases.

For these reasons there is a case for the industry to consider how water issues – and solutions – relate specifically to mining; and to go beyond generic business water initiatives.

3 Overview of issues

Overall, there has been a considerable maturing of thinking and actions on water as an issue in the minerals industry over the last 5 years. However, this is still patchy and much remains to be done to develop broad societal confidence in the industry as a responsible water user; ensuring that water is not a barrier to maintaining the social license to operate.

Government policies to regulate and manage water are changing. Not only is regional, integrated water planning becoming more common, there is evidence that regulatory conditions are becoming more stringent. In some jurisdictions, access to water access is cost-based (government recovering their costs of supply) and this is sometimes being implemented through the introduction of water markets.

Water connects a minerals operation to its surrounding landscape and its communities. In many countries, water planning and regulation authorities use integrated water resources management approaches. Mines are increasingly being called upon to participate in regional/basin planning both to access and secure water and to develop meaningful relationships with communities; often including indigenous groups.

In response, it has become necessary for those with responsibility for water in mining companies to develop expertise well beyond the engineering excellence that has been traditionally required. This is a major challenge for individuals and companies. There is evidence that the industry is developing the human capital necessary to deal with this complexity. There is, however, considerably more that can be done.

One constraint to increasing both the public's and governments' confidence in the mining industry's management of water is the lack of an agreed vocabulary (which needs to be based on a basic water balance) and the need for clear, consistent and simple reporting to the public. Better communications on water is required between minerals operators so as to increase improvement across the sector. Better communications are also required with local communities as well as investment stakeholders who both need to gain confidence in the industry's management of water.

On the production front, there is a growing realisation of the importance of frugal water management. In some cases this is an urgent necessity in order to deal with regional water scarcity. In other cases, the overriding driver is societal perceptions of water use. However, frugal water use can result in changes to water quality which can compromise efficiency of minerals recovery. This is a growing understanding of this link between responsible water management and economic efficiency.

Climate change and climate variability are also areas of significant concern. Changes in rainfall and evaporation from global warming can alter availability of water resources in many regions which can have significant impacts on mining operations. Other related considerations include the relationship between water and energy efficiency (because energy is required in all aspects of water transport, treatment and management) and between water and related biodiversity and carbon links e.g., bio-sequestration.

A summary of water issues is given in Table 1. The table also highlights key trends for each issue and puts forward the authors' suggestions for actions.

Table 1. Summary of water issues, trends and recommendations

category	Issue	Key points and trends	Recommendation
DYNAMICS OF THE OPERATING ENVIRONMENT	Unforeseeable changes to life-of-operation plans	The operating environment within which mining occurs is dynamic; thus, mining operations and their water use change over time.	<p><i>Recommendation 1.</i></p> <p>Develop a guideline to assist companies and operations in combining technical water approaches with engagement with communities and water authorities, including representative case studies</p>
	Community expectations and perceptions	There is a trend towards increasing involvement of communities in mine approvals processes.	
	The changing regulatory environment	There is a trend towards increasing stringency in the regulatory environment (Recommendation 4).	
TECHNICAL WATER MANAGEMENT	Water quantity	<ul style="list-style-type: none"> • There is anticipated to be increased demand for water resources in future; this will cause two main challenges for the minerals industry: <ol style="list-style-type: none"> 1. Constraints on access to water 2. Societal pressure to manage water frugally • Over-extraction of surface and groundwater resources is anticipated to continue. • The degree of water stress and scarcity is anticipated to increase. • Operations in wet climatic and hydrological regions with high rainfall face challenges of excess water. • Climate variability poses significant operational management challenges. 	<p><i>Recommendation 2.</i></p> <p>Develop a strategy for dealing with a limited number of high priority technical water issues. The strategy should focus on dialogue and knowledge exchange with, where appropriate, provision of tools. Groundwater extraction limits and water treatment technologies emerge as two priority areas.</p> <p><i>Recommendation 7:</i></p> <p>Support research to establish an integrated approach to managing water quantity and water quality. This will require a paradigm shift from water quality management being viewed as solely a pollution issue</p>
	Water quality	<ul style="list-style-type: none"> • The release of water may have environmental consequences, e.g. compromising quality of freshwater resources. • Site water quality must be managed to avoid production losses (Recommendation 7). 	

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	Waste (by-product) management	The industry faces legacies and liabilities associated with the management and storage of mining wastes (Recommendation 8).	
GLOBAL CHANGE AND ASSOCIATED IMPACTS	Climate Change	<ul style="list-style-type: none"> Climate change is anticipated to result in hydrological changes and increase climate variability. Some communities expect that the minerals industry will play a role in local adaptation to climate change. 	<p><i>Recommendation 1. (as above)</i></p> <p><i>Recommendation 7. (as above)</i></p> <p><i>Recommendation 8.</i></p>
	Other Changes	Water is linked to a number of global-scale issues (e.g. provision of water for food production, biodiversity). In future, there may be increased pressure from the community for minerals companies to play a role in addressing such issues.	Assess how well water-related risks are being managed globally. The general assessment could be undertaken as a site-level survey for a sample of mining operations around the globe, representing diversity in location, commodity and degree of water scarcity. The assessment would seek to understand agglomerated risks by country or commodity, particularly in relation to water-land-carbon interactions and tailings legacy liabilities. Participating sites would be asked to contribute a small number of leading indicators. Data would be kept confidential.

category	Issue	Key points and trends	Recommendation
DATA AND INFORMATION TOOLS AND GUIDELINES	Management	The information needed to support water management at an operation differs over its life cycle. Water related data is needed for day to day management, strategic planning, and reporting.	<i>Recommendation 3.</i> Build on the GRI Mining and Metals Supplement to improve water indicators and ensure there is a consistent underlying approach to water balance and terms used to report it
	Planning	All sites should maintain a set of minimum, up-to-date documentation on the site water system. Tools to separate and support strategic and operational planning are needed (Recommendation 8).	
	Reporting	There is a need for tools, agreed vocabulary and more effective indicators that enable and communicate improved water reporting (Recommendation 3).	
POLICY AND REGULATORY ENVIRONMENTS	Environmental pollution	Environmental regulation is anticipated to become more stringent in future. To aid companies in using a risk management approach to environmental protection, there is a need for improved data acquisition and water systems modelling.	<i>Recommendation 4.</i> Develop an overview of current water access arrangements across a range of countries globally. The overview should be complemented by sharing of advice on how to protect water resources and provide good access to them thereby contributing to building the good reputation of the industry. The results of such a study could also be communicated to governments to aid in formulating policy relating to water access.
	Water allocation	There is a global trend towards pricing of water on the basis of cost recovery, and towards the distribution of water between users via water markets. Minerals companies may be perceived negatively if the community holds them responsible for rising water prices.	

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CUMULATIVE IMPACTS/ EFFECTS		Some water related issues are difficult to characterize and manage as they are the responsibility of multiple operations, e.g. changes in down-aquifer environmental ecosystems. Interviewees perceived such cumulative impacts to be a major challenge to the minerals industry.	<p><i>Recommendation 5.</i></p> <p>Develop or adopt a framework for cumulative effects and the impacts of mining and minerals processing on operational, local and regional water systems. Stakeholder engagement would be essential for development of the framework, and the product would inform the dialogue between industry, regulators and communities on the effective and equitable sharing of responsibility on water issues.</p>
CLOSURE		Generally, interviewees felt that the technical challenges around water issues after mine closure were being addressed to some extent, but that there is a need for further investment in research and knowledge transfer.	<p><i>Recommendation 6.</i></p> <p>Develop a short statement/guideline on water management issues surrounding mine closure. This could add to the ICMM closure toolkit.</p>

4 Prioritising Water Issues

Each operation, corporation and region has specific contextual conditions. Therefore, the relative priority of a specific water issues will vary across this spectrum. The approach that would appear most rational for setting priorities at the local, company or regional level is to check which issues meet a business case for action. We propose that the business case should be assessed by comprehensively considering the following four components.

1. Financial considerations;
2. Formal licence to operate;
3. Social licence to operate; and
4. Company standards and policies based on stated values and ethics.

Whilst this list provides guidance as to what should be in the business case, there is a need for a robust framework that ensures that priority water issues are adequately dealt with, and desired outcomes achieved, once the business case has been established.

Recommendation 9. Develop guidance and a tool to support the evaluation of the business cases for water management that can be used to prioritise water issues. This tool can also be used as the basis for measuring outcomes of water management projects.

5 Prioritising recommendations

Whilst it is desirable to use local prioritisation it is also possible to deal with priority at a more agglomerated level. Each of the recommendations has been rated by the authors in terms of three criteria: (1) leadership potential; (2) importance as an emerging issue; and (3) how well it consolidates an existing strong industry position. Each recommendation was rated either high (H=3 points) medium (M=2 points) or low (L=1 point). A priority was allocated on the basis of the sum of points for each recommendation. The results are presented in Table 2. Recommendation 8 – assessment of water-related risks is the only one assessed as high in all categories.

Table 2. Prioritisation of recommendations.

Priorit y	Recommendation	Leadershi p	Emerging issues	Consolid ation of position
4	1) <i>Community Engagement</i>	M	L	H
4	2) <i>Technical water issues</i>	L	M	H
5	3) <i>Water indicators</i>	L	L	H
4	4) <i>Water access arrangements</i>	L	H	M
3	5) <i>Cumulative impacts</i>	H	H	L
5	6) <i>Closure</i>	L	M	H
2	7) <i>Integration of water quantity and quality</i>	H	H	M
1	8) <i>Water-related risks</i>	H	H	H
3	9) <i>Water business case</i>	H	M	M

6 Conclusions

Water management is a priority issue for the global minerals industry. Much is being done by individual mines and companies to improve management and the communication of that. We conclude that:

- ICMM member companies have a high level of awareness of water issues as demonstrated through the interview and assessment of publically available literature.
- The majority of water issues are global in nature in that they occur commonly for companies in many different geographical environments and socio-political situations.
- More assistance could be provided to the industry to help organise, prioritise and respond to water issues taking into account local context and company priorities. Much of this assistance could be achieved through a more collaborative approach to sharing information and capability. This would require the industry coming to agreement that a global reputation for the minerals industry as a responsible water manager has a better business case outcome than that which would be appropriated by individual companies performing better than others.
- From the analysis of water issues it is clear that there is considerable potential for action on water that will demonstrate minerals industry leadership in water management. It is evident that the industry has already achieved considerable positioning and there are actions that can be taken to consolidate this. It is apparent that the industry has recognised a number of emerging water issues and is in a strong position to deal with them.