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A comparative overview of legal frameworks governing water use and waste water discharge in the mining sector

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ABSTRACT

Mining operations require access to a secure and stable water supply. Obtaining water use and discharge licenses has become increasingly challenging for mining companies in many resource rich jurisdictions. This can be attributed in part due to competing water uses in water scarce regions and pollution caused by existing and legacy mines. This report provides a comparative review of the water management regulatory frameworks of some of the largest gold and copper producing jurisdictions. The jurisdictions reviewed include Australia (Western Australia), Canada (British Columbia), Chile, China, Peru, the Philippines, South Africa, and the United States (Alaska, Arizona, Nevada and New Mexico). Interviews of mining company representatives working on water management issues complement the legal review to highlight the perceived regulatory risk by investors of the analyzed jurisdictions.

1. Introduction

Mining is increasingly associated with water risk – both in terms of water access and surrounding water quality. This is especially so where mines operate in water scarce regions, or upstream of communities that rely on the same water source for consumption or agriculture. Water impacts are also increasingly at the center of social conflicts between local communities and mining companies. In turn, the civil unrest surrounding mines has begun to shape legal frameworks governing water use and waste discharge to varying degrees.

As part of a three-year project – in collaboration with the Water Center at Columbia University and support by Norges Bank Investmnet Management (NBIM) – to assess water related risks in the copper and gold mining sector, the Columbia Center on Sustainable Investment (CCSI) has reviewed the laws and regulations governing water use and discharge by mining operations in 12 jurisdictions in 8 countries, namely Australia (Western Australia), Canada (British Columbia), Chile, China, Peru, the Philippines, South Africa, and the United States (Alaska, Arizona, Nevada and New Mexico). The jurisdictions reviewed were chosen for two reasons: 1) they each produce significant volumes of gold and/or copper, and 2) together, they provide a diverse and comprehensive basis for comparison from both a geographical and a legal perspective. In this regard, note that while Russia is a top gold and copper producing country, it was excluded due to language barriers. To conduct the review process, a standard template was designed and completed for each jurisdiction on the basis of desk research and interviews with legal, mining and water experts. The main categories assessed in each review included the legal framework governing: water-use, water quality and discharge, monitoring requirements, post-mine closure requirements, and enforcement mechanisms. Readers interested to learn more about a particular jurisdiction reviewed for this project can access all jurisdictional reports.[1] This paper provides a comparative summary of these legal frameworks in the Annex. In so doing, it provides insight into the different approaches jurisdictions have taken to manage their water resources.

The quality of a law alone is not necessarily indicative of the level of risk associated with water use in any one country. Political or administrative discretion, respect for the rule of law, and the capacity of a state to monitor and enforce water and environmental regulations are often crucial factors for determining investment risk related to water use by mining companies. To incorporate some of these factors, the study also included interviews of ten mining company representatives working in water-management or related positions within the jurisdictions analyzed. The interview questions broadly followed the categories of the legal template. They aimed to understand how these regulations translate into practice and what these practices' consequences are for mining companies. The interviewees all worked for large international gold and copper companies at the time of the interview – a prerequisite for the selection process – with some having worked in multiple countries. Key points from the interviews are

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[1] http://ccsi.columbia.edu/work/projects/assessing-water-related-risks-in-the-mining-sector/reports

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summarized in text boxes throughout this paper.

The aim of this comparative study is to provide insights for both mature and nascent mining jurisdictions on how others manage similar water related issues. The remainder of the paper is divided into four sections. The first section provides an overview of how jurisdictions allocate water to mines, what the water permitting process is, terms of the water licenses, and other measures implemented to encourage more efficient water use. Section two focuses on water discharge and water quality, comparing the various discharge permit regulations, rules around tailings storage, and post mine closure obligations. The third section outlines enforcement rules of the various jurisdictions and the reporting obligations. Section four summarizes the findings.

2. Water allocation

Access to a reliable source of water is critical for mining operations. Large volumes of water are required for each stage of the mining process to suppress dust, process ore, cool and wash mining equipment, and manage waste tailings. Clean water is also needed for consumption by the mine workers themselves. Hard rock mineral mining is particularly water intensive because of the extensive processing and beneficiation of minerals that is required to separate the minerals from hard rock and other matter.

2.1. Allocation of water as a function of state constitutional structure

The constitutional structure of a country determines at which level of government and from whom the water allocation permits are obtained. For example, in centralized countries like **China**, **Chile**, **Peru**, the **Philippines**, and **South Africa**, a national water department or ministry operating centrally, or through a provincial or local branch determines whether to grant a water allocation permit. In more decentralized countries such as the **United States**, **Canada,** and **Australia**, the power to allocate water has been devolved to the state or provincial government. All jurisdictions reviewed use a water authority approach – based on political or administrative divisions – to allocate water based. None use a water basin approach, whereby all water allocation decisions are made by a separate water basin authority. Only in **China** do the water drainage authorities, which regulate water use from water basins that span more than one province, become involved in a water allocation decision when a water source spans provincial lines.

2.2. Basis for water allocation

Often for historical reasons, the jurisdictions reviewed allocate water in slightly different ways. All jurisdictions require mining companies to obtain a water permit for the use of a certain allocation of water, and to carry out some level assessment of the availability of water resources, the impact of proposed activities on water sources, and the actual water requirements of the mining operation. This process generally occurs in parallel to the mine permit application process, or after a mine permit has been obtained. In most cases, information about the quantity of water required and the impact on surrounding watercourses must be submitted along with a mine permit application (usually as part of an environmental impact assessment (EIA) or statement). One exception to this is **Chile**, where a mine permit and water license can be approved before an EIA is approved, though the findings of the EIA, once available, can later result in a reduction in the quantity of water originally allocated to the project. In **Alaska** and some other resource-rich U.S. states, the permits required for a mining project, including water permits, are consolidated in a single procedure and application process.

Countries with a common law tradition, such as **Canada,** historically considered water rights to be land-based and attached to the land (riparian doctrine). Landowners whose properties adjoined a stream or other water source had the right to make 'reasonable use' of the water as it flowed along, through or over their properties. In such countries, competition for water was historically regulated by fixing water right allotments in proportion to the frontage of the water source. Today, other factors – such as the environmental impact of a water use or the priority right to access of certain users over others – may also impact the determination of a water allocation decision in such jurisdictions.

In contrast, jurisdictions with a civil law background have adopted an approach based on the old Roman principles, whereby people could only obtain use rights for running water not attached to the land. The legal frameworks of **Chile** and **Peru** reflect this approach in granting use rights: **Chile** has a private water rights system that grants fully transferrable water rights, whereas in **Peru** water rights are not tradable.

The **United States** has a hybrid system. While the laws of the United States derive from common law principles, different states have adopted variations of the land-based riparian approach and the use-based approach to regulate water allocation. Most eastern states follow a land-based riparian approach for allocating water rights, while resource-rich states in the west of the country, including four jurisdictions reviewed (**Alaska, Arizona, Nevada** and **New Mexico**), have adopted a use-based prior appropriation doctrine based on mining customs established by miners during the time of the Gold Rush in the 19th Century. This use-based prior appropriation approach dictates that the first person to use water, divert it for a beneficial use, or, more recently, apply for a license for a particular water allocation, has the perpetual right to use the water against all subsequent users as long as the appropriator puts the water to beneficial use ("first use in time, first in right"). For these purposes, mining is generally considered to be a beneficial use, and as such, if the right has been granted first in time, then it has priority over other users.

Due to extreme groundwater shortages in parts of **Arizona**, the state has adopted a 'reasonable use' doctrine for groundwater use that allows a landowner to withdraw sufficient groundwater to make reasonable and beneficial use of her property. There are strict groundwater use regulations for areas that are extremely water scarce.

Water allocations to Indian reservations across the United States are subject to separate rules, which have subsequently been extended to some federal public lands. Historically, adequate water was allocated to a reservation in order to fulfill the purpose for which the reservation was established (Winters v. United States, 1908). In states that follow the use-based prior appropriation doctrine, an Indian reservation's water right is linked to the date the reservation was established, which often pre-dates the rights of other users.[2] In 1963, the Supreme Court approved a decision that assumed the purpose of an Indian reservation to be agricultural, and that a reservation should be allocated sufficient water to irrigate all of the "practicably irrigable acreage" within the boundaries of the reservation on the basis of two criteria: (i) the land must be able to reasonably sustain crops; and (ii) the cost of supply water to the crops must not be unreasonable (Arizona v. California, 1963). The application of the Winters Doctrine in practice, however, has been complicated by questions on how to quantify "practicably irrigable acreage" and to what water sources it should apply. This has been particularly problematic where other water users, including mining operations, bordering or located on such reservations or federal public lands appropriate the same water sources according to state water allocation laws.

The **Philippines**, which inherited some of its legal principles from Spain (a civil law country) and the U.S., follows a use-based approach to allocating water. However, in contrast to other jurisdictions applying the use-based prior appropriation doctrine, the perpetual nature of allocated water rights can be cut short in the Philippines if the National Water Resources Board revokes or cancels a license, or makes a

[2] The Winters Doctrine was established in two landmark Supreme Court cases, Winters v. United States and the United States v. Rio Grande Dam and Irrigation Co.

determination, after due notice and hearing, to revoke a water permit in favor of a project that is considered to be of greater beneficial use.

2.3. Source and amount of water that can be allocated

The number of water permits required for a mining operation depends on whether the law considers all sources of water together, or whether different sources of water (ground, surface, etc.) are treated separately. Some jurisdictions do not distinguish between water sources, and thus require a single water permit (**Alaska**, **China**, **South Africa**[3], the **Philippines**, **Western Australia**). By contrast, three of the states reviewed in the United States (**Arizona**, **Nevada**, **New Mexico**) and **British Columbia** distinguish between ground and surface water sources – and even recycled water in the case of **Arizona** – requiring separate permits for each.

The volume of water a mining operation is entitled to use varies across countries, from as much water as it has historically required (in those U.S. states where use-based prior appropriation doctrine applies) to no surface water at all (**Chile**). Jurisdictions are increasingly implementing laws and procedures that require water allocation decisions to consider the availability of water and competing water users. For example, in the **Philippines**, each water allocation should include an evaluation by the National Water Resources Board. This evaluation compares the mining company's requested water, the water available, the capacity of the water source to supply such water, and the effect of the proposed use on other users. Similarly, in **South Africa**, each request for a water permit undergoes assessments both at a regional level and by the national office. It is ultimately up to the chief director in the national office to approve a water rights application. Out of the jurisdictions reviewed, **Western Australia's** procedures for assessing an application for a water permit appear to be the most rigorous, which includes an in-depth assessment of water source options, water demands, the management of dewatering volumes, the need for efficient water use, and the broader ecological, social and cultural values that may be impacted.

During the interviews it was highlighted that consistent decision-making processes with objective criteria improves predictability of whether a water permit request is granted and how much water is allocated. As such, these criteria may reduce the risk of unexpected outcomes. However, it was also noted that even though several criteria are in place in many countries, it is sometimes difficult to discern the extent to which decisions are made on an objective basis.

2.4. Community involvement in decision-making

A few jurisdictions, including **Chile, Canada,** the **Philippines,** and some **U.S. states**, provide a notification period in which communities can contest the issuance of a water permit before it is issued. For example, in **Chile**, **Nevada** and **New Mexico**, notice of a water application must be published a certain number of times in a newspaper. In the case of **Chile**, notice must also be given on the radio for a period of 30 days during which time anyone with a legitimate objection to the grant of the additional water rights can contest the allocation. While **Peru** does not require a consultation with the public for the granting of water permits, mining companies must ensure that indigenous communities give free prior and informed consent for a project before beginning a mining operation. Similarly, **British Columbia** requires consultation with potentially affected First Nation communities.[4]

*Interviewees noted that opportunities for communities to give early and time-bound input on a water permit application present the least risk from a mining company's perspective. In **South Africa**, where there is not a specific time bound period for the public to provide its views, objections can arise at any time, even after significant mining project investment has been made. In **China**, third parties do not have an opportunity to provide input on proposed water use by a mining company, which mining representatives identified as creating potential social risk down the line. **Peru,** on the other hand, has introduced advanced public consultation requirements to mitigate social risk, given the recent clashes between communities and mining companies.*

Even in jurisdictions where community engagement is not required as part of the water licensing process, companies include water related issues in their community engagement strategies, given that water is one of the community's primary concerns.

2.5. Restrictions on the length and scope of a water permit

The time period for which water rights are granted is influenced by the legal tradition of a jurisdiction, though this has been changing. In five of the jurisdictions reviewed (**Alaska**, **Arizona**, **Chile**, **Nevada**, **New Mexico),** water rights are valid for so long as water is used for a beneficial purpose. This is also the case for the **Philippines,** although as noted above, the perpetual nature of the water right is uncertain because the National Water Resources Board can revoke a license if it grants a permit for what it considers to be a more beneficial purpose. In the U.S. states with a use-based prior appropriation doctrine, water rights are generally perpetual unless the water is not being used for its beneficial purpose. By contrast, in **Chile**, where water rights are also granted in perpetuity, retention of water rights does not require full water allocation use (though users may be subject to a penalty for not doing so).

In four of the eleven jurisdictions surveyed, water is allocated for a specific use and timeframe, generally the time period stipulated in the mine permit. In **Peru**, for example, although water rights are granted independently of the land on which a mining operation is located, a water license is generally valid for the duration of the mine permit. The maximum length of a water permit in **China** depends on the scale of the mining operation, with the longest validity period for large-scale operations being 30 years. In **South Africa**, water use rights are granted for up to 40 years; this does not necessarily correspond to the duration of a mining permit, but is long enough to provide stability of water supply.[5] In **British Columbia,** there are no prescribed time limits for a water license, but there is a compulsory review of the water license after 30 years. Finally, in **Western Australia**, a water permit can be granted for either a fixed period of time or in perpetuity, depending on the water source and assessment.

In **Nevada,** water rights are given for a specific period of time depending on the stage of the mining project. In order to retain rights to the allotment of water granted, users must demonstrate that the full allotment is being put to beneficial use

While interviewees agreed that the "you snooze, you lose" approach used in several U.S. states helps governments for planning purposes, they noted that this approach does not encourage companies to increase water intake efficiencies.

In general, all jurisdictions reviewed allow for the renewal of water use permits where the water use right is not perpetual. However, the length of the renewal term varies. In **Peru**, for example, time-bound

[3] South Africa just requires a permit for water that is separately sourced for a mine. If water is obtained from a local water authority, or from dewatering, no permit is required.

[4] While beyond the scope of this study, note that there are some interesting community-based water management systems in operation in certain Sub-Saharan African countries such as Rwanda.

[5] Thus far, limited information has been found indicating a correlation between water allocation permitting and mine permitting. In prior appropriation jurisdictions, there is no correlation found between mining and water allocation; it is not clear if non-prior allocation water regime jurisdictions attempt to coordinate the length of water allocation permits and mine permits.

water permits may only be renewed once for a period of two years from the expiration of the initial permit.

2.6. Ability to change water license terms

In some of the jurisdictions reviewed, mining companies can amend the terms of a water permit, for example, to increase or decrease the amount of water permitted to be used, or to change the permitted uses of water. In **Arizona,** a company must apply for an amendment to the existing permit. To amend an existing permit in **South Africa,** the mining company would have to apply for a new permit altogether.

In addition to company driven permit changes, water authorities in **Peru** and **South Africa** can alter the allocation of water to a mine where: (i) the volume of available water changes; (ii) there is insufficient water to meet the needs of all users; or (iii) other users have been accorded a higher priority to access water than industrial users such as mines under a jurisdiction's constitution or water laws. By contrast, in jurisdictions that have adopted a beneficial use approach to water prioritization, like **Alaska**, **Arizona**, **Chile**, **New Mexico**, **Nevada**, and the **Philippines**, there are generally no mechanisms to require an existing mine to limit its water use.

> *Interviewees revealed concerns about not being able to plan for long-term water permits given that certainty of water supply is critical to mining operations. **South Africa,** for example, is perceived as high risk given that water permits can be amended part way through a project. One company representative said that recently his company has had to re-negotiate water permits every 2–5 years and permit revocation is a constant threat. **Australia** and the jurisdictions reviewed in **United States**, on the other hand, were identified as low risk given that once the permit is issued amendments are unlikely.*

In most of the jurisdictions reviewed, if a mining company breaches conditions of its permit, the permit may be revoked.

2.7. Water markets

In **Western Australia**, **Chile**, and many **U.S. states** where water rights are considered to be proprietary and fully transferable, such rights may be purchased on legally recognized "water markets".[6] These markets allow for the trading of existing water use rights in a system that runs in parallel to a permitting system. For example, in **Chile**, where it is now extremely difficult to secure a water allocation for a mining operation, mining companies with insufficient water for their operations have been purchasing additional water use rights from farmers and other users.[7] Similarly, in **New Mexico**, where almost all of the state's water has already been allocated, mining companies that require additional water can buy water rights from existing water users. Unlike in **Chile**, water market transactions in **New Mexico** must be approved by the state level water authority responsible for approving all water allocation permits. Similarly, in **Western Australia**, the right to trade water rights requires approval by the Government of Western Australia's Department of Water.

Water markets are being implemented as part of an effort to ensure the most appropriate allocation of water among users, although they have been subject to some criticism in jurisdictions where more powerful water users – such as large-scale miners – have been able to outbid other users in such a market. In **South Africa**, for example, the mining industry could offer 10–20 times the price that agriculture smallholders can offer for water rights. If an unregulated water rights market were to be fully implemented there, the imbalance may result in the complete transfer of water rights from smallholder farming towards the mining sector.

The implementation of a water rights market therefore should provide the necessary arrangements to ensure water supply meets water demand, but also protect actors to address equity concerns. To function effectively, water markets require a robust institutional framework to allow for the transparent and efficient trading of water rights (Toledano and Roorda, 2014).

2.8. Water permit processing times

Permit processing times can be a critical issue for mining companies and investors attempting to align the financing of an operation with the time it will take to begin operations. Some jurisdictions, such as **China, Chile,** and **South Africa,** stipulate a timeline for processing a water application in the law, though the actual processing time may be longer in practice. In **China**, for example, the prescribed process time is between 50 and 70 working days depending on whether the water basin authority must approve the permit, in addition to the relevant water administration authority. Some U.S. states, such as **Alaska,** allow all permits required for large-scale mining projects to be applied for at the same time in order to fast track the general permitting process.

> *Interviewees revealed that in general, the toughest and longest permit processing times are in the **United States**, though this is more likely related to environmental permits rather than water allocation permits (see Section 2). In **Chile**, obtaining a water license is supposed to take 7–8 months, but in practice is expected to take 2–5 years. In **Western Australia,** the process may take between 1 and 3 years. **Peru**, the **Philippines,** and **South Africa** are thought to be the quickest, where water permits can take 6 months to 1 year.*
>
> *Interviewees highlighted, though, that the period of time for obtaining a water permit is not the primary concern if these time periods are predictable and clear at the outset. The risk is related to unanticipated delays, non-adherence to timelines, and subsequent denial of a license for unclear reasons. In countries with high water license rejection rates such as the U.S., companies tend to prepare contingency plans for alternative water sourcing, so a new permit request can be submitted if/when a license is not approved.*

2.9. Water tariffs

In most of the jurisdictions reviewed, mining companies are required by law to pay for fresh water used, though the amount payable is generally a relatively small cost. In **British Columbia**, **China**, **Peru**, **Nevada**, **South Africa**, and the **Philippines,** mining companies must pay a water charge at a rate set by the relevant local authority. By contrast, in **New Mexico** and **Chile**, there is no water charge payable on the amount of water used to the extent it is self-sourced. In **Alaska**, there is no water tariff per se, though an administrative levy is charged on the quantity of water allocated to a mine to cover administrative costs.

> *Most interviewees agreed that water is not priced appropriately. Particularly water rich jurisdictions like several provinces in **Canada** do not value water at all. Water scarce regions tend to charge tariffs, with the exception of **Australia**, but tariffs tend to be low and not a major expense for mining operations as a whole.*

2.10. Encouraging efficient water use and water recycling

Half the jurisdictions covered have some legislation aimed at limiting mining operations fresh water intake. This is generally done by limiting the amount of fresh water mining companies are permitted to extract from underground or surface water sources (**Chile**); by

[6] Research suggests that water rights trading is possible in South Africa and China, however such trading is not regulated. More research on this topic is needed in these jurisdictions.

[7] More data collection is needed on the amount of time required to obtain a permit and the process for renewing water use permits.

requiring mining companies to implement water efficient processes in the design phase of a mine (**South Africa**, **Western Australia**); or by offering financial incentives for using less than the volume of water allocated (**China**).

Interviewees suggested that mining companies choose to adopt water efficient mining practices primarily because of the increasing competition for water rather than in response to legislation. The interviewed mining representatives were not aware of legislation or regulations that specifically require recycling measures by operations.

2.11. Environmental considerations in the allocation of water rights

In some jurisdictions, in addition to the environmental impact assessment process, water quality considerations are taken into account when reviewing water permit applications. For example, in **Canada**, applications for surface and ground water licenses are reviewed by the Ministry of Forests, Lands and National Resources Operations; the ministry considers the potential impact of the water rights applied for on the quality, quantity, and timing of water flow required to maintain aquatic ecosystems (Government of British Columbia Website). If the use or diversion of water is likely to result in an adverse impact on water quality, a mining company may be required to submit a plan with proposed mitigation measures before a surface or ground water permit is issued. Similarly, in **China**, information about mining operations and discharges must be submitted as part of an application for a water use permit.

3. Water discharge and water quality

In contrast to water allocations, which tend to be regulated at the state or provincial level, the environmental impact and discharge of mining is more likely to be regulated at the federal or commonwealth level.

3.1. Discharge permits

In most of the jurisdictions reviewed, one or more permits are required to discharge prescribed amounts of waste from a mining site into surrounding watercourses. While some jurisdictions, such as **British Columbia, China, South Africa, Chile**, and **Peru** require only a general permit for mining discharges, others – particularly in the **United States** – require multiple permits for the discharge of pollutants into different types of water sources from federal and state authorities. In **Arizona**, for example, mining companies must obtain separate permits in relation to the impact of mining on aquifers, surface water, and groundwater. In **British Columbia** and **Western Australia**, environmental impact assessments required as a condition to obtaining a mine permit also require detailed descriptions of expected pollutants to be discharged in surrounding water sources, as well as plans to mitigate water quality disruption.

*Most interviewees highlighted that getting a water discharge license is an issue in all jurisdictions. In **Peru**, water discharge is always a significant community concern, and getting a permit can be a lengthy process. There are a number of legacy issues in the country resulting in strong distrust against the industry. The social risks trump the regulatory risks there. In **Nevada**, getting a water discharge permit is also a lengthy process, but the process is well understood with the risks easily identifiable.*

*In **Australia**, water allocation permits are relatively easy to obtain as compared to discharge permits. The latter form part of the environmental approval process that can take a long time and will typically start two years before looking to apply for a water license. Surface and groundwater impact assessments are the most expensive parts of EIAs. These require water-sharing plans that model water quality and quantity under different scenarios, which are reviewed every five years and reassessed every 10 years.*

It was also noted that in cases where multiple permits are required from various government agencies, there is generally a higher risk for project delays.

3.2. Tailings storage

In most jurisdictions reviewed, mining companies are required to design their operations in a way that minimizes environmental risks such as leakages from tailing dams or other waste rock impoundments. These design requirements must generally be accounted for in the environmental impact assessment submission. For example, in **British Columbia** and **New Mexico**, mining companies must provide a detailed description of how they will manage tailings and give justification for the approach. In other jurisdictions, the tailings design is addressed in the discharge permits, or in a separate permit. For example, in **Arizona**, engineered plans for the disposal of waste water must be submitted for approval with the state wastewater disposal permit, whereas in **Nevada**, a permit is required before the construction or modification of any tailing impoundments. Other jurisdictions, such as **South Africa** and **Chile**, just provide specific requirements for the technical design of tailing ponds.

Interviewees recognized the increasing risks in tailing dam failures and mentioned that following the San Marco and Mount Polley disasters, mining jurisdictions globally have increased scrutiny for large tailings. Companies are acutely aware that licensing for large dams will be more challenging in the future, particularly in jurisdictions that have recently been affected by tailing dam failures.

3.3. Post-mine closure obligations

In addition to limitations on the discharge of contaminants during the life of a mine, the legal frameworks in most of the jurisdictions reviewed require mining companies to take measures to mitigate the environmental impact of a mine after a mine ceases to operate. In **Arizona**, for example, copper mines must incorporate acid drainage mitigation plans into their overall post-mine closure plan. In **New Mexico**, copper mines must construct impoundments containing leach solutions according to design requirements established by the state Water Quality Control Commission. These requirements are meant to guard against impoundment overflow and water contamination, to accommodate rainfall and surface water levels up to those expected during a 100-year flood.

In most jurisdictions, as a condition for the approval of a mining permit, a post-mine closure plan must be submitted. The plan should set out how the company intends to minimize water contamination at the end of a mine operation's life. Environmental impact assessments/statements also assess post-closure environmental risks, and are required to set out mitigation measures. The extent to which such post-mine closure plans are assessed prior to approval varies greatly in practice, depending on the jurisdiction and the capacity of the relevant authority to undertake such an assessment and any associated monitoring.

In some jurisdictions, mining companies are required to prepare a budget for the implementation of the post-mine closure plan, and/or to submit a financial security or bond to cover the anticipated cost of post-mine closure activities. Jurisdictions differ on who is required to certify the anticipated cost, the extent to which such amount is negotiable, and for how long the security or bond must be maintained. In **South Africa** and **China**, any security or bond submitted may be released or refunded in full when the mine site is certified as having implemented all required post-closure actions, typically before a mine is fully decommissioned. By contrast, in the **U.S. states,** reviewed mining authorities may refund portions of the bond posted as segments of the post-mine closure

plan are successfully implemented. Such post-closure requirements may be certified as complete either before or after a mine is decommissioned. In **Nevada** and **New Mexico**, where the closure requirements include a 5-year and 12-year monitoring period, respectively, after the mine has ceased operating, the financial assurance may only be refunded in full at the end of the monitoring period.

In some jurisdictions – notably the **United States**, **Canada, Chile** and **Australia** – mining companies remain liable for water quality impacts for some period of time following mine closure. In **British Columbia** and **Peru,** mining companies remain liable for water quality impacts within the project site for three years following mine closure. In **Chile**, mining companies remain liable for five years following mine closure. Mining companies that declare bankruptcy or dissolve the legal entity that held the original mine permit tend to avoid liability arising after a mine has been closed.

Few of the jurisdictions reviewed outside of the United States require any active monitoring of the mine site post-mine closure. For example, in **China**, the **Philippines** and **South Africa**, once a mining company has been certified to have met the post-closure requirements at decommissioning, it is no longer required to monitor the mine site and is not liable for any post-closure environmental harm.

*Interviewees noted that legacy issues are a big concern in mature mining jurisdictions. While standards to avoid contamination have increased, legacy mines continue to pollute water resources. This results in community backlash to current projects that are not necessarily responsible for the contamination. Operating projects therefore have an interest in helping clean up legacy mines in close proximity. In **South Africa,** the Government levies a fee on currently producing mining companies in order to pay for legacy mines to be pumped out and address water pollution.*

Several interviewees expressed that more focus and work should be done on post-mine closure obligations to ensure that public sentiment towards the industry improves. Institutional controls need to be in place for post-closure contingencies, and financial models need to take these costs into account.

4. Enforcement

4.1. Mechanisms

A range of mechanisms aimed at ensuring compliance with water use permits and water quality standards exist across jurisdictions. The relevant environment or water authority is generally charged with ensuring compliance with water quality requirements, which could include issuing warnings, imposing fines, suspending environmental quality certificates, temporarily closing the mining site, or suspending mining operations. In **China**, if three or more serious violations occur, the mining site can be permanently shut down (as has happened at several mine sites).

Each jurisdiction reviewed also provides some level of civil or criminal remedy that may be initiated by the competent state authority for a violation of the applicable permits or environmental damage. In addition, in the **U.S.**, **British Columbia**, **Chile**, and **South Africa**, individuals or communities negatively impacted by mining operations can directly bring a claim against a mining company. For example, environmental legislation in **South Africa** allows downstream communities and companies affected by polluted water to institute civil action claims against mines responsible for the pollution (NEMA, 2009).[8]

All jurisdictions reviewed have legal enforcement mechanisms for identifying and penalizing non-compliance with water and water-related environmental legislation. However, there is a large disparity between the enforcement regimes set out in law and the on-the-ground reality, which is generally a function of the financial and human resources available to a government to monitor, assess, and enforce such laws.

4.2. Reporting obligations

Reporting requirements are tied to both water quality permitting and water allocation in the mining, environmental, or water regulations governing mine water use or discharge. Most jurisdictions (with the exception of **China**) require self-reporting, and few jurisdictions independently monitor the accuracy of such reporting. In addition, few jurisdictions require periodic updates of the environmental impact assessments initially carried out. No jurisdictions reviewed require community participation in the reporting requirements.

*Several mining company representatives explained that their company had participatory monitoring arrangements with nearby communities to test for the water quality near discharge locations. Most welcomed such an approach and even have promoted such initiatives in new mining locations to build trust and obtain, or retain, the social license to operate. While communities in countries such as **Peru** are interested in such initiatives, other communities in **Canada** and the **U.S.** were found not to be interested. While difficult to confirm, it was suggested by one interviewee that there might be a correlation between the government's monitoring capacity and the interest by communities to be part in such initiatives: where government capacity to monitor is higher, communities may be less interested in taking part in participatory monitoring initiatives.*

5. Findings

While there is no perfect water use/discharge model and each jurisdiction's regime has evolved from its historical underpinnings to accommodate for its context specificities, a few common trends can be observed from the laws reviewed.

First, water allocation mechanisms are closely linked to the relevant country's legal tradition, and how the responsibility for the administration of the water rights is assigned between the central and local level depends on the level of decentralization of the country. Second, regions with a long mining history tend to have more advanced and complex water regimes, whereas frontier-mining countries have a less-developed legal framework. Third, jurisdictions with pollution problems from legacy mines tend to have more stringent discharge and post-closure requirements. To receive discharge permits in such jurisdictions, comprehensive analyses need to be undertaken as part of the environmental impact assessment. Fourth, water scarce jurisdictions or regions with a significant amount of competing water users tend to have more stringent water allocation regimes and have set up markets to trade water rights.

The interviews with the mining company representatives suggest that there is not necessarily a link between the complexity of the water regimes and the perceived regulatory risk, but rather the main determinant of perceived regulatory risk is predictability: are the rules for water rights allocation and monitoring clear? Will they be complied with? A positive answer to these two questions is more important than the time it takes to receive water rights. If a company knows that the granting of the water allocation/discharge license takes three years and the deadline will be complied with, the company can plan for this in the

[8] In sections 28(2) and 32(1) of South Africa's NEMA, criminal liability arises due to environmental damage relating to mining misconduct. Anyone can therefore approach the state to investigate as if there is a prima facie case. Section 32(1) of the NEMA also grants standing to mining communities and enterprises that live downstream a river and

(*footnote continued*)
are affected by polluted water to institute civil class actions against mines.

project design timeline. Lack of clarity and inconsistency are more problematic.

The overall regulatory water risk of a mining jurisdiction from a company's perspective can be summarized as being a combination of (1) the predictability of the timeline for the processing of water requests, (2) the probability of the water permits being approved, and (3) the likelihood of having this permit being contested or revoked.

For governments looking to reduce regulatory risks related to water rights, this suggests that sufficient and certain time frames should be allocated to review water impact assessments (also to be performed on a cumulative basis where several mining projects are operating in the watershed), and community consultations should be built into the process at an early stage. Furthermore, there should be clear guidelines that outline the decision-making criteria, and such criteria should be applied in a consistent manner. Such predictability needs to be balanced with the changing water dynamics in the region that may require water right review mechanisms on a regular basis to assess their suitability to the evolution of the mining water demand, hydrology, and competition with other users.

ANNEX. Summary table of key template terms

	Legal system	Basis of allocation of water	Duration of water right	Basis of regulation of discharge	Requirement for an Environmental Impact Assessment	Community participation	Post-closure obligations	Enforcement
Australia (Western Australia)	Common law	Water licensing system with separate permits for ground and surface water operated by the Department of Water. Also a private water market to trade those water rights.	Can be of indefinite period, or as otherwise set in a permit.	Permitting process operated by the Department of Environment Regulation.	Yes – as a requirement to obtain a mine permit.	Stakeholder engagement required for the mine closure plan. Such engagement may be undertaken to prepare the operating strategy in respect of the water license and the EIA process.	Comprehensive mine closure plan to be prepared with post-mine closure monitoring conducted for a set period of time.	The Department of Water, Department of Environment Regulation and Department of Mines and Petroleum are each responsible for enforcing compliance under the legislation they administer.
Canada (British Columbia)	Common law	Water permitting system for surface water and, since 2016, ground water operated by the Ministry of Forests, Lands and Natural Resource Operations.	No time limit per se. There is a compulsory review of water permits after 30 years.	Separate permitting processes operated by Environment Canada and Fisheries and Oceans Canada.	Yes – as part of the process to obtain a mining permit.	N/A	Mine closure plan required to specifically address the restoration of land, watercourses, and cultural heritage resources.	Chief inspector of mines oversees monitoring and compliance with mining permit conditions and mine closure plan. Fisheries and Oceans Canada can also impose fines for non-compliance with its discharge permit.
Chile	Civil law	Permitting process for ground and surface water operated by the Dirección General de Aguas. Also a private water market to trade those water rights. Miners have rights to all other water found in their	Water rights are granted in perpetuity. The right to use water located within the boundaries of a concession is limited to the length of the mine permit.	Following the approval of an EIA for a mining project, the requisite permits will be issued for a permitted amount of discharge by the Environmental Evaluation Service (SEA).	The relevant environmental permits (RCAs) must be obtained before a water right can be applied for.	Community consultation in EIA and extensive community rights to contest allocation of water rights.	Mining companies are required to file a closure plan for approval by the National Service of Geology and Mining (SERNAGEOMIN) before mining operations begin. The environmental aspects of the plan will also be evaluated and either approved or	The Superintendence of the Environment (SMA) is responsible for taking regulatory enforcement. Environmental courts have also been established to hear cases in relation to breaches of environmental law.

		mine concession area.					rejected during the environmental assessment of a mining project.	
China	Soviet-inspired socialist legal framework	Water permitting process administered by the Ministry of Water Resources.	Usually 5, but up to 10 years.	A pollutant discharge permit is required to be obtained from environmental authorities.	Yes – must be completed before construction of a mining project.	N/A	A mine closure application as well as the geological report on mine closure must be submitted for approval to the relevant administrative authority that issued the original mining permit 1 year prior to the completion of mining activities.	The Ministry of Water Resources or the Environmental Protection Agency can take enforcement action.
Peru	Civil law	Water permits granted by the National Water Authority (ANA). Water is not tradeable.	For the duration of a mining concession.	Discharge permits granted by ANA.	Yes – for approval by the Ministry of Energy and Mines (DGAAM), unless a mining project is classified as category III, in which case the relevant environmental authority (SENACE) must approve it.	Yes – extensive community consultation required.	A mine closure plan must be filed with the DGAAM within 1 year of approval of the EIA.	ANA is responsible for enforcement.
Philippines	Mix – Roman law and Anglo-American common law.	Permit issued by the National Water Resources Board (NWRB).	Water right valid for as long as water is beneficially used (and NWRB does not revoke the water right).	Wastewater discharge permits issued by the Regional Office of the Environmental Management Bureau.	Environmental Compliance Certificates are required to be obtained for any activities beyond exploration.	Stakeholder engagement for the EIA and mine closure plans required.	Mine closure plan to be submitted 5 years before decommissioning.	Carried out by the Environmental Management Bureau (EMB).
South Africa	Mix – Roman-Dutch law and common law.	A water licensing system operated by the Department of Water Services.	License issued for up to 40 years.	A permitting system operated by the Department of Water Services.	Yes – an EIA must be conducted in order to obtain a mining permit. The EIA must include a water monitoring plan.	Yes – for the EIA and mine closure plan.	A mine closure plan must be submitted with the application for a mining permit. Mining companies self-monitor during the life of a mine and there is no monitoring required post-closure.	The Department of Mineral Resources and Department of Water and Sanitation can enforce breaches under the Acts they administer. Communities that have standing can separately sue for common law remedies.
US	Common law	Regulated at the state level. Jurisdictions reviewed follow the doctrine of	Can be indefinite – so long as water is used for a	Yes - Sections 202 and 204 of the Clean Water Act – administered either federally	Yes – pursuant to the Clean Water Act.	No.	Yes – regulated at the state level.	Public and private enforcement actions can be taken pursuant to

	prior appropriation.	beneficial purpose.	or at the state level.	applicable state and federal law.

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Winters v. United States, 1908. 207 U.S. 564.

Glossary

Dewatering: The process of draining the water that collects in the open pits during the mining process. Water collects in the open pits when ore or coal is excavated below the water table, or from rainfall.

Land-based riparian doctrine: the right of a landowner whose properties adjoin a stream or other water source to make reasonable use of the water as it flows along, through or over their properties. This right is tied to the land meaning that the right transfers only with transfer of the land to a new owner.

Tailings: The waste stream of ground rock and process effluents (including unrecoverable and uneconomic metals, minerals, chemicals, organics and process water) that are generated in a mine processing plant during beneficiation. Tailings are usually discharged, normally as slurry, to a final storage area commonly known as a Tailings Management Facility (TMF) or Tailings Storage Facility (TSF) ("What are Tailings").

Use-based prior appropriation doctrine: The prior appropriation doctrine states that water rights are determined by priority ("first use in time, first in right") and beneficial use. This means that the first person to use water or divert water for a beneficial use or purpose can acquire individual rights to the water (Cornell Law School).

Winters doctrine: A water use doctrine developed in the case of Winters v. United States which established that where Congress reserves land for an Indian reservation, Congress also reserves water sufficient to fulfill the purpose of the reservation (Brougher, 2011).