UNEP Finance Initiative
Innovative financing for sustainability

UNEP

Chief Liquidity Series

Water-related Materiality Briefings for Financial Institutions

Issue 3 • October 2012

Extractives Sector

Geographies
Australia
Brazil
Canada
China
South Africa

Local guidance on a global issue
A briefing series by the Water & Finance Work Stream of the United Nations Environment Programme Finance Initiative

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Prepared for UNEP Finance Initiative by

WWF

PEGASYS Strategy and Development

UNEP **Finance Initiative**
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Foreword from the United Nations Environment Programme Finance Initiative (UNEP FI)

Since the second issue of the Chief Liquidity Series for the Power Sector was finalized in August 2010, the world's water problems have further exacerbated. From droughts in the Yangtze River basin and floods in China, the record drought in the USA leading to higher soft commodity prices and floods and droughts in Australia, it becomes more and more apparent that the nexus between energy, food, water and climate change is increasingly becoming visual by the day.

This third issue of the Chief Liquidity Series focuses on extractive industries. Given that extractive industries are also depending on water for a range of operations, it is crucial for the sector itself and for financiers, investors and insurance firms that service these companies to understand how changing availability and quality of water can impact extractives, how these companies can mitigate these risks, and how financial institutions can assess, value and integrate such considerations in due diligence procedures, risk management, loan agreements and the selection and weighing of stocks.

Mining and oil and gas operations constitute the backbone of many countries around the world. It is therefore crucial to see how these industries can continue to deliver in a 21st century that is likely to be more water scarce because of population growth and growing demand for limited water resources.

UNEP FI encourages its members and the wider financial sector to read this publication and to use the information in dealing with their clients in extractive industries.

Yuki Yasui
Officer-in-charge UNEP Finance Initiative

UNEP **Finance Initiative**
Innovative financing for sustainability

Foreword from the UNEP FI Water and Finance Work Stream (WFWS)

Unlike agriculture and the power sector where the link with water has been clear, the extractive industries have been divorced from water considerations in the past. In recent years the dependence of the extractive industry on water and the impact of previous short-sighted mining activities causing acid mine drainage and contamination of land have come to the fore.

The extractive industries have been regulated in many jurisdictions away from regulatory considerations around natural capital preservation and conservation. In actual fact the extractive industries have in the past stood in direct contradiction to the aims of natural capital preservation and conservation.

Mining in the 21st Century has similar to the agricultural and power generation sectors reconsidered its use of natural capital and put systems in place to efficiently use water. Regulatory developments as a result of NGO and public pressure have seen strict environmental requirements emerging from mining authorizations. Water use and waste management have emerged as the most important considerations in environmental impact assessments of proposed mining activities.

What this publication aims to do is to create awareness of the risks associated with financing extractive industries in a world where natural capital is a finite resource and demand is already exceeding supply. These risks include physical risks such as water scarcity and droughts, regulatory risk such as enforcement of water regulations and restrictions and reputational risk where the extractive industries impact on society's need for clean water.

Mining operations take a lifetime to complete in some cases and the financial support is spread over periods exceeding 20 years. With the current projections of the impact of climate change on temperature and water the variables have become uncertain. Financiers will have to look well into the future and pre-empt the physical, regulatory and reputational risk associated with financing extractive industries.

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WATER RISKS FOR EXTRACTIVE INDUSTRIES AND FINANCIAL INSTITUTIONS

Water risks for extractive industries and financial institutions

Water resources are under unprecedented strain. Whether the focus is on biodiversity, energy, agriculture or social needs, water lays at the heart of these defining challenges to a growing planet. Population and economic growth with improved living standards in many parts of the world will likely double the consumption of water in the next 20 years.[1] At the same time, more than one billion people on Earth already lack access to fresh drinking water.[2] It is estimated that by 2025 approximately 2.7 billion people will face severe water shortages if consumption continues at current rates.[3] Unsurprisingly, water is therefore deemed the most contested resource of the 21st century.[4] It is against this backdrop that water has become a crucial issue for businesses around the world, as it informs reputational, operational and regulatory risks.

One of the key challenges for decision-makers in policy and business will be to 'de-couple' their view of economic growth from water consumption and pollution. Achieving this goal will have benefits for the environment and society, as well as ensure long-term economic growth. In light of these factors, businesses and financial institutions that are able to ensure the 'water sustainability' of their operations and investments will have a competitive advantage.[5]

In 2007, UNEP FI's Water and Finance Work Stream published the publication 'Half Full or Half Empty'[6] providing a set of universal but indicative guidelines for water-related risks as well as opportunities for financial institutions. Over time it has become clear that financial institutions need a more sect oral and geographic view of how water risks and opportunities are material to their clients and therefore to their own loan portfolios, investments and other products.

The *Chief Liquidity Series* (CLS) seeks to equip financial institutions with a better understanding of water challenges around the world, how this impacts business performance and what financial institutions can do to be better informed and what tools to use to work with clients in addressing water-related issues so as to reduce risks linked to loans, investments and insurance contracts. This CLS series aims to guide banks, investors and other financial institutions on how to assess the operations of clients and investee companies with regard to water impacts and their exposure to water risks. Water pressures and their implications for business and finance generally manifest locally and will vary considerably by sector and geography.

This 3rd issue of the CLS series focuses on a number of sub-sectors within the broader extractive industry. Water is a crucial input in the production process of many aspects of this industry's sub-sectors. Any delays, disruptions or shutdowns as a result of lack of water can have an immediate effect on business operations.[7] Water is also a resource in high demand with multiple shared users - making the behavior and performance of the mining sector important for social and reputational reasons. Given the fact that extractive industries are often the only primary industry operating in water-scarce areas, and in many cases extractives disrupt the natural landscape and its water provisioning capacity, sometimes permanently, this provides a strong case for focusing the 3rd issue on the broad extractives sector.

How to use these briefings

This issue explores water challenges for extractive industries in the following countries and on the following sub-sectors:

Country	Sub-sector
Australia	Coal and seam gas
Brazil	Gold
Canada	Oil sands
China	Coal and base metals
South Africa	Coal and precious metals

The report is divided into two parts. The first addresses the conceptual framework of water risk focusing on specific risks to the extractive industries and how this relates to financial institutions. Departing from the other reports, this report focuses on the institutional landscape created by water risk. The second part discusses the different ways in which water risk can manifest in a particular region based on hydrological, environmental, social, political, and economic factors. The report concludes with a reflection on the integration of the two sections and suggests indicators for water risk in the extractive industries.

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PREVIOUS BRIEFS AND KEY LITERATURE

In the past decade, much analysis and literature has been dedicated to exploring and quantifying water risks for businesses.[8] This work has been heavily influenced by the concerns surrounding climate change, the global financial crisis, decreasing freshwater supplies and increasing public awareness around water. Both NGOs and financial institutions have written widely on the issue, seeking to provide advice to companies and investors on how these risks will manifest and be managed. Previous CLS reports on agribusiness and the power sector provide insight into water risk in those industries. With the addition of this report, the CLS series presents a clear picture of water risk across a number of key water intensive sectors for financial institutions' consideration.

Chief Liquidity Series – Issue 1: Agribusiness[9]

The first report of the Chief Liquidity Series focused on agribusiness. The aim was to examine the water sustainability issues specific to agricultural operations to inform financial decision-makers, and in particular, credit institutions. Five different geographies, Australia, Brazil, India, South Africa and the Mediterranean Basin, were selected to demonstrate the ways in which water risk intersects with growth and sustainability of the agriculture sector and in light of climatic changes.

Chief Liquidity Series – Issue 2: Power Sector[10]

The second report of the Chief Liquidity Series focused on the power sector. This report segmented its analysis into the same geographic regions as CLS 1 for consistency. It examined the complexities that arise in local situations around water and power generation and focused primarily on thermal power generation and provides a brief treatment of the difficulties associated with hydropower.

Mine the Gap – World Resources Institute[11]

In September 2010, the World Resources Institute (WRI) released the report, 'Mine the Gap', which sought to provide an overview of the water risk that mining companies face. This overview is aimed at investors to understand the nature of the water risk for mining operations and the quality and quantity of water risk information released by mining companies. The report indicates that companies experience water risk through availability (the lack of water for operations) and quality by means of downstream impact on the basin. As mining requires a great deal of water (in particular for precious metals), WRI reports that mining companies have long been aware and attentive to water risk issues. WRI identifies regulatory, legal, and reputational risk as primary factors that arise from quality and quantity issues related to mining.

Towards Sustainable Mining - Citigroup[12]

In 2006, Citigroup released a report which sought to evaluate sustainability practices of global mining companies. The report argues that sustainability practices will significantly impact the long term value generation capacity of mining companies as stakeholders begin requiring better company practices globally. The report identified and examined five pillars, which are commodity exposure, country exposure, mine development, HSE in operations, and sustainability governance, of sustainable development in the mining sector, detailing the factors which would determine long term financial success.

Watching Water - JPMorgan[13]

In 2009 JPMorgan Global Equity Research released a report as a guide to investors on evaluating corporate risks in an increasingly water scarce world. The report reviews the conceptual framework of water risk and examines how these risks manifest in different industries including power generation, extractive industries, food and beverage, manufacturing, insurance, and leisure. The main lessons from the report are as follows:

- Exposure to water scarcity and pollution may be greater in the supply chain of companies as opposed to their own operations, depending on the industry.
- Power generation, extractive industries, and the food and beverage sector are particularly exposed to water-related risks.
- Corporate disclosure of water risks is inadequate and often misplaced in environmental sustainability reports rather than regulatory filings.

Lloyd's 360 Insight Water Risk – Pegasys/WWF[14]

In early 2010, Pegasys in association with WWF published a report on water-related risks for investors as part of the Lloyd's 360 Insight series. The report identified a number of factors to consider when assessing corporate water risk, including:

- Water is extremely sensitive to local constraints and factors. Two neighboring water basins may face entirely different issues.
- Water is a finite, yet renewable resource. It is constrained not only physically but in many places legally through historical water rights agreements.
- It is variable in both long term and short term availability. Unlike other natural resources, it is challenging to determine future water availability based on changing hydrological cycles and climate variability and change.
- Water availability heavily influences food and energy markets. A drought in a region can drive up food prices, while scarcity in another can lead to reduced energy output.
- In many developing countries managing corporate water risk may be more proactive due to varying degrees of institutional capacity.

Additionally, a number of organizations have initiatives or publications which focus on different aspects of water risks for the business community. The table below provides an overview.

Organization	Initiative	Target Audience
UNEP FI	Half full Half Empty	Financial sector
WWF and DEG[15]	The Water Risk Filter	Private sector incl. finance
Water Resources Institute	Mine the Gap	Financial sector
International Council on Mining and Minerals[16]	Water Accounting Framework	Private sector
CERES[17]	The Ceres Aqua Gauge	Private sector incl. finance
Citigroup	Towards Sustainable Mining	Private sector, financial sector
JPMorgan	Watching Water	Private sector, financial sector
Lloyd's Bank	360 Insight Series – Global Water Scarcity	Financial sector
Minerals Council of Australia[18]	Strategic Water Management in the Minerals Sector	Private sector

Organization	Initiative	Target Audience
Carbon Disclosure Project[19]	Water questionnaire	Financial sector
World Business Council for Sustainable Development[20]	Global Water Tool	Private sector
UN Global Compact - CEO Water Mandate[21]	Water Disclosure and Policy Guidelines and "state of play" of emerging practice on corporate water accounting	Private sector
World Economic Forum[22]	Water Disclosure Methodology and Indicators of water management	Private sector
Pacific Institute[23]	Research on "state of play" and emerging practice on corporate water reporting	Private sector

3

WATER RISKS IN EXTRACTIVE INDUSTRIES

The materiality of water for businesses will not ebb away, but is becoming more real by the year, especially for sectors that are water intensive or for which water is a crucial aspect in the production process. Although financial institutions are not in the business of managing water, it is paramount for risk managers, credit analysts, portfolio managers and loan officers to understand how water can be material to their corporate clients or companies they have invested in. For example Newmont's US $ 5 billion Minas Conga project in Peru experienced significant delays as a result of concerns regarding the impacts of the mine on water availability. This not only resulted in costs associated with the delay, but also required an investment of approximately US $150 million from the investment partner Minera Yanacocha.[24] Protests near Xstrata's Tintaya mine killed two and left dozens injured.[25]

Water-related risks depend on numerous factors, including hydrology, the strength of civil society, the role of the regulatory environment and enforcement capacity of governments to name a few. The use of water and its interaction with other stakeholders are as much of interest as the actual *consuming amount*. To accurately assess water-related risks to investments and loans, financial institutions need mechanisms to measure them. However, this task poses a number of challenges, since water often serves competing purposes, namely as a business input, an environmental requirement, and a social good.[26] All three domains are priced and valued differently; yet the multiple roles, users and benefits of water are central to any risk analysis. There is a number of potential cost drivers associated with water risks, including:

- Compensation payments
- Production suspension
- New or higher regulatory costs
- Higher resource costs
- Higher insurance premiums
- New capital expenditures
- License loss
- Diminished good will

The effects of water risk could cause any of the above depending on the nature of the risk and its severity. The ways in which water risks may become material to extractives, financiers and investors are provided as follows:

1. Conceptual framework to understand water risk
2. Water risks for extractive industries
3. Water risks in extractive industries sub-sectors
4. Water risks for investors in extractive industries
5. Responding to water risks in the extractive industries

3.1 Conceptual framework to understand water risk

Within the context of this briefing we have chosen a methodology to frame water risks for extractives using three main categories: (1) physical or operational risks, (2) regulatory risks, and (3) reputational risks[27]. In addition we also differentiate between basin and company specific risks (**See Figure 1**).

Figure 1

Company and basin-related water risks

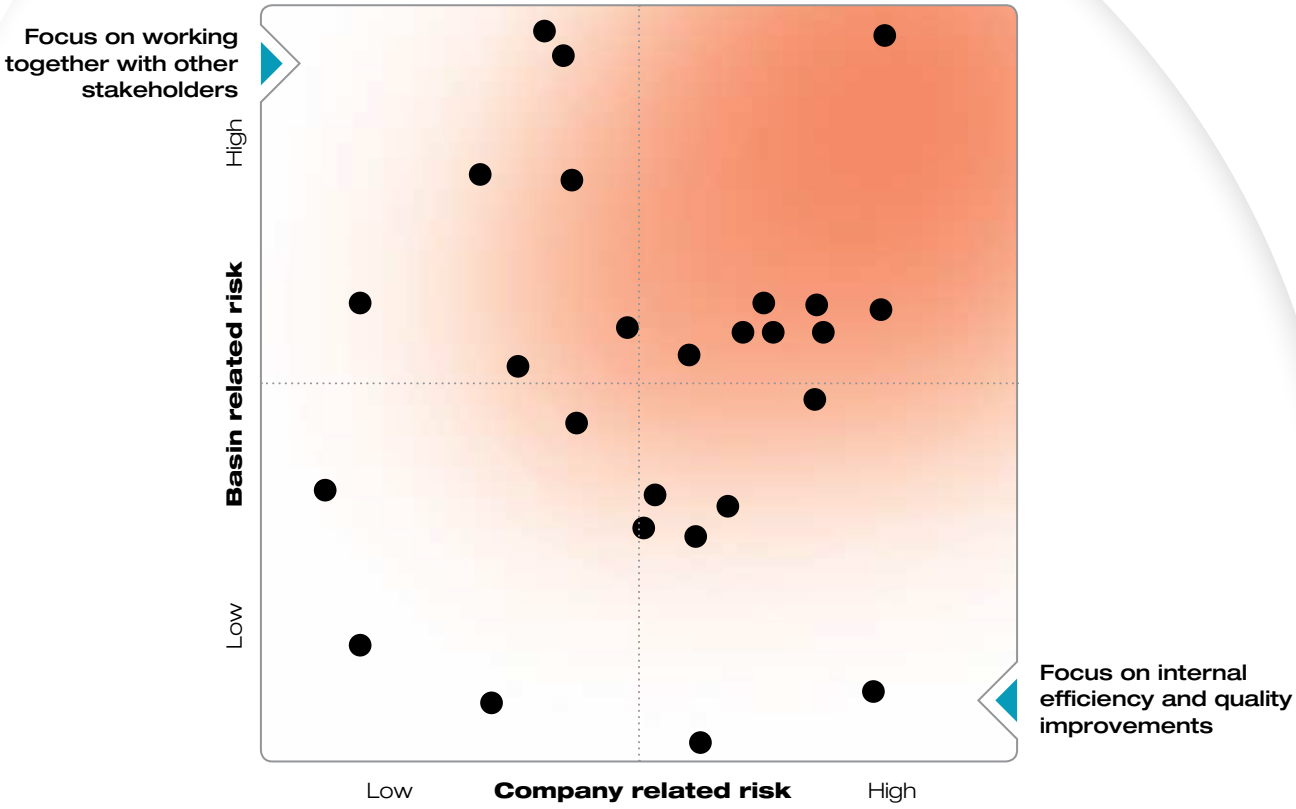
	Physical Risk	Regulatory Risk	Reputation Risk
Basin related risk: Linked to the location of the company	Water quantity (scarcity, flooding, droughts) and quality (pollution) within the river basin and the impacts this might have on society and the environment	Strength and enforcement of water regulations and the consequences of restrictions by public institutions. Either felt through direct regulatory action or from neglect, blockages or failure	Perceptions around water use, pollution and behaviour that may have negative impacts on the company brand and influence purchasing decisions. Public perceptions can emerge rapidly when local aquatic systems and community access to water are affected
Company related risk: Linked to the behaviour of the company	Water quantity and quality issues related to the performance of the company and its supply chain	The potential for changes in pricing, supply, rights, standards and license to operate for a particular company or sector	When the actions of the company are poorly executed, understood or communicated with local stakeholders and where perceptions and brand suffer as a consequence

Figure 1 is based on the structure of The *Water Risk Filter*, developed by WWF and DEG in 2011.[28] This tool allows companies, investors and financiers to factor in different types of risks in a given location. This reflects risks incurred through company actions as well as –other stakeholder activities.

By splitting the basin and company related risks, this risk framework results not in a single risk level per investment, but rather a high level strategic guidance for the investor (**Figure 2**). The investor is given a clear understanding of the types of issues that the company might face and any subsequent responses. Depending on the position as a minor, major or sole investor, the financial institution might request that its client take actions that help reduce risk and create a more attractive investment.

Figure 2

Conceptual framework of the Water Risk Filter



The focus of many companies is to assess and mitigate risks directly influenced by the company itself, which is reflected in the horizontal axis of the framework.[29] When company-related risks are high, the chief focus will be on water efficiency and quality improvements. This approach however may be insufficient to drive down risk as reflected in the importance given in the *Water Risk Filter* to risks driven by external factors. In order to reach a level of sustainable water resource management, a company (or any stakeholder for that matter) will require that not only their own house to be in order, but that they are engaged in the external environment where risks are present. In this case, the focus lies in improving and supporting better basin cooperation and dialogue, to engage stakeholders and improve the general state of how the river basin is governed. Almost always, a combination of internal and external action will be required to manage risks. For investors and banks, the main task is to understand where the pressures and risks emanate to ensure that the company is responding in the most constructive - and most risk effective way.

Box I:
Local opposition to mining developments can stem from water concerns

In 2002, after several years of community opposition to a proposed gold mine by the Canadian firm Manhattan Minerals in the agricultural region of Tambogrande, Peru, 94 percent of the population voted against permitting the mine. Opposition to the project was based primarily on the mine's expected impact on water resources central to the local economy. Peru's Ministry of Mining upheld the referendum and stopped the project, preventing the company from developing an ore body with a projected value of $1.33 billion. Similarly, Nevada-based Meridian Gold had to halt development of an open-pit gold mine upstream from the tourist town of Esquel, Argentina in 2006, when less than 20 percent of the town supported the project in a referendum. In response, the government passed a law imposing a three-year moratorium on mining activity in the region.

Source: Barton, B., 2010. Murky Waters - Corporate Reporting on Water Risk. Ceres: Boston

In regions where water is becoming scarce, regulation is likely to make it more onerous for access to mining operations and the public will become more aware and apprehensive about a business's relationship to water.[30] This is particularly true where local communities do not have access to sufficient amounts of freshwater to fulfill their basic needs, or where the values they apportion to water are being eroded by poor water quality. Government's management mandate in these instances is to ensure that water is being managed in the 'public interest'. These interlinking questions should be a concern to financial institutions. An operation that is actually or allegedly polluting a water source may receive high penalties from a local regulator in addition to compensation payments to communities.[31] The resulting reputational damage may influence valuation of the company's equities. Operations may continue, but will do so at a much higher cost affecting long term profitability and capacity for financial returns. From the perspective of financial institutions, key questions that arise in examining these risks include:

- Is there sufficient water available to sustain a client's operations?
- Are there any potential water-related issues and risks that are important to understand in this river basin?
- What is the institutional capacity and regulatory regime in the country area of operations?
- Does the client / company have a track record of good performance and engagement?
- Is the client adhering to the highest environmental standards of use and discharge?
- Does the client have the capacity and is it applying to accurately forecast the relevant water dynamics and manage use when projects are operational?
- Does the client / company have policies and management systems in place to manage any water related risks?
- Does the client or company disclose its risk exposure to water through annual reports, SEC filings (in the case a client/company is based in the US) or sustainability report?

The above points reflect a balance of dependency, impact and behavior considerations. All will need to be considered in any assessment of a client, with the recognition that the local situation will determine which of these are more material than the other.

The complexity of water risks makes it difficult for financial institutions to hardwire it deep into credit risk analysis and investment decision making.[32] Still, there is scope to believe that companies that demonstrate proactive management of water risk and engagement with other stakeholders could be regarded as attributing a lower risk which could hence be reflected in terms of loan or investment contract. This view is consistent with positions from a number of investors who state that while water footprints and risk assessments are useful and informative, they are more concerned with how a company is reacting to these footprints and risks.[33] It is critical that investors understand water challenges differently from other environmental issues such as carbon. The management of water risk requires a more nuanced approach such that the willingness and ability of companies to engage external and internal risk factors is seen as the most useful indicator to evaluate instead of the absolute amount of water use.

3.2 Water impacts and dependencies by extractive industries can turn into risks

Extractive industries experience water risk differently from many other industries. Mining operations cannot be relocated, making the sector particularly susceptible to changing local water availability and pressure from local communities to reduce water use and water quality impacts. Since they often do not have the luxury to site and mine in areas of low water risk exposure, this means that extraction, treatment, and sometimes processing is done in areas under high levels of water constraint. Since the location is fixed, these operations receive water from an individual catchment or transfer scheme thus create significant opportunities for risk to emerge.[34] The oil and gas sector faces a variety of water-related risks. Leaks, spills, and the disposal of produce water pose contamination risks, while extraction, upgrading, and refining can require large quantities of water, thus exposing companies to water supply risks.

With spatially bound operations, examples of re-directed rivers and special water supply channels for mines in water scarce areas have shown that water is very expensive to move.[35] The extractive industry is a large contributor to local economies through direct job creation, wealth creation, and positive economic externalities for other local industries.[36] Yet despite the positive economic benefits the extractive industry creates, operations have often come at high environmental and social costs.[37] Using the framework presented above, the typical risks related to the extractive industries are described in **Table 1**.

Table 1:

Framework for Water Risks in the Extractive Industries

Dimensions of Water Risk in Extractive Industries			
	Physical Risks	**Regulatory Risks**	**Reputational Risks**
Basin specific risk	• Availability of freshwater limited as a result of other user requirements such as demographics, shifting economic activities or environment policy • Other basin users might pollute water resource • Climate change might alter hydrology of basin and user needs	• Institutional weakness or failure can affect quantity or quality • International basins at risk if other riparian state(s)have poor regulations • Local companies favored over multi-nationals for licensing and fees • Demographic and environment policies which affect supply	• Poor performance and diligence on social and environmental concerns may lead to justified outrage • Large (mining) companies are also easy scapegoats for basin wide water risk issues around quality and quantity even if they are not the primary contributing party • End users may chose not to purchase product from a particular basin if there is high risk
Company specific risk	• High reliance on freshwater with high water quality impacts • Mines geographically fixed so continual adverse conditions cannot be solved by relocating • Disruptions of operations due to extreme weather events • Constant assurance of supply requires external and higher risk engagements	• Increasing competition with other users might lead to water rights curtailment or revocation • Increasing cost for rights, storage, waste treatment, and discharge • Government may reject licenses based on stakeholder concern • Inconsistent and unstable regulatory regime	• Concerns of stakeholders around quality and quantity from company operations can cause distribution to operations or increase cost of doing business • Depletion of resource may create negative perceptions elsewhere in the basin • Higher profile within the basin creates easy targeting

Water plays a vital role in the mining extraction process and most large scale mines require water to perform a variety of functions, including cooling and lubricating heavy drilling equipment, transporting and processing ore, managing waste tailings, and suppressing dust. Impacts are experienced through soil erosion, sinkhole formation, high biodiversity loss and the contamination of soils.[38] This high use of water can strain freshwater resources for other uses such as agricultural, other industry, and urban supply as well as ecosystems.[39]

Ore mining and processing both have the ability to contaminate surface and groundwater. Many mining operations extract ore from below the water table, requiring them to manage flows in mines by extensive groundwater pumping, which can affect local hydrology and ecosystems.[40] Acid runoff and decant affects water quality directly by reducing pH levels and increasing concentrations of toxic metals or heavy metals like copper, lead and mercury. In addition, spills of coal sludge or cyanide can severely affect freshwater resources.[41] Closed mines can also pose significant long-term environmental liabilities, as they must be pumped and treated for a very long time to prevent contamination of shared surface and ground water.[42] Contamination of water may occur as follows:

- Waste rock that is determined unfit for mining may contain heavy metals compounds which, if left exposed creates, drainage problems.
- Abandoned mines may create water quality problems as acid drainage may continue long after mine closure in particular if appropriate environmental closure processes were not followed.
- Open pit walls may cause drainage problems if not properly managed through the mining process.
- Tailings impoundments are large areas that contain the remaining material after the mining process and can cause pollution through leaching if not properly managed. Extreme weather events may also disrupt impoundments releasing toxins into the air and local watersheds.[43]
- Dewatering process leads to often unaccounted for changes in hydrology and water supply in what are often operating environments where agrarian livelihoods are prominent.

The concerns are well known in the environmental community and often legislated in highly regulated developed countries. However there are often significant challenges for water quality in countries with weaker legislation, or inadequate enforcement of legislation. Even under high regulation, water quality problems may not be identified or predicted fully in environmental impact assessments and cumulative impacts may be missed. If not properly accounted for, these can result in social and political backlash with substantial financial consequences.[44]

Beyond pollution, water scarcity is a main concern for many mining companies. Water scarcity is often the result of a combination of physical (naturally dry conditions) and governance factors (poor regulation and management).The lack of sufficient amounts of freshwater needed for operations has been the main cause for the closure of a number of large mines, for example in Chile and South Africa.[45] The balance between the dependence on the resource and the impacts of the resource use are dependent on the local situation.

3.3 Water risks in mining for precious metals, coal, base metals and oil-sands

The impact of the extractive activities on water varies between the different subsectors. The sub-sector focus provides an opportunity to draw out a more detailed perspective for selected regions and explore various solutions (**Table 2**). The subsectors selected for this report are as follows:

- **Coal:** one of the largest mining subsectors, which has particular quality and quantity impacts on water as well as a high dependency.
- **Base metals (copper and iron ore):** also one of the largest mining subsectors which occurs in different regions around the globe with varying impacts on water resources
- **Precious metals:** less water intensive than other subsectors but high value specialty metals such as chrome and platinum also have implications for beneficiation.
- **Oil sands:** rapidly growing subsector currently characterized by water intensive extraction process and water quality impacts that are not clearly understood, as well as other environmental impacts such as carbon emissions and landscape modification.

Table 2

Water Risks in the Extractive Industries Subsectors[46]

	Mining methods	Water use	Water risks		
			Physical / Operational	Regulatory	Reputation
Coal	• Open pit mining • Underground mining	• Dewatering for operations and water used for dust suppression, washing, and slurry transport. Volumes vary by coal type and region	• Acid mine drainage • Acid rain • Large water usage in scare areas	• Heavy regulation and financial consequences for clean up • Impairment of future licenses	• Social action from affected communities
Oil sands	• Surface mining of relatively shallow deposits (less than 250ft) • In-situ production for exploitation of deeper deposits	• Used primarily during extraction phase separating bitumen from sands. On average, 12 to 14 barrels of water are required to produce one barrel of oil. 80 -95% of water is recycled so approximately 2.5 barrels of fresh "new water" is used[47]	• Over extraction during low flows • Water quality impacts not clearly understood • Access to fresh water • Tailings embankment failures	• Regulations for water taking based partially on first-in-time basis • Water regulation for this type of mining is immature, but this might change	• International and domestic pressure from perceptions of water pollution • Local pressure from competing users of water
Base metals	• Underground mining • Open pit mining	• Dewatering for operations and water used for dust suppression, processing to increase quality of ore, and transport via slurry pipelines	• Acid mine drainage • Dissolved heavy metals • Surface runoff problems through erosion and carryover of tailings and mining residues. • Large water withdrawal in scarce areas • Submarine and riverine tailings disposal	• Heavy regulation and financial consequences related to pollution and for clean up after closure	• Significant social unrest due to large water consumption and pollution
Precious metals	• Underground mining • Open pit mining • Typically smaller mines than base metals and coal mines	• Dewatering for operations and water used for hot and cold water pressure washing • Separation medium	• Very high tailing to ore ratio • Gold/Silver cyanide/mercury pollution • Acid mine drainage • Tailings embankment failures • Large water withdrawal in scarce areas • Submarine and riverine tailings disposal	• Often in regions with limited regulation or enforcement • Closure and remediation considerations related to acid mine drainage	• Under special attention of human rights watchers • Proximity to indigenous peoples and communities with agrarian livelihoods creates special concerns

Regulatory risks for oil and gas, metals and minerals change by region and between mineral types. Regulations for coal, base metals and precious metals have been established over the past 50 years. For the most part there is a clear understanding of the environmental risks from these mineral processes as many take years to materialize and are then validated through research. Therefore regulatory regimes are relatively stable or at a minimum predictable regarding costs and penalties.[48]

This global regulatory history is unavailable in the context of oil sands and other new oil and gas extraction technologies such as hydraulic fracturing (fracking). Even regulatory regimes in the institutionally strong countries such as Canada have not come to terms with the environmental and social impact and costs of these operations.[49] However over time, as environmental and social impacts become apparent and are scientifically validated, the regulatory regime will adjust according to social, political, and economic pressures. **Table 3** provides a snapshot of recent legislation passed in countries to ban or limit hydraulic fracturing.

Table 3:

Examples of countries that have banned or placed moratoria on hydraulic fracturing

Country	Legislation on hydraulic fracturing
France	The French government banned hydraulic fracturing in 2011, largely due to concerns about its impacts on water quality. The law not only blocks future development but also revokes existing permits, effectively stranding significant investments by a number of companies. This includes Europe's third largest oil company Total SA, whose Montelimar permit was canceled.[50]
USA	Hydraulic fracturing is banned in Vermont and North Carolina and under moratoria in New Jersey, Maryland, and New York (although there may be regional allowances).[51]
South Africa	International bans and moratoria are in place in South Africa, the Canadian province of Quebec and Bulgaria.[51]
Canada	
Bulgaria	

The assumptions about profitability for the sector might then change and financial institutions should be prepared to address these trends by remaining abreast of the changing regulatory thinking and structure.

Beyond new technologies, regulatory regimes will have to adjust to the impacts of climate change, which are predicted to impact availability of freshwater resources and the concentration of hazardous materials.[52] These effects of climate change will likewise affect the profitability of extractive industry projects and therefore should also be closely monitored.

3.4 Water risks for banks and investors in relation to extractive industries

Many financial institutions are carefully scrutinizing new mineral investments in water scarce areas in South Africa and Australia. Water risk has the potential to stall future investments in extractive industries, yet financial institutions often struggle to ask information on all relevant aspects of water risk, and to translate the raw data into risk levels.[53]

As a result of increasing water constraints in a number of countries and regions around the globe, financial institutions have started to actively demand disclosure of the use of water and its management from both listed and non-listed companies.[54] Ceres, a US investor network, assessed corporate disclosures of water-related risks in SEC Filings. The US Securities and Exchange Commission (SEC) has required companies to disclosure financially material risks from climate change to their investors. These risks include "significant physical effects of climate change, such as effects on the severity of weather (for example, floods or hurricanes), sea levels, the arability of farmland, and water availability and quality. All 12 mining companies (100%)

researched disclosed to the SEC about physical and regulatory water-related risks they face, followed by litigation (67%) and reputation (42%).[55] Generally, corporate disclosure of water risk information to external audiences such as investors is inconsistent and incomplete. This is largely due to the complexity of the water topic and the local nature of risk and response.[56] This is also a fast area of debate and action of new and improving initiatives such as the CDP Water Initiative and the CEO Water Mandate.[57]

Based on six interviews with UNEP FI members, most acknowledge that their current water risk assessments are not sufficient and need improvement, and that they are looking for innovations on this in the market.[58] In discussions with financial institutions, varying perspectives on water risks in relation to clients in extractive industries emerged.

(1) **Asset management.** At present, very few FIs seek to monitor and mitigate water risk across their equity and bond portfolios in a systematic way and on a regular basis. Water risks only become material in the case that one investment continually experiences water-related disruptions. The important focus is to broadly understand risk factors, response strategies, and proactive corporate action such that investments may be more effectively managed. In the case of green funds, reputational risk is also regarded as being a very important risk factor.

(2) **Corporate finance.** In this broad asset class reputational and market oriented risks are regarded as important factors. Corporate finance will have the most impact by ensuring that progressive water management policies are developed and adopted by a company.

(3) **Project finance.** FIs indicated that they undertake detailed analysis of the basin and its risk factors for projects that have an impact on water resources. The important focus is to understand the inherent risks of a project and the individual sets of response strategies that should occur to mitigate risks.

Interviews were carried out with IDC, Nedbank, Robeco, Citi, Royal Bank of Canada, and Calvert. The following answers illustrate some key insights and differences between the respondents. See Appendix I for full list of questions used as a framework for the interviews.

What is the importance of water risks in due diligence and portfolio phases?

- Most FIs that were interviewed are aware of water challenges and risks, yet often have difficulties to properly assess water risks due to the complexity of water issues. For others, water was not an issue on the top of their minds. There is overall a growing awareness that water risks can pose significant threats to the economic viability of investments. Some are actively supporting the development of tools which will enable them to assess and quantify water risks.
- Most banks consider high-level water aspects (water withdrawals and discharge water quality) in their environmental and social risk analysis. Most investors do not weigh water factors in their valuations. Robeco – a Dutch asset manager part of Rabobank Group – is an exception (see Box II).
- Some FIs perform regular (annual) assessments of the environmental and social risks within their investment portfolio, in which water aspects are taken into account.

Are water aspects embedded in investment policies?

- None of the interviewed FIs had water specific investment policies. Most incorporated water aspects in their environmental and social policies. A few have incorporated water aspects in specific mining investment policies and any prospect investment must be compliant to these policies. However the level of concreteness seems to vary significantly. Most would welcome the development of standard water-related elements that they can include in their policies.

What is the influence of water on credit risk and return on investment?

- All had experienced (potential) investments that had stalled, or whereby their bank had divested based on water-related issues or risks. Examples mentioned to stall (investigation into) investments included

the lack of planning for sustainable water management and an unreliable future water supply. Examples of reasons mentioned to divest investments included severe water scarcity and therefore water supply constraints and withdrawal of water licenses due to non-compliant practices.

Do FIs engage in global processes related to water risk?

- Many of the interviewees are signatories to the Equator Principles and some participate in UNEP FI's Water and Finance work-stream, the CEO Water Mandate and reply to the questionnaire from the Carbon Disclosure Project. Few are actively involved in the development of the Ceres Water Gauge or the WWF-DEG Water Risk Filter.

Box II:
Robeco's approach to assess water risks of clients

Water is included as part of the overall environmental assessment and incorporated into the valuation of the company (accounted for in discounted cash flow calculations). Robeco (which owns Sustainable Asset Management (SAM) which provides the intelligences to the SAM Dow Jones Sustainability Index. SAM performs all the environmental assessments based on a large (approximately 1000) set of indicators/questions that the company has to answer deemed to be material for their sector or sub-sector. About 10-15 of these questions are water-related. SAM provides the results of the quantitative analysis in the form of scores to Robeco's analysts and portfolio managers as an initial screening. Robeco's analysts combine this information with their own research and an assessment from EIRIS which provides an additional qualitative assessment on environmental performance. A final decision is made based on these analyses. This is one means of assessing water related risks in a portfolio. The types of methodologies that are applied depend on the type of asset class.

3.5 Corporate responses to water risks in the extractive industries

Response strategies vary from mining company to company, with some adopting aggressive approaches to managing water risk, while others have either failed to acknowledge their impacts or seriously addressed issues that have impeded operations. From the perspective of a financial institution, it is often difficult to determine what responses are important from their clients or to understand what constitutes 'best in class' water responses and policies.

Internal Actions: In their own operations, many companies have embarked on water efficiency programs, which are primarily driven from locations of water scarcity or extreme hydrological variability. These programs and the applicable technologies are often adopted into operations globally, such that each facility achieves a corporate-prescribed level of water efficiency. However in some cases there is the realization that they cannot manage the full extent of water risks simply by increasing the efficiency of operations. In areas of water scarcity, the behavior of local stakeholders may greatly impact the ability to receive freshwater of the required quantity and quality. In these instances the companies have actively partnered with local institutions and stakeholders to ensure a long-term water supply. For instance, Anglo-American's platinum operation created a long-term partnership with the municipality in Rustenberg South Africa, which includes funding infrastructure and institutional training in exchange for a secure water supply contract over the course of the life of the project.[59] Similarly, De Beers in South Africa have partnered with WWF-SA to work with local stakeholders in Limpopo to address shared risks of increasing water demand and climate change.

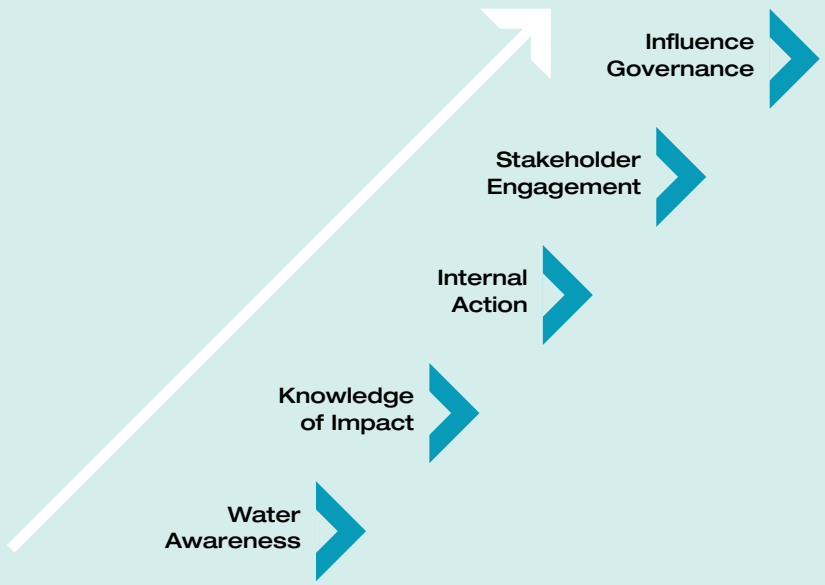
External Actions: Over the course of the last several decades international, regional, and local NGOs with a focus on environmental and social concerns have contested the extractive industry on a number of fronts. By creating networks between local concerns and international resources, extractive industries have been held to a higher account of its practices, especially where water is of primary importance to local ecosystems and communities. In turn many financial institutions have begun to demand better behavior from companies and developed industry-wide standards on environmental concerns such as the Equator Principles. Many are engaged and collaborating with local, regional, and international organizations to address water concerns, which are gradually being reflected in corporate policy.

The confluence of internal and external pressure has prompted proactive external engagement often referred to as 'water stewardship' (see box III). These policies are not the norm in the industry but have been explored by companies such as Rio Tinto, Anglo-American, and Suncor. There is still a great deal of work to be done to better operationalise good water stewardship across the extractive industry, and even in those companies that have adopted water policies and actions. There are international initiatives which are lead by multi-stakeholder forums such as the CEO Water Mandate under the UN Global Compact and the Alliance for Water Stewardship (AWS) among others. These initiatives seek to set guidelines for corporate engagement with external stakeholders on water, create usable metrics and standards to address water risk, and create platforms for partnerships to address local water issues.[60]

Box III:
Understand water risks through water stewardship

The process of understanding water risk and addressing it through a progressive set of steps is commonly referred to as water stewardship. The water stewardship 'journey' refers to a framework in which corporations can minimize their impact on the water environment, engage and collaborate with other users to reduce impacts, and help strengthen the way in which river basin resources are managed. It is across this range of iterative steps that companies can build strategies that encompass both internal and external actions and seek to build a more directed and less *ad hoc* approach to long-term water risk.

Schematic overview of water stewardship



Source: WWF International

A key component of water stewardship is the engagement with local stakeholders - in particular, local public institutions. For the mining industry, this institutional engagement will be the primary focus of stewardship practices. While mining companies can usually source the water necessary for operations and ideally be able to comply with discharge standards, a failure to address these in socially and environmentally sensitive ways are as problematic as operating where weak or ineffective water management institutions pose significant problems. This lack of adequate oversight or mismanagement of the river basin can amplify the water risk that a company faces with many response strategies requiring active engagement and even financial or capacity support to institutions to assist in addressing local management failures (Pegram et al, 2009). As such, the FI's attention to their clients' responses should be guided by a stewardship approach and not just one of efficiency and compliance.

4

COUNTRY CASE STUDIES

These country case studies go deeper into the challenges that extractive industries face in South Africa, Australia, Canada, Brazil, and China, and what this means for the financial sector. Given that water is often a local or regional issue, it is important to realize that water risks are influenced by both the hydrology of the country or region in question, and the institutional capacity to cope with these challenges:

(1) **Hydrology.** The countries selected have distinctive hydrological regimes. South Africa and Australia are generally water scarce, while Brazil and Canada have an abundance of fresh water resources at national scale. In China and Canada, the hydrological regimes vary quite dramatically by region. This distinction is critical as water risks change depending on their inter-seasonal and intra-seasonal regimes. Furthermore these countries and regions have variable climate features, which impact water risks.

(2) **Institutional capacity.** Countries also have varying levels of institutional capacity. South Africa, Brazil, and China have moderate institutional capacity to address environmental risks, while Canada and Australia have a higher capacity to cope with water risks.

The differences in hydrology and institutional capacity significantly impact the degree to which water risks occur and are addressed in these countries. It is important to note that it is more likely that the larger financial risks for regulation will arise from those less regulated markets. The reason is that governments in these countries where there is weak or little regulation will take more retrospective action when serious problems occur, which tends to involve heavy costs. As countries experience greater water risks and their institutional capacity increases, there is a greater likelihood of significant regulatory change. In the OECD countries, the risk of greater change is less likely although regulatory compliance may be more costly at present. This distinction presents different risk profiles for equity related investments which have a shorter term view and for debt related investments which are more concerned with longer time horizons. These nuances are explored in the following country sections.

The 3rd issue of the Chief Liquidity Series (CLS 3) portrays water risk in terms of "blue water scarcity" (see below for a description of key terms). These are portrayed for each of the five focus countries in terms of:

1) *Average annual* blue water scarcity
2) *Maximum monthly* blue water scarcity

Furthermore, case studies are used to explain how water is material to mining companies.

5

SOUTH AFRICA

Sub-sector focus: coal and precious metals

5.1 Overview

South Africa has a long history with the extractive sector in coal, precious metals, and base metals. Mining has played a central role in the development and growth of the South African economy in particular the areas around Johannesburg. The mining industry impacts water resources in different ways in different locations throughout the country.

South Africa is a relatively water scarce country. The areas where current mining operations exist and future ones are planned are situated in the most water arid regions of the country such as the northeast and in the relatively high water yield areas of the grasslands. The arid areas are forecasted to receive less precipitation in general climate models. Therefore in these areas mining faces water scarcity but also social challenges from communities that are historically disadvantaged (including disadvantages in their access to water). To compound these problems, South African mines often experience inadequate service provision and compliance regulation from institutionally weak local authorities. Therefore, both current and future planned mining operations must aggressively plan water strategies to maintain their operations.[61]

South African mining operations are impacted by water and use water in a number of ways. These impacts and uses can broadly be structured into four categories:

- **De-watering.** Inflows of ground water have to be pumped out (de-watering) in order to maintain safety in the workings. In South Africa, some gold mines are situated in an area where the ore body is overlain by water bearing dolomitic strata. Mines can be required to pump some 70 Ml of groundwater per day to surface. This water is generally collected, treated, re-used or disposed. De-watering operations can have water pollution impacts and severe pollution has occurred where water has not been dewatered effectively before it comes into contact with sulfide-bearing host rocks.
- **Abandoned mines.** Mine companies rarely make adequate financial provision to continue dewatering after mining has ceased. South Africa has nearly 6000 abandoned mines, many of which result in uncontrolled Acid Mine Drainage (AMD). Currently the government (the South African tax payer) is footing the bill for treating AMD in the Witwatersrand basin where gold mines have closed down and have not made provision to treat groundwater flowing into old mine shafts. The water level is rising and in some areas of the Eastern Basin, is discharging into springs and rivers.[62]
- **Water for processing.** Most mines undertake extensive treatment and recycling of water in order to use it for dust allaying, cooling and metallurgical processes. De-watering provides some water for these activities and mines purchase any surplus they require from local water service providers.
- **Water for domestic needs.** Mines often require potable water in order to supply employee settlements situated near the mine for drinking, cooking, ablution and sanitation. It is estimated that 30% of the water purchased from Rand Water by mines in South Africa is distributed for such domestic applications. In some remote areas where the mine forms the apex of the settlement, the mine operations include water services provision.

South Africa has decreasing water resources and some areas are fully allocated and already experience water stress. This situation places pressure on water users and the challenge is further compounded by a need to redistribute or reallocate water resources toward those who were previously disadvantaged. Although South Africa has recently undertaken reforms in water administration, there are often bureaucratic and regulatory inefficiencies, which can impact upon mining operations. South Africa therefore presents

an interesting cross-section of water risk profiles for extractive industries.[63] This briefing focuses on two important sub-sectors in South Africa:

(1) **Coal.** South Africa has the fifth largest coal deposits in the world. In 2006 coal accounted for 93% of the electricity generated in South Africa, followed by nuclear (4.6%) and hydropower (2.2%). By 2030, the Revised Balanced Scenario proposes that South Africa's generation mix should be as follows: 48 % coal, 14 % nuclear, 16 % renewable energy and 9 % peaking open cycle gas turbine.[64] This is less of a reallocation as it is a scale up of energy requirements to meet the needs of industrial expansion. This reflects that coal will continue to play a leading role in South African power generation and its economic development.

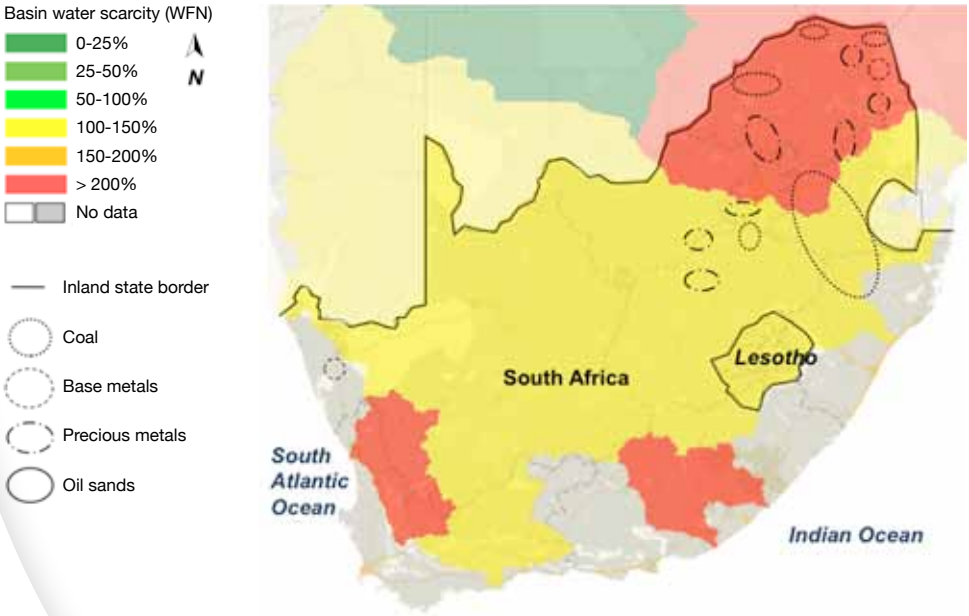
South Africa also exports a large volume of coal to other countries. Coal rents, the difference between the value of both hard and soft coal production at world prices and their total costs of production,[65] as a percentage of GDP were 5.07(%) in 2010. Its highest value over the past 40 years was 9.10% in 2008. The coal industry is located primarily in the Mpumalanga and Limpopo provinces in the north of the country.

(2) **Precious Metals.** The precious metals industries in South Africa consist mainly of platinum and gold. South Africa is the number one supplier of platinum and one of the top five producers of gold globally. In 2009, according to the Chamber of Mines of South Africa, the mining industry as a whole contributed 8.8% directly, and another 10% indirectly to the country's GDP.[66] These industries therefore are of great economic and geo-political importance to the country. Like coal, the precious metals deposits are located in semi-arid regions primarily in the Northwest and Limpopo provinces.

Geographical distribution of coal and precious metals mining in South Africa in the context of water scarcity.

Figure 3:

Average annual blue water scarcity for South Africa

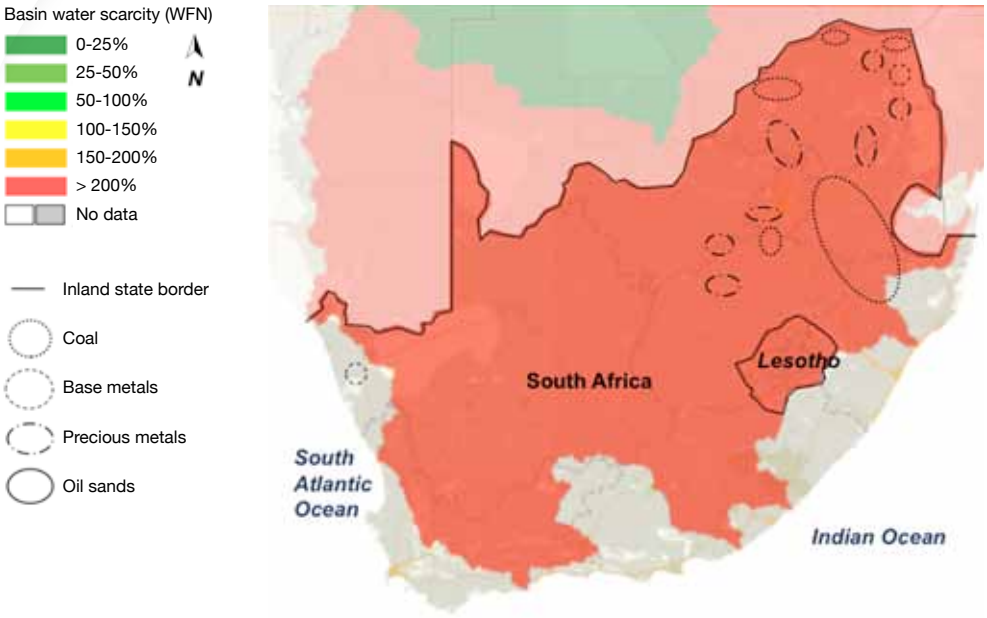


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint "how much water is consumed" (rather than withdrawal) to blue water availability, where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water. 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

Figure 4:

Maximum monthly blue water scarcity for South Africa



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

5.2 Case Study 1: Increased water charges due to water scarcity

South African platinum mines in the Olifants face long term risks associated with escalations in water charges. Charges for additional water supply in the Olifants River system will be ten times their current value by 2020, due to water scarcity in the region. This is a significant cost factor for new mining operations. Furthermore, due to negative stakeholder perceptions about mining impacts on water, there have been instances where water supplies were allocated to agriculture rather than mining despite economic benefits associated with the reverse.

The Olifants River System in South Africa supplies both mining operations and agriculture. The Eastern limb of the system is platinum rich and a number of new platinum mines have recently been established, or are currently under construction, in the area. These developments will further burden the existing water resources in the area and, as such, water users in this region are facing short term water supply shortages and longer term risks of high water costs. At present, water demand exceeds the 98% level of assurance for supply (which is what indicates a higher risk of short term shortages.) In the long term, the Department of Water Affairs reconciliation scenario indicates that long term supply augmentation options are extremely expensive and the costs of new sources of water will be R19/m^3 by 2020 (USD2.50/m^3) which is almost ten times more than the cost of current sources.

The need for significant long term water supply augmentation is in large part due to the phasing in of ecological water requirements, which will assist in supplying the Kruger National Park, but the ecological

water requirements have put additional strain on an already challenging situation. Opportunities exist to manage demand through industrial and agricultural efficiency measures. Nationally the Department of Water Affairs has launched a campaign called *War on Leaks* (WAR) to strengthen water demand management and reduce losses due to leaks from aging infrastructure in urban supply systems. In some areas, miners are collaborating with this process to ensure water availability for their operations.

Water scarcity in the Olifants can lead to two types of risks for miners that banks, investors and other financial institutions should pay attention to:

- **Financial risk:** New operations will face water charges that are ten times higher than what is currently paid. This represents a significant cost for new investments in the Olifants.
- **Reputation risk:** Water scarcity and competing water usage in the Olifants have led to negative stakeholder perceptions around water for mining. It has impacted decisions around water allocation in the region.

5.3 Case Study 2: Acid Mine Drainage

Acid mine drainage (AMD) poses a severe risk to communities as well as ecological systems and the magnitude of the task to overcome AMD increases exponentially as the implementation of intervention measures are delayed. The South African Government is responding by formulating a strategy for pollution charges. They are also considering an environmental levy on operating mines to cover the costs of treating AMD of mines that have been closed.

The gold mining sector and the growing platinum and coal mining sectors in South Africa pose a severe strain on the environment in the form of AMD.[67] When mining activities cease and there is no longer de-watering, a hydrological recovery process begins where water in the underground mine rises to its previous levels and comes into contact with sulfide minerals, making the water highly acidic. This water then reacts with other minerals, which in turn produce other pollutants in the water such as aluminum, lead, zinc, uranium and radium. AMD refers to the phenomenon whereby this underground, highly polluted, acidic water flows outwards onto the surface from abandoned mines. AMD is responsible for costly environmental and socio-economic impacts. For example, as the underground polluted water rises to the surface, it decants into springs and rivers and becomes a part of the drinking water that is utilized by both the urban as well as agrarian population. The intake of this water is highly hazardous to human health as a result of the presence of a mix of toxic metals including aluminum and uranium in the water and neutralisation and sometimes reverse osmosis of the water is necessary to make it potable or suitable for other economic uses (AMD cannot, for example, even be used to grow food crops).[68] AMD not only poses a hazard to South Africa's water supplies, but also to its major industrial centers. As water levels recover in previously dewatered areas there is an increased risk of sink-hole formation.

Despite significant progress being made in South Africa in shifting policy frameworks to address mine closure and mine water management, implementation of the current legislative framework does not adequately address the risks posed by AMD. However, the issue is gaining media attention and the social impacts, especially those on urban populations, are becoming too great to ignore. Government can therefore be expected to take retrospective action. The entire mining sector and its position in the public and private sectors is under review by the ANC (in particular the SIMS report - State Intervention in the Mining Sector) and new policies are expected to emerge at the end of 2012 from the ANCs policy conference at Mangaung.

The magnitude of the task to overcome the threat of AMD is a costly exercise and the costs associated increase exponentially as the implementation of intervention measures is delayed. The Department of Water Affairs is currently formulating a pollution charges strategy aimed at more fully recovering the cost of water treatment to miners and other polluters. However, since AMD is largely the result of water rising in abandoned mines where de-watering has ceased, the Department has also tabled an environmental levy

which will be placed on operating mines and is designed to partly cover the costs of dealing with AMD and the legacies of past mining.

AMD poses four types of risks to South African mining operations and should therefore be noticed by banks and investors that finance operations where AMD can become a liability:

- **Physical risk:** AMD impacts on water scarcity in a region as it reduces the availability of usable water.
- **Regulatory risk:** Compliance is made more difficult by the current time lags in various environmental, water and prospecting and mining license processes which are not harmonized. Lack of enforcement and monitoring encourages miners to take regulatory risks and proceed with insufficient legal compliance.
- **Reputation risk:** AMD is associated with mining operations and these impacts on stakeholder perceptions. As water scarcity increases the need for reallocation of water between water users (which is carried out with stakeholder engagement), miners will face greater uncertainty over their water supply allocation unless they engage with this risk.
- **Financial risk:** The long term costs of treating AMD, particularly post-closure, are not adequately accounted for on miners' balance sheets at present. Pump-and-treat management of mines post-production may be necessary for several decades as water levels and flow regimes re-establish a new equilibrium. If these costs are fully internalized, mine production costs would be significantly higher.[69]

5.4 Case Study 3: Regulatory risks related to water permits

South African mining faces regulatory risk where there is a disconnect in the timing of granting of mineral licenses and water licenses. It is not uncommon for mining operations to be halted by long lead times in water permit applications. There are also instances where operations have begun without a permit and where government has forcefully suspended illegal operations until the requisite approvals are gained.

In 2009, a parliamentary question highlighted an estimated 104 mines in South Africa were operating illegally because they did not have a required water license.[70] This situation occurs because there is a lack of coordination between the two government departments which issue mining and water rights. This environment of uncertainty and regulatory inefficiency has an element of risk for mining operations in South Africa.

Although the Department of Water and Environment officials are engaging with the Department of Mines to rectify the situation, the official position of the Department is that in cases where a mine needs a water license for its activities and it has not applied for one or the information submitted in the application is incomplete, mining should be suspended.

In 2011 a state-owned coal mine in Mpumalanga and two other mining companies in the province were issued with a pre-directive to shut down operations until they were issued with their water licenses. The pre-directives were in line with the National Water Act.[71]

The mine chief executive admitted the company was operating without a water license but also added the application for an integrated water-use license was submitted to the department of water affairs in 2008. As a result of the shutdown, the majority of mine employees were retrenched and it is anticipated the mine will not reopen for six months.[72]

It is also notable that a mining license will often be revoked when mining companies fail to submit an Environmental Management Plan to the Department or do not implement the Plan as submitted. In 2011, the Department of Mineral Resources sent a Section 47 notice to Central Rand Gold, informing it of the intention of the Minister to suspend or cancel the mining operation in question''. This is because neither the social and labor plan nor the environmental management programme was fully implemented.[73] The company was ordered to cease mining operations until approval was obtained from Water Affairs and environmental authorization is issued by the Department for EIA (Environmental Impact Assessment) listed activities.

Bureaucratic inefficiency and regulatory uncertainty can lead to mining operations being undertaken by some actors without the requisite authorizations in place. This can have costly repercussions when plant shut-down is enforced by regulators.

Based on the case studies, some key considerations emerge for water risk in South Africa.

	Asset management	Corporate finance	Project finance
Water Scarcity	Loss of dividends and dip in share price where water scarcity impacts on production levels, increases the costs of water or there is reputational risk associated with AMD.	Change in risk profile as a result of delay of future investments or temporary closure of mine.	Delay or cancellation of project or premature closure.
Regulatory Risk	Failure to meet regulations as a result of permitting delay which leads to operational suspension. Profitability structure of investments change as additional regulatory costs emerge.	Change in corporate profitability profile as a result of project delay, suspension or termination.	Permitting delay, failed acquisition or additional regulatory charges lead to project cancellation or costs associated with significant rehabilitation.
Water quality risk	Lower dividends or dip in share price as a result of increased costs from AMD impacting on water quality.	Inability to have projects approved as a result of past corporate performance.	Permitting delay or failed acquisition because of poor behavior from other mines or significant clean up costs.

6

AUSTRALIA

Sub-sector focus: coal and seam gas

6.1 Overview

Extractive industries are routinely described as *"the backbone of the Australian economy"*. Mining contributes approximately 6% to Australia's GDP and mineral exports make up approximately 35% of Australia's total export value. As one of the largest global producers of global iron ore, coal, nickel, uranium, diamonds, gold, and zinc, and as an OECD country situated in Oceania, Australia faces a number of socio-political complexities around its resources. The reason for this is over 65% of Australia's runoff is in the three drainage divisions located in the sparsely populated tropical north. In contrast, most large urban cities are situated in southern regions with irrigated agriculture principally located in the Murray Darling Basins with only 6% of the national run-off. So while Australia has significant water resources, the majority of its population and agricultural activities are concentrated where water resources are most limited.[74] While water scarcity is an issue for much of Australia, because of the location of most mining operations, water is not constraining mining expansion in Australia at present.

To compound an already complex issue, Australia is also one of the most hydrologically-variable countries in the world, experiencing both extreme droughts and extreme floods. In 2010, severe floods in Queensland led to operations in 90% of coal mines either partially or wholly shut down. This resulted in lower export volumes and, in turn, pushed up the international coal price.

As can therefore be expected, access to water is an extremely political issue in Australia and the country has undertaken several iterations of water reforms in response to the rising demand for water resources. The majority of mining operations in Australia compete with agricultural and other industrial operations for access to water, although the response of mining operations has generally been to acquire water for operations when required. Although not all mining takes place in highly water scarce regions, Australia has strict environmental regulations.

Institutionally, Australia has a strong water regulatory regime. As a result of intense water scarcity, Australia has pioneered a number of water policies and standards for mining, agriculture, and other industries which have served as international benchmarks. Australia has established a number of sophisticated systems for managing water supplies and risk especially following experiences in the Murray Darling Basin. However a number of concerns continue to emerge for operators in Australia as climate variability begins to become more extreme.[75] Extractive industries therefore face a number of water-related challenges as they navigate this complex space.[76] This briefing focuses on two sub-sectors in Australia:

(1) **Coal.** Coal provides 85% of Australia's electricity production. Australia is also the largest coal exporter in the world. Approximately half of the coal mined in Australia is exported, the majority to destinations in eastern Asia, including Japan. In addition, Australia has the largest sea-borne coking coal reserves in the world. Australian coal is mined primarily in Queensland, New South Wales and Victoria where impacts of climate variability have had a significant impact on mining operations.

(2) **Seam Gas.** Coal Seam Gas (CSG) is a natural gas found in coal deposits. Coal seam gas is used in the same way as any other form of natural gas for cooking and heating as well as in industrial processes and electricity generation. With advances in technology, CSG has developed into a key transition fuel, helping to lower Australia carbon emissions as it moves toward a low carbon future. CSG now makes up a significant proportion of Australia's natural gas supply. Exploration for CSG in Queensland began in 1976 in the Bowen Basin, but the CSG industry did not really start to grow until the early 1990's and

commercial production began in Queensland as recently as 1996. In short, CSG extraction is a relatively new technology.

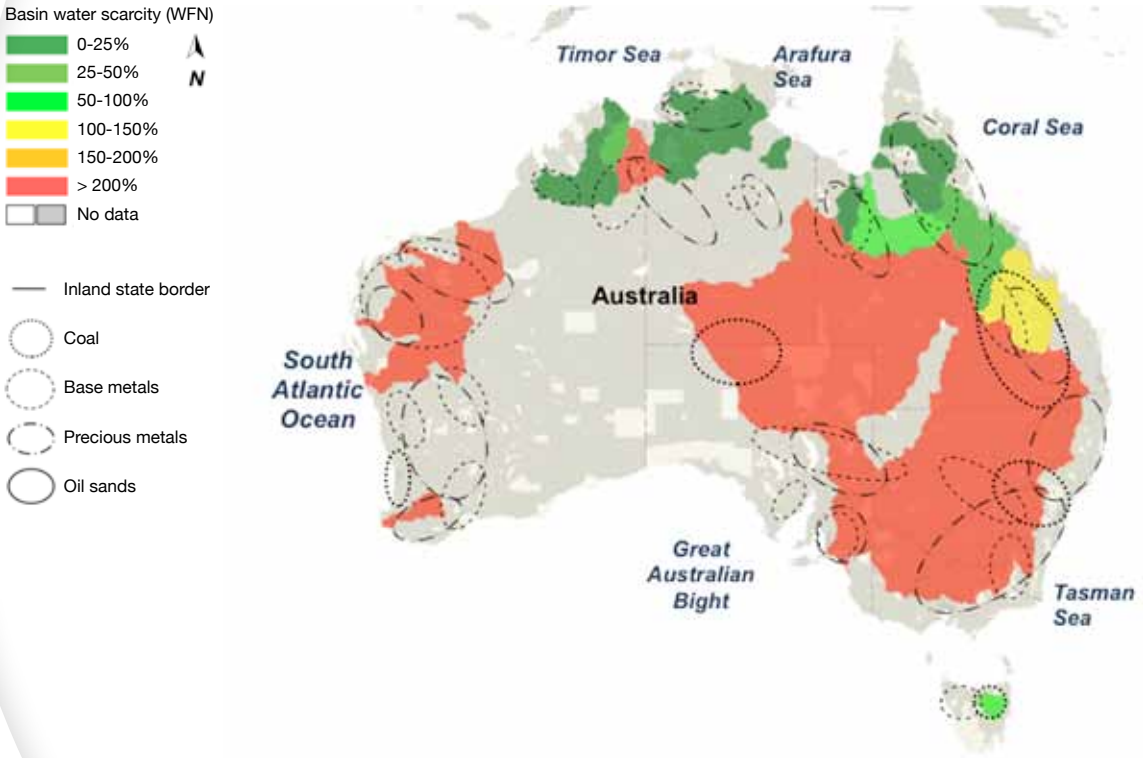
To extract CSG, a steel-encased hole is drilled into the coal seam below ground. As the pressure within the coal seam declines due to natural production or the pumping of water from the coal-bed, both gas and underground water come to the surface through tubing. Often this can be very large amount of water which can mean other users loose access to that water. The gas is sent to a compressor station and into natural gas pipelines. The water is released into streams or used for irrigation. The water typically contains dissolved solids such as sodium bicarbonate and chloride and it is necessary to treat the water before it is released. Often there is too much water and it is released on too regular a basis for it to be useful for irrigation.

Associated with CSG is the fracking method. Fracking involves pumping water, sand and chemicals to fracture the coal seams and bring their mixture of gas and saline water to the surface. Not all coal seams need fracking to make gas flow. However, it has been observed that fracking requires a water supply and, in turn, can contaminate adjacent groundwater or high-quality water can be lost from underground aquifers as it seeps into fracked coal seams.

Geographical distribution of coal mining and seam gas in Australia in the context of water scarcity.

Figure 5:

Average annual blue water scarcity for Australia

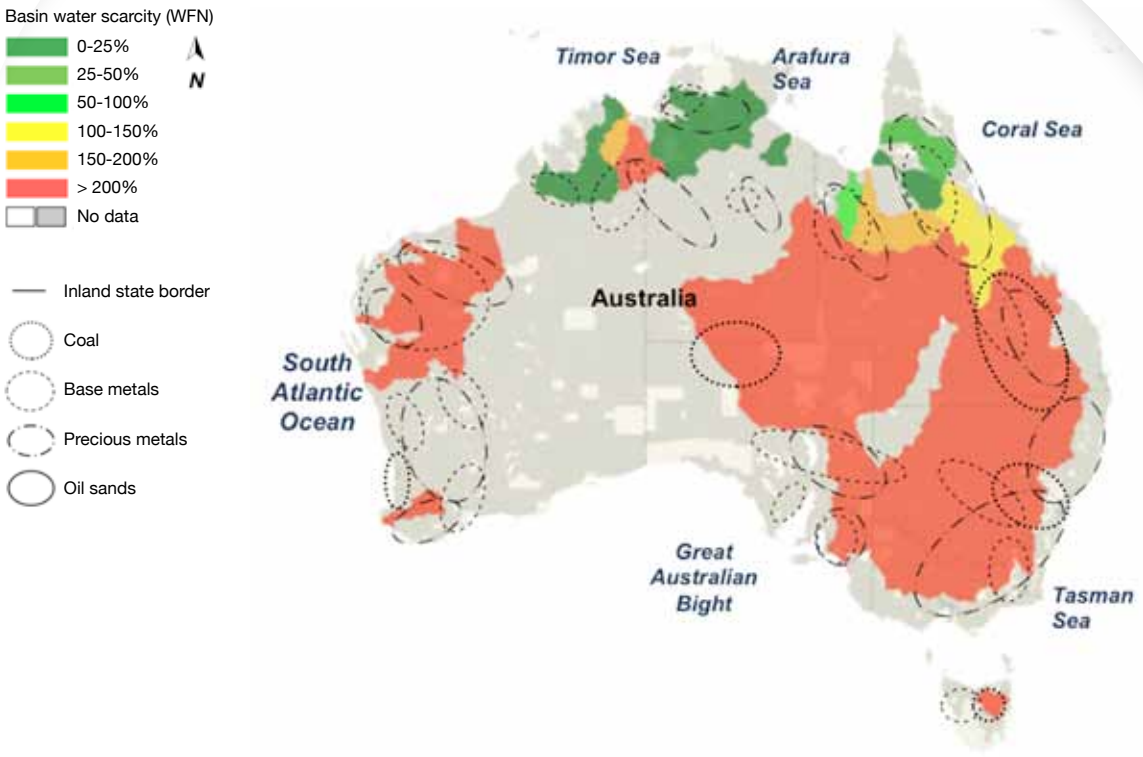


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2).

Figure 6:

Maximum monthly blue water scarcity for Australia



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

6.2 Case Study 4: Weather extremes lead to water challenges for extractives

Australia has one of the most variable hydrological systems of any country in the world. It experiences both intense drought and intense flooding. Recent climatic events in Queensland have demonstrated the need to understand what these extremes may be, in order to respond to climatic variability in the future. This translates into profound physical risks for extractive industries and others including financial institutions.

The state of Queensland has typified the Australian hydrological situation over the last 10 years – a severe drought from 2000 to 2007 has been followed most recently by successive years of flooding and record-breaking rainfall.[77] These extremes have had dramatic impacts on coal mining operations within the Bowen Basin, which is the largest source of seaborne coking coal in the world.

Over 7 years (2001-2007), the Bowen Basin experienced a multi-year drought, which saw allocations from some government-owned raw water supply infrastructure reduced. This represented physical risk exposure across several mining assets all located in the same Basin, which threatened mining production levels and highlighting the vulnerability of mining operations to climatic variability. The greatest risk to operations is due to insufficient raw water for the various activities on site, but particularly for processing coal. Mining companies have responded by gearing up to build water infrastructure in order to have more secure water supplies.

Following the 7-year drought, the 2010/2011 wet season saw huge flooding in the wider state of Queensland. The magnitude of the flooding was so great that it caused 85% of mines to be partially or fully non-operative.

Within Australia, variability in climatic conditions has not typically been considered when planning or developing a new mine. Similarly, existing mines have generally given little or no consideration to their ongoing water management strategies – the approach has historically been one of adaptation to the emerging risks of a variable climate as they arise, rather than planning for and mitigating the potential risks in advance. This has served to compound the risk associated with climate variability in Australia.

The risks experienced are therefore not merely physical. And there is risk in the limited understanding of climatic variability, its impacts on operations, and in the lack of planning to mitigate these risks. Drought presents sustained prolonged risk to operations, which could shut down production for periods ranging from a month to years. High rainfall events, on the other hand, result in short-term production losses but also more immediate, operationally focused management and compliance issues associated with discharging the water off-site and the costs of associated pollution impacts.[78]

In order to manage the potential risk to operations posed by extreme climate change, better understanding is required of the extremes of climatic variability for the existing and new operations and the mitigating triggers for action when challenged with climatic extremes. This greater understanding enables the range of options that may be available to be assessed, both within the mine site itself (in terms of onsite water management) and for external water sources and associated infrastructure.

6.3 Case Study 5: The Queensland Water Act requires offsetting water impacts

Queensland's Water Act provisions require companies to 'make good' any impacts mining operations might have on ground water resources. When there is little understanding of the potential effects of operations being undertaken – such as those involved in extracting Coal Seam Gas (CSG) - this potentially represents a 'blank cheque order' for the future.

Coal Seam Gas (CSG) extraction can have several impacts, including a lower water table, challenges associated with water disposal once it is extracted and ground water pollution through fracking. The actual impact of any CSG extraction will depend on the hydrology of the particular groundwater systems and yet these impacts are generally not well understood.

Despite this limited understanding of the impacts of CSG operations, approvals for CSG extraction in Australia are being provided.

The Australian National Water Commission's policy on CSG water allocations is they should be managed along with other water users as part of a water planning process, which ensures sustainable outcomes. The state of Queensland, however, has departed from this approach and has instigated new legislation, which requires companies to 'make good' explanation any impacts on groundwater for agricultural users or the environment.[79]

The practicality of 'making good' the loss of groundwater where levels have dropped significantly, is highly questionable. Given approvals are being provided without a full understanding of the impacts of extraction, this legislation is effectively providing for an "after the fact" cleanup order which will potentially be both extremely expensive and involve uncertainty around the costs involved. Affected users are cattle farmers who use the ground water to water their cattle or crops. Also, there are also ground water springs, which have high environmental value.

The cost associated with open-ended requirements such as the 'make good' provisions of the Queensland Water Act could be very significant to address. Financial institutions considering CSG projects should be fully informed of the potential costs of addressing legislative requirements and incidents in the future.

These liabilities will not only extend over the life of the projects (in the order of 30 years) but potentially decades further as the full impacts on groundwater are realized.

There is high uncertainty involved when proper impact assessment and management conditioning is deferred to post-approval management plans. This will mean many environmental requirements will only be fully specified once financing has already been approved and construction is underway.

It is advisable for a preliminary economical and technical feasibility study to be prepared in conjunction with a preliminary appraisal to identify and assess potential environmental and social issues associated with production activities. It is also important to develop a 'closure plan', and to determine the need for mitigation and protective measures and the costs that would be associated with these measures. The state of Queensland, with its 'make good' legislation, has transferred the risk of depleting groundwater to mining companies and institutions that finance their operations.

Based on the case studies, two major areas of concern emerge:

1. **Impact of climate change on water stress:** Australia experiences very large swings in seasonal hydrology and will see much more extreme variability in the future due to climate change.
2. **Changing regulatory structures for new technology:** While Australia has a robust institutional structure for existing technologies, CSG extraction involves new technology that is not yet well understood and therefore regulated.

	Asset management	Corporate finance	Project finance
Climate related water risk	Value of dividends and of the share price jeopardized as a result of extreme climate events	Risk profile changes due to unpredictability and a lack of understanding of climate events	Inability to repay loans in particular year as a result of mine closure from climate events
Changing regulatory structure	Profitability structures of investments change as additional regulatory costs emerge.	Risk profile changes as a result of potential changes to regulatory structure	Impositions of additional regulatory costs severely impact cash flow and debt service
Water allocation risk	Share price fluctuates as a result of risk of significant water curtailment in the region	Overall risk profile changes given significant curtailments for a number of projects	Curtailment forces long term downsizing in operations leading to decreased asset value and revenues.

7

CANADA

Subsector Focus: Oil Sands

7.1 Overview

Not many countries can claim the same degree of wealth in mining resources as Canada. It ranks top five in the production of 12 minerals (1st for potash, 2nd for uranium, 3rd for titanium and aluminum, 4th for nickel and sulfur, 5th for diamonds, platinum, chrysotile, molybdenum, salt and cadmium).[80] The country has the world's third largest oil reserves, and is the fourth largest producer of natural gas.[81] **Table 4** below provides an overview of the distribution of mining activities in Canada. Altogether, in 2010, there were 967 active mines in the country.[82]

Table 4:

Location and mined resource in Canada

Location	Mined resource
Northern Canada	Diamonds, gold, copper, silver, tungsten
British Columbia	Aluminum, lead, zinc, copper, gold, molybdenum, coal
Alberta	Oil sands, nickel
Saskatchewan	Potash, uranium
Manitoba	Gold, copper, zinc, nickel, cobalt
Ontario	Gold, nickel, copper, zinc, lead, cobalt, platinum group metals, diamonds
Quebec	Aluminum, copper, gold, zinc, lead, chrysolite, nickel, iron, magnesium
Atlantic Canada	Iron, aluminum, copper, zinc, lead, gypsum

Given these endowments, the mining sector is a cornerstone of Canada's economy. In 2010, the value of mining to the Canadian economy reached $36 billion, making up 2.9% of the country's GDP. Mineral extraction and processing sectors employed over 300 thousand workers in 2010, and the country has the second largest mining supply sector in the world. The mining industry occupies an important place in the country's trade mix, accounting for 21% of the total value of Canadian exports. Canada is also the world's primary destination for investments in mining exploration, totaling 19% of global spending. Investments in mining projects are expected to be $136 billion over the next decade.[83]

In addition to housing a wealth of mined resources, Canada's natural capital is also apparent in its freshwater resources. It accounts for 7% of the world's renewable freshwater resources.[84] Hydrological conditions vary considerably across the country. Approximately 60% of water resources flow north towards the Arctic Ocean away from 85% of the population that lives within 300km of the southern border with the United States.[85] There is also significant lateral variability in hydrological conditions, with the Prairie Provinces typically experiencing dryer conditions than other parts of the country.

In Canada, management of water resources and aquatic ecosystems are shared under a complex framework of federal and provincial policies, legislation and regulations, and planning processes. In the Canadian federation provincial governments hold the majority of power to create laws and policy for management

of natural resources, including water. Water allocation decisions and permitting fall primarily under the purview of provincial governments, but there is considerable variability in water allocation systems across provinces, including a variety of legal bases (e.g., riparian rights, prior allocation, civil code).[86] Provinces also hold primary responsibility for regulation and management of water quality.

The federal government has clear constitutional powers relating to fisheries, shipping, and First Nations peoples and the lands reserved for them. Legislation provides for federal jurisdiction over pollution prevention, interprovincial and international shared waters, and waters on federal lands. The federal government also plays more significant role in water management in the territories Yukon; Northwest Territories and Nunavut.

Historically, the Fisheries Act has been recognized as the strongest piece of federal legislation relevant to the management of freshwater resources and ecosystems in Canada and is administered by the Department of Fisheries and Oceans (DFO). However in 2012, significant changes to the Act stand to weaken its role in protecting freshwater ecosystems, and significant cuts to the staff and budgets of the DFO are likely to undermine the federal government's capacity to administer and enforce the legislation.

Along with changes to the Fisheries Act, other key federal environmental laws have been altered by the Government of Canada in 2012, including the introduction of a dramatically reformed Canadian Environmental Assessment Act, which is an important tool for assessing, managing and mitigating the impacts of major industrial projects. Critics argue that Canada's new environmental assessment law is less comprehensive than its predecessor. The new Act will narrow the scope on which projects require an environmental impact assessment to be conducted prior to approval. The reformed Act also includes provisions for delegating environmental assessment processes to provincial governments, which may lead to different standards across the country. Taken together, the recent changes to major federal environmental laws in Canada are anticipated to weaken environmental protection and management across the country. It is unclear how these changes will be received and interpreted by financial institutions.

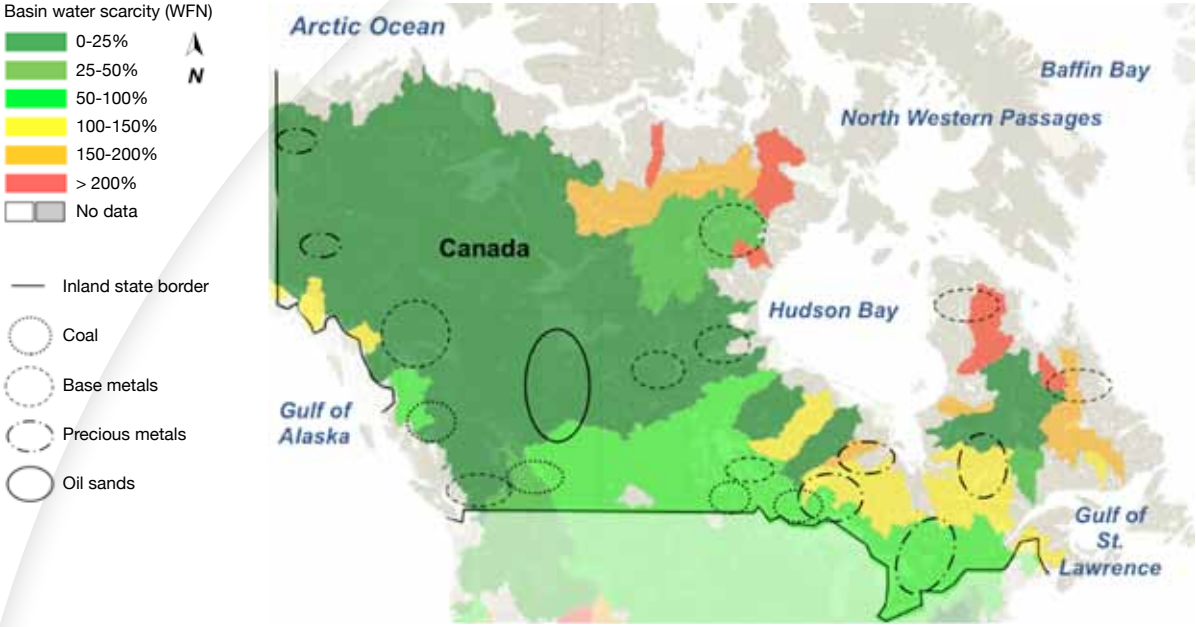
The scope and scale of the legislative reforms introduced by the Government of Canada in 2012 is likely to lead to a period of significant uncertainty, and thus risk, related to major industrial projects and water governance in Canada. The changes have already played into heightened tensions among governments, NGOs, communities and First Nations, for example, regarding major oil pipeline projects (e.g. Keystone, Northern Gateway). The changes also pose risks to companies' social license to operate, as expectations for environmental protection remain high in Canada regardless of the more lax regulatory standards under which the industry may be operating. This briefing focuses on one important sub-sector in Canada:

(1) **Oil Sands Mining.** The oil sands represent a large area of economic growth and development for the Canadian economy. The industry plays an important geo-political role in potentially redirecting oil dependence from states in more volatile regions. With oil sands development projected to increase significantly in years to come, water quantity and quality concerns could potentially become an increasingly contentious issue.

Geographical distribution of oil sands mining in Canada in the context of water scarcity.

Figure 7:

Average annual blue water scarcity in Canada

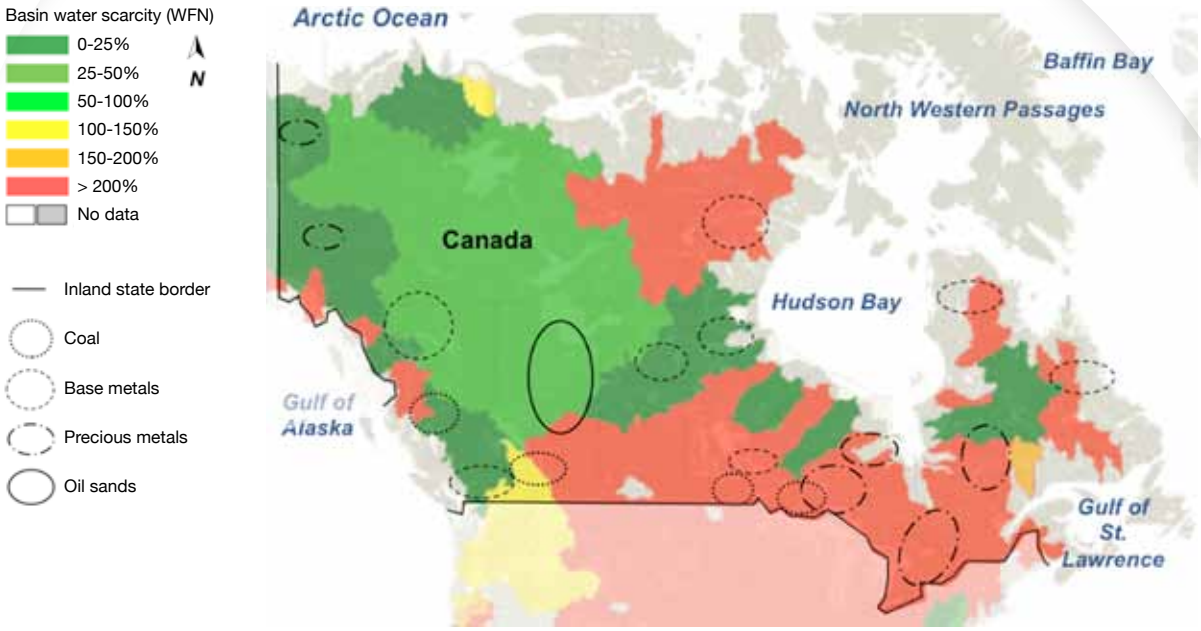


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

Figure 8:

Maximum monthly blue water scarcity in Canada



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water and are based on data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

7.2 Case Study 6: Water quality and quantity impacts through oil sands mining

Canada's oil sands deposits underlie 140,200 km² of boreal forest, muskeg, and prairie and contain an estimated 1.8 trillion barrels of crude bitumen, of which approximately 10% (169.3 billion barrels) is recoverable using current technology. This places Canada third in the world in terms of proven global crude oil reserves.[87]

Oil sands deposits are found in three regions (Athabasca, Cold Lake and Peace River) in the province of Alberta. However, only those found in the Athabasca region are shallow enough (within 75 meters of the surface) to be extracted by open-pit mining methods.[88] Oil sands deposits that extend into the province of Saskatchewan are at present not recoverable.[89] Of the 169.3 billion barrels of recoverable bitumen in Canada's oil sands, approximately 20% is considered to be recoverable by mining methods and 80% by in-situ, or in place, drilling methods.[90] Crude bitumen production from mining methods currently exceeds production from in situ methods (51% of bitumen produced in 2011 was mined), but the reverse is expected by 2015.[91] In recent years the oil sands industry has rapidly expanded and is expected to continue to do so in the future.

Oil sands development is a key component of the Canadian, North American, and global economy and a contributor to energy supply.[92] Investment in oil sands project was $10.6 billion (CAD) down from a record $20.7 billion (CAD) in 2008, while royalties collected by the Government of Alberta reached $3.7 billion (CAD) in the fiscal year 2010/2011.[93] In 2011, crude bitumen production from oil sands mining was 892 thousand barrels per day, and although exact projections may vary,[94] crude bitumen production from oil sands mining is expected to reach approximately 1.5 million barrels per day in 2020 and 2.2 million barrels per day by 2030.[95] The forecasted growth in bitumen production is expected to quickly surpass the existing

transportation capacity which has led to the proposal of additional transportation projects to the west coast of Canada intended to create link with the world market. In particular the Northern Gateway Project, a 525 thousand barrel per day pipeline between Alberta and a deep water port in the province of British Columbia, is currently under regulatory review.[96] Regardless of the future development scenario, investment, revenues, and royalties from oil sands development are expected to substantially increase and accumulate.[97]

Although the economic benefits of oil sands development are substantial, the associated and potential environmental impacts are less understood but have received considerable national and international attention in recent years.[98] It could be argued that any engagement in oil sands development presently carries some reputational risk due in large part due to the associated and potential environmental impacts.[99] Oil sands mining projects have a range of environmental impacts.[100] For water impacts are usually considered in terms of quantity and quality, and the related implications for biodiversity and ecosystem health, and are typically centered downstream of mining operations.[101]

The oil sands mining process begins by clearing trees and removing the top layer of earth to expose the ore body, and then mining the oil sands, separating the bitumen from the sand which is a water-based extraction process, and finally upgrading the bitumen for use at refineries.[102] The primary source of water for the oil sands mining industry is the Athabasca River, a large free-flowing river, average annual flow of ~627 m^3/sec with a highly variable flow regime.[103] Current oil sands mining operations consume a net average of just less than two and a half barrels of fresh water, taken primarily from the Athabasca River, to produce every barrel of oil.[104] All of the water used in the extraction process cannot be returned to the river and must be stored in tailings ponds.[105] Although the cumulative water allocation of the industry currently amounts to approximately 2.2% of the Athabasca River's average annual flow,[106] water demand as a percentage of average annual flow masks significant inter- and intra annual flow variability and potential impacts on river ecosystems from water withdrawal during low flow compared to average or high flow periods.[107]

The primary issue of concern with regards to water by oil sands mining operations is the protection of the Athabasca River's aquatic ecosystem during low flow periods.[108] The current regulatory framework for oil sands mining water use limits withdrawals during low flow periods but not sufficiently to protect the aquatic ecosystem during certain low flow conditions.[109] There are also economic and social benefits derived from the Athabasca River's aquatic ecosystem as it supports a world-class fishery and sustains multiple traditional uses.[110] The regulatory framework governing oil sands mining water use is currently under review with the main issue of contention being potential management actions during low flow periods. There are both regulatory and reputational risks for oil sands mining operators with regards to water quantity, specifically with regards to the actions of certain operators during low flow periods and an evolving regulatory setting that may in addition to a past economic focus, meet social and environmental interests in water management. Due in part to a regulatory setting that provides priority for water use on a first-in-time basis, there may also be physical and regulatory risks to newer oil sands operators that would materialize in the form of different and more restrictive regulations than senior operators and additional water supply mitigation measures and costs. The Government of Alberta is expected to review its water allocation management system in the near future, which may provide the opportunity to ensure water is equitably and efficiently used to meet a range of needs and interests.[111]

The potential impacts of oil sands mining on water quality, and subsequently on ecosystem and human health are controversial, and a wide range of opinions and facts exist.[112] There are a number of potential pathways between oil sands mining and water quality impacts that range from seepage from tailings ponds to deposition of airborne emissions. However an overarching issue is that the Athabasca River and some of its tributaries flow through natural oil sands deposits leading to background concentrations of some contaminants of concern, and thereby presenting a challenge in distinguishing between natural and anthropogenic influences.[113] In recent years a number of studies[114] have suggested that oil sands mining developments measurably impact water quality (increased concentrations of polycyclic aromatic compounds including polycyclic aromatic hydrocarbons and various trace metals) in the Athabasca River, which

was for the most part in contrast with decades of water quality monitoring in the basin.[115] These findings led to a number of reviews of the current water quality monitoring system, which along with the studies collectively concluded that the current monitoring system was not able to detect or quantify the effects of oil sands development.[116] This prompted the development of a joint federal and provincial monitoring program intended to enhance water quality and other monitoring in the oil sands region.[117] As the impacts of oil sands mining on water quality are not clearly understood, this will remain and contentious issue resulting in potential physical and regulatory risks for oil sands operators. Oil sands operators already face reputational risks associated with water quality and pollution due to years of operation without the ability to identify whether or not water quality impacts have occurred. Together, the following issues should be considered by companies mining oil sands and financiers:

1. **Emerging scientific understanding of the impacts of oil sands mining:** As oil sands extraction is a relatively new technology, the scientific evidence of impacts associated with these operations is still being refined. Regulations and public perceptions are likely to evolve as the scientific evidence deepens and becomes more broadly understood.
2. **Weakening of federal regulations and laws that protect the environment:** Legislative reforms introduced by the Government of Canada intended to speed up approvals of industrial developments may come at a serious cost to the environment and carry implications for company or projects' social license to operate.

	Asset management	Corporate finance	Project finance
Emerging scientific understanding of the oil sands' impacts	Profitability structure of investments potentially change as regulations evolve in response to emerging science	Reputational risks are significant and could become subject to even greater public scrutiny as the science on impacts becomes clearer	Potential imposition of additional costs linked to poor brand reputation and environmental and health impacts could slow profitability and investments in a project
Weakening of federal regulations and laws that protect the environment	Portfolios in country face the risk of uncertainty due to significant changes to federal regulatory framework	Under a weaker regulatory framework, a company's social license to operate is subject to greater risk if environmental and social conditions are compromised	Mounting public concerns over perceived environmental and social costs of a project may slow the pace of development

8

BRAZIL

Subsector Focus: gold

8.1 Overview

Hydrologically, Brazil has abundant water resources accounting for approximately 12% of the world's available freshwater resources. Average availability across the country is high although the Northeastern region has a semi-arid climate, which comprises a large part of the population. Some water stress exists here as well as in the south of the country where most of the urban population resides.

However, although Brazil is a mostly water rich country, it has traditionally had a weak water regulatory system punctuated by poorly managed and maintained supply systems. A number of water conflicts have arisen as a result of weak institutions. The main water challenges are deforestation in the Amazon basin and related water impacts, water pollution in Rio de Janeiro, Sao Paulo and several other large cities, water pollution caused by improper mining activities, wetland degradation and severe oil spills. In the face of these, Brazil is rapidly increasing its institutional capacity in water resource management. Many watershed and basin committees have been formed to manage local resources, which are enforcing national policy precepts of "users pays" and "polluter pays".

Brazil is an example where water pressures and resulting financial risks are not a consequence of chronic water shortages or prolonged droughts but unsustainable water management and pollution from agricultural or industrial processes. As Brazil continues to develop economically and mining activities increase, water-related regulatory risks will continue to rise around institutional and social issues. The country has large deposits of precious metals and iron ore (**see Figure 9 and 10**). This briefing focuses on one important sub-sector in Brazil:

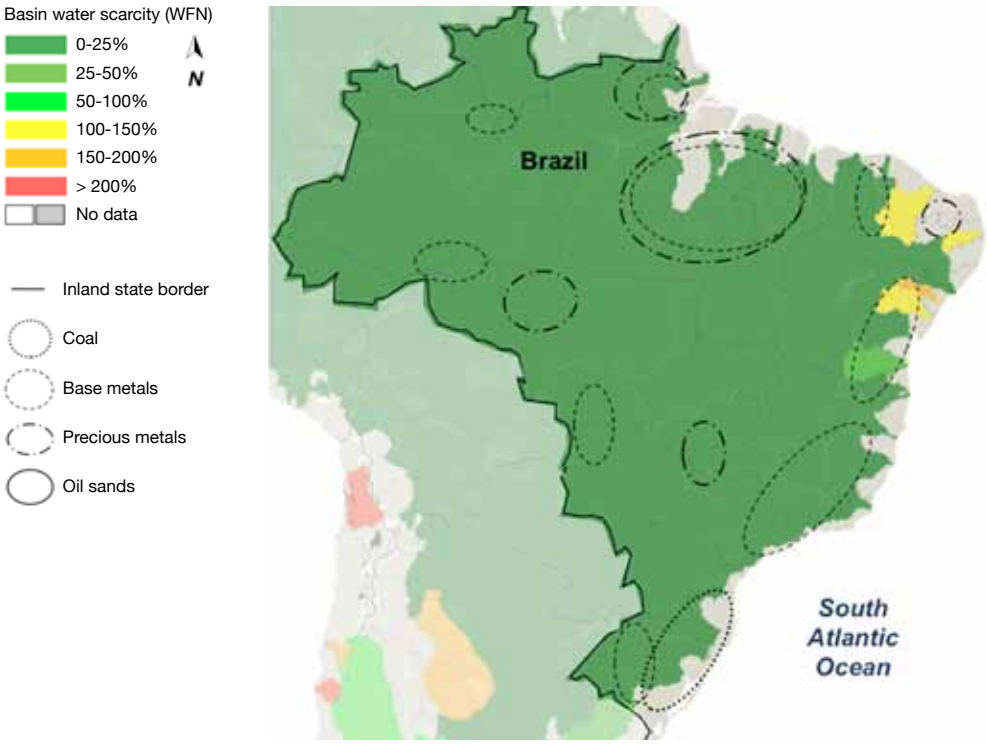
(1) **Gold.** Brazil is among the top 15 producers of gold in the world. The principal gold producing companies in Brazil are: AngloGold Ashanti, with 19% of the total; Mineração Serra Grande (Anglo and Kinross) with 13%; Rio Paracatu Mineração (Kinross) with 17%; Yamana Gold 27%; and others, including production in informal mine settlements, also known as garimpos, with 24%. Brazil's gold deposits are primarily located in the Brazilian states of Minas Gerais and Pará with some lesser mining in Goiás, Mato Grosso and Bahia. Brazil exports just under half of its gold production. In 2008, export revenues were valued at $1bn FOB (free on board).

The Amazon region has been responsible for a major share of Brazilian gold production in recent years. The region has witnessed a sizable gold rush which spawned a powerful informal mining sector. There have been environmental effects of gold mining in the region, in particular mercury pollution in the rivers. The environmental costs of the present extraction technology will be faced primarily by future generations, because of natural chemical processes and key elements of the environmental problem are as a result of the informal miner economy.[118]

Geographical distribution of mining activities in Brazil in the context of water scarcity.

Figure 9:

Average annual blue water scarcity for Brazil

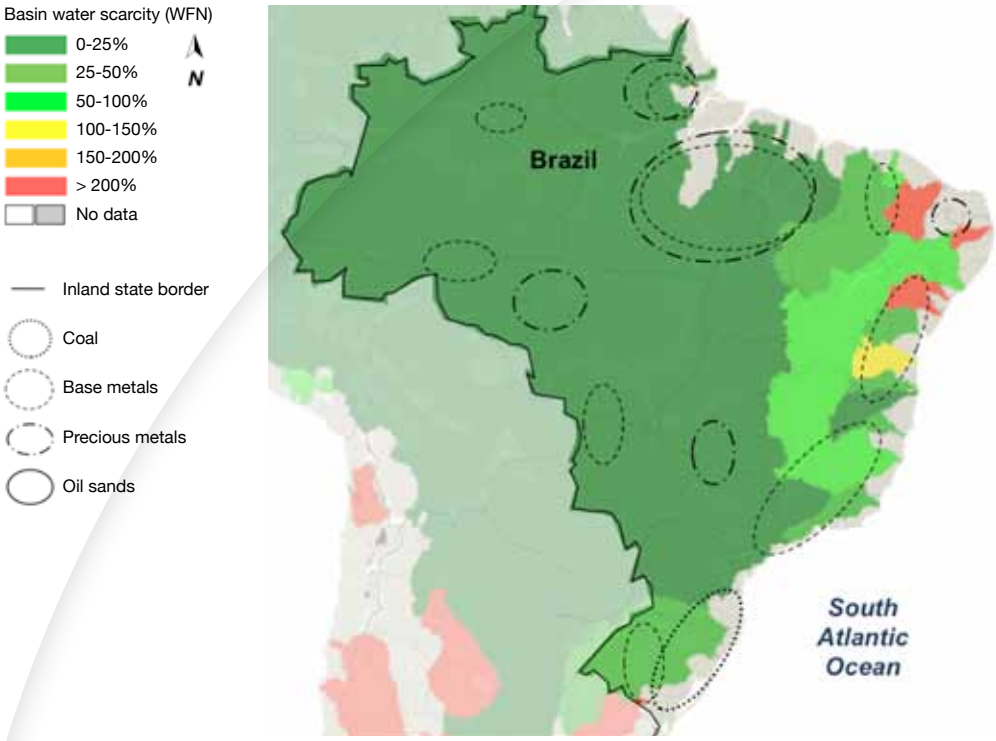


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water on the basis of data from 1996-2005.

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

Figure 10:

Maximum monthly blue water scarcity for Brazil



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month. Blue water resources are surface water and ground water on the basis of data from 1996-2005.

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8.2 Case Study 7: Gold Mining in the Amazon

The example of gold mining in the Amazon draws an important distinction between large corporate action and small and medium-scale operations. Low regulation of small scale operators creates both physical and regulatory risk for larger operators.

Gold mining in the Amazon Basin happens in a remote region. There is little regulation over these operations and yet there are lasting environmental issues where mining run-off empties into local streams and creates severe water quality problems. The impacts on water quality are difficult to monitor given nature of small-scale operations, which are highly mobile and operators move from one site to another very quickly.

There are a number of difficulties that attend this gold mining process. Small-scale operations use basic gravimetric washing practices, which lead to missing fine particles of gold and other metal materials, which then pollute local water resources. Furthermore there are no instruments to measure usage of water so the throughput is much higher than in larger operations. A number of environmental impacts are associated with these mining practices including deforestation, land degradation, deterioration of surface water, mercury pollution, and loss of aquatic flora and fauna. These water-related impacts also adversely impact local communities. Many of these risks may be attributed to the following:

- Small farmers and artisanal miners do not handle technical and environmental information at various stages of mining activity.
- The mining activity is carried out with little environmental responsibility.
- Introduction of technology without planning and implementation without environmental responsibility.
- Absence of the competent environmental authority to control and plan the development of the mining industry.

The very large risk associated with this type of situation lies with the potential impact on larger companies who begin or who are operating in region. Most large companies have higher standards of environmental practice and traditionally work with communities and NGOs to limit water risk. However, there is a risk these companies could receive blame for deteriorating water quality that is contributed to by smaller scale operations. Such potential reputational risks can then turn into disruptions of operations. In these areas there is little institutional oversight leaving almost no protection for communities. Based on this case study, three major areas of concern emerge:

1. **Evolving regulatory structures**
2. **Water quality concerns**
3. **Limited engagement with local stakeholders**

	Asset management	Corporate finance	Project finance
Evolving regulatory structure	Profitability structure of investments change as additional regulatory costs emerge	Risk profile changes as a result of potential changes to regulatory structure	Impositions of additional regulatory costs severely impact cash flow and debt service
Water quality concerns	Share price may fall due to increased reputational and regulatory risk.	Risk profile changes when pollution coming from the company becomes increasingly transparent.	Permitting delay or failed acquisition as a result of poor behavior
Limited engagement with local stakeholders	Share price may fall due to increased reputational risk, in case water consumption is not in balance with other stakeholders	Without good local relations, especially large multinational companies can have higher risk to be blamed for local water mismanagement	Local stakeholders may increasingly be able to shut down or significantly curtail current mines or new developments

9

CHINA

Subsector Focus: base metals and coal

9.1 Overview

China has large hydrological resources with up to 7% of world freshwater resources. The majority of water resources lie in the south of the country. The north has approximately 22% of freshwater resources and 64% of arable land, with which it produces close to 45% of industrial output. Many of China's water resources emanate from glaciers, which are measured to be in retreat. As a result of rapid industrial development, a number of river basins have come under significant stress creating a number of risk factors.

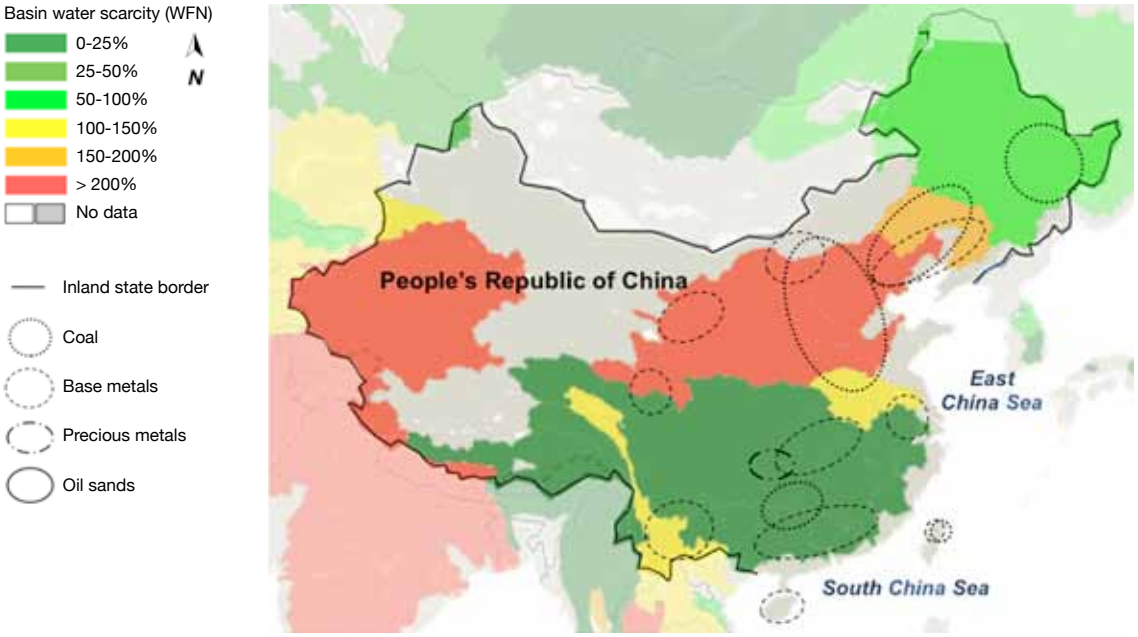
Institutionally, China has an increasingly robust water regulatory regime. The Chinese government has historically favored industrial development over water resource protection over the past several decades. However, as water resources continue to be stretched and increasing water risks emerge, the government has focused on creating more stringent regulations to ensure more sustainable long-term growth. They have effectively shifted the focus in water development from expansion to improvement in efficiency, productivity and quality.

Over the last 30 years, China has begun to intensively mine base metals and coal. Furthermore, China opened new mining activities (some in other countries) following the recent increase of demand for high value specialty metals. China is the global market leader in this highly intensive form of mining.

Geographical distribution of mining activities in China in the context of water scarcity.

Figure 11:

Average annual blue water scarcity for China

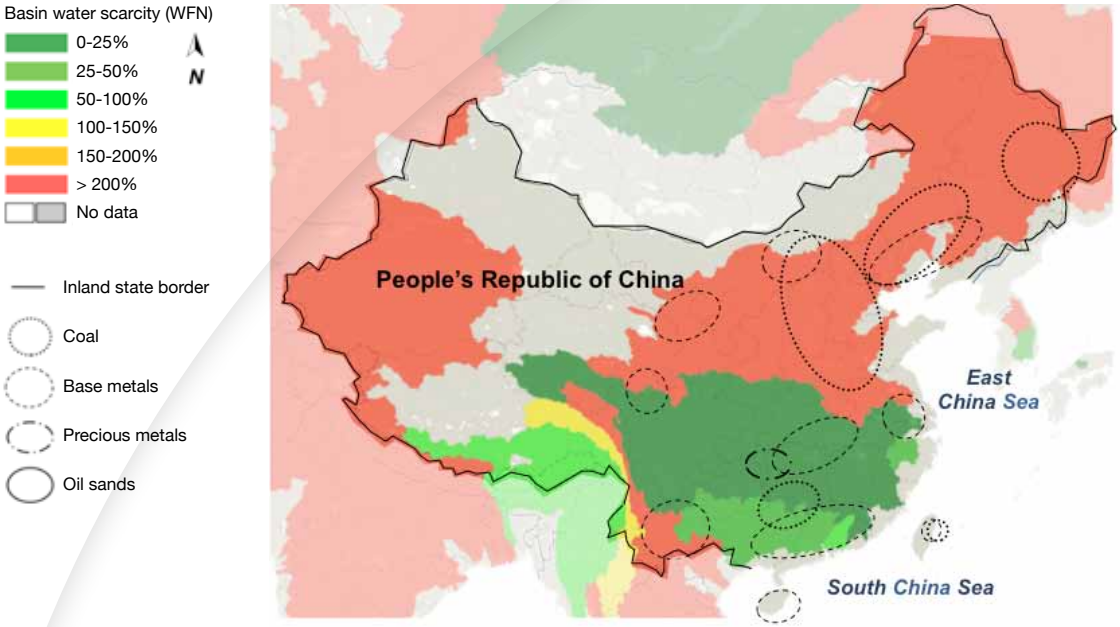


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental flow. Blue water resources are surface water and ground water on the basis of data from 1996-2005

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

Figure 12:

Maximum monthly blue water scarcity - China



Description: Blue water scarcity in the month with the highest scarcity level - defined as the ratio of blue water footprint to blue water availability – where the latter is taken as natural runoff minus environmental flow. >100% means that consumption is higher than availability in that particular month Blue water resources are surface water and ground water on the basis of data from 1996-2005

Source: Hoekstra, A.Y., Mekonnen, M.M., Chapagain, A.K., Mathews, R.E. and Richter, B.D. (2012) Global monthly water scarcity: Blue water footprints versus blue water availability, PLoS ONE 7(2)

The intensity of mining in China has increasingly caused environmental challenges around water quality and quantity and the economic and political need for resources has pushed a number of these systems to tipping points. China's particular water risks are around acid rain, which results from air pollution as a result of China's reliance on coal) as well as pollution from industrial effluents, and water shortages in the north.

Particular to China is the sudden change in regulatory approaches. The Government has taken an increasingly aggressive stance towards mines that create large environmental damage. Large fines and clean-up costs are being imposed. In addition to these costs, companies can sustain significant reputational damage. Compounding the risks associated with this increased regulatory activity is the limited information on environmental infractions by Chinese miners in the past. This will mean investors cannot accurately assess the regulatory risk associated with historical activity that may be realized in the future.

9.2 Case Study 8: Coal and Acid Rain in China

Acid Rain caused by coal mining has long-term environmental impacts. China has adopted legislation to limit sulfur dioxide pollution. But coal mining catalyses the Chinese economy. Hence, the intersection of environmental concerns and economic development needs leads to uncertainty and risk.

In 1998, China adopted national legislation to limit ambient sulfur dioxide (SO2) pollution and to stem the growing incidence of acid rain. There are many reports that detail the ill effects of acid rain on cities and agriculture, including manmade structures, forests and other ecosystems, water bodies, and especially agricultural productivity. Major environmental challenges include water quality as well as air pollution and land degradation.[119]

One of the challenges of controlling sulfur pollution in China is that the economy is dependent upon coal for both power and iron ore processing in steel production and the demand for coal is expected to grow over the next 20 years. With the passage of the TCZ legislation, the Chinese government took an unprecedented step to control sulfur emissions. These concerns are most profound in provinces in the northeast. It is predicted that acid mine drainage (AMD) will increasingly become a concern in these locations as freshwater resources are continually stressed. Yet controlling sulfur pollution in China is more difficult than in North America or Europe for several reasons:

- China's economy is extremely dependent upon coal, and the demand is expected to grow over the next 20 years. The environmental costs will be part of economic development and there will be imbalances in how China manages these costs.
- Capital is not always allocated towards environmental mitigation strategies, given competing demands from competing infrastructure interests.
- Institutional capacity for managing pollution in China is underdeveloped, and most local environment agencies do not have sufficient capacity to monitor and regulate sulfur emissions effectively.

The regulation of SO_2 emissions can be expected to become a significant cost to companies as the effectiveness of the regulation increases. Yet acid rain impacts on water resources will also increase while SO2 emissions are not successfully mitigated despite the legislation.

The problems stemming from coal mining and coal to power combustion present a complex set of water-related risks in the rapidly growing Chinese economy. AMD and acid rain present significant environmental and health concerns from contaminated water supplies and degraded land. These negative environmental impacts impede agricultural development and worker productivity. Competing interests of power generation, infrastructure, agricultural production, and community health could cause severe friction points, which may cause operational disruption or closure in extreme cases.

9.3 Case Study 9: Mining Spills and Company Fines in China

The Chinese government has taken an increasingly aggressive stance towards mines that create large environmental damage. Large fines and clean costs may be imposed. Companies can sustain significant reputational damage from such situations.

China has embarked on a rapid industrial expansion, which has sought to prioritize industrial development or environmental protection. However as a result of increasing limitations posed by environmental damage, the Chinese government has begun to take more aggressive action against polluters. One such case is the Zijin Mining Group, one of the largest gold, copper, and non-ferrous metal producers in China.[120]

In July 2010, 2.4 million gallon toxic spill contaminated the Ting River from a copper mine in the Fujian Province operated by Zijin. The extent of the spill is still being investigated but it is estimated that the environmental damage is comparable or greater than the BP deepwater oil spill. At present the Chinese government has detained three senior personnel from the facility for failing to disclose the incident for 9 days. Zijin may have to pay up to $120 million in fines, remediation, and water treatment costs as a result of the spill. In addition the Zijin stock price lost 12% of its value during the time of the spill.[121]

While shocking to many investors, Zijin has had a history of environmental infractions. Since 2005, the company has been cited every year for poor environmental management or pollution in many provinces including Fujian. However Zijin failed to disclose its infractions although a law passed in 2008 required it to do so. As a result of its failure to disclose environmental information, investors were unable to accurately assess the water risk in the Zijin portfolio and price the value of the company accordingly.[122]

Based on these case studies financial institutions should take into account the following key considerations:

1. **Tightening environmental controls:** As the Chinese government pursues a more environmentally conscious path; this is expected to lead to higher regulatory risks for mining companies.
2. **Wastewater and acid mind drainage (AMD):** Water quality has increasingly become an issue. Given the changing government position, heavy penalties and new regulations may occur.
3. **Environmental control vs. economic development:** China is beginning to balance economic growth with environmental imperatives. These changes will have lasting impacts on mine development and operations.

	Asset management	Corporate finance	Project finance
Tightening of environmental controls	Portfolios in country may significantly change based on resetting of national regulatory priorities	Risk profile changes as a result of inability to permit new mines undermining profitability	Projects may be delayed or become much more costly jeopardizing repayment periods and debt service ability
Waste water drainage	Change in share price as a result of a large environmental event	Inability to have projects approved as a result of past performance	Permitting delay or failed acquisition as a result of poor behavior which impacts cash flow
Economic development vs. environmental protection	Share price fluctuates a result of resetting of national/ regional priorities	Overall risk profile changes due to inability to secure new projects	Environmental concerns may shut down or significantly curtail current mines or new developments affecting cash flow

10

CASE STUDY RECOMMENDATIONS

The case studies in this 3rd issue of the Chief Liquidity Series has shown that water risks manifest themselves differently from those of the power and agribusiness sectors, which had been the focuses of previous CLS Briefings.

In the case of Canada, the fall-out of the significant regulatory changes underway may be too early to predict, but where regulations are weakened to allow business to thrive unencumbered, this will ultimately transfer the risks to society and the environment. Short term profits will always come at a cost if the balancing of legitimate concerns is ignored. The resulting consequence of political pressure may be more draconian and expensive regulation later. FIs can play a leadership role in ensuring that this is not the case, by defining regulations as essential for long-term risk mitigation and responding accordingly through financial due diligence and loans to higher risk profile operations.

The regulatory environment in China has undergone a shift with increasing attention being paid to water quality impacts and environmental impacts. This has come with tighter controls and fines. Increased attention will be paid to water quality impacts and environmental impacts by miners in the coming years. Mining companies who uphold international standards for operational safety and water management will invest more in maintaining that reputation even in countries where regulation has historically been poor. This becomes important in limiting risk where other water users and institutions are weak.

Brazil has a stronger environmental ethos, which has not been translated into strong regulatory controls on mining. However, cumulative impacts of small poorly controlled mining operations may gain greater public awareness, with the consequent regulatory attention, which may spillover into those larger operations that are maintaining standards. This highlights the importance of investors to consider the broader mining environment in assessing water related risk, in addition to the behavior of the specific investment opportunity.

Australia's mining operations are exposed to changing climate variabilities. In order to manage the potential risk to operations posed by extreme climate change, better understanding is required of the extremes of climatic variability for the existing and new operations and the mitigating triggers for action when challenged with climatic extremes. This greater understanding enables the range of options that may be available to be assessed, both within the mine site itself (in terms of onsite water management) and for external water sources and associated infrastructure.

The fracking technology in Australia makes it advisable for a preliminary economical and technical feasibility study to be prepared in conjunction with preliminary environmental appraisal to identify and assess the potential environmental and social issues associated with production activities. In this way, miners may determine the need for mitigation and protective measures and the costs which would be associated with these measures.

In South Africa, the pollution impacts of mining operations (both waste water discharges but also AMD) have led to negative stakeholder and regulatory perceptions around water from mining. These carry both regulatory and reputation risks. The increasing cost of water and the likely imposition of a waste discharge charge system will have financial consequences, but should also mitigate some of the emerging regulatory risk. Investors and financers can benefit from a proactive approach and a plan for managing water quality and combating pollution impacts.

As indicated the central water risk from the extractives sector relates to water quality impacts, with water availability and flood extremes posing challenges in some places. Water quality impacts tend to be even more localized to catchments, while water availability issues may be reflected at the large basin or infrastructure supply system scale. Furthermore, the financial requirements for cleanup can significantly exceed the costs of water supply.

11

CONCLUSIONS

11.1 Recommendations

Based on the research and interviews with a number of financial institutions the following recommendations can be made:

1. Banks, investors and other financial institutions should (further) increase their understanding of the complexity of water issues, to ensure the disclosure of the right indicators is demanded from (potential) investments, loans and insurance policies as well as performing the right analyses.

2. Financial institutions can use a number of levers to assess, monitor and control water-related risks, including but not limited to:
   - Risk assessments in the due diligence phase and at a portfolio level on a recurring basis.
   - Development and implementation of credit and investment policies that clearly account for water aspects.
   - (Proxy) voting during annual shareholder meetings

3. Once water-related risks have been identified, financial institutions can engagement with clients on how to mitigate risks, either by offering technical assistance (typically development banks) or by sharing the risk analysis and lists of possible mitigation actions to encourage investments to adopt risk mitigation strategies.

In addition, it is important to be aware that water risk is distinct from other environmental risks, such as carbon and climate change risks. Whereas carbon is a global issue, water risk is inherently local. Specific ecological, social, and economic characteristics determine the extent to which operations and investments experience water risk. As such, overall reductions in water use, while useful in some situations, do not make a necessary proxy for positive action. Assessments which companies are located in areas of high water stress alone are equally insufficient, as the objective for action is more aligned to how knowledgeable, supported and competent companies are in managing their risk under these conditions.

Financial institutions will need to look at the individual risk exposure of clients to be confident that companies are responding correctly to the right strategies and interventions to drive down risk. In many cases this will involve qualitative information, such as changes in water policy, community engagements or investments in certain basin processes. This is particularly true for the extractives sector, as their investments and operations are by their nature geographically fixed, which usually creates relationships with regulatory authorities and water managers. It becomes crucial to the longevity of the company.

Companies will experience physical, regulatory, or reputational risk under different conditions and often for very different reasons. Therefore response strategies to water risk will reflect these realities, making it hard to be prescriptive about what the right responses should be.

11.1.1 Risk assessment

In order to adequately assess and address water risk in loans and investment portfolios, FIs should adopt a system for water risk management, which includes tools and indicators. These should be based on a comprehensive understanding of water risk based on relevant data moving beyond the current practice of examining local water scarcity and waste discharge as the framework above demonstrates.

At present, most FIs evaluate water risk as part of their broader environmental and social risk assessment. As the framework of **Figure 1** demonstrates, water risk is complex and multi-faceted which, in some cases, requires a specific analysis. Moreover the assessment of water risk must be addressed in a more systemic fashion. The following principles should be taken account of:

- A framework for understanding water risk that takes into account its multiple dimensions;
- Relevant, reliable, and comparable data across geographies;
- Selection or if necessary creation of appropriate and consistent indicators that capture the complexity of water risk but are usable;
- Sets of response strategies to mitigate water risks demonstrated by indicators.

To recommend appropriate response strategies in a specific location a more in-depth study of any specific investment location should be conducted. However a risk tool that follows the guidelines outlined above will provide a sense of the contour of the risks, their magnitude, and the sets of response strategies that one could adopt. This risk tool should be used in the credit decision-making process as a way to better understand risk elements and recommend mitigation strategies to clients.

11.1.2 Investment policies

To incorporate water risk into lending and investment policies, clear policy guidelines need to be established for clients in the extractives sector. There are three general approaches for financial institutions to consider water risk:

- Consider water risk as part of general environmental and social risk policy. Most FIs interviewed for this publication use this approach.
- Consider water as part of any industry specific investment policy, such as a policy for investments in the extractive industry.
- Create a separate policy for water to be used across industries.

Currently, water risk is treated as a subset of operational risk. However, the incorporation of water risk as only existing in operations or in a breakdown in daily operations, only partly captures its full risk dimension. The starting point should be how water (along with other material ESG issues) can affect the credit risk of loan, a specific investment, or the risk/return ratio of an investment fund. Operational risks, reputational and regulatory risks are all factors that can contribute to this. With regard to basin risks, credit risk for water should consider the wider strains on the shared water source, such as increased use by other stakeholders in the form of increased irrigation or requirements for urban and industrial use, climate change manifesting in flood or droughts, the depletion of ground water resources, or basin augmentation such as dams or water flow reduction channels.

In addition to consistent water investment policies, financial institutions could use "red flag" areas of high water risk to be generally avoided. These need to be discerned from high-risk areas that have the potential to be mitigated. Examples include, where extractive companies have been dissuaded from exploiting minerals in wetland areas, disposing of tailings in open rivers, shallow or submarine sea water, or mountain top removal. Additional "red flag" areas or activities can include areas where competition for water is so fierce that it will lead to acute operational risks in the short term and areas where existing mining companies have already polluted local water resources that have yet to be cleaned up.

11.2 FI Perspectives on key water risks in the extractive industry

There are relatively few studies that have been conducted which focus specifically on water risks in extractive industries. Some financial institutions such as Citigroup and JPMorgan have released focused reports on the extractive industry and sustainability but none have yet focused solely on water risk. From interviews and various reports, there are a number of key concerns that the financial industry has voiced.

(1) **Corporate water governance:** Financial institutions are interested in extractive companies having an internal institutional framework that ensures that good practice lessons from projects can be replicated throughout the company's portfolio. Companies that focus on good governance tend to experience less overall water risk.

(2) **Increasing regulation:** Many financial institutions expressed concern over institutional capacity and increasing regulation. While developing countries have had weaker regulatory regimes, most countries with significant mineral deposits are moving towards more stringent laws, licensing and environmental assessment standards. Companies with more sustainable practices will likely experience fewer regulatory hurdles and can translated to easier access to natural resources.

(3) **Disclosure of water risks:** Disclosure of relevant water data by extractives can and should improve in order to enable financial institutions to systematically integrate these in their risk management procedures, loan requirements and selection and weighing of stocks in investment funds. Industry standards need to be established with comparable data and metrics.

(4) **Credible response strategies:** Most financial institutions do not have a firm grasp on the array of response strategies that a company can take to mitigate water risks. As described above these risks are complex and multi-faceted due in large part because they are specific to a given location. However, water risk tools are emerging that can shed light on local nuances and response categories.

(5) **Investment in water efficiency:** financial institutions are interested in seeing greater investment in water efficiency technologies to reduce water demand and increase wastewater recycling. These efforts, critical for "getting your own house in order," have proven to be useful in mitigating some internal risks.

(6) **Equal access to water:** Many financial institutions are also beginning to recognize that companies need to ensure equal access to water between economic and social uses. Many water risks stem from conflict over access to freshwater sources. As a result companies must begin to adopt policies that ensure that water is available and of a certain quality for social uses to ensure their long term of the resource.

11.3 Summary of Chief Liquidity Series Recommendations

Following the publication of the three issues of the Chief Liquidity Series the following generic takeaways can be made:

Assessing and valuing water risks

(1) Create appropriate risk metrics and tools, which incorporate a comprehensive framework for understanding water risk. All relevant risk aspects beyond the usual water scarcity and pollution should be taken into account, including degradation of ecosystems, regulatory and reputational risks.

(2) Vulnerability of water systems to climate change is considered a highly important risk aspect.

(3) Requirement for common understanding and assessment of water risks across industries.

Mitigating water risks

(1) Water risk mitigation strategies vary by industry and location.

(2) To address water risk, companies must begin to look outside their own operations and actively engage in the catchment area.

(3) Engage in partnerships with local stakeholders that are critical to addressing shared water risk.

(4) The regulatory environment is critical in addressing water risk.

For financial institutions

(5) There is a need to develop standard credit and investment policies that account for water risks for specific industries and across industries.

12

RISK INDICATORS

To help financial institutions to better understand and mitigate water-related risks identified within their client portfolio, we have provided a number of risk indicators specific for the extractives sector. These indicators outline the most relevant aspects and expand on recommendations from earlier work as elaborated in section 4.2. These can be used as part of an engagement process with clients, as part of due diligence or as part of annual portfolio risk assessments.

Six basin related and six company related risk indicators have been identified that are generally relevant for the extractives sector. These are shown in **Table 5**. In addition, sub-sector specific indictors are provided for coal and base metals, oil sands and precious metals in **Table 6**. Please note that these risk indicators are not exhaustive. Instead, the can be used as a preliminary guidance tool for financial institutions that seek to incorporate water risks in a systematic way for clients in the extractives sector.

Table 5:

Risk indicators for extractives sector

	Risk Indicator	Description	Rationale & Materiality
Basin related risk 1	Is the location of the mining operation characterized by water stress?	Understanding this basic element of water availability is not necessarily the key determinant of risk but is a good proxy for identifying hot-spots for further attention or action. Also important for identifying where water issues may come more immediately to the fore.	In regions facing water stress or scarcity a greater consideration must be given to water efficiency technologies and external engagement in the management of the resource. In some cases the lack of available water may lead to re-allocation or reduced water rights. Scarcity can also be characterised by the functioning or failure of public institutions.
Basin related risk 2	How vulnerable is the local water situation to climate change impacts?	The effect of climate change should be properly assessed, accounting for seasonal variability and projected changes in demand. Using a range of different climate change scenarios rather than a single estimate is preferable and will provide better insights.	Climate change will impact mainly through water availability and timing. This will have implications for how management systems can deal with these changes and how mining operations can adapt to changing regulations, physical droughts and flood events.
Basin related risk 3	How vulnerable is the company to droughts and floods?	Companies should assess the estimated occurrence of droughts and floods in the region, including their seasonal character. Droughts can have serious effects on water availability and therefore operations of the mining company. Floods can lead to halted operations when flooding water enters mine shafts or through spreading waste and contaminants into the wider environment.	The construction of water storage can enable companies to operate during droughts where regulations permit. Special flood protection may need to be implemented around mine operations and contingency plans developed.

	Risk Indicator	Description	Rationale & Materiality
Basin related risk 4	Is the location of the mining operation characterized by water pollution?	Water quality can usually be dealt with through strong regulation and technological innovation. Yet too often, water quality is affected by poor company management systems, poor investment or enforcement of policy or weak regulations. Water quality can have detrimental impacts on downstream users, particularly communities and the environment with associated reputational, regulatory and cost implications.	Focus on pollution reductions, adherence to higher discharge standards and investments in technology. Engagement with public authorities charged with municipal works and regulatory policies will be crucial.
Basin related risk 5	Has the company assessed its impact on the environment?	Threats to freshwater biodiversity are not just a concern for NGOs but often are the food source for local populations. Functioning ecosystems delivery numerous services to communities and business and will need to be maintained in the long-run.	Assess the impacts of operations through a full environmental and social impact assessment. Failure to account for biodiversity and the environment could result in higher fines, regulations or community backlash.
Basin related risk 6	What is the institutional capacity of the local, regulatory, and national management bodies?	Local and regional governance structures, including relevant institutions, water managers and regulators, control most of the conditions that cause risk to companies. This will be based on their ability or not to manage, invest, implement, regulate and enforce relevant policies. A failure to do so transfers risk to people, the environment and business.	Engage with those charged with managing and controlling the external environment. Understand their weaknesses, failures and strengths and actively work together with others, to support these larger governance structures.
Basin related risk 7	Is there local stakeholder pressure for water access or pollution control?	Local use of water is a highly political issue and where these are not met, can translate into a political issue and ultimately regulatory pressure on commercial users and polluters.	Assess the social access to water of adequate quality and the degree to which local communities are articulating demands.
Basin related risk 8	Are the costs of water supply or waste disposal/ discharge likely to increase dramatically?	Water supply in arid regions or waste discharge in polluted catchments can become a considerable cost of mining, that may be mitigated by improved water use efficiency and waste disposal systems	Assess the degree to which charging regimes may change and possible production responses to mitigate these financial impacts.
Company Related Risk 1	Does the company use the most efficient water processing technologies?	Practicing the latest advancements of technology and ensuring efficient use of water is not only good business sense but is also important as a negotiating position with external parties (i.e. our house is in order).	Under stressed environments, efficiency is usually already being pursued but will often be inefficient to deal with wider risks. While a desirable outcome is to explore better technology, getting your own house in order makes it easier to engage externally with others.
Company Related Risk 2	What is the extent of measures taken to prevent, minimize, and control mining tailings and effluents within outflow?	Water quality breaches will always increase the risk of tighter regulation, community backlash and blame. Often this blame will be apportioned to companies regardless of their contribution to the problem.	Quality measurements of the water the company withdraws and discharges by the company itself or an external company
Company Related Risk 3	Has the company been accused or prosecuted for breaches regarding water use and discharge?	Full compliance is an essential basis for community trust, reduction of regulatory risk and perceptions by other stakeholders.	Compliance of the company to legal quality discharge standards for wastewater is a basic minimum and a failure to comply creates unnecessary risk and costs to the company.

	Risk Indicator	Description	Rationale & Materiality
Company Related Risk 4	Were stakeholders consulted during the water assessment for project development?	Engaging with other local basin stakeholders like municipalities, governments, companies, farmers and NGOs to solve water-related conflicts and to manage local water resources is essential to drive down risk.	Most risk will occur due to the external environment and perceptions of the company. Being active will help mitigate risks that might otherwise occur if not engaged.
Company Related Risk 5	What are competing social and economic plans for water resources in the basin over the medium to long term?	Assessing the full range of other water users and stakeholders (upstream and downstream) in its area of operations helps a company understand its importance as a water consumer in comparison to other stakeholders. Companies should research platforms by which stakeholders come together to discuss water-related issues of the basin.	Failure to understand stakeholder uses and needs is a high risk, particularly in stressed environments. It is essential within the river basin to anticipate future changes and potential risks.
Company Related Risk 6	Does the company have a water policy, strategy and/or management plan?	Internal governance around a water strategy is essential to identify who has the highest level of responsibility within the company for the policy, strategy and/or plans as well as who is monitoring (waste) water quantities and quality.	Keeping top management abreast of risk issues, opportunities and developments will help to remain proactive and on top of risk occurrences.

Table 6:

Risk indicators for different sub-sectors in broader extractives sector

	Risk Indicator	Description	Rationale & Materiality
Coal and Base Metals specific 1	Has there been a change in risk profile as a result of closure of mines from Acid Mine Drainage (AMD)?	Governments are more aware of AMD related issues, and will likely demand that all mines will have a plan to deal with AMD while the mine is operating and after its closure	Long term business cases for mines is impacted negatively when (potential) costs related to dealing with AMD after the mine will be eventually closed are included.
Coal and Base Metals specific 2	Has there been a dip in share price as a result of reputational risk from AMD?	Some coal and base metals mines had to pay significant compensation payments to (often local) external organizations when it was proven they did not act as good environmental stewards	Impact on profitability as a result of significant compensation payments or increased premiums
Coal and Base Metals specific 3	Can the company obtain and maintain water licenses for operations?	Local and national governments are more than ever before aware of the fact that water allocations to a large water user as a coal or base metals mine must be done in a balanced manner vis-à-vis social and environmental needs of water	Additional capex required to adhere to new regulations or environmental damage
Coal and Base Metals specific 4	Is the mine already (re-)using water in an efficient way, and are appropriate measures taken to reduce pollution?	There is much knowledge and experience available on significantly reducing the water withdrawals (by re-using/recycling and more efficient technologies and processes), and on reducing pollution (treatment facilities)	More difficult to attract investors and strong community opposition when investors and public opinion understand the mine is underperforming

	Risk Indicator	Description	Rationale & Materiality
Oil Sands specific 1	Has the company an increased local regulatory or reputation risk as a result of downstream impacts?	The oil sands are under the spotlight for the environmental performance of operations. The probability of higher risk emanating from this area is higher because of this attention.	Decrease in share price and dividends stream as a result of mine closure or decline in international standing
Oil Sands specific 2	How likely is it that the company has to close or reduce its operations significantly due to international pressure?	International governmental and consumer pressure can lead to loss of (social) license to operate	Increased likelihood of default as a result of closure or significant reduction in operations
Oil Sands specific 3	How likely is it that flow allowances will be altered by governments as result of competition with other users	Governments realize more and more that large water consumers as oil sands operations threaten the local social and environmental water requirements	Change to profitability as result of altered flow allowances due to competition with other users
Oil Sands specific 4	Is the company anticipating increasingly strong regulation regarding water and oil sands?	Given the relative new legislation on oil sands, it is expected that stronger legislation (incl. on water) will be implemented in the coming years	Additional capex required to adhere to new regulations or environmental damage, or loss of license to operate
Precious Metals specific 1	Is the mine using the latest technologies to be water efficient in the transport of the ore and tailings, and in the washing and separation processes?	Given the high tailings-to-ore ratio, the amount of water used in the different processes per kg ore is very high. A company can reduce its dependency on water by leveraging technical solutions and optimized processed	Production to be (temporarily) halted or mine to close down because of water availability issue. This risk can be reduced significantly by becoming more water efficient.
Precious Metals specific 2	Has the mine implemented solid social standards?	The precious metals sector is under special attention of human rights watchers	Production to be (temporarily) halted or mine to close down because of loss of social license to operate, or additional capex required to implement measures suddenly
Precious Metals specific 3	Does the company at least comply with local regulations?	Precious metals mines are often located in regions with limited regulation or enforcement. Companies should pro-actively ensure they comply with local regulations (at minimum), even where enforcement is poor. Due to the trend of radical transparency mistakes will come to the surface quicker than ever before	Loss of (social) license to operate. Payment of (significant) fines or penalties
Precious Metals specific 4	Did the company implement measures to reduce gold/silver cyanide pollution?	This kind of heavy (and toxic) pollution is typical for precious metals, and if not taken seriously can lead to serious human health risks	Loss of (social) license to operate. Reduced ability to attract capital for the mine

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APPENDIX I

As part of this Briefing interviewed have been held with the following institutions to better under their perspective towards water risks and how they address these issues with their clients: Industrial Development Corporation (IDC, South Africa), Nedbank (South Africa), Robeco (the Netherlands), Citi (USA), Royal Bank of Canada (Canada), and Calvert (USA). The following questions were used to structure each interview.

1. How significant is water risk in investment decisions for the extractive industries in particular base metals (copper & iron ore), coal, precious metals (chrome, platinum, etc.) and oil sands?
2. How is this water risk measured for the extractive industries?
3. How is water risk factored into investment decisions for the extractive industries?
4. Is water as a topic covered in your investment/lending policies? If yes, are there specific policies covering the water topic, or is the water topic embedded in industry specific (in this case extractives) policies?
5. Have the results of a water risk analysis fundamentally changed the nature of the investment in the extractive industries (monetary value, interest rates, repayment period, termination clauses, etc.)?
6. Has water risk ever stalled or terminated an investment decision for the extractive industries?
7. Do you have any experience of investments that have severely faltered or failed as a result of experiencing water risk?
8. Which regions have the highest water risk for the extractive industries? Why?
9. Does the institution seek to balance water related risk within investment portfolios?
10. Are you engaged in any global processes and/or platforms related to water risk? If yes, which ones and why have you chosen them? If no, why not?

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About UNEP FI

The United Nations Environment Programme Finance Initiative (UNEP FI) is a global partnership between the United Nations Environment Programme and the private financial sector. UNEP FI works closely with more than 200 financial institutions that are Signatories to the UNEP FI Statements, and a range of partner organisations, to develop and promote linkages between the environment, sustainability and financial performance. Through regional activities, a comprehensive work programme, training activities and research, UNEP FI Carries out its mission to identify, promote, and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

About the Water & Finance Work Stream

The UNEP FI Water & Finance Work Stream creates awareness and capacity among financial institutions in order to promote their proactive approach towards water issues, both in the area of water-supply and sanitation as well as with regards to water as a production factor in businesses downstream. This is done by identifying and addressing the common grounds between the commercial objectives of financial institutions and the water sustainability of society at large.

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About WWF

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global Network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

http://wwf.panda.org/

About Pegasys

PEGASYS is a specialist consulting group with an international profile in management and development expertise, particularly in the water resource and public infrastructure sectors. It was founded in 1999 in response to a need to support African public sector institutions in achieving transformation and service delivery objectives in the water, land, transport and environmental sectors. Pegasys is a thought leader around corporate stewardship and engagement with water risk, having worked with WWF, UN CEO Mandate and WEF. We advise public and private institutions in managing public assets to contribute to a sustainable future free of human and environmental poverty, with the highest level of good governance.

About the UNEP Finance Initiative

The United Nations Environment Programme Finance Initiative (UNEP FI) is a strategic public-private partnership between UNEP and the global financial sector. UNEP FI works closely with over 200 financial institutions that are Signatories to the UNEP FI Statements, and a range of partner organisations, to develop and promote linkages between the environment, sustainability and financial performance.

Through a comprehensive work programme, regional activities, training and research, UNEP FI carries out its mission to identify, promote and realise the adoption of best environmental and sustainability practice at all levels of financial institution operations.

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