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.

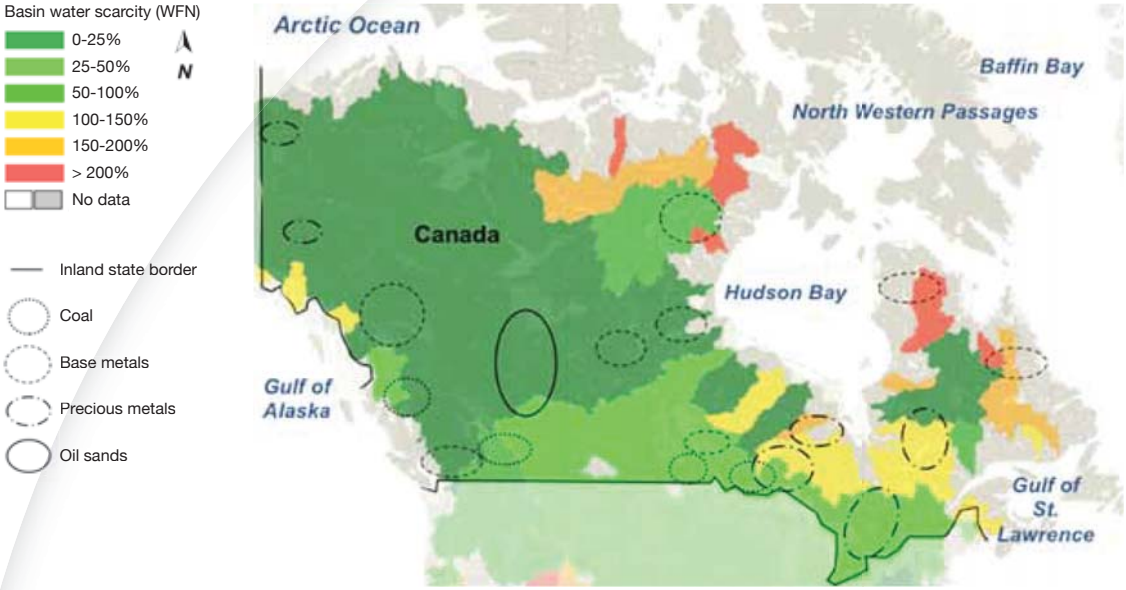
The scope and scale of the legislative reforms introduced by the Government of Canada in 2012 is likely to lead to a period of significant uncertainty, and thus risk, related to major industrial projects and water governance in Canada. The changes have already played into heightened tensions among governments, 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

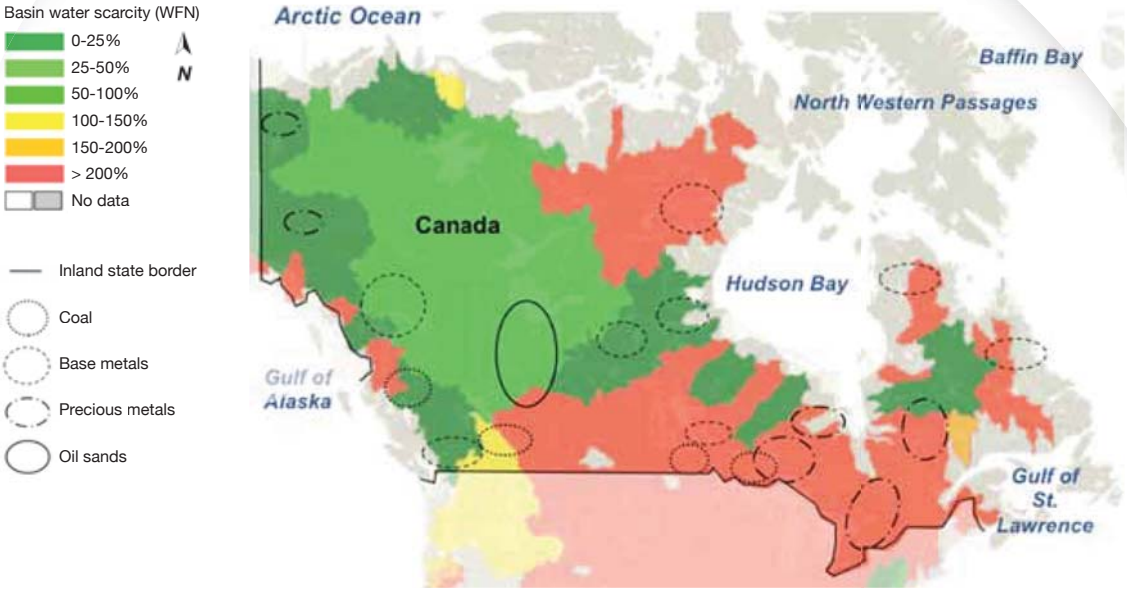


Description: Annual average of the twelve monthly blue water scarcity values per basin, equally weighted. Blue water scarcity is defined as the ratio of blue water footprint (based on consumption rather than withdrawal) to blue water availability – where the latter is taken as natural runoff minus environmental 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