Down to the Last Drop

The Athabasca River and Oil Sands

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The Athabasca River winds 1,538 kilometres from its source at the Athabasca Glacier in Jasper National Park to Lake Athabasca in Wood Buffalo National Park. It is Alberta's longest river, and one of North America's longest free-flowing (undammed) rivers.[1]

Oil sands operations require large quantities of water to extract bitumen from the oil sands.

Water withdrawals for oil sands surface mining operations pose threats to both the sustainability of fish populations in the Athabasca River and to the Peace-Athabasca Delta.[2]

The Athabasca River north of Fort McMurray. Clear rules are needed to protect the Athabasca River from harm when it is most at risk. *Photo: David Dodge, The Pembina Institute.*

Just the facts: Oil sands and water

- At 1,538 kilometres long the Athabasca River is Alberta's longest river and one of the few free-flowing (undammed) rivers left in North America;
- Each barrel of oil requires 2 to 4.5 times as much water to produce;
- Approved and operating oil sands operations are allowed to withdraw 349 million cubic metres (m^3) of water per year—that's enough water to meet the needs of a city of two million people, a population twice the size of the City of Calgary.
- Planned oil sands projects will increase water withdrawals more than 50% higher to 529 million m^3 per year— more water than is used by the City of Toronto in a year.[3]
- Oil sands represent 65 % of the water withdrawals from the Athabasca River;
- Almost all of the water withdrawn from the Athabasca River for oil sands operations winds up in toxic tailings ponds— contaminated water from these ponds is recycled to the extent possible and is not released back into the ecosystem;
- Continued water withdrawals in the winter when river flows are naturally lower threaten the sustainability of fish

[1] Athabasca District Chamber of Commerce. 2003. Source: http://www.town.athabasca.ab.ca/visiting/tour.php

[2] For a description of the threats to the integrity of the Peace-Athabasca Delta, see http://www.pnr-rpn.ec.gc.ca/nature/whp/ramsar/df02s06.en.html.

[3] In 2004, the City of Toronto used 1.43 million m^3 per day, for an annual total of approximately 522 million m^3. Source: Toronto Water. 2004 Annual Report. Available at http://www.toronto.ca/water/annual_report/pdf/annual_report_2004.pdf.

populations – a minimum amount of water must continue to flow to provide adequate fish habitat.
- Present government rules for oil sands water withdrawals use targets instead of limits and are voluntary instead of compulsory;
- There are cost-effective options to ensure adequate river flows are maintained.

Oil sands mining, extraction and upgrading will directly affect entire watersheds, perhaps permanently, as well as the Athabasca River—a precautionary approach is warranted. *Photo: Chris Evans, The Pembina Institute.*

Overview of Recommendations

1. There must be clear limits on water withdrawals to ensure adequate river flows.
2. Limits on water withdrawals must be precautionary by design, especially because the entire ecosystem is being heavily impacted by oil sands mining, which also affects river flows and water quality.
3. Strengthen Alberta Environment's Interim Framework by requiring:
   a. Green zone – all licensees operate normally and are encouraged to continuously improve practices to reduce water requirements.
   b. Yellow zone – when river flow rates fall into the yellow zone the aquatic ecosystem health is given priority and reductions in withdrawals are made until flow rates return to the green zone.
   c. Red zone – no oil sands water withdrawals are permitted except for domestic and safety needs.

For a complete list of recommendations, please refer to the Conclusions and Recommendations on page 13.

Introduction

As development of Alberta's oil sands continues its rapid pace, questions regarding how to manage the growth of the industry's environmental impacts to Alberta's air, land and water are becoming impossible to ignore. One question that needs an answer today is:

How much water can be withdrawn by oil sands mining operations without impairing the ecological sustainability of the Athabasca River?

After more than five years of scientific research and analysis and with several proposed oil sands mines currently seeking licenses to withdraw water, clear rules are needed to protect the Athabasca River from harm when it is most at risk – during the winter months in years when low rates of precipitation in the Athabasca Basin have led to low flow conditions in the river. These rules should be based on science, they should be precautionary and protective, and they must be mandatory.

Alberta Environment's *Interim Framework: Instream Flow Needs and Water Management System for Specific Reaches of the Lower Athabasca River* (the "interim framework") is not the right answer. Like the draft Mineable Oil Sands Strategy (MOSS) for Alberta, the interim framework presents another example of the Alberta Government placing oil sands extraction ahead of protection of the environment. The interim framework's approach is voluntary, relies on targets rather than limits, and allows avoidable ecological impacts to the Athabasca River to occur.

Historically it was believed that the Athabasca River had sufficient flows to meet the needs of oil sands operations. Now we understand that this might not be the case, particularly during the winter when flows are naturally lower, and growing demand for water withdrawals could lead to long-term ecological impacts. However, the oil sands industry has viable options for getting the water it needs during periods of low flow. Most companies are already building water storage into their projects. In addition, a 2004 study demonstrated the viability of storing additional water from the Athabasca River in off-stream reservoirs that avoid damming the Athabasca River. This practice is routinely used in southern Alberta irrigation to supply water during low flow periods. The industry has both the financial capability and intrinsic capacity for technological innovation to address those periods of time when its withdrawals may need to be limited or stopped to protect the Athabasca River. The ecological sustainability of the Athabasca River is of paramount importance. Much of its watershed in the oil sands region is or will be directly impacted by oil sands mining and *in situ* development. If Alberta Environment does not replace the interim framework with a framework that guarantees the protection of the River that choice will raise obvious questions about how it will rule on the long list of environmental and health issues that are linked to rapid oil sands development. Will the region's air quality be further degraded? Will threatened species be allowed to go extinct? Will the biodiversity of the boreal forest be lost?

In 1999, the Government of Alberta's Regional Sustainable Development Strategy for the Athabasca Oil Sands Area made a commitment to "balance resource development with environmental protection."[4] As will be illustrated by this report, living up to this commitment

[4] Alberta Environment. 1999. *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area*. p.5.

will require the political will and foresight to strengthen and improve the interim framework by implementing precautionary and mandatory limits on water withdrawals.

Oil sands rush

Alberta's northeastern boreal forest is undergoing a rapid transformation as billions of dollars are invested in extracting bitumen from the oil sands. Much of this investment is focused on the surface mineable deposits, which contain 110 billion barrels of bitumen and underlie approximately 2,800 square kilometres of boreal forest.[5] These deposits stretch north of the city of Fort McMurray along both sides of the Athabasca River (Figure 1).

Melody Lepine, Director of Industrial Relations for the Mikisew Cree, with a map showing the oil sands leases between Fort McMurray, Alberta and Wood Buffalo National Park. Discover Melody Lepine's concerns in "Oil Sands Fever: The Video at www.oilsandswatch.org." *Photo: David Dodge, The Pembina Institute.*

Until the mid-1990s, development of the oil sands was considered risky and unprofitable. But as a result of preferential fiscal policies (low provincial royalties and federal tax breaks) and new technologies that reduced operating costs, oil sands investment began to rapidly increase. Between 1995 and 2004, oil sands production more than doubled to approximately 1 million barrels per day. As a result of high oil prices and oil-thirsty international markets, total investment in the oil sands is now projected to hit $100 billion and increase bitumen production to five million barrels per day by 2030.[6]

This rate of oil sands growth is placing stress on the region's air, land and water and on the global climate system, and decisions are being made in the absence of adequate management and mitigation of the growing cumulative environmental impacts.

This report is focused on one specific issue: the impact of the oil sands industry's withdrawal of fresh water from the Athabasca River and the need for a management system that protects the River.

The ecological integrity of the River is threatened during the winter months in years when low precipitation rates in the Athabasca River basin lead to low flow conditions. Industrial water withdrawals must be limited during these brief periods to protect the health of the River. These withdrawal limits must be based on the precautionary application of current scientific knowledge and must acknowledge the impacts to the Athabasca River's resilience arising from active oil sands mining operations within its basin.

A complete description of oil sands development and the major environmental issues can be found in The Pembina Institute's November 2005 book *Oil Sands Fever: The environmental implications of Canada's oil sands rush* (available at www.oilsandswatch.org).

[5] Data was taken from Table 2.3 and converted from cubic meters to barrels using a conversion factor of 6.2929 barrels/cubic metre. Alberta Energy and Utilities Board. 2005. *Alberta's Reserves 2004 and Supply/Demand Outlook/Overview*. Statistical Series (ST) 2005-98, p. 2-7.

[6] Deborah Yedlin, "The oil sands come of age," *Globe and Mail*, February 7, 2006.

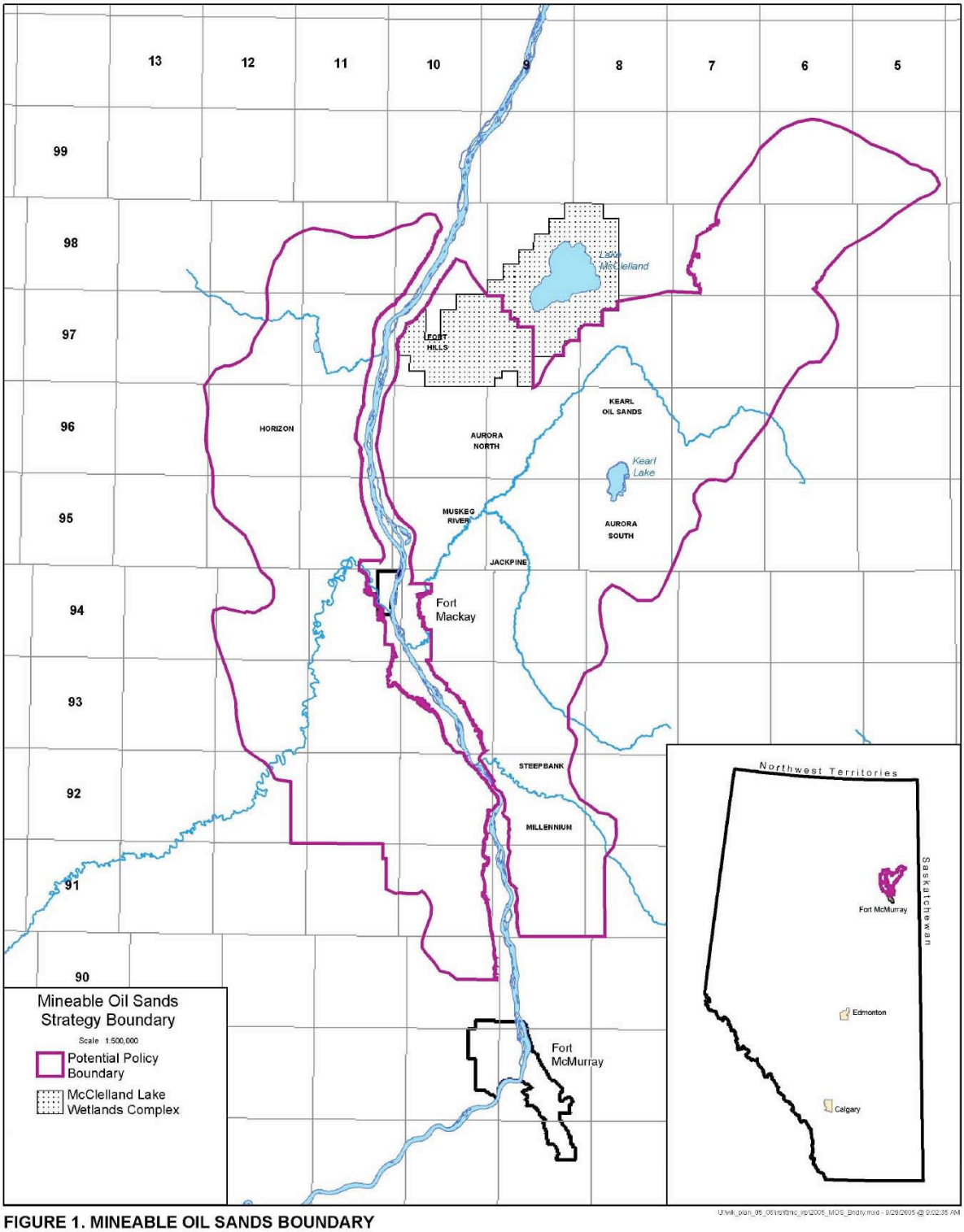


FIGURE 1. MINEABLE OIL SANDS BOUNDARY

Source: Mineable Oil Sands Strategy. Government of Alberta. October 2005. Figure 1.

Demand for water

Oil sands mining operations are dependent on large quantities of water to extract the bitumen from the sands. The Alberta Chamber of Resources has identified water use as one of the top four challenges for mining operations.[7] Current oil sands technology requires between 2 and 4.5 cubic metres of water withdrawn from the Athabasca River for each cubic metre of synthetic crude oil produced.[8] Unlike other forms of water use, oil sands mining operations return very little water to the Athabasca River. The vast majority of water is removed from the Athabasca River basin and effectively tied up for an indefinite period of time in the operations' tailings ponds.[9] Of all the users of water from the Athabasca River, oil sands mining operations are by far the largest and the fastest growing, currently representing about 65% of withdrawals (Figure 2).[10]

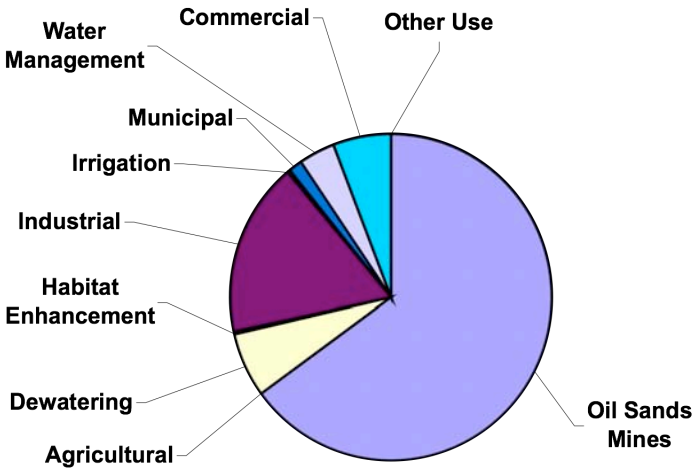


Figure 2 – Licensed surface water allocations from the Athabasca River and its tributaries, 2005[11]

Approved oil sands mining operations have already been granted licenses by Alberta Environment to divert 349 million m^3 of water per year from the Athabasca River. This is approximately two times the volume of water required to meet the municipal needs of Calgary, a city of almost one million people, for a year.[12] However, unlike municipal water use where the water is continuously treated and released back to its source, oil sands mining operations will not

[7] Alberta Chamber of Resources. 2004. *Oil sands Technology Roadmap: Unlocking the Potential. Final Report*. Figure 3.3, p. 21, http://www.acr-alberta.com/Projects/Oil_Sands_Technology_Roadmap/OSTR_report.pdf.

[8] Personal communication between Alberta Energy Utilities Board and Mary Griffiths, Pembina Institute. February 8, 2006.

[9] Peachey, B. 2005. *Strategic Needs for Energy Relate Water Use Technologies. Water and the EnergyINet,* p. 34; http://www.aeri.ab.ca/sec/new_res/docs/EnergyINet_and_Water_Feb2005.pdf

[10] Source of data is Golder Associates Ltd. 2005. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach.* Prepared for the CEMA Surface Water Working Group. Table 13.

[11] Source of data is Golder Associates Ltd. 2005. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach.* Prepared for the CEMA Surface Water Working Group. Table 13.

[12] For example, in 2003 the City of Calgary's population was 922,315 and its municipal water requirement was approximately 174 million cubic metres per year. Water use data: Sustainable Calgary, 2005. 2004 State of Our City Report. p. 48. http://www.sustainablecalgary.ca/sooc/sooc2004.pdf Population data: http://content.calgary.ca/CCA/City+Hall/Business+Units/Community+Strategies/Social+Data/Research+Services/Population+Size.htm

begin releasing water back into the watershed until the their projects end, 30 to 50 years into the future.[13] Planned oil sands mines, which have yet to receive approval, would push the cumulative withdrawal of water from the Athabasca River to 529 million m^3 per year (Figure 3).[14]

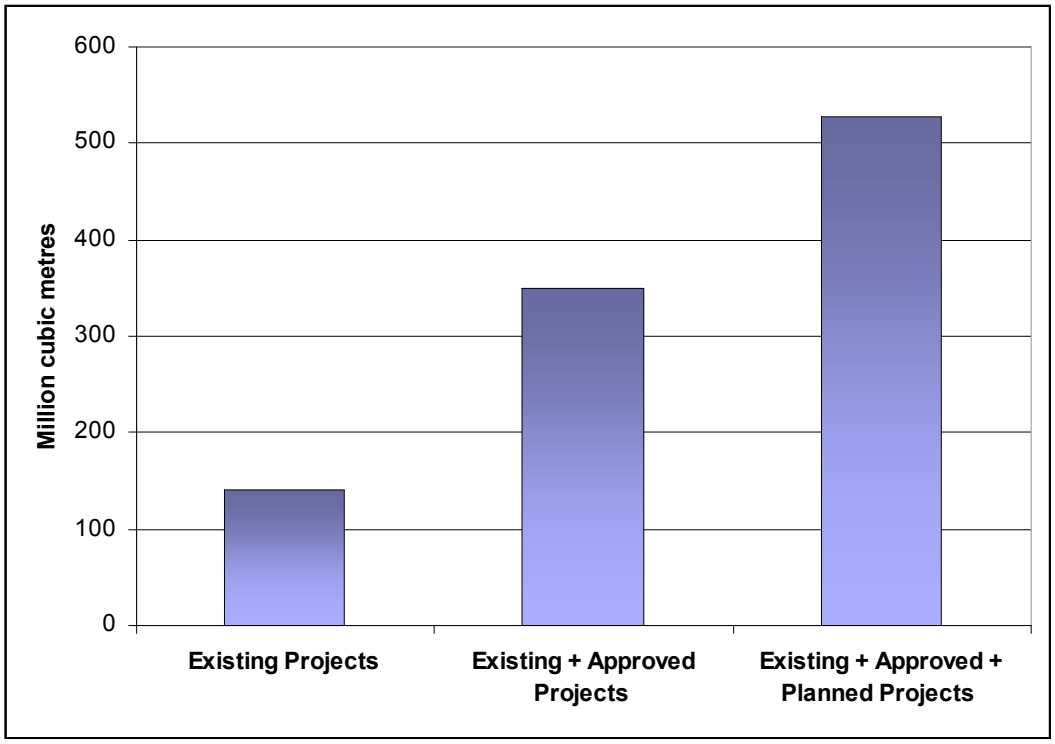


Figure 3 – Cumulative Athabasca River water allocations for existing, approved and planned oil sands mining operations[15]

The Athabasca River

The Athabasca River winds 1,538 kilometres from its source at the Athabasca Glacier in Jasper National Park to Lake Athabasca in Wood Buffalo National Park. It is Alberta's longest river, and one of North America's longest undammed rivers.[16] It enters Lake Athabasca at the Peace-Athabasca Delta, the largest boreal delta in the world, a World Heritage Site, and one of the most important waterfowl nesting and staging areas in North America.[17] Water withdrawals for oil

[13] For example, the earliest planned release of water from an oil sands mine end pit lake is currently scheduled to occur in 2031 by the Albian Sands Muskeg River Mine. Golder Associates Ltd. 2005. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach.* Prepared for the CEMA Surface Water Working Group. Table 12.

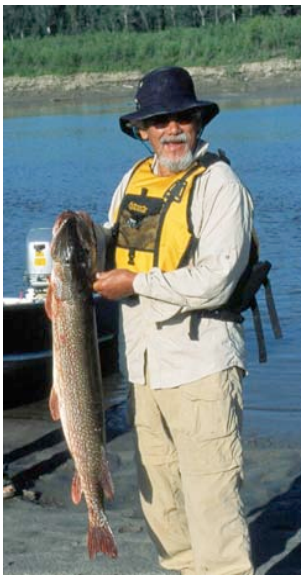
[14] Golder Associates Ltd. 2005. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach.* Prepared for the CEMA Surface Water Working Group.

[15] Source of data is Golder Associates Ltd. 2005. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach.* Prepared for the CEMA Surface Water Working Group.

[16] Athabasca District Chamber of Commerce. 2003. Source: http://www.town.athabasca.ab.ca/visiting/tour.php

[17] Source: http://www.pnr-rpn.ec.gc.ca/nature/whp/ramsar/df02s06.en.html.

sands surface mining operations pose threats to both the sustainability of fish populations in the Athabasca River and to the Peace-Athabasca Delta.[18]



A northern Pike caught on the Fire Bag River near the Athabasca River was estimated to be 66 years old. The Northern pike are currently listed as a common fish in the Athabasca River. *Photo: David Dodge, The Pembina Institute.*

In boreal aquatic ecosystems, low water temperatures mean that fish production is generally low, with many species needing 6 to 10 years or more to reach reproductive size.[19] Thirty-one species of fish have been found in the lower Athabasca River. Much of the research evaluating the impacts of water withdrawals on fish has focused on six of these fish species (Table 1).[20]

The lower Athabasca River, where oil sands mining operations are situated, offers habitat for these species throughout their life cycle – from eggs, and fry, to juveniles and adults. The river provides an important migratory route from Lake Athabasca to spawning areas upstream of Fort McMurray, as well as to tributary watercourses.[21]

Table 1 – Key fish species of interest in the Athabasca River[22]

Species	Abundance*
Arctic grayling	U
Burbot	U
Goldeye	A
Lake whitefish	S
Northern pike	C
Walleye	A

*A=Abundant, C=Common, U=Uncommon, S=Seasonal, R=Rare

Protecting river flows

The ecological integrity of all of Alberta's river ecosystems depends on adequate river flows. The Athabasca River is subject to variable seasonal flows, with the lowest flow periods occurring between November and March when run-off is limited and much of the river is flowing under ice (Figure 4). Between 1958 and 2002, the mean river flow in the November to March period was 169 cubic metres per second (cms).[23] The River's ecosystem and fish populations are most sensitive to wintertime water withdrawals in those years when low rates of precipitation in the Athabasca Basin lead to unusually low river flows. The river's instream flow

[18] For a description of the threats to the integrity of the Peace-Athabasca Delta, see http://www.pnr-rpn.ec.gc.ca/nature/whp/ramsar/df02s06.en.html.

[19] David Schindler. Boreal Fresh Waters. http://www.nrcan-rncan.gc.ca/cfs-scf/national/what-quoi/sof/sof05/special02_e.html

[20] Golder Associates Ltd. *Athabasca River Instream Flow Needs Scoping Study* (2004), Prepared for the CEMA Surface Water Working Group. p. 54.

[21] Golder Associates Ltd. *Athabasca River Instream Flow Needs Scoping Study* (2004), Prepared for the CEMA Surface Water Working Group. p. 54.

[22] Adapted from Table 16 of Golder Associates Ltd. *Athabasca River Instream Flow Needs Scoping Study* (2004), Prepared for the CEMA Surface Water Working Group. p. 51.

[23] Golder Associates Ltd. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach* (2005), Prepared for the CEMA Surface Water Working Group. Table 5.

needs (IFN) is a threshold that represents the minimum amount of water flow (expressed as cubic metres per second of flow) that must be flowing to maintain the health of the river's ecosystem. The Alberta Government has made the development and implementation of IFN-based management frameworks a priority for Alberta rivers through its Water for Life Policy.[24]

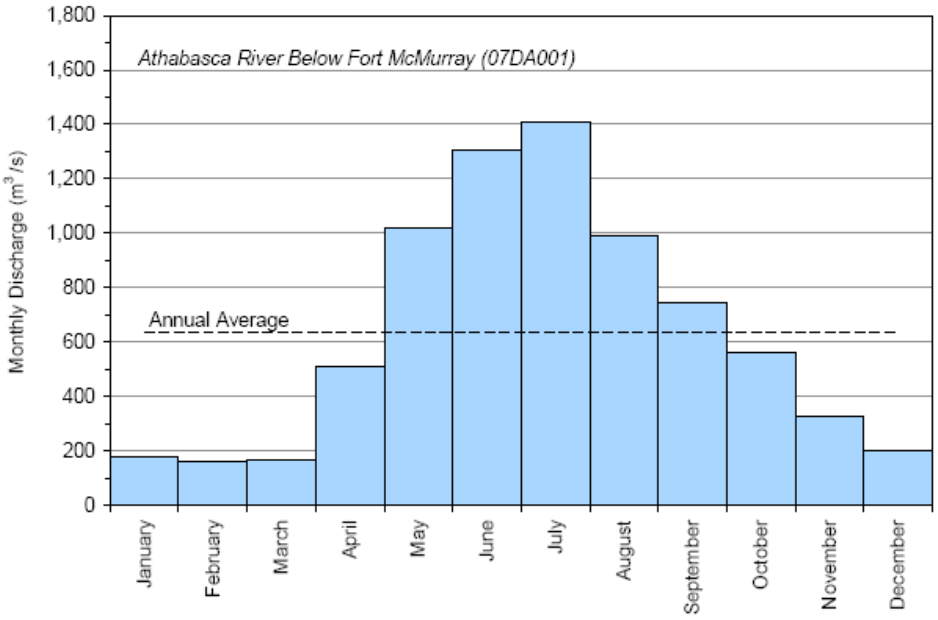


Figure 4 – Mean monthly flows recorded at the Athabasca River below Fort McMurray Station (Period of record: 1958-2002)[25]

Field studies and the traditional ecological knowledge of regional First Nations and Métis groups have demonstrated that multiple fish species use the Athabasca River during the winter period. During these naturally lower flow periods (mean flows of 169 cms), the amount of habitat available for these fish species is reduced. Water withdrawal by oil sands operators can further limit the amount of fish habitat and impact the survival of fish populations.

Tailings ponds already cover 50 square kilometers of boreal forest. *Photo by Chris Evans, The Pembina Institute.*

Reduced ecological resilience

The expression "death by a thousand cuts" is often used to describe the accumulation of multiple small environmental impacts that may appear insignificant on their own, but collectively lead to significant ecological damage. The health of the Athabasca River's ecosystem is affected by impacts to the entire watershed that affect the quantity and quality of water entering the River and the availability of fish habitat in tributary

[24] Letter from Ernie Hui, Director, Northern Region, Alberta Environment to the Cumulative Environmental Management Association. January 26, 2006.

[25] Source: Golder Associates Ltd. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach* (2005), Prepared for the CEMA Surface Water Working Group. Figure 6.

rivers and streams.

Oil sands mining operations are affecting the resilience of the Athabasca River in a number of ways beyond the direct withdrawal of water from the river. Mining affects the quality and quantity of water that is flowing into the Athabasca River from its tributaries and destroys some of the natural habitat available to fish in the River. The Muskeg River watershed, a sub-system of the Athabasca River watershed, will be subject to extensive oil sands mining. It is unlikely that this river basin can sustain this degree of industrial development and still retain any significant degree of ecological integrity. Environment Canada has recognized potential risks of irreversible effects on the Muskeg River watershed as a result of the operation and reclamation of multiple oil sands projects in the watershed.[26]

Alberta Environment's interim framework

In late 2005 Alberta Environment set about determining the Athabasca River's IFN threshold and developing the interim framework to fulfill its commitment to implement such a system by early 2006.[28] In late January Alberta Environment implemented its *Interim Framework: Instream Flow Needs and Water Management System for Specific Reaches of the Lower Athabasca River* (the interim framework). This framework is now in place for the Athabasca River. Alberta Environment has also asked for public comments on the interim plan by March 20, 2006.[29]

> "The purpose of the interim framework is to protect the aquatic ecosystem of the lower Athabasca River and to ensure development can occur without threatening long-term ecosystem sustainability."
>
> Alberta Environment[27]

Table 2 provides a summary of Alberta Environment's proposed IFN thresholds and associated management actions. We contend that the interim framework is not adequately precautionary and protective, and relies too much on voluntary actions by companies to protect the river. As such, we believe the interim framework falls well short of its aim of ensuring the long-term ecological sustainability of the Athabasca River.[30] Economic alternatives are available to industry that would eliminate the threat to the Athabasca River. These alternatives will only be developed if Alberta Environment implements rules that are based on the precautionary application of science and clearly define mandatory management actions. Extreme low flows during the wintertime are a relatively rare occurrence, with mean river flows of 169 cms between 1958 and 2002, and as such application of the management actions described in Table 2 will be the exception rather than the rule.

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[26] Alberta Energy and Utilities Board. 2004. *Shell Canada Limited Applications for an Oil Sands Mine, Bitumen Extraction Plant, Co-generation Plant, and Water Pipeline in the Fort McMurray Area. Joint Panel Report. EUB Decision 2004-009*, p. 68.

[27] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. P. 18.

[28] At Joint Panel regulatory hearings in 2003 for proposed oil sands mines, Alberta Environment, Alberta Sustainable Resource Development and the Federal Department of Fisheries committed to cooperatively develop and implement an IFN management system for the lower Athabasca River by December 31, 2005, in the event that CEMA failed to deliver an IFN recommendation by this date. These commitments were reflected in the Joint Panel's recommendations included in the decision reports for both of these projects. For example, see p. 41 of Alberta Energy and Utilities Board. 2004. *Canadian Natural Resources Ltd. Application for an Oil Sands Mine, Bitumen Extraction Plant, and Bitumen Upgrading Plant in the Fort McMurray Area. Joint Panel Report. EUB Decision 2004-005*.

[29] Letter from Ernie Hui, Director, Northern Region, Alberta Environment to the Cumulative Environmental Management Association. January 26, 2006.

[30] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. P. 18.

Table 2 – Summary of Alberta Environment's Interim Framework

Zones	Environmental Implication	Management Action
Green	Flows are sufficient – impacts to aquatic ecosystems are negligible.	All licensees operate normally and operate within the conditions of their licenses.
Yellow	Potential short term impacts on ecosystem.	Voluntary conservation practices to meet a "target" of a 10% (of available flow) total maximum diversion rate (i.e. 10-20 m^3/second) Recent and new licences may include conditions that mandate incremental reductions.
Red	Impacts on aquatic ecosystem are expected. Increased duration and frequency may threaten ecological sustainability.	Mandatory reductions and use of storage. Move towards a cumulative diversion rate target – may be 6 m^3/second. Applies to all licenses in a variety of ways.
Black	Unsustainable	To be determined based on CEMA recommendations

To support the implementation of the interim framework, a robust monitoring system must be in place. Currently, no such system is in place for the Athabasca River to monitor the effects of low river flows on fish habitat and fish population. Alberta Environment provides some recommendations as to what type of monitoring program should be implemented but it fails to commit government resources to developing and implementing such a program.

Is it adequately precautionary?

For the past five years the Cumulative Environmental Management Association (CEMA), a multistakeholder group tasked by government with developing regional environmental management systems for the Athabasca oil sands, has been gathering scientific data and traditional ecological knowledge and conducting a variety of analyses to better understand the Athabasca River. As a result, Alberta Environment was able to utilize this information to formulate IFN thresholds.

While a detailed scientific review of Alberta Environment's IFN thresholds is beyond the scope of this paper as shown in Box 1, there remain a number of unknowns that we believe warrant a more precautionary application of the IFN science and management actions. We accept Alberta Environment's use of the South Saskatchewan River Basin (SSRB) methodology (which

Precautionary Principle

Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.[31]

[31] Source: http://www.pco-bcp.gc.ca/raoics-srdc/docs/precaution/Discussion/discussion_e.htm

is consistent with accepted IFN methodologies) but contend that it should be applied in a precautionary manner, leaving more water in the River by increasing the flow thresholds used to determine the required management action.

Box 1 – Unknowns associated with Alberta Environment's IFN thresholds

Key impacts not measured: "The scientific basis for establishing an IFN examines the impacts future water withdrawals and discharges will have on water quality, fish habitat, river geomorphology and riparian vegetation. An examination of each of these components was not possible in determining the interim IFN threshold values, and those that have been examined are spatially limited to the 130 km immediately downstream of Fort McMurray."[32]

Climate change not accounted for: "This assessment assumes past hydrology and climate reflect future conditions; it does not address impacts from climate variability or changes on factors such as ice dynamics and geomorphology or the compounded interaction of these with biotic components."[33]

Knowledge limited to a small portion of the affected areas of the River: "Potential impacts to the Athabasca River downstream of the Embarrass River confluence, including the Athabasca Delta, have not been considered at this time."[34]

The impacts of oil sands mining on tributary watersheds, such as the Muskeg River Watershed, and the outright loss of some tributaries has reduced the resilience of the Athabasca River's fish populations. The full implication of this for fish populations is not well understood, and as such warrants additional precaution when managing water withdrawals that will result in further reductions in fish habitat. Similarly, while Alberta Environment contends that it believes it has used the most sensitive reach of the Athabasca River to develop its IFN, it does not yet have the information to confirm that this is the case. Further, its relaxation of management actions during the River freeze-up period is not warranted given that the aquatic ecosystem is already under stress.

Is it stringent enough?

Yellow Zone

Alberta Environment believes that impacts occur in the "Yellow Zone".[35] However, the interim framework calls for voluntary water conservation measures be employed to meet a "target" of limiting withdrawals to 10% of available river flow, which under these flow conditions represent a withdrawal rate of 10 to 12 cubic metres per second from the Athabasca River. Based on projected water withdrawal rates, the Yellow Zone "target" could be achieved without any reduction in water withdrawals by oil sands operations. A CEMA report prepared by Golder Associates Ltd., entitled *A compilation of information and data on water supply and demand in the lower Athabasca River Reach,*

Based on projected water withdrawal rates, the Yellow Zone "target" could be achieved without any reduction in water withdrawals by oil sands operations.

[32] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. p. 18.

[33] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. p. 20.

[34] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. p. 22.

[35] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. p. 23.

calculated that the maximum projected water diversion rate from existing, approved and planned oil sands mine operations would reach a peak at 11.21 cubic metres per second.[36]

Alberta Environment has indicated that it "may" mandate incremental reductions from recent and new licenses. However, the actual interim framework does not require reduced water withdrawals when flows are in the Yellow Zone and the Athabasca River is at risk of short-term impacts to its aquatic ecosystem.

Rather than mandating reduced water withdrawals, Alberta Environment has selected a voluntary approach and will allow "latitude in achieving these targets with the expectations that a strong research and monitoring program is in place to support adaptive management."[37]

Red Zone

In the "Red Zone" long-term ecological impacts are expected, and depending on the frequency and duration of these impacts they could threaten the ecological sustainability of the Athabasca River. When flows are below 100 cms Alberta Environment states that it will mandate water withdrawal reductions, but does not describe by how much. Alberta Environment uses uncommitted language that does not translate into requirements for industry. Alberta Environment "may" implement a total cumulative diversion rate "target" of six cubic metres per second and senior licence holders will be expected to "voluntarily limit their withdrawals to the extent possible." Alberta Environment does state that recent licence holders will use stored water to offset 50% of their withdrawals and new licence holders will use storage to offset 50% or more of their withdrawal.[38] This requirement is not as onerous as it sounds. The licensed pumping rates of oil sands operations are usually substantially greater than that required for normal operations. For example, the Canadian Natural Resources' Horizon Mine project is licensed to withdraw water from the Athabasca River at a maximum rate of 3.1 cms,[39] whereas its operating requirements under normal conditions are estimated to be 1.62 cms.[40] Alberta Environment's imposition of a 50% reduction relative to the licensed pumping rate would still allow the Horizon Mine to withdraw the amount of water it requires to maintain normal operations.

If Alberta Environment were to revise the interim framework and mandate withdrawal reductions to achieve a maximum cumulative diversion rate of 6 cms, there would still be a greater frequency and duration of times during which the River would be subject to ecological impacts with long-term implications. Based on 2001 flow records (one of the lowest flow years on record),[41] application of Alberta Environment's interim framework would have allowed for 7

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[36] Golder Associates Ltd. *A compilation of information and data on water supply and demand in the lower Athabasca River Reach* (2005), Prepared for the CEMA Surface Water Working Group. Table 14, p. 26.

[37] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. P. 7.

[38] Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. P.10.

[39] Water Act Licence No.00186921-00-00 for the Canadian Natural Resources Horizon Mine. Available at http://envext02.env.gov.ab.ca/pdf/00186921-00-00.pdf.

[40] Sawatsky, Les. Golder Associates. *Water supply security for oil sands mines by upstream offsite storage.* Presented at the CONRAD Oil Sands Water Usage Workshop, February 24-25, 2004. Source: http://www.conrad.ab.ca/seminars/water_usage/Water_supply_security_for_oil_sands_mines_Sawatsky.pdf

[41] Seneka, Michael. 2005. *Streamflow characteristics of the Lower Athabasca River*. Presentation provided to members of the Surface Water Management Task Group by Pat Marriott, Alberta Environment.

weeks of "Red Zone" conditions in the winter (November to March) period because of continued withdrawals of 6 cms.[42] This represents more than double the 3 weeks that would have occurred naturally with no withdrawals.

The next section of this report discusses the availability of cost effective options to avoid water withdrawals during rare periods of low flow, whose implementation make an increase in the frequency and duration of "Red Zone" conditions unnecessary.

Cost-effective options for protecting the Athabasca River

There are a variety of cost-effective options available to the oil sands industry that would allow for the protection of the Athabasca River. We acknowledge that there is no "one size fits all" solution, and as such would expect that different oil sands mining operations would choose to employ various approaches to prevent impacts to the Athabasca River.

On-site Storage of Water

Recently approved oil sands mines have incorporated up to 30 days of on-site water storage into their project designs to limit water withdrawals from the Athabasca River during periods of low flow.[43]

Off-stream Storage of Water

In 2004, Golder Associates Ltd. conducted a study that evaluated the feasibility of building off-stream water storage[45] in the Athabasca oil sands region, upstream of the oil sands mine operations.[46] This would entail identifying a low-lying area where storage space could be created by constructing a small dyke, and then pumping water from the Athabasca River during periods of high flow to create a stockpile of water. This water could then be released back to the Athabasca River during periods of low flow to increase river flows, thereby allowing oil sands mine operations to continue water withdrawals. Golder's study found that the creation of off-stream storage was more cost effective than storing extra water at the mines, and undertook a preliminary analysis of the costs of various options. Golder evaluated a number of potential options that could store enough water for four oil sands mines to operate for four months. The study's preferred option was the Athabasca off-stream storage, which would meet the needs of four oil sands mining operations and require a capital investment of approximately $37 million dollars, with annual

> *"Water supply storage could be developed to supply 100% of raw water needs in winter so that river withdrawals do not reduce natural flows in the river."*
>
> Golder Associates, 2004.[44]

[42] Derived from Figures A4 and A5. Alberta Environment. January 25, 2006. *Interim Framework: Instream flow needs and water management system for specific reaches of the lower Athabasca River*. pp. 29-30.

[43] For example, the Shell Jackpine Mine – Phase 1 project will include water storage that will allow Shell to minimize its water withdrawal for up to 30 days during low-flow periods. EUB/CEAA Joint Review Panel Report for Shell Jackpine Mine – Phase 1 (EUB Decision 2004-009). February 5, 2004. p.28.

[44] Sawatsky, Les. Golder Associates. *Water supply security for oil sands mines by upstream offsite storage.* Presented at the CONRAD Oil Sands Water Usage Workshop, February 24-25, 2004. Source: http://www.conrad.ab.ca/seminars/water_usage/Water_supply_security_for_oil_sands_mines_Sawatsky.pdf

[45] As opposed to on-stream storage, which is achieved through the construction of a dam to create a reservoir.

[46] Sawatsky, Les. Golder Associates. *Water supply security for oil sands mines by upstream offsite storage.* Presented at the CONRAD Oil Sands Water Usage Workshop, February 24-25, 2004. Source: http://www.conrad.ab.ca/seminars/water_usage/Water_supply_security_for_oil_sands_mines_Sawatsky.pdf

operating and maintenance costs of $1.1 million. In light of these findings, Golder concluded that off-stream storage represents a "practical solution to the problem of low winter flow in the Athabasca River."[47]

Improved Water Conservation

While it is widely assumed that alternatives to water-based extraction technology will likely not emerge by 2030,[48] further improvements in bitumen extraction technologies that require less water or that allow for higher rates of water recycle are possible. The oil sands industry has demonstrated its ability to reduce its water requirements from the Athabasca River per barrel of synthetic crude oil produced. For example, Suncor Energy reduced its water withdrawal intensity per unit of production by over 30% between 2000 and 2004.[49] For this capacity for innovation to be unleashed, water availability for oil sands development must become linked to the river capacity to supply water.

Temporary shut downs

Some companies may decide that the most cost-effective option is to design facilities to allow for reduced rates of bitumen production during periods of low river flows. However, this option is unlikely to be selected because the value of the deferred income (from delayed bitumen production) would exceed the cost of storage or other approaches.

Conclusions and Recommendations

Large-scale oil sands development in the Athabasca River watershed will undoubtedly impact the ecological sustainability of the River through diversion and mining of its tributaries. While the removal of these streams and rivers cannot be avoided if oil sands mining is to proceed, long-term ecological impacts from water withdrawals can still be proactively managed through the implementation of a precautionary framework and the adoption of cost effective options to reduce water requirements during periods of low flow.

The Athabasca River flows into the Peace-Athabasca Delta, the largest boreal delta in the world, and one of the most important water fowl nesting and staging areas in North America. *Photo: David Dodge, The Pembina Institute.*

Alberta Environment's interim framework does not guarantee protection of the Athabasca River. It allows "business-as-usual" oil sands development to proceed and fails to send a clear signal to the oil sands industry that it will need to employ its capacity for innovation to reduce its water requirements and develop creative solutions to manage periods of time in which water will not be available. Table 3 summarizes the Pembina Institute's recommendations for changes to the

[47] Sawatsky, Les. *Water supply security for oil sands mines by upstream offsite storage.* Presented at the CONRAD Oil Sands Water Usage Workshop, February 24-25, 2004. Source: http://www.conrad.ab.ca/seminars/water_usage/Water_supply_security_for_oil_sands_mines_Sawatsky.pdf

[48] Alberta Chamber of Resources. 2004. *Oil Sands Technology Roadmap – Unlocking the potential*. p. 3.

[49] Suncor reduced its water withdrawal intensity from 6.2 to 4.2 cubic metres of water between 2000 and 2004. Suncor Energy. 2005. 2005 Report on Sustainability. p. 66.

interim framework. The revised framework should be based on precautionary water withdrawal limits that trigger mandatory requirements for changes in water use and management. In the Yellow Zone, mandated reductions in withdrawals should occur to achieve Green Zone flows, and in the Red Zone no withdrawals should be permitted until flows return to the Green Zone. These revisions should be made in advance of regulatory hearings regarding proposed oil sands mines planned to occur in the next several months, and before water withdrawals for recently approved oil sands mines commence.

In addition, Alberta Environment should implement a robust and comprehensive monitoring program both to gauge the flow of the Athabasca River and to better comprehend the impact that reduced river flows has on fish habitat and fish populations.

Table 3 – Pembina Institute recommendations for managing water withdrawals to protect the Athabasca River

Zones	Environmental Implication	Pembina Institute Recommendations
Green	Flows are sufficient – impacts to aquatic ecosystems are negligible.	All licensees operate normally and operate within the conditions of their licenses. All licensees are encouraged to continuously improve technologies and practices to reduce water requirements.
Yellow	Potential short term impacts on ecosystem.	Aquatic ecosystem health is assigned priority. Mandatory reduction of withdrawals to achieve Green zone: - use water storage - reduce water requirements - enhance recycling
Red	Impacts on aquatic ecosystem are expected. Increased duration and frequency may threaten ecological sustainability.	No withdrawals permitted (with the exception of domestic and safety needs) by any oil sands operators. If necessary, limit oil sands production.

The maintenance of fish populations and fish habitat is enshrined in the federal *Canadian Fisheries* Act, and as such the Department of Fisheries and Oceans (DFO) must evaluate whether the interim framework will achieve these responsibilities. We therefore also direct these recommendations to DFO.

Alberta Environment has the opportunity to protect the Athabasca River by improving and strengthening the interim framework, and in doing so can fulfill its commitment to Albertans to "balance resource development with environmental protection."[50] The oil sands industry has cost-effective options for managing its water requirements during periods of low flow; the industry has both the financial capability and intrinsic capacity for technological innovation to address this issue. By implementing precautionary and mandatory limits on water withdrawals Alberta Environment can protect the Athabasca River and demonstrate the political will, foresight and vision that Albertans expect.

[50] Alberta Environment. 1999. *Regional Sustainable Development Strategy for the Athabasca Oil Sands Area*. p. 5.

This report is Oil Sands Issue Paper No. 1 in a series of papers addressing the issues associated with the development of the oil sands in northern Alberta. Additional copies of this publication may be downloaded from our websites: http://www.oilsandswatch.org or http://www.pembina.org.

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The Pembina Institute creates sustainable energy solutions through research, education, consulting and advocacy. It promotes environmental, social and economic sustainability in the public interest by developing practical solutions for communities, individuals, governments and businesses. The Pembina Institute provides policy research leadership and education on climate change, energy issues, green economics, energy efficiency and conservation, renewable energy, and environmental governance. More information about the Pembina Institute is available at http://www.pembina.org or by contacting: info@pembina.org

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