Going in Reverse: The Tar Sands Threat to Central Canada and New England

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I. EXECUTIVE SUMMARY

Canadian pipeline company Enbridge Inc. appears to be reviving a previous pipeline plan that would take tar sands oil to central Canada and New England. In 2011, Enbridge took a step toward implementing this plan by filing a permit application with Canada's National Energy Board to reverse the flow of a portion of one of its pipelines. Less than a year later, they took another step forward in May 2012 announcing their plan to fully reverse its pipeline through Ontario and Quebec. The long-term plan would reverse the direction of oil flowing through two major pipelines—Line 9 and the Portland-Montreal Pipe Line—along an approximately 750-mile route, running through central Canada and down to the New England seacoast for export. Under the plan, the pipeline would carry Canadian tar sands oil, the dirtiest oil on the planet.

The Plan to Pump Tar Sands Through Eastern Canada and New England

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The Portland-Montreal Pipe Line flows underground through dozens of communities throughout New England and central Canada.

© Natural Resources Council of Maine

A tar sands pipeline spill causes much more harm than a conventional oil spill, particularly to waterways.

The pipeline project would transport tar sands oil through some of the most important natural and cultural places in Ontario, Quebec, Vermont, New Hampshire, and Maine. Areas the pipeline puts at risk include the Saint Lawrence River, the most important river in eastern Canada and a seasonal home for blue whales; the Androscoggin River, a New England waterway popular with anglers and paddlers as well as bald eagles, black bears, and moose; and Sebago Lake, home to native landlocked Atlantic salmon and a major drinking water resource for Portland, Maine's largest city. An oil spill in these areas could devastate wildlife, pollute water, and compromise the health of local residents.

Pipeline spills can and do occur, and there are indications that due to its corrosive qualities, tar sands oil spills are more prevalent than conventional oil spills. Tar sands are like hot liquid sandpaper, corroding pipelines faster and risking oil spills along the route. A tar sands spill near rivers, lakes, and other waterbodies causes much more harm than a conventional oil spill because tar sands oil can sink and seriously complicate cleanup efforts.

Tar sands oil causes damage even before it ends up in pipelines. The extraction and processing of tar sands oil requires a vast and destructive industrial operation. It razes and fragments large swaths of the Boreal forest, and burns enough energy to make tar sands oil production the fastest-growing contributor to Canada's greenhouse gas emissions. It also harms the public health of communities located near oil refineries, including First Nations.

Transporting tar sands on this new route would only bring risks to central Canada and New England. Reversing existing pipelines is not necessary and should not be put into operation. As a starting point, the following steps are required to protect public safety and the environment:

- The Canadian National Energy Board should treat Enbridge's Line 9 reversal permit application as part of a long-term plan to bring tar sands oil east to the New England seacoast.
- The Canadian and U.S. federal governments should complete more thorough reviews of plans to transport tar sands oil through central Canada and New England, evaluating the need for new safety regulations for tar sands pipelines.
- Given potential safety concerns, and that increasing reliance on dirty fuels like tar sands oil contradicts clean energy and climate policies, provincial, state, and local governments should actively engage to ensure these issues are thoroughly vetted in the regulatory process.
- Governments at all levels in Canada and the United States should develop long-range clean energy plans before committing to large-scale infrastructure projects that would increase oil consumption, and evaluate policies that would reduce oil demand.

II. PURSUING A NORTH AMERICAN EASTERN TAR SANDS PIPELINE

© NTSB

In 2010, a rupture in an Enbridge Inc. pipeline near Marshall, Michigan resulted in the largest tar sands spill in U.S. history.

On August 8, 2011, the Canadian pipeline company Enbridge filed a permit application at a federal regulatory office in Calgary, Alberta, for a project called "Line 9 Reversal Phase I." This was a permit application pertaining to an existing oil pipeline.[1] The stated purpose of the permit was to reverse flow direction for roughly 120 miles of the pipeline's length. The reversal would affect Line 9 from the large refinery complex in Sarnia, Ontario, to the Westover Oil Terminal, located amidst farmland outside of Hamilton, Ontario. Although this permit application was filed last year, the beginnings of the project actually stretch back four years.

In 2008, Enbridge announced a plan to help move tar sands oil from Alberta to refineries in the United States.[2] Originally branded "Trailbreaker," it was a $400 million project to get tar sands oil to the Texas Gulf Coast by piping it east to Portland, Maine, and then loading it onto supertankers. The Trailbreaker plan stalled in 2009 because of the economic downturn. Enbridge said "….the scope and objective of Trailbreaker, as previously contemplated, is no longer being pursued."[3] However, with oil prices high and global demand increasing, a project with a similar objective—moving tar sands oil east—may once again be emerging as a real possibility.

While Enbridge now seems to have dropped the "Trailbreaker" name, it appears to be approaching the project section by section, still with an effort to bring tarsands eastward. In May 2012, Enbridge announced expansion plans that confirmed a long-range goal to ship tar sands to Montreal, Quebec.[4] However, the overall goal of moving tar sands oil out of Quebec and through New Hampshire and

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Portland Montreal Pipe Line at Casco Bay. A significant spill in Casco Bay could crush Maine's economically and culturally vital commercial fisheries.

© Natural Resources Council of Maine

Casco Bay. If the plan to ship tar sands eastward moves forward, tar sands will flow several thousand miles from Alberta, Canada to Casco Bay where it would be loaded onto tankers for export.

Vermont, eventually reaching the Maine coast appears to be the larger goal of the project.

The pipeline plan being pursued by Enbridge would differ in at least one key way from both the highly publicized Keystone XL pipeline project, which would transport tar sands oil directly to the Gulf Coast, and the proposed Northern Gateway pipeline project, which would deliver tar sands oil across British Columbia to Canada's west coast. Unlike these pipelines, Enbridge's eastern tar sands pipeline does not require new pipeline construction.

The original Trailbreaker plan called for a flow reversal in two pipeline systems, one in Canada and the other in New England:

- **Enbridge Line 9** travels a path more than 500 miles from refineries in Sarnia, Ontario, to a refinery in Montreal. For long stretches of Line 9's route, the pipeline roughly follows Highway 401 as it skirts to the north and northwest of Lake Ontario and the Saint Lawrence River.[5] Currently, Line 9 carries conventional light oil. The pipeline is 37 years old.[6]
- **The Portland-Montreal Pipe Line** consists of two parallel, 236-mile pipelines that link Montreal refineries at the eastern end of Line 9 with a crude oil terminal near the tanker port at South Portland, Maine.[7] The pipeline travels across northern Vermont and New Hampshire, as well as western Maine.[7] The pipeline that would be reversed is 62 years old and currently carries light to medium crude sourced from overseas.

III. TAR SANDS PIPELINES: A THREAT TO COMMUNITIES AND WATERWAYS

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The Portland-Maine Pipe Line crosses the Androscoggin River. If this pipeline begins to carry tar sands and experiences a leak or break, waterways such as these would be contaminated with tar sands oil.

Although it is too early to tell exactly which types of oil will flow through the Enbridge Line 9 and Portland-Montreal pipelines once reversed, based on previous plans, tar sands oil is likely to be one of them. It is therefore important to understand the different physical and chemical properties of tar sands crude oil and how these properties represent a serious threat to pipeline infrastructure.

In recent years, the majority of tar sands oil not refined in Alberta has been piped south to refineries in the United States. Midwestern pipelines have a relatively long history of transporting Canadian tar sands oil, and between 2007 and 2010, pipelines in North Dakota, Minnesota, Wisconsin, and Michigan—all pipelines carrying tar sands oil—spilled almost three times more crude oil per mile of pipeline when compared to the U.S. national average.[1]

In the past, most raw tar sands oil was upgraded to synthetic crude oil before it traveled through the interprovincial pipeline network. This meant a more refined, less corrosive product was transported out of Alberta. However, in recent years, production has outpaced on-site upgrader capacity, and Alberta now pipes an increasing amount of diluted bitumen to refineries elsewhere. (please see **Piping Tar Sands** on page 7 of this report).

Transporting increased amounts of tar sands diluted bitumen is a dangerous trend. For people living beside Enbridge's and the Portland-Maine aging pipelines, it is important to realize that tar sands diluted bitumen has the potential to cause more frequent and serious spills than the industry has previously experienced with conventional crude oil. Here is why:

- **It is acidic.** Tar sands diluted bitumen normally has organic acid concentrations up to 20 times higher than conventional crude oil, and contains up to 10 times more sulfur.[2]
- **It is hot.** Tar sands diluted bitumen flowing through pipelines creates friction, which raises the material's temperature and amplifies its corrosive qualities.[3] An accepted industry standard is that corrosion rates double with every 10-degree Celsius increase in temperature.[4]
- **It is abrasive.** Tar sands diluted bitumen has suspended in its mixture abrasive materials like quartz and pyrite sand particles.[5]
- **It is viscous.** Tar sands diluted bitumen is 40 to 70 times more viscous than North American conventional crude oil.[6] This high viscosity requires tar sands pipelines to operate at higher pressures than conventional pipelines.[7]

© Jesse Seymour-Perkins

Tar sands diluted bitumen traveling through pipelines is like high-pressure liquid sandpaper that can grind and burn its way through the pipe, increasing the chance that weakened pipelines will rupture. Furthermore, older pipelines were not designed to carry a heavy crude like diluted bitumen. This is especially true for the 62-year-old pipeline on the Portland-Montreal route, which was constructed decades before large-scale commercial tar sands extraction began. There are similar concerns for Line 9, which is almost 40 years old.

Tar sands diluted bitumen traveling through pipelines is like high-pressure liquid sandpaper that can grind and burn its way through the pipe, increasing the chance that weakened pipelines will rupture.

Piping Tar Sands

The tar sands oil that flows through pipelines is not the same as conventional oil. Because tar sands, or bitumen, is nearly solid at room temperature, it is mixed with natural gas liquids and other volatile petroleum products to create diluted bitumen.[a] Even after it is blended, diluted bitumen remains viscous and can only be transported under high pressure and at high temperatures.[b]

Diluted bitumen contains higher concentrations of hazardous materials and toxins compared to conventional oil, resulting in a more abrasive and corrosive material. Once diluted bitumen is exposed to oxygen, the flammable, volatile chemicals are at increased risk of explosion.[c] When exposed to air during a spill, the chemicals in diluted bitumen quickly evaporate, leaving the heavy tar sands to sink beneath the surface. This happened in the Enbridge Kalamazoo spill in Michigan, where tar sands oil that sank to the bottom of the river complicated cleanup operations.

a Canadian Oil Quality Association, CRW Characteristics, p. 14, 2007, Coqa-inc.org/Segato0608.pdf (accessed May 19, 2012).

b W.A. Slusarchuk, "Hot Pipelines in Permafrost: Hydraulic, Thermal and Structural Considerations," p. 2, 1972, Nrc-cnrc.gc.ca/obj/irc/doc/pubs/ir/ir394/ir394.pdf (accessed May 19, 2012).

c Diluted bitumen can form ignitable and explosive compounds in the air at temperatures above-17.8 degrees Celsius. Diluted bitumen pipelines often operate at temperatures in excess of 50 degrees Celsius. Imperial Oil Material Safety Data Sheet: Natural Gas Condensates, 2002, Msdsxchange.com/English/show_msds.cfm?paramid1=2480179 (accessed May 19, 2012).

IV. THE PLAN TO PUMP TAR SANDS TO CENTRAL CANADA AND NEW ENGLAND

It is clear that Enbridge is already pursuing a substantial part of the original Trailbreaker plan that will likely bring tar sands from Sarnia, Ontario, to Montreal for the entirety of Line 9. Additionally, Enbridge is now pursuing significant expansions for several of its pipelines bringing more tar sands oil eastward.[1]

But there are several reasons to believe that Enbridge may also pursue reversing the flow direction for at least one of the Portland-Montreal pipelines in order to bring tar sands from Alberta to the Maine coast: 1) previous public comments by oil industry executives; 2) permit applications at associated pumping stations and pipelines; and 3) the shifting dynamics of the oil market.

The Portland-Montreal Pipe Line is managed by two linked companies: the Montreal Pipe Line Limited, which owns and operates the Portland-Montreal Pipe Line with its wholly-owned U.S. subsidiary, the Portland Pipeline Corporation.[2] The Portland-Montreal Pipe Line company, as well as Enbridge Inc., have been open about their intent to move tar sands oil east through central Canada and New England. In 2011, Portland Pipe Line Corp. expressed publicly, "We're still very much interested in reversing the flow of one of our two Pipe Lines to move western Canadian crude to the eastern seaboard," treasurer Dave Cyr was reported saying. "We're having discussions with Enbridge on their Line 9 and what it means to us."[3]

Additionally, the Montreal Pipe Line Limited has been seeking a permit to add a pumping station along its right-of-way in Quebec.[4] The purpose would be to allow the flow of oil to be reversed on the Portland-Montreal link, bringing it in sync with Line 9's expected new direction.[5] In February 2012, a judge in Quebec denied the company's request to build the pumping station, which would have been located between the Montreal and Vermont border.[6] Notably, the Montreal Pipe Line Limited is reportedly owned in large part by Imperial Oil Limited and Suncor Energy Inc. Imperial and Suncor have major stakes in tar sands mining and refining projects in Alberta.[7]

Also, in October 2011, Enbridge CEO Patrick Daniel was reported as confirming that his company was talking with multiple refineries in eastern Canada and along the East Coast of the United States regarding a flow reversal that would necessitate complete reversals of Line 9 and the Portland-Montreal Pipe Line.[8] A few months later, however, after these comments drew increased public attention, the company was reported as saying it had no "active plans" at this time for the Portland-Montreal Pipe Line reversal, but did not rule out the option completely.[9]

Tar Sands Spills Threaten Great Lakes

Millions of people in both Canada and the United States rely on the Great Lakes for drinking water, recreation, fishing, and transportation. Congress has invested more than $1 billion into the Great Lakes through the Great Lakes Restoration Initiative. Any increase in tar sands pipeline activity is a threat to this freshwater resource.

However, Enbridge has announced major expansion plans that would increase the volume of tar sands flowing in pipelines near and under the Great Lakes, putting their watersheds at risk of a spill. The expansion plan would increase the volume of tar sands oil flowing through Enbridge's Lakehead system, which features pipelines that flow under and around Lakes Michigan, Huron, Superior and Erie.

Enbridge's expansion plans also include the reversal of Line 9 (thereby appearing to revitalize its 2008 Trailbreaker pipeline proposal), which has a pathway just north of Lake Ontario. The plans also propose expanding Line 6B, the same tar sands pipeline that spilled more than 1 million gallons of diluted bitumen into the Kalamazoo River watershed. Line 6B flows just south of Lake Huron, beneath the St. Clair River and north of Lake Erie.

Aerial view of Goderich, Ontario, on Lake Huron.

Tar sands oil companies have clearly stated their interest in accessing eastern markets for tar sands exports, and the complete reversal of Line 9 and the Portland-Montreal pipelines would link tar sands oil production centers to international shipping facilities in Maine.[10] Enbridge is likely seeking to transport tar sands oil to the East Coast because tar sands crude is increasingly oversupplied locally and producers now receive $30 less per barrel than the average global price for crude oil.[11] Like all the other major tar sands oil companies, Enbridge seems to want to improve its industry's access to U.S. refiners and the demand of the global oil market.

The oil industry wants access to other markets like the Gulf coast and markets abroad, to increase their per-barrel tar sands profits. Reversing Line 9 and the Portland-Montreal pipelines would be one of the quickest ways for the industry to achieve this goal, as it would not require new pipeline construction or the associated regulatory delays faced by other tar sands export pipeline projects like Keystone XL and Northern Gateway.

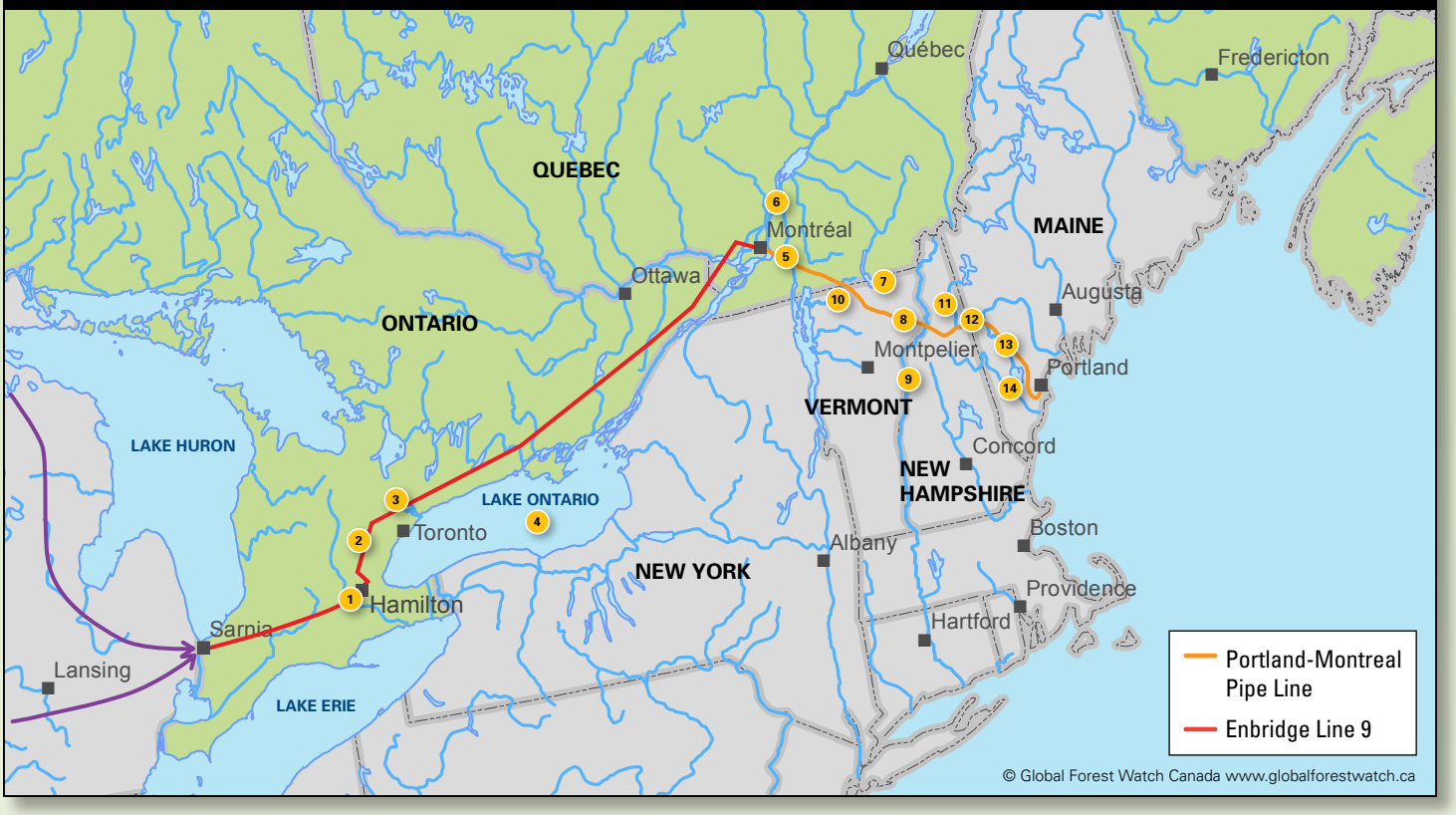
© Natural Resources Council of Maine

A New Kind of Crude Oil on the Maine Coast?

Reversing the flow of one of the Portland-Montreal pipelines would rely on a retrofit of the South Portland Marine Terminal in Maine. This retrofit would be necessary to accommodate the loading of massive oil tankers that have the capacity to transport up to 1 million barrels of tar sands crude out of Portland Harbor, Casco Bay, and the Gulf of Maine to refineries in places like Philadelphia, the Texas Gulf Coast, or elsewhere on the global oil market. If one of these tankers were to flounder on Maine's rocky seacoast, or otherwise become compromised and spill a load of tar sands oil, the results could be devastating.

A significant spill could crush Maine's economically and culturally vital commercial fisheries. It could also force a complicated cleanup of tar sands that have sunk to the bottom of the sea, requiring not only booms to contain surface spills, but also dredging equipment to retrieve sunken bitumen. The dredging process would likely agitate toxic sediments already settled on the floor of Portland Harbor and Casco Bay if a spill were to occur in that region.

V. SPECIAL PLACES AT RISK

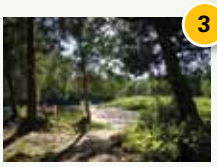


1 GRAND RIVER (ONTARIO)

A Canadian Heritage River, the Grand is home to more than 215 species designated as at-risk or endangered.[1] The pugnose shiner, one of the rarest minnows in North America, lives in the clear, slow-moving streams of the Grand's watershed. Over the past 50 years the species has disappeared from two Ontario sites, in part due to its sensitivity to water pollution.[2] Line 9 crosses the Grand River near Cambridge, Ontario.

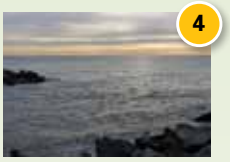
2 NIAGARA ESCARPMENT (ONTARIO)

The Niagara Escarpment is a ridge of fossil-rich sedimentary rock with geologic origins dating back 450 million years. The escarpment spans a 725-kilometer area, from Niagara to Tobermory, and its highest elevation soars more than 500 meters. A mosaic of forests, fields, cliffs, streams, wetlands, and historic sites, the Niagara Escarpment has been designated a United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Biosphere Reserve.[3] Endangered species include the red-shouldered hawk and the Jefferson's salamander, which are most often seen in woodland ponds during spring breeding season.[4] Line 9 crosses the escarpment near Campbellsville.



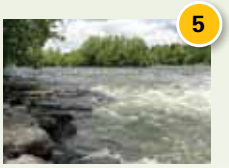
3 ROUGE RIVER (ONTARIO)

The Rouge River flows through Toronto and into Lake Ontario. The river is home to the endangered redside dace minnow, which favors cool, clear waters and gravelly river bottoms.[5] The Rouge River Park is also an important recreation area, home to the first urban national park in Canada. The pipeline crosses the Rouge River upstream from the park area.



4 LAKE ONTARIO (ONTARIO, NEW YORK)

One of the beloved Great Lakes, Lake Ontario is important to major population centers along the lake's shoreline, including Toronto and Rochester, New York. Line 9 crosses directly underneath numerous waterways just before they flow into Lake Ontario, including the Humber, Trent, and Rogue rivers. A spill into the lake would threaten countless bird and fish species, and impact millions of people living along the lake on both sides of the border.



5 RICHELIEU RIVER (QUEBEC)

Flowing north out of Lake Champlain in Vermont, the Richelieu is a major tributary to the Saint Lawrence. The Richelieu is home to the endangered copper redhorse fish, which is endemic to southwestern Quebec.[6] Pollution is one of the main threats to this fish's habitat, and the pipeline crosses the Richelieu east of Montreal, not far from the river's confluence with the Saint Lawrence.

6 SAINT LAWRENCE RIVER (QUEBEC)

The Saint Lawrence is eastern Canada's most important river, providing drinking water for about 50 percent of Quebec's population. The river widens as it flows northeast toward the Atlantic Ocean, and at this point the Saint Lawrence becomes the seasonal home to a small population of blue whales.[7] Beluga whales live there year round.[8] The Portland-Montreal Pipe Line crosses the Saint Lawrence at Montreal.

7 LAKE MEMPHREMAGOG (QUEBEC, VERMONT)

This 27-mile long glacial lake is located in Quebec and Vermont and serves as a drinking water resource for both Canada and the United States.[9] Anglers visit the lake to fish for rainbow trout, landlocked salmon, and walleye.[10] The Portland-Montreal Pipe Line crosses Vermont's Black River, one of the lake's major tributaries. A 1977 oil spill occurred along the pipeline's right-of-way and contaminated Memphremagog.

8 VICTORY STATE FOREST (VERMONT)

After hibernating, hungry black bears emerge from their dens to find early spring meals in this 15,000-acre state-owned complex, which includes Darling State Park and the Victory Wildlife Management Area. At the forest's lowest elevations stands of spruce trees grow on lush beds of sphagnum moss, and in the heart of the basin is a 20-acre boreal bog. More than 130 bird species have been identified in Victory Basin. Some of them—including the black-backed woodpecker, gray jay, and white-winged crossbill—are Boreal forest species not commonly found in other parts of Vermont.[11] The Portland-Montreal Pipe Line crosses through this state forest.

9 CONNECTICUT RIVER (VERMONT, NEW HAMPSHIRE, MASSACHUSETTS, CONNECTICUT)

More than 400 miles long, the Connecticut River is the mightiest river in New England and an American Heritage River. The river drains about one third of New England's landscape and provides 70 percent of all freshwater inflows to Long Island Sound.[12] The pipeline crosses the Connecticut River at Guildhall, Vermont, just north of the popular Moore Reservoir. An oil spill could have far-reaching impacts to a variety of wildlife including the American shad and black duck which is increasingly declining and threatened by hybridization with mallards.[13]

10 MISSISQUOI RIVER (VERMONT, QUEBEC)

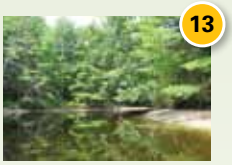
The 88-mile Missisquoi River is one of the major tributaries to Lake Champlain. The river's headwaters are in Lowell, Vermont, and its watershed encompasses 767,000 acres of both Vermont and Quebec. At the mouth of the river is the 6,700-acre Missisquoi National Wildlife Refuge. Its vast waters and wetlands provide habitat for large flocks of migratory birds, particularly waterfowl. Refuge lands also protect the Shad Island great blue heron rookery, the largest colony in Vermont.[14] The pipeline cuts across the river.

11 COÖS COUNTY (NEW HAMPSHIRE)

New Hampshire's northernmost and least populated county, part of the region known simply as the "North Country," is the keeper of New Hampshire's rural and environmental heritage. Many of the state's most spectacular mountains, forests, rivers, streams, lakes, and ponds are found in Coös County. The pipeline route through Coös County follows the Presidential Highway, through the Israel River Valley to the northern slopes of the Presidential Range, just north of the Appalachian Trial, Mount Washington, New England's tallest peak, and the recreational mecca of Pinkham Notch. A pipeline spill in this rugged area could harm the county's extraordinary ecology and habitats, as well as its vital natural resources and four-season tourism industries. A spill could also impair the reputation of the White Mountains as a wild, pristine destination—a key economic engine for New Hampshire's economy as a whole.

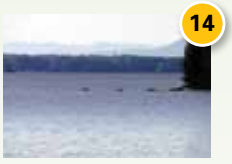
12 ANDROSCOGGIN RIVER (NEW HAMPSHIRE, MAINE)

The oil pipeline twice crosses, and for 13 miles runs alongside a river affectionately known as the "Andro," as it passes thru a gap in the mountains between New Hampshire and Maine. Moose, black bear, and bald eagles are frequently seen on this waterway, as well as fishermen and recreational paddlers. Sustained community efforts have helped restore this river after decades of pollution from upstream towns and paper mills. Now this stretch has busy public boat launches, guided fishing float trips, canoe rentals, and scenic roadside views. An oil leak along this portion of the Andro would severely harm the river's recreational value and wildlife habitat, with additional impacts to riverside villages and industry downstream.



13 CROOKED RIVER (MAINE)

A favorite of anglers and whitewater enthusiasts, the Crooked boasts more than 50 miles of free-flowing river, with Class I and Class II rapids. The river also has a healthy wild brook trout population and is the primary spawning and nursery ground for Sebago Lake's landlocked Atlantic salmon. Because of this strong fishery, Maine's legislature has granted the river Class AA status—the state's highest level of protection. The Crooked also provides 40 percent of the surface water inflow to Sebago Lake, a vital drinking water resource to more than one in ten Mainers.[15] The oil pipeline crosses the Crooked River six times.



14 SEBAGO LAKE (MAINE)

Sebago Lake covers 30,000 acres and stretches for more than 50 miles, including across parts of 24 towns.[16] Sebago Lake boasts Maine's busiest state campground and a renowned fishery that supports 40,000 angler days per year.[17] The lake is exceptionally pristine exempt from expensive filtration processes and provides clean drinking water to Portland, which is Maine's largest city. The lake is also home to a native species of landlocked Atlantic salmon, Salmo salar sebago. The pipeline passes through the Sebago Lake watershed and comes within approximately 1,000 feet of the lake itself.

VI. THE TROUBLE WITH TAR SANDS EXTRACTION

Open-pit mining lays waste to millions of acres of carbon storing Boreal forest. The Canadian Boreal forest is one of the world's largest storehouses of carbon.

Alberta tar sands oil does not flow freely from the ground like the gushers portrayed in the movies. In its raw form tar sands oil has been described as dirt that smells like diesel, and its extraction requires two destructive methods:[1]

- **Open-pit mining** uses massive excavators to load oily dirt into dump trucks the size of houses. The tar sands oil is then hauled to plants for initial processing. This mining style razes thousands of hectares of forestland, and the consequences of clear-cut forest destruction are far-reaching.[2] The Canadian Boreal forest contains the nesting grounds of millions of birds like the evening grosbeak and the olive-sided flycatcher.[3] The forest soil and wetlands are also one of the world's largest storehouses of carbon, and the destruction of wetlands and trees on such a massive scale contributes to climate change.[4]
- **In-situ drilling** is approximately 2.5-times more greenhouse gas-intensive than open-pit mining.[5] The in-situ process involves burning natural gas above ground to generate steam which is then forced into pipes drilled deep beneath the forest floor. Heat emanating from these pipes melts bitumen, which gathers in wells before being pumped up to the surface. In-situ mining's footprint fragments the Boreal forest, leading to habitat disruption for wild animals, such as the woodland caribou. It also releases harmful air pollutants, such as sulfur dioxide, into the atmosphere.[6]

The landscape left behind after tar sands oil extraction is one of extreme industrial devastation. Tar sands mining operations require between two to four barrels of fresh water for every barrel of oil produced.[7] There are already more than 65 square miles (170 square kilometers) of man-made toxic lakes and ponds in the tar sands region, an area bigger than Vancouver or Washington, D.C.[8] To the occasional flock of migrating waterfowl, these tar sands tailings ponds look like good landing sites; clearly, they are not. An example of the threat these sites pose occurred in 2008, when more than 1,600 ducks died after landing on the toxic surface of a sludge-coated waste lake.[9]

Compounding the environmental destruction of tar sands operations is the level of emissions that they emit into the atmosphere. In fact, tar sands operations are the fastest-growing source of global warming emissions in Canada. Global warming emissions from tar sands extraction and upgrading are estimated to be three to five times higher per barrel than production of a barrel of conventional Canadian or U.S. crude.[10] From its extraction in Alberta to its final use in a car, tar sands oil is, on average, 14 to 20 percent more carbon intensive than other imported crudes to the United States.[11] Tar sands operations have helped push Canadian politicians to withdraw from national commitments to the Kyoto Protocol on Global Warming.[12]

Clean Fuels Standard in the Northeast and Mid-Atlantic

The oil industry's aggressive push to increase U.S. imports of the dirtiest oil on the planet is being counteracted in the Northeast and Mid-Atlantic regions of the United States by calls for a new Clean Fuels Standard (CFS). Adoption of a CFS would require oil producers and refiners to reduce the carbon footprint of the fuels they sell.

The model being considered by 11 states in the Northeast and Mid-Atlantic—including Maine, Vermont, and New Hampshire—is similar to one already in place in California. The plan would take into account the lifecycle emissions of various fuel types and cut the carbon intensity of transportation fuels by as much as 15 percent over the next 10 to 15 years.[a]

If instituted, a CFS would provide a market incentive to choose fuels with a lower climate impact than tar sands oil, and could help states like Vermont, New Hampshire, and Maine craft energy policies that would lead to a $40 billion boon to their regional economies.[b]

However, oil industry groups like Americans for Prosperity and the Consumer Energy Alliance (CEA) undermine these standards by promoting high-carbon tar sands oil.[c] For example, CEA is reported to have met with legislators, governors, and regulators on this issue.[d] In Canada, a shift in the oil supply toward more tar sands oil would contradict provincial climate change goals. Ontario has committed to reducing the climate impact of transportation fuels, while Quebec has been a North American leader on climate change.

a Jason Plautz, "Northeast States Considering Low-Carbon Fuel Rule Based on Calif. Model," *New York Times*, August 15, 2011.
b NESCAUM, "Economic Analysis of a Program to Promote Clean Transportation Fuels in the Northeast/Mid-Atlantic Region," August 2011.
c Maria Gallucci, "Northeast Markets Eyed for Oil Sands as Clean Fuels Standard Fades," *InsideClimate News*, March 29, 2012, http://insideclimatenews.org/news/20120327/northeast-staets-clean-fuels-standard-low-carbon-fuels-program-california-rggi-new-jersey-new-hamsphire-afp-cea.
d Ibid.

Tar Sands Refineries' Air Impacts

As tar sands oil production expands, so do the negative impacts associated with the refining process—including smog, increased greenhouse gas emissions, and severe public health problems like cancer.

Alberta currently has a lack of adequate upgrading capacity. With the potential for tar sands to flow to central Canada, cities like Sarnia, Ontario, and Montreal could potentially experience an increase in tar sands oil refining activities, either through the construction of new refineries or the retrofitting of old ones.[a]

Sarnia already has the worst air quality in Canada, and Montreal is not far behind.[b] Sarnia is home to dozens of chemical plants and large oil refineries. In Montreal, studies have shown that refinery emissions can be linked to high asthma rates.[c]

Refining more low-quality fuels, such as tar sands, in communities near oil refineries can worsen already serious environmental health risks.[d]

It is estimated that switching from refining lighter crude oils to heavier tar sands crude oils could double or even triple refinery emissions of greenhouse gasses.[e]

a Environmental Defence and Equiterre, "Trailbreaker – Refinery Emissions Report," p. 6.
b Tara Jeffrey, "Sarnia's air Canada's worse," The Observer, September 27, 2011, http://theobserver.ca/ArticleDisplay.aspx?e=3312431&archive=true (accessed April 11, 2012).
c Ecojustice, "Exposing Canada's Chemical Valley: An Investigation of Cumulative Air Pollution in the Sarnia, Ontario Area," p. 13, http://www.ecojustice.ca/publications/reports/report-exposing-canadas-chemical-valley/attachment (accessed April 11, 2012). Audrey Smargiassi et al., "Risk of Asthmatic Episodes in Children Exposed to Sulfur Dioxide Stack Emissions from a Refinery Point Source in Montreal, Canada," Environmental Health Perspectives, April 2009, http://ehp03.niehs.nih.gov/article/fetchArticle.action?articleURI=info%3Adoi%2F10.1289%2Fehp.0800010 (accessed April 11, 2012).
d Greg Karras, "Refinery GHG emissions from dirty crude," Communities for a Better Environment, April 20, 2009, p. 9.
e Greg Karras, "Combustion Emissions from Refining Lower Quality Oil: What is the Global Warming Potential?," Communities for a Better Environment, November 14, 2010, http://pubs.acs.org/doi/abs/10.1021/es1019965 (accessed April 11, 2012).

VII. TAR SANDS OIL SPILLS

Oil pipeline operators acknowledge that leaks and spills are an inherent risk when it comes to pipelines. Enbridge, for example, notes a wide range of potential leak causes including equipment failure, operator error, and catastrophic events like natural disasters, fires, and explosions.[1] The cleanup process for a tar sands oil spill is far more complex than the cleanup for a conventional oil spill, and the impact is often more damaging to environmental and public health for the following reasons:

- The natural gas condensate used to dilute tar sands oil increases the risk that spilled material will explode if it comes in contact with high heat, sparks, static electricity, or lightning.[2]
- Exposure to diluent toxins like benzene, n-hexane, and polycyclic aromatic hydrocarbons can affect the human central nervous system.[3]
- If spilled, diluted bitumen contaminates a body of water, and the diluents can quickly evaporate, leaving the heavy bitumen to sink to the bottom.[4]

Enbridge has experience with tar sands oil pipeline spills. On July 25, 2010, an Enbridge pipeline near Marshall, Michigan burst open, spewing more than 1 million gallons of diluted bitumen from a large gash in a black pipe.[5] The spill originated in an open field, but the oil eventually flowed into Talmadge Creek, where it traveled several miles before spreading down a 30-mile stretch of the Kalamazoo River and contaminating a lake.[6] Despite multiple alarms and warning signals, operators did not shut down the pipeline for more than 17 hours after the spill began.[7] The Michigan governor at the time called Enbridge's initial spill response "anemic."[8]

Enbridge's line spilled for more than 17 hours, devastating the Kalamazoo watershed and much of its wildlife.

"This was the first time the Environmental Protection Agency or anyone has done a submerged cleanup of this magnitude. I would never have expected ... that we would have spent two or three times longer working on the submerged oil than surface oil."

– Ralph Dollhopf, EPA Incident Commander for the Kalamazoo spill[9]

Shortly after the spill, people in the vicinity began reporting "strong, noxious odors and associated health symptoms."[10] According to a 2010 report by the Michigan Department of Community Health, in the weeks after the spill, health officials identified 145 patients who reported illness or symptoms associated with the leak.[11] A door-to-door survey of 550 people showed that 58 percent of those contacted suffered from adverse health effects, most commonly headaches, respiratory problems, and nausea.[12] In addition to health problems, the real estate market near the spill site has been transformed. After the spill, Enbridge instituted a home buyout program for residents living directly along Talmadge Creek and the Kalamazoo River. Enbridge has purchased at least 130 homes in two counties, leading some residents to express concerns over how the spill itself and the resulting buyback program will affect real estate prices.[13] As of spring 2012, the cleanup is continuing with nearly 400 acres identified as having a significant amount of submerged tar sands oil. Its cost is estimated at $725 million.[14]

© Michigan DEQ

Wildlife such as this Great Blue Heron was soaked in oil after the Enbridge spill.

A History of Spills

Enbridge strives for zero spills, but when it comes to pipeline safety, the company has an oil-splattered record. According to Enbridge's own data, between 1999 and 2010, the company had 804 spills, releasing 6.8 million gallons of hydrocarbons.[a]

a Richard Girard and Tanya Roberts Davis, "Out on the Tar Sands Mainline," Polaris Institute, May 2010, p. 49. http://www.tarsandswatch.org/files/Updated%20Enbridge%20Profile.pdf (accessed April 12, 2012).

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Enbridge's tar sands pipeline spilled more than 1 million gallons of diluted bitumen, which is tar sands oil mixed with natural gas liquids and other volatile petroleum products.

VIII. FIRST NATION AND NATIVE AMERICAN CONCERNS

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Enbridge's Line 9 pipeline, which would likely ship tar sands eastward, crosses the Saint Lawrence River, which provides drinking water for nearly 50 percent of Quebec's population

In an October 2011 letter to the National Energy Board, Enbridge suggested that reversal of Line 9 along its privately owned corridor would not adversely affect traditional Aboriginal rights. "The current land use at the Project sites is incompatible with any traditional use and the lands are not currently being used for the purposes of exercising Aboriginal traditional rights, and have not been used in that respect for decades," Enbridge lawyer Francis Durnford wrote.[1]

However, what Enbridge was not taking into account is that the pipeline's risks extend beyond the project sites themselves. Some of the associated risks from Line 9 and the Portland-Montreal pipelines that could affect First Nations or Native Americans include increased air pollution from the refining process, and oil spills that could damage waterways.

For example, oil refineries in Sarnia, the city at the western terminus of Line 9, have contributed to the region's significant increase in air pollution. A 2005 report detailed an uncommon discrepancy in the sex ratio of babies born on the Aamjiwnaang First Nation, located near Sarnia. The number of boys in this community has been declining at an alarming rate compared to the number of girls.[2]

Reversing the flow of pipelines to bring tar sands east raises the likelihood that larger quantities of heavy crude oil will be processed in Sarnia. This could mean the residents of Sarnia and the Aamjiwnaang community will have to contend with greater amounts of toxic pollution.

The pipeline itself poses another risk to First Nations, as well as Native Americans. As Enbridge and other pipeline companies readily admit, operating an oil pipeline comes with an inherent risk of leaks.[3] In Canada, a spill of diluted bitumen could impact First Nations communities like the Chippewas of the Thames, who live downstream of Line 9 near the Thames River; the Six Nations of the Grand River, who live downstream near the Grand River; and the Mohawks of the Bay of Quinte, who live on the Bay of Quinte downstream of the Salmon River.

In the United States, the pipeline oil spill could also affect the land and waters of the Missisqoui, Memphremagog, and Nulhegan watersheds—the territory that is home to the many families and peoples of the Nulhegan Abenaki Tribe.

IX. RECOMMENDATIONS

In the absence of specialized regulations, the rapid growth of tar sands oil pipeline development in Canada and the United States necessitates a close examination of any oil pipeline proposal. A new tar sands pipeline is not only unnecessary, but it would bring only risks to eastern Canada and New England. In short, plans to reverse the Enbridge and Portland-Montreal pipelines should not be put into operation. As a starting point, the following steps are required to protect the environment and public safety from the potentially dangerous impacts of tar sands oil pipelines:

The National Energy Board (NEB) should consider Enbridge's Line 9 reversal permit application as part of a broader plan to bring tar sands oil east from Alberta to Ontario, Quebec, and New England. A broader scope would allow the NEB to consider the impacts of a Trailbreaker-like project on: the climate change and energy security objectives of various jurisdictions; the consequences of the tar sands oil production expansion; the risks associated with tar sands oil pipeline spills; and the effects of likely pollution increases at refineries. A broader scope would reveal that the Line 9, Phase 1 permit should be denied.

Complete more thorough reviews of pipeline plans. Included in the reviews should be impacts on environmental and public health, as well as the impacts of potential tar sands oil spills. Both the NEB in Canada and state and federal agencies in the United States should complete comprehensive reviews, under applicable environmental protection laws, of broader plans to transport tar sands oil via pipeline from Alberta to central Canada and New England. These reviews should be coordinated across international boundaries and address air, land, and water impacts, as well as threats to public health and safety. Any such environmental reviews should consider the potential of tar sands oil spills, and the impact such spills might have on the environment and the economy.

Both the Canadian and U.S. governments should restrict future tar sands diluted bitumen pipeline development until adequate safety regulations are in place. Applications for diluted bitumen pipeline projects such as the Line 9 reversal should be denied until the NEB and the Department of Transportation (DOT) evaluate additional risks posed by diluted bitumen pipelines, and ensure that adequate safety regulations are in place to handle these risks.

Conduct long-range clean energy plans before committing to large-scale infrastructure that would increase oil consumption. Any Canadian and U.S. environmental reviews should be made within the framework of a national transition to clean energy. In Canada, this means embracing clean energy as part of a comprehensive national energy strategy before making irreversible commitments to large-scale oil pipeline infrastructure. In the United States, Northeastern and Mid-Atlantic states should adopt a clean fuel standard, which would promote investment in clean transportation fuels, create new business opportunities, and add jobs.

Embrace policies that would reduce oil demand. Governments in both Canada and the United States should embrace oil-savings policies rather than invest in dangerous tar sands oil pipelines. Adopting a series of U.S. oil savings policies would in 20 years reduce American oil imports and consumption by 5.7 million barrels per day, which is about twice as much oil as Canada currently produces. Examples of oil-saving measures include: increasing fuel efficiency in vehicles, as well as in aviation, rail, marine, and other non-highway transportation equipment; supporting both public transportation and community planning initiatives; and reducing oil use in industrial processes and in building heat.[1]

ENDNOTES

II. Pursuing a North American Eastern Tar Sands Pipeline

1 National Energy Board Filing Receipt, Line 9 Reversal Phase I Project, Filing ID No. A30643, Enbridge Pipelines Inc., August 8, 2011, https://www.neb-one.gc.ca/ll-eng/livelink.exe/fetch/2000/90464/90552/92263/706191/706437/770257/706045/_B-01A_-_Line_9_Reversal_Phase_I_Project_Application-_A2C0U9.pdf?nodeid=705901&vernum=0.

2 "Enbridge pares plans to ship to Gulf Coast," *Calgary Herald*, July 10, 2008. http://www.canada.com/calgaryherald/news/calgarybusiness/story.html?id=fd6e1a3f-0d8a-4a21-9698-24828fc3d12a (accessed June 11, 2012).

3 Enbridge Inc., "Line 9 Reversal Phase I Project Overview," http://www.enbridge.com/Line9ReversalProject.aspx (accessed May 19, 2012).

4 Enbridge Inc., "Enbridge (ENB) and Enbridge Energy Partners L.P. (EEP) project expansions May 2012," http://enbridge.com/EEP-and-ENB-project-expansions-May-2012.aspx (accessed May 17, 2012)).

5 Line 9 has a 30-inch diameter and a capacity of 240,000 barrels per day. Since its construction in 1975, the flow direction of Line 9 has been switched several times; Trailbreaker would return the flow to its original direction, though the Phase I reversal application before the Canada National Energy Board only applies to the Sarnia-North Westover segment.

6 Portland Pipe Line Corporation, Montreal Pipe Line Limited, "Crude Oil Quality Group Presentation," June 18, 2009, http://www.coqa-inc.org/061809Gilles.pdf (accessed May 17, 2012).

7 A third pipeline on the route was decommissioned.

III. Tar Sands Pipelines: A Threat to Communities and Waterways

1 North Dakota, Minnesota, Wisconsin, and Michigan have approximately 5,475 miles of crude pipeline, or about 10.9 percent of the U.S. total. U.S. Department of Transportation, PHMSA, State Mileage by Commodity Statistics, 2011, http://primis.phmsa.dot.gov/comm/reports/safety/MI_detail1.html?nocache=8335#_OuterPanel_tab_4 (accessed May 19, 2012). Bureau of Transportation and Labor Statistics, Table 1-10: U.S. Oil and Gas Pipeline Mileage, 2009, http://www.bts.gov/publications/national_transportation_statistics/html/table_01_10.html (accessed May 19, 2012). Meanwhile, between 2007 and 20010 crude pipelines in North Dakota, Minnesota, Wisconsin, and Michigan spilled 38,220 barrels of crude, or 30.3 percent of the 125,862 barrels of crude spilled in the United States.

2 Gareth Crandall, "Non-Conventional Oil Market Outlook," Presentation to IEA Conference on Non-Conventional Oil, 2002, p. 4.

3 California Office of the State Fire Marshal, "An Assessment of Low Pressure Crude Oil Pipelines and Crude Oil Gathering Lines in California," p. 53, April 1997, osfm.fire.ca.gov/pipeline/pdf/publication/lowstresspipeline.pdf (accessed April 12, 2012).

4 Construction Industry Research Association, Chemical Storage Tank Systems – Good Practices, p. 204.

5 S.A. Lordo, New Desalting Chemistry for Heavy/High Solids Crude, 2010, p. 12, coqa-inc.org/20100211_Lordo_Solids_in_Crude.pdf (accessed April 12, 2012).

6 Pipeline operator tariffs require that product not exceed 350 cST viscosity. Enbridge Pipelines Inc., Crude Petroleum Tariff, p. 3, March 2008.

7 Industry defines a high-pressure pipeline as one that operates at pressures greater than 600 pounds per square inch (psi). Line 9 has a maximum operating pressure range of 559 to 779 psi.

IV. The Plan to Pump Tar Sands to Central Canada and New England

1 Michelle Lalonde, "Enbridge wants to pipe tarsands oil to Montreal," *Montreal Gazette*, May 18, 2012, http://www.montrealgazette.com/news/Enbridge+pipe+tarsands+Montreal/6640747/story.html (accessed May 23, 2012). Testimony of John Quinn, General Manager, Integration and Planning, Refining and Marketing, Suncor Energy Inc., Standing Committee on Natural Resources, Parliament of Canada, 41st Parliament, 1st Session, February 2, 2012, http://www.parl.gc.ca/HousePublications/Publication.aspx?Language=E&Mode=1&Parl=41&Ses=1&DocId=5355101&File=0#Int-6471198 (accessed May 19, 2012).

2 Portland Montreal Pipeline, "About Us" http://www.pmpl.com/about.php (accessed May 25, 2012)

3 Nathan Vanderklippe, "Critics target Enbridge plan to reverse pipeline flow," Globe and Mail, August 25, 2011, http://www.theglobeandmail.com/report-on-business/critics-target-enbridge-plan-to-reverse-pipeline-flow/article2142484/ (accessed April 12, 2012). The Portland-Montreal Pipeline is operated by the Montreal Pipe Line Limited based out of Canada and its wholly owned subsidiary the Portland Pipe Line Corp. based out of the United States.

4 Elizabeth McGowan, "Plan to build East Coast Gateway for Canada's Oil Sands hits legal snag," *InsideClimate News*, March 20, 2012, http://insideclimatenews.org/news/20120319/montreal-maine-oil-sands-pipeline-east-coast-enbridge-quebec-court-national-energy-board-environmentalists (accessed April 12, 2012).

5 Ibid.

6 Societe Quebecoise d'Information Juridique, Pipe-lines Montreal Itee c. Durand, February 16, 2012, http://www.jugements.qc.ca/php/decision.php?liste=59141834&doc=2595D23C769B45A6FE0C0E8B9C99107E3724B50852113D2F3EB4FAD6CA1501B6&page=1 (accessed April 12, 2012).

7 Elizabeth McGowan, "Plan to Build East Coast Gateway for Canada's Oil Sands Hits Legal Snag," *InsideClimate News*, March 20, 2012, http://insideclimatenews.org/news/20120319/montreal-maine-oil-sands-pipeline-east-coast-enbridge-quebec-court-national-energy-board-environmentalists (accessed June 11, 2012).

8 Brad Olson and Jeremy van Loon, "Enbridge Talking with Valero on East Coast Pipeline Reversal," *Bloomberg*, October 5, 2011, http://www.bloomberg.com/news/2011-10-06/enbridge-talking-with-valero-on-east-coast-pipeline-reversal.html (accessed May 18, 2012).

9 Susan Sharon, "Canadian Judge's Decision Could Delay any Tar Sands Flow to Portland," Maine Public Broadcasting Network, April 3, 2012, http://www.mpbn.net/Home/tabid/36/ctl/ViewItem/mid/3478/ItemId/21173/Default.aspx (accessed April 12, 2012).

10 Janet Davison, "Does sending Alberta oilsands crude east make more sense?" *CBC News*, May 14, 2012, http://www.cbc.ca/news/business/story/2012/05/08/f-pipelines-east.html; (accessed May 23, 2012); Carrie Tait, "Enbridge firms up pipeline reversal plan," Globe and Mail, May 16, 2012, http://www.theglobeandmail.com/globe-investor/enbridge-firms-up-pipeline-reversal-plan/article2435079/ (accessed May 18, 2012); Nathan Vanderklippe and Shawn Mccarthy, "TransCanada looks east as Gateway pipeline gets bogged down" Globe and Mail, March 22, 2012. http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/transcanada-looks-east-as-gateway-pipeline-gets-bogged-down/article2378494/?utm_medium=Feeds%3A%20RSS%2FAtom&utm_source=Home&utm_content=2378494 (accessed April 12, 2012).

11 Bill Mann, "Proposed Canada pipelines: A crude gesture Sending oil to Cushing resulting in steep Canadian discount" MarketWatch, March 29, 2012, http://www.marketwatch.com/story/proposed-canada-pipelines-a-crude-gesture-2012-03-29 (accessed May 23, 2012).

V. Special Places at Risk

1 Grand River Conservation Authority, "A Watershed Forest Plan for the Grand River," June 2004, p. 49, http://www.grandriver.ca/forestry/ForestPlan_complete.pdf, http://www.grandriver.ca/forestry/ForestPlan_complete.pdf (accessed May 23, 2012).

2 Royal Ontario Museum and Ontario Ministry of Natural Resources, Species at Risk: Pugnose Shiner, http://www.rom.on.ca/ontario/risk.php?doc_type=fact&id=73 (accessed April 12, 2012).

3 Niagara Escarpment Commission, About the Niagara Escarpment: Overview, http://www.escarpment.org/about/overview/index.php (accessed April 12, 2012).

4 Royal Ontario Museum and Ontario Ministry of Natural Resources, Species at Risk: Jefferson Salamander, http://www.rom.on.ca/ontario/risk.php?doc_type=fact&id=154 (accessed April 12, 2012).

5 Royal Ontario Museum and Ontario Ministry of Natural Resources, Species at Risk: Redside Dace, http://www.rom.on.ca/ontario/risk.php?doc_type=fact&id=70 (accessed April 12, 2012).

6 Fisheries and Oceans Canada, Aquatic Species at Risk, http://www.dfo-mpo.gc.ca/species-especes/species-especes/copper_redhorse-chevalier_cuivre-eng.htm (accessed April 12, 2012).

7 GREMM, "Whales Online: Blue Whale," http://www.baleinesendirect.net/eng/pag.php?PagRef=3-2-12 (accessed June 11, 2012).

8 Beluga, "Beluga whale research," http://www.beluga.is/default.asp?Page=95 (accessed June 11, 2012).

9 Monitoring and Assessment Work Group of the Quebec/Vermont Steering Committee on Lake Memphremagog, "The Water Quality of Lake Memphremagog," May 8, 2008, http://www.vtwaterquality.org/lakes/docs/lp_monjointque-vtreport.pdf (accessed April 12, 2012).

10 Vermont Fish and Wildlife, "Victory Basin Wildlife Management Area," http://www.vtfishandwildlife.com/library/factsheets/AccessAreas/Johns%20River.pdf (accessed April 12, 2012).

11 Ibid.

12 Peter Alden and Brian Cassie, National Audubon Society Field Guide to New England (New York: Alfred A. Knopf, 1998), p. 13. Connecticut River Watershed Council, "The Connecticut and its tributaries," http://www.ctriver.org/our_region_and_rivers/about_our_rivers/index.html (accessed April 12, 2012). Connecticut River Watershed Council, "Watershed Facts," http://www.ctriver.org/our_region_and_rivers/river_facts/index.html (accessed April 12, 2012).

13 U.S. Fish and Wildlife Service, Silvio O. Conte National Fish and Wildlife Refuge Final Action Plan and Environmental Impact Statement, October 1995. http://www.fws.gov/r5soc/library/natural_resources/watershed_species.doc

14 U.S. Fish and Wildlife Service, Missisquoi National Wildlife Refuge brochure, http://www.fws.gov/northeast/missisquoi/pdf/Missisquoi.pdf (accessed April 12, 2012).

15 Maine Rivers, Crooked River Dam Proposal Under Review, http://mainerivers.org/projects/crooked-river/ (accessed April 12, 2012).

16 Portland Water District, Sebago Lake, http://www.pwd.org/environment/sebago/sebago.php (accessed June 4, 2012).

17 Maine Rivers, Crooked River Dam Proposal Under Review, http://mainerivers.org/projects/crooked-river/ (accessed April 12, 2012).

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VI. The Trouble with Tar Sands Extraction

1 Elizabeth Kolbert, "Unconventional Crude," *The New Yorker*, November 17, 2007.

2 Anthony Swift et al., "Pipeline and Tanker Trouble," Natural Resources Defense Council, November 2011, p. 5, http://www.nrdc.org/international/pipelinetrouble.asp (accessed April 12, 2012).

3 Jeff Wells et al., "Danger in the Nursery: Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest," Natural Resources Defense Council, 2008.

4 Rebecca Rooney, Suzanne Bayley, and David Schindler, "Oil sands mining and reclamation cause massive loss of peatland and stored carbon," Proceedings of the National Academy of Sciences (Department of Biological Sciences, University of Alberta) August 30, 2011. http://www.pnas.org/content/early/2012/03/06/1117693108.full.pdf+html?sid=ef516cad-3bdf-43c3-9093-bd598712f3f7.), August 30, 2011, http://www.pnas.org/content/early/2012/03/06/1117693108.full.pdf+html?sid=ef516cad-3bdf-43c3-9093-bd598712f3f7 (accessed May 23, 2012).

5 Marc Huot, Lindsay Fishcer and Nathan Lemphers, "Oil sands and Climate Change: How Canada's oilsands are standing in the way of effective climate action," September 2011, http://www.pembina.org/pub/2262 (accessed April 12, 2012).

6 Pembina Institute, "Mining vs. In Situ Fact Sheet," p. 3, www.pembina.org/pub/2017 (accessed April 12, 2012).

7 Pembina Institute, "Oil Sands 101: Water Impacts," http://www.pembina.org/oil-sands/os101/water#footnote7_rad4k0c (accessed April 3, 2012).

8 Government of Alberta, Press Release, "ERCB Approves Fort Hills and Syncrude Pond Plans with Conditions," April 23, 2010, http://www.ercb.ca/portal/server.pt/gateway/PTARGS_0_240_2627953_0_0_18/ (accessed April 12, 2012).

9 Josh Wingrove, "Syncrude guilty in ducks trial," *Globe and Mail*, June 25, 2010, http://www.theglobeandmail.com/report-on-business/industry-news/energy-and-resources/syncrude-guilty-in-ducks-trial/article1618384/ (accessed April 12, 2012).

10 Marc Huot, Lindsay Fishcer and Nathan Lemphers, "Oilsands and Climate Change: How Canada's oilsands are standing in the way of effective climate action," Septmeber 2011, http://www.pembina.org/pub/2262 (accessed April 12, 2012).

11 Richard K. Lattanzio, "Canadian Oil Sands: Life-Cycle Assessments of Greenhouse Gas Emissions," Congressional Research Service, May 15, 2012, p. 8. http://www.fas.org/sgp/crs/misc/R42537.pdf (accessed June 15, 2012).

12 Mark Kennedy, "Canada pulling out of Kyoto accord," *Postmedia News*, December 12, 2011. http://news.nationalpost.com/2011/12/12/canada-formally-withdrawig-from-kyoto-protocol, (accessed May 23, 2012).

VII. Tar Sands Oil Spills

1 Enbridge, 2010 Annual Report, p. 99, http://ar.enbridge.com/ar2010/assets/Downloads/2010_Enbridge-Inc-Annual-Report.pdf (accessed June 11, 2012).

2 Diluted bitumen can form ignitable and explosive compounds in the air at temperatures above -17.8 degrees Celsius. Diluted bitumen pipelines often operate at temperatures more than 50 degrees Celsius. Imperial Oil, "Material Safety Data Sheet: Natural Gas Condensates," 2002, msdsxchange.com/english/show_msds.cfm?paramid1=2480179 (accessed April 12, 2012).

3 Imperial Oil, "Material Safety Data Sheet: DilBit Cold Lake Blend," 2002, msdsxchange.com/english/show_msds.cfm?paramid1=2479752 (accessed April 12, 2012).

4 Esso, "General Oil Spill Response Plan: Fate and Effects of Spilled Oil," September 1999, esso.com/Chad-English/PA/Files/Sect04.prn.pdf (accessed April 12, 2012).

5 U.S. Environmental Protection Agency, "EPA's response to the Enbridge Oil Spill," epa.gov/enbridgespill/ (accessed April 12, 2012).

6 Ibid.

7 David Sassoon, "Enbridge Restarted Ruptured Oil Pipeline—Twice—During 2010 Michigan Oil Spill," *Inside Climate News*, May 30, 2012, http://insideclimatenews.org/news/20120530/enbridge-restarted-ruptured-oil-pipeline-%E2%80%94twice%E2%80%94-during-2010-michigan-oil-spill?page=show.

8 Sarah Lambert, "Granholm slams Enbridge on spreading oil spill," Battle Creek Inquirer, July 28, 2010, http://www.battlecreekenquirer.com/article/20100728/OILSPILL/7280318/Granholm-slams-Enbridge-spreading-oil-spill (accessed April 12, 2012).

9 Fritz Klug, "Kalamazoo River oil responders 'writing the book' on submerged oil clean up," July 24, 2011, http://www.mlive.com/news/kalamazoo/index.ssf/2011/07/kalamazoo_river_oil_spill_resp.html (accessed May 19, 2012).

10 Martha Stanbury et al., "Acute Health Effects of the Enbridge Oil Spill," Michigan Department of Community Health, November 2010, p. 4, battlecreekenquirer.com/assets/pdf/A5167647127.pdf (accessed April 12, 2012).

11 Ibid, p. 6.

12 Ibid, pp. 10-12.

13 Lara Skinner and Sean Sweeney, "The Impact of Tar Sands Oil Spills on Employment and the Economy," Cornell University Global Labor Institute, March 2012, p. 13. http://www.ilr.cornell.edu/globallaborinstitute/research/upload/GLI_Impact-of-Tar-Sands-Pipeline-Spills.pdf (accessed April 12, 2012).

14 Enbridge Web site, Frequently Asked Questions, http://response.enbridgeus.com/response/main.aspx?id=12783#Cost (accessed April 12, 2012).

VIII: First Nation and Native American Concerns

1 Francis Durnford, Enbridge Legal Counsel, Aboriginal and Regulatory, Letter to National Energy Board, October 21, 2011, http://www.enbridge.com/Line9ReversalProject/~/media/www/Site%20Documents/Delivering%20Energy/Projects/Line9/B5-1_-_Letter_to_NEB_regarding_Environmental_Defence_August_26_Letter_and_Interested_Parties__Comments_-_A2G0L3.ashx (accessed April 12, 2012).

2 Constanze Mackenzie, Ada Lockridge, and Margaret Keith, "Declining sex ratio in a First Nation community," Environmental Health Perspectives 113, 2005.

3 Enbridge, 2010 Annual Report, p. 99, http://ar.enbridge.com/ar2010/#home (accessed April 12, 2012).

IX. Recommendations

1 Anthony Swift, Lorne Stockman, and Luke Tonachel, "Keystone XL Pipeline: Undermining U.S. Energy Security and Sending Tar Sands Overseas," Natural Resources Defense Council and Oil Change International, January 2012, p. 5, http://www.nrdc.org/energy/files/kxlsecurity.pdf (accessed April 12, 2012).

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