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From Water Management to Water Stewardship—A Policy Maker's Opinion on the Progress of the Mining Sector

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Abstract: Water is a critical resource for mining operations, as it is for many other water users within any local catchment. With operations often located in water scarce areas, mining companies are increasingly experiencing competition for access to water resources. Concerns over the potential adverse impacts of mining on these shared resources has resulted in the sectors water management approach and practices being challenged by external stakeholders including local communities. This paper overviews the drivers that have resulted in the mining sector expanding its approach from water management within the operational fence line to catchment water stewardship, some of the major obstacles to continued progress and the related needs for guidance, research and research applications.

Keywords: water; stewardship; mining; drivers; barriers; future research

1. Introduction

Access to water is one of the largest global challenges of the 21st Century—as reflected by Sustainable Development Goal (SDG 6) of the 2030 Agenda for Sustainable Development. Water resources are under increasing pressure from population growth, rising water consumption, pollution, and climate variability [1]. This is resulting in greater water scarcity, which is driving increased competition for water access and escalating conflicts amongst water users [1–3]. With an estimated 52 per cent of the world's population at risk by 2050 due to unsustainable pressures on water resources and the natural environment [1], water challenges require genuine, targeted leadership from all actors—including government, civil society, and the private sector.

The private sector is increasingly recognising that it is not immune to the global water challenge, with water crises ranked as one of the top five risks facing the world's economy, in terms of impact, since 2012 [4]. Water stewardship has emerged as the principle approach adopted by the private sector, largely multinational companies to date, for the responsible management of water [5]. Water stewardship, as defined by the Alliance for Water Stewardship Standard [6] is "the use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site-and catchment-based actions." In other words, water stewardship requires a fundamental shift in the way private sector companies view and manage water as a shared resource, which extends beyond the operational fence line to the water catchment level.

This paper provides an overview of some of the drivers, barriers, and responses by the mining sector in moving from water management focused within the operational fence line to a stewardship approach. This is illustrated by select examples of recent leading practice and closes with potential opportunities for future research and expert guidance to support further progress in the sectors water management practices.

2. The Drivers for Change

At the global scale, the mining sector's total water consumption is comparatively small [7] to the agricultural sector, which accounts for 70 per cent of global fresh water withdrawals [1]. In contrast, the mining sector uses approximately 1–2 per cent of total water consumption in countries such as USA, Canada and Australia [7,8]. Mining operations within a local catchment are often the greatest consumers of water [8] and have the potential to significantly impact water resources including through reduced water availability and water contamination [9,10].

The mining sector's vulnerability to water-related risks is exacerbated by its need to secure a predictable supply of water for its life-of-mine operations, which may extend for many decades, and the need to manage water issues post closure.

Within all mining operations, water is a vital for performing a variety of functions, including supplying drinking water to site workers, cooling heavy drilling equipment, transporting and processing ore, managing waste tailings, suppressing dust, to generating hydroelectric power.

In addition, mines are often situated in water scarce areas [11] where there is increasing competition for access. Some 70 per cent of mining operations, those associated with six of the largest global mining companies, are located in areas of high (56 per cent) or moderate risk (14 per cent) of water stress [12]. The increasing occurrence and intensity of flooding events challenge the mining sector, with the 2010 floods in Queensland alone costing an estimated AU$5.7bn in lost production [13].

Unlike other water-dependent sectors, such as the beverage industry, mining companies have less flexibility in moving their operations to areas with lower water risk exposure, as they are bound to the location of economically viable mineral deposits. Water-related infrastructure expenditure is significant and estimated to account for approximately 10 percent of the industry's capital expenses [14], although it may be much higher in many situations [15].

As a consequence of these challenges, the mining industry increasingly appreciates water as a critical resource for its mining operations, the environment, and communities and other businesses in the catchment. Historically, the mining sector has conceptualised water as an inside the 'operational fence line' issue, wherein business water risk could be solely managed by the company through improved efficiency, water reuse and control over effluent discharges [16,17]. However, many mining companies have learnt the difficult lesson that water risks are experienced by people and ecosystems at the local catchment scale [18]. Hence, inadequate consideration of the water needs of local users has resulted in costly project delays, cancellation of licenses, community conflicts, and reputational damage.

In the 17 years between 2000 and 2017, water-related issues were implicated in 58 percent of mining cases lodged with International Finance Corporation's Compliance Officer Ombudsman [19]. Water is as a leading cause of community-company conflict [20,21]. The costs of conflict for both the company and local community can be significant. For example, it has been estimated that loss of productivity due to temporary shutdowns or delays at a major mining project (with capital expenditure of between US$3 and 5 billion) will result in approximately US$20 million per week of delayed production in net present value terms [22].

Further, there are a number of mining projects throughout the world that have been on hold or 'stranded' for many years due to unresolved tensions associated with water-related issues. These include, the Yananocha Project in Peru and the Pascu Lama Project, at the border between Chile and Argentina [23].

Such experiences have been a wake-up call for the sector. For example, in January 2017 companies that account for approximately a third of global mining activity committed to binding action to support the responsible use of water [24]. Mining needs to shift its approach from simple management of its operational water needs to one in which the values, priorities, aspirations and concerns of other users at the catchment scale are considered. This more expansive approach requires proactive collaborative action with government, communities and other business entities in the catchment to enhance the sustainability of water as a shared resource. Several international civil society organisations and

industry associations are active in trying to support companies in this area and circumvent the need for more individual companies to experience water crises first hand before taking meaningful action.

Not surprisingly, the investment community has also recognised the sector's exposure to water-related risk and is concerned by the potential for associated impacts on financial performance. In response there have been calls for a step-change in sector disclosure on water [25,26] and a number of tools and models have been developed by the investment community to assist in the valuation of mining-related water risks [14,27]. Perhaps though the best way to summarise the growing level of interest amongst investors is to quote the CEO of Gold Fields, Nick Holland. During a CEO panel at the 2017 Mining Indaba Conference in Cape Town, Nick stated, "investors say to us: 'don't talk to us about returns'; they want to know how we're managing water [28]."

3. The Barriers to Change

Despite clear drivers for action, the mining sector has struggled for many years to redefine its approach to water resource management. The common barriers to progress outlined below are based on 20 years personal experience working directly within and advising the sector, and discussions with mining company representatives.

(a) **Linking local to global**—The complexity associated with developing a global or corporate approach/strategy that effectively accommodates the diverse range of water related issues present across different operating locations.

(b) **Understanding stewardship**—The noise and confusion created by the number of external water stewardship initiatives and cacophony of terms used [29].

(c) **The organisational challenge**—The complexities associated with the holistic management response to water challenges, which includes range of touchpoints across multiple functions of the business. These touchpoints often fall outside the remit of the environmental function where accountability for water issues conventionally lay. Relevant functions may include geotechnical, engineering, infrastructure, production, safety and health, community development, cultural heritage, government affairs and even product marketing.

(d) **Stepping outside the fence**—Engagement with other water users and participating in collective action may require considerable level of ongoing commitment and effort, with uncertain timeframes and outcomes. Further, there is reluctance to openly share data and involve others in decision-making processes due to concerns over how the information will be used and leveraged, which requires a shift in mindset and culture to overcome. In addition, presenting the business case for a collaborative approach remains challenging as there is currently no recognised method for quantifying the 'value' of water stewardship actions.

(e) **Transfer of approach between operations**—The local nature of water means that the approach taken by each mine site needs to be tailored to the local context. A localised approach to water takes time to develop and may not be able to be simply applied or scaled to other mine operations within the company's portfolio.

(f) **(Mis)understanding water value**—The frequent and significant discrepancy between the actual market price of water and its true value as a business-critical resource, which makes it futile to simply use the cost of water to influence internal decision making [30]. Mining companies that have suffered significant project delays or interruptions due to direct or indirect water-related impacts (e.g., drought resulting in intermittent hydroelectricity supply to the site) have thus begun to apply a 'value at risk' lens to water decision making.

4. Making the Paradigm Shift: Policy and Actions

Water stewardship has emerged across the private sector as the best approach to enhance corporate management of water [5,31]. The approach requires a commitment from companies to the sustainable

management of shared water resources in the public interest through collective action with other businesses, governments, non-government organisations (NGOs) and communities [29].

In reality, water stewardship as a formalised concept is relatively new being only a decade old. Considering the concept's relative infancy, most private sector companies are still in the early stages of its application, with implementation on the ground needing to catch-up with the high-level concepts [31].

Nonetheless, the mining sector has made considerable progress over the past five years in advancing its approach to water management [29]. In April 2014, the International Council of Mining and Metals (ICMM) launched its water stewardship framework at the UN Global Compact's CEO Water Mandate Conference in Lima, Peru [32]. The framework leveraged relevant external standards, such as the Alliance for Water Stewardship, to define water stewardship in a meaningful way for the sector and thereby provides a standardised set of guidelines to support an effective industry response.

The framework also served to align conversations at the sector level to identify water management areas for priority attention—the two highest priority areas being: (1) the identification, evaluation and response to external water-related risks at the catchment level; and (2) the development of a robust and globally harmonised approach to water reporting and disclosure.

Two recent ICMM initiatives support the sector in these areas and demonstrate the memberships' commitment to advancing the sectors' water management maturity. The first was sector-specific practical guidance around the adoption of a catchment-based approach to water management [33]. The development of a holistic catchment-based approach that incorporates the considerations of other water users can take many years to implement and is an iterative exercise in reflection of the ever-changing local dynamics. However, examples of collective leadership addressing shared water challenges at the local catchment level are beginning to emerge [19,34].

One innovative example of such action relates to the Voluntary Mining Code for common water management and reporting for the mining industry in the South Gobi region [19,34]. Convened by the International Finance Corporation, and involving 2030 Water Resources Group and the largest mining companies active in the region, the initiative has enabled the mining companies to engage collaboratively with the Mongolian Government and community. This is resulting in the development of training programmes to raise awareness around groundwater protection, and work towards a catchment-based water accounting framework. Another example is US mining company Freeport-McMoRan's decision to invest in catchment-scale water supply. The company planned to expand its copper and molybdenum mining operations in Cerro Verde, Peru, in a catchment where water was almost fully allocated. Freeport-McMoRan engaged with the national and local government, the local utility and civil society representatives to find a suitable supply of water to meet its proposed demand. As an outcome, the company developed a treatment plant to deliver drinking water to the more than 300,000 people in the region. In addition, a wastewater treatment plant was constructed that delivers treated wastewater for use in the mining operations, while at the same time improving water quality in the river, thus benefitting both the mining company and the community [19,35].

Such noteworthy examples and clear improvements in external engagement on water-related issues are encouraging. However, all parties must communicate and engage on operational water issues so that information is relevant, accessible and understandable for local stakeholders warrants further attention [36]. In recognition, a number of companies have implemented participatory monitoring programs on site with local stakeholders to demonstrate transparency on water impacts and performance and help build trust with communities [37–39].

The second supporting initiative was the development of sector-specific practical guidance around consistent water reporting [40]. Hence, mining is one of the few sectors globally with an articulated approach and is thus recognised as a leader in this area. The ICMM guidance was focused on improving the consistency and quality of reporting at the minimum level to promote a step-wise change in the comparability and quality of the sector's reporting, whilst maintaining an accessible entry point for all sector companies. The guidance outlines a Minimum Disclosure Standard for ICMM member

companies which includes: (1) a standardised set water performance metrics, based on the Minerals Council of Australia's Water Accounting Framework (WAF); and (2) an accompanying contextual narrative of a company's water dependence, risk-opportunity exposure and management response aligned with recognised external practice [41]. The guidance is still in the two-year implementation phase, yet some companies are beginning to release water reports tailored to these requirements [42].

5. The Continued Need for Water Stewardship Research and Guidance

The sector would benefit from independent expert guidance and research to address barriers to progress and further advance water management practices. The areas recommended for further research and expert guidance below have been identified through a combination of a review of published material, personal experience, and discussions with external experts and sector representatives.

Collaborative action—the business case for companies to engage in collaborative action could be enhanced through an independent and detailed review of water-related collaborative action projects which are currently being undertaken, or have been recently completed, by the sector. Such a review would help the sector better understand the approaches taken, challenges encountered, benefits yielded, and lessons learned. The current lack of publicly available case examples of collaborative action means companies embarking on the journey often have to learn in isolation and continue to sell the case internally. Further, available case examples do not typically provide the level of insight required to yield beneficial learnings by companies, the sector and other actors.

Innovation outside the fence line—in many instances, achieving water security at the catchment level is required for companies to truly manage their water-related risks, realise opportunities, and protect/create business value. This may involve approaches to water-related governance, institutions and financing that companies are yet to consider or be exposed to. A detailed analysis of innovative multi-stakeholder approaches to enhance catchment-level water security and sustainability with improved water outcomes for all water users, including mining companies, would advance thinking and help catalyse transformative action.

The Global Water Partnership and CEO Water Mandate are currently exploring how private and public sector efforts to more effectively manage water resources could be better aligned and coordinated. Mining companies could further contribute to good catchment governance through supporting the development of water related institutions, management plans and knowledge platforms, and transparently advocating for water policy regimes that underpin integrated water resource management.

Organisations such as WWF [43] are promoting innovative finance mechanisms (e.g., blended finance) as well as a suite of bankable water project types, including green infrastructure, that the private sector can join with others to address shared water challenges.

Future water scenarios—given that the life of mining operations often extends into the decades, decision-makers within companies need to understand future changes in water availability to help secure ongoing access and to reduce their potential impacts. For example, water-related capital investments are frequently based upon historical hydrological data and existing external water users, without considering future water challenges. The future of water resources is highly uncertain due to growing water demand, climate variability, policy developments, and a suite of other factors. Mining regions also can experience specific challenges such as project-related in-migration and host community livelihoods dependent on natural resources susceptible to a changing climate. The mining sector would benefit from the development of robust and practical tools that help companies identify and understand their future water-related risks and opportunities across a range of plausible scenarios. Whilst scenario planning for climate change is an emerging decision-making tool [44], the expansion of such approaches to cover other water-related considerations is limited.

6. Conclusions

The mining sector is increasingly experiencing competition for access to the critical water resources requited for its operations. The increased competition as well as other drivers including climate change and scrutiny by external stakeholders has resulted in the sector having to expand its water management approach to incorporate catchment-level considerations. This paper overviews some of the major barriers to the advancement of water resource management practices by the sector and provides suggestions for associated areas that would benefit from further research.

It is encouraging that the mining sector has moved faster to address water impacts and challenges than most sectors [29]; and it is important to recognise the considerable progress made by many companies within the sector. However, significant additional effort is still required to establish mature practices at scale across the whole sector, encompassing some 2400 metals and mining companies listed on global exchanges [45]. Accordingly, the mining sector could benefit from further expert guidance, research and research applications to advance water management practices. Areas warranting focus include assisting the sector build an evidence-based business case for companies to engage in collaborative action, an independent analysis of innovative multi-stakeholder approaches to enhance catchment water security, and the development of practical tools to help companies identify water-related risks and opportunities under plausible future scenarios.

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