This letter of comment will discuss two primary issues: the degree of need for the Line 9 Reversal, and the potential risks of the project.

The discussion of needs is further divided into discussion of the needs which the Reversal meets, and the needs with which the Reversal conflicts.

In considering risks, I will discuss both the risks of the pipeline if it operates as it is intended, and the risks if and when it does not operate as intended (i.e., if there is a significant spill).

What needs are met by the pipeline reversal?

The most obvious need met by the pipeline is the business need by tar sands operations for greater transport capacity from Alberta to other provinces and possibly other countries.

In recent years, sale of crude oil from the tar sands has faced a severe hurdle in the form of restricted transport capacity. One result has been that tar sands oil has sold at a substantial discount, due to a glut of oil in the west-central Canadian provinces and US states. Another response has been a dramatic increase in shipment of crude oil by rail, which is both more dangerous and more expensive than transport by pipeline. In response, we have seen a sustained lobbying effort by the Canadian government to build more pipeline capacity from Alberta, accompanied by expansion plans from pipeline companies. The most famous has been the Keystone XL pipeline to the southern US, but other major proposals include the Northern Gateway pipeline to the BC coast, and the just-announced Trans-Canada west-east pipeline proposal.

It is in this context that Enbridge has sought permission to reverse the flow of Line 9, allowing the company to ship oil from western Canada through Ontario to Montreal, where it can be processed by refineries or possibly transported further east or even out of the country.

Pipeline projects are long-term investments, so it is safe to conclude that the above-mentioned projects are not meant to solve merely a short-term shortage of transport capacity. The number and diversity of major pipeline proposals is an indication that western Canadian oil producers are seeking a major increase in transport capacity, to accommodate a major increase in tar sands extraction activities.

Thus a recent *Toronto Star* headline reads: "River of oil set to flow eastward" (July 9, 2013). The article summarizes a Canadian Association of Petroleum Producers study which projects a growth in western Canada oil production from about 3 million barrels/day currently to more than 6 million by 2030.

The CAPP report, issued in June 2013 under the title "Crude Oil: Forecast, Markets and Transportation", shows that nearly all the increased production will come from tar sands operations. Conventional oil production is projected to rise insignificantly, from 1.4 million barrels/day to 1.5 millon barrels/day. Production of oil from the tar sands, meanwhile, is projected to nearly triple, from 1.8 million barrels/day to 5.2 million barrels/day.

The CAPP notes "The oil sands represent the vast majority of Canada's crude oil reserves, so naturally this resource will be the primary driver for future overall growth."

Line 9, with a capacity of 300,000 barrels/day, will clearly be only a small part of what the oil industry needs to meet its goals for tar sands expansion. It is not certain that in the short term, Enbridge will use Line 9 to transport dilbit (diluted bitumen), or ship conventional western crude through Line 9 and thereby open up pipeline space for dilbit in other lines. However, in the longer term almost all Canadian oil production increases are projected to come from the tar sands, and so the various pipeline proposals mentioned above should all be seen as part of a co-ordinated effort to make tar sands expansion economically feasible and profitable.

The perceived need to prolong the fossil-fuel economy as long as possible

The massive expansion of tar sands extraction, in turn, is part of a much larger pattern: an intensive effort to stave off a transition to a low-carbon economy, even though liquid fossil fuel resources are rapidly decreasing in quality and increasing in price. Tar sands extraction, in common with deep-sea drilling and hydraulic fracturing, represent one possible response to the fact that reserves of low-cost, conventional crude oil are now being depleted, and increasingly difficult technological feats will be required to oil production at levels which can keep up with current demand.

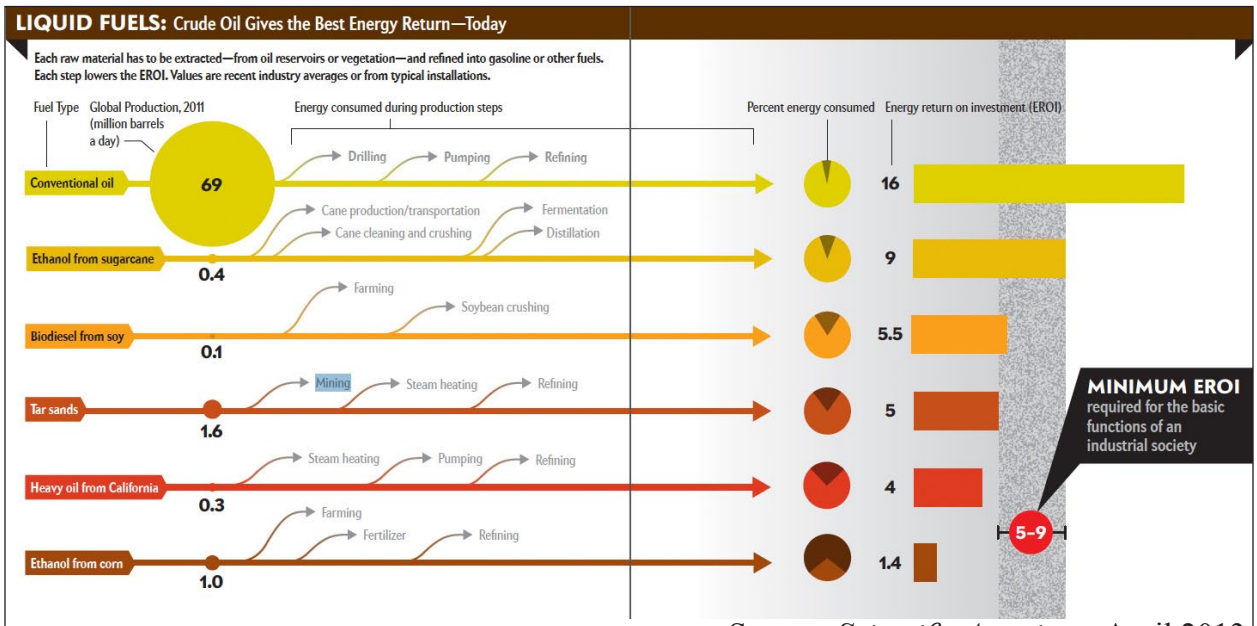
The tar sands reserves, vast though they are, are so expensive to extract that production grew slowly until the past decade, when world oil prices took their sudden climb to $100/barrel levels. Not coincidentally, tar sands oil is near the bottom of the rankings for Energy Return On Investment (EROI). This refers to the ratio of the energy output of an energy product, compared to the energy that was needed to produce that product.

A recent *Scientific American* examination of Energy Return On Investment (April 2013) calculated the average EROI of conventional oil in 2011 as 16. (This ratio has come down drastically since the 1930's, when major oil fields in Texas and Saudi Arabia produced steady flows of oil with an EROI as high as 100.) The EROI of tar sands oil is shown as 5 in the chart below.

A 2013 article in the journal *Energy*, by Adam Brandt, J. Englander and S. Bharadwaj, found that the EROI of mined tar sands petroleum has climbed over the past 40 years, to an EROI of about 6 in 2010. However, they found that in situ production, which will account for a large proportion of tar sands expansion, still has an EROI of about 3.5 to 4.

The originator of the EROI methodology, Environmental Science professor Charles A. S. Hall, estimates that a modern industrial society can only be sustained on an EROI of 5 or more – meaning that tar sands oil is a bottom-of-the-barrel resource.

The petroleum industry has invested vast sums of capital, along with intensive intellectual and physical effort, in finding new sources of oil. This addresses a perceived need to maintain the fossil-fuel economy at all costs. This perceived need is one of the most powerful motivators in our political and economic system today, and this perceived need shapes contemporary attitudes at a deep, often even unconscious level. For many people, the fossil-fueled way of life of the past three or four generations seems "normal", and it is all-but unthinkable that we might need to dramatically cut our fossil-fuel consumption, and even less thinkable that we might continue to enjoy a very high-quality of life in prosperity even though we cut back on energy use in general, and on fossil-fuel use in particular.



Source: *Scientific American,* April 2013

But society is far from unanimous in believing that we can, should, or must continue to organize our economies around the extraction and consumption of fossil fuel.

First of all, numerous economists, social scientists and energy analysts have pointed out that the per capita use of energy at today's North American levels is not essential to or even correlated with a high quality of life. The large increases in material consumption in North America over the past 50 years have not resulted in corresponding increase in personal happiness. Conversely, citizens of prosperous European nations typically live in small houses, drive small (or no) cars, and buy fewer goods to fill their small closets – but their quality of life is widely admired.

As energy economist Jeff Rubin notes in *The End of Growth*, Denmark has reduced its carbon emissions by 13% since 1990 (while North American emissions have increased 30%), but this has not driven Denmark into misery. Rubin writes "it's not like Danes are flooding foreign embassies in a desperate attempt to emigrate to places with cheaper power. Surveys show Danes, who enjoy one of the highest standards of living in the world, are among the happiest people on earth."

There is a wealth of literature and many real-life examples showing that it is possible to provide good employment, prosperity and a high quality of life while consuming a fraction of the energy that average Canadians now consume. The oft-repeated line that if we oppose expansion of fossil fuel use we are condemned to "freeze in the dark" is only convincing to those who have small imaginations and short memories. Nevertheless, the "freeze in the dark" theme is frequently used to distract people away from serious consideration of our looming environmental challenge:

The overwhelming majority of climate scientists believe that it is urgent that we reduce, immediately, substantially and steadily, our consumption of fossil fuels. This is a view which most governments of the world, including the Canadian government, have accepted in theory, though relatively few governments have accepted this view in practice.

The need to shrink our fossil-fuel consumption as fast as possible

Climate scientists are nearly unanimous in concluding that carbon dioxide emissions from fossil fuels are contributing to a dangerous warming of the planet; that the time delay in the climate system means that most of the warming due to past carbon emissions will occur over the coming decades, even if we stopped all carbon emissions tomorrow; that global warming, as serious as it already is, will be much worse if we run our economy on a "business as usual" course for another few decades; and that a global temperature rise of a few degrees Celsius will cause

problems serious enough to shake the foundations of human civilizations and lead to the extinction of huge numbers of species.

As a result of this concern, an international climate conference in Copenhagen in 2009 came to agreement on one important figure: 2° Celsius. The Copenhagen Accord stated that "we agree that deep cuts in global emissions are required … so as to hold the increase in global temperature below two degrees Celsius." The Copenhagen Accord, in other words, gave worldwide political recognition to the belief that a global warming of more than 2°C would be so damaging, to ecosystems and human society alike, that we need to begin now with systematic changes to our energy production and consumption patterns.

Included in this consensus was Canada. To begin the "deep cuts in global emissions" which the 2°C target requires, Canada's federal government has announced a (non-binding) goal that by 2020, Canadian carbon emissions will be 17% lower than Canadian emissions in 2005. This emission reduction goal matched the goal set by the United States.

Meanwhile, climate scientists have calculated how much additional carbon we can emit, globally, before the climate system is pushed over the 2°C threshold. Bill McKibben summarized the results of these studies in a widely cited July, 2012 article in *Rolling Stone*. Approximately 40 different computer models have been run, by scientists in different countries over a period of years, and they converge on a figure of about 565 gigatons – if more than 565 gigatons of additional carbon is released into the atmosphere, then global warming will exceed a 2°C rise.

That 565 gigatons is small, compared to the gigatons of carbon in the fossil fuel reserves recorded as economically recoverable by the world's energy corporations. Current proven reserves as of 2012 were approximately 2,795 gigatons. In McKibben's words, "We have five times as much oil and coal and gas on the books as climate scientists think is safe to burn. We'd have to keep 80 percent of those reserves locked away underground to avoid that fate."

If we decided to keep 80 percent of fossil fuel reserves in the ground, how would the tar sands fare? Would we choose to expand tar sands production, while reducing correspondingly our consumption of remaining sources of conventional oil? Not if we were operating rationally.

Oil from the tar sands is not only very low in Energy Return On Investment terms, as discussed above, but it is high in carbon emissions. David Biello writes for *Scientific American*, "All told, producing and processing tar sands oil results in roughly 14 percent more greenhouse gas emissions than the average oil used in the U.S. And greenhouse gas emissions per barrel have stopped

improving and started increasing slightly, thanks to increasing development of greenhouse gas–intensive melting-in-place projects." (www.scientificamerican.com, January 23, 2013)

Nevertheless, we have seen an unprecedented international lobbying effort by the Canadian government in favour of expanded exploitation of the tar sands. The lobbying has been accompanied by multi-pronged attacks on environmental groups, and a gutting of environmental assessment regimes which might have delayed approval of new tar-sands-related projects.

With all this federal focus on expanding tar sands production, has there been much effort to meet the federal government's publicly professed goal of a 17% cut in carbon emissions by 2020? Not nearly enough, according to the 2012 report entitled *Reality Check: The State of Climate Progress in Canada.*

The report was produced at the government's invitation by the National Round Table on the Environment and the Economy, an independent policy advisory group founded in 1988. The report's conclusion was clear: "The NRT's original and comprehensive analysis demonstrates *a large gap* between Canada's emissions trajectory and the federal government's target of 17 per cent below 2005 levels by 2020. Further, we show that the cost of achieving the Canadian climate policy target is high owing to the *short time frame* remaining to meet the target, *a lack of coordination by governments*, and the *growing emissions from some economic activities.*" (emphasis mine)

"There is some good news in our analysis," the report said. "Progress has been made and Canada will likely achieve almost *half of its 2020 target*, taking into account all existing and *proposed* emission-reduction measures." (emphasis mine)

The NRT warned that continuing delays in action would make the emission reduction targets increasingly difficult. The report noted that due to previous government inaction, the targets which Canada had ratified in the Kyoto Treaty had eventually begun to seem too onerous, leading to Canada's withdrawal from the Treaty. Likewise, the NRT said, delays in enacting measures to achieve the more modest goals Canada has set for 2020 might well result in Canada backing away from those goals as well.

This message was not a welcome one to the Harper government and it reacted decisively, by shooting the messenger. Even as *Reality Check* was being finalized, funding for the National Round Table was eliminated, and it died on March 31, 2013.

The need to preserve share prices of fossil-fuel corporations

Why might the government pay lip service to the scientific consensus about the urgency of cutting carbon emissions, while simultaneously engaging in vigorous promotion of one of the most carbon-intensive liquid fuels on earth? There may be no one single answer, but it is always a good idea to "follow the money".

As noted above, in order to follow through on the Copenhagen Accord's goal of keeping global temperature rise to 2°C or less, it would be necessary to leave approximately 80% of proven fossil fuel reserves in the ground. This would entail a dramatic realignment of global finance.

In Bill McKibben's words, "this coal and gas and oil is still technically in the soil. But it's already economically aboveground – it's figured into share prices, companies are borrowing money against it, nations are basing their budgets on the presumed returns from their patrimony. It explains why the big fossil-fuel companies have fought so hard to prevent the regulation of carbon dioxide – those reserves are their primary asset, the holding that gives their companies their value." (*Rolling Stone*)

It wouldn't matter if a decision to leave most fossil fuel unburned were taken formally by international treaty, or by a web of regulations, or simply by market mechanisms which assigned a price to the carbon pollutant that is now dumped into the atmosphere free of charge. The result would be that Canada's tar sands would not be exploited, because they are a terribly expensive resource, with a very low Energy Return On Investment, coupled with high carbon emissions, relative to other petroleum.

According to Natural Resources Canada, current production of tar sands crude is roughly equivalent to conventional crude, with tar sands accounting for 52% of Canadian crude production in 2010. However, the situation is far different when considering the reserves on which future production will depend. NRCan figures show that 97% of Canada's proven reserves of crude oil are in the tar sands. While oil companies in Canada still get much of their revenue from conventional oil, the values on their aggregate balance sheets are overwhelmingly tied to tar sands resources – and the implicit plan to extract and burn those resources.

Finally, we note that the tar sands, which account for nearly all of Canada's crude reserves, are located in Alberta, the long-time voter and donor base of Canada's current governing party. Furthermore, petroleum stocks with a tie to the tar sands account for a sizable chunk of most pension funds and private stock portfolios in Canada, meaning that the investor class right across the country has a pecuniary interest in promoting greater consumption of high-carbon fuel.

When we follow the money, it makes a certain sense that Canada's ruling Conservatives would vigorously oppose any effective price on carbon emissions, that they would stalwartly bring up the rear in international climate action efforts, and that they would vigorously promote the expansion of tar sands extraction even while proclaiming their official support for carbon emission reductions. Simply put, the current wealth of their support base is protected to the extent that climate science is ignored.

The National Energy Board and the climate crisis

The NEB has published a List of Issues which will be considered by the Board in making a decision on the Enbridge Line 9 Reversal proposal. The List concludes with these words.

> "The Board will not consider the environmental and socio-economic effects associated with upstream activities, the development of oil sands, or the downstream use of the oil transported by the pipeline."

In other words, in passing judgment on a pipeline which will facilitate the expansion of tar sands extraction, the Board will consider neither the environmental effects in the vicinity of these operations, nor the contribution of these operations to the ongoing and worsening climate disaster.

In an ideal world, there would be a clear justification for the Board's careful limitation of the issues it will consider. On matters as sweeping in their scope as climate change, the highest levels of government should be acting in a focused way for the good of the entire country, to protect the interests not only of voters and donors to the ruling party, but also the interests of our children and grandchildren. Such a government would not only proclaim its intention to systematically reduce total carbon emissions, but would take effective measures to translate these goals into reality. In such a world, the national government would not engage in vigorous efforts to expand one of the most carbon-intensive industrial projects of our era, while simultaneously paying lip service to the need for immediate and major reductions in emissions.

In such a world, the highest levels of government would set policy that would adequately deal with "the environmental effects of downstream use of oil transported by the pipeline". The NEB would then be quite justified in limiting its hearing to specific issues such as the design of the pipeline, potential impacts in the immediate area of the pipeline, and contingency planning for possible spills.

Obviously that's not the world we live in. The highest levels of the federal government have decided not to take seriously the long-term environmental effects of the expansion of the tar sands and the resultant major increase in Canada's carbon emissions. The highest levels of our government have decided that while acting to mitigate climate change is a noble thought, it is not a priority. The highest levels of our government have made a choice: while it would be nice to keep global warming below the 2°C threshold, and spare our grandchildren the problems of increasingly frequent and severe weather disasters, dramatically rising sea levels, mass movement of climate change refugees, basic resource wars, and mass starvations, it is more important to defend the stock portfolio values of the grandparents. And thus the official carbon emissions target of the Canadian government remains a sad joke, taken seriously by no one.

The members of the NEB have an important choice. You cannot reasonably argue that "we need not consider the environmental effects of the use of the oil passing through this pipeline, because a higher level of government is properly looking after that issue" – because that is clearly not true. Accordingly, you can simply ratify the federal government's practice of downgrading climate issues in favour of the promotion of tar sands expansion. Or you can register your disapproval of the federal government's agenda and call attention to the long-term environmental effects of the tar sands expansion project.

If either of those options are seen to go beyond the National Energy Board's purview, you could take a particularly conservative position, and defer your decision on this project until you receive a clear and unambiguous policy directive from the highest level of government. You could defer your decision until the government adopts just one of the following mutually contradictory positions, instead of both: 1) the Government of Canada will take strong measures to limit the growth of high-carbon-emissions industry, as part of the international effort to stop global warming from exceeding a 2°C threshold; or 2) the Government of Canada will energetically promote the extraction and consumption of low-quality, high-carbon-emissions fuel, thereby helping to boost global warming beyond the 2°C threshold.

Possible local effects of the Line 9 proposal

The effects of a temporary failure of a reversed Line 9 – i.e., a spill – are likely to be far less serious than the effects of a reversed Line 9 which works as intended, given that the intent is to facilitate much greater consumption of tar sands products. However, given the specific environment which Line 9 traverses, and given the properties of diluted bitumen, a significant spill could have serious impacts on a local ecosystem, local economy, and local quality of life, and these impacts could last for several years or more.

First I will discuss the consequences of a spill of dilbit, with reference to the largest on-land spill to date, from Enbridge's Line 6B in Michigan. Next I will discuss the environmental context in my own community, Port Hope, Ontario, and discuss the possible impact of a dilbit spill here.

Enbridge's Line 6B ruptured about 6 pm on July 25, 2010. The spill continued for about 18 hours. Approximately 877,000 US gallons spilled (about 3,320,000 litres, or about 20,880 barrels). The dilbit flowed initially into Talmadge Creek, and then into the Kalamazoo River, contaminating a 40 km stretch of the river.

Residents in the areas first affected were sickened by the overpowering stench of the dilbit. After several days of trying, unsuccessfully, to get adequate information about the spill, the local health department called for the evacuation of 61 riverside homes (and residents of more than 100 homes outside the evacuation zone chose to move out as well, due to the intense smell that pervaded the area).

The cleanup would stretch on for years, and some residents chose to accept a buyout of their homes by Enbridge rather than return.

A major complication in formulating an adequate response to the disaster was that local and Environmental Protection Agency (EPA) officials had not been told in advance that the pipeline was carrying diluted bitumen, and they were not given this crucial information until the clean-up efforts were well underway. By that point, the volatile chemicals in the diluent had likely separated from the bitumen and had evaporated or had been washed away on the surface of the river, while the heavier bitumen had sunk out of sight.

Clean-up workers were initially baffled:

> Tar balls the size of marbles were being swept along the river's bottom with the clay, sand and other organic material that is normally caught up in river currents. Basically, the tar balls were bouncing downstream, stopping only when a deep pool, an eddy or a man-made barrier like a dam halted the ride. At low points in the riverbed, they were settling into as

much as six inches of sediment. Mark Durno, who has 20 years of experience with the EPA, had never seen anything like it.

"We had no idea sinking oil would be such a problem," Durno said. "Not only was this material submerged but it was mobile and moving along the river bottom." (from *The Dilbit Disaster*, by Elizabeth McGowan, Lisa Song, and David Hasemyer, ©2012 InsideClimate News)

The peculiar characteristics of bitumen-in-water added greatly to the difficulty of clean-up. Bitumen balls did not move at a steady pace with the water, but sometimes settled into low spots, only to move again later when river flow changed. Months after the spill, "Close to 30 miles of boom was positioned along the river. But more oil kept turning up. It saturated soil and plants along the floodplain. It contaminated small islands along the river. It was embedded in up to six inches of underwater sediments."

Enbridge missed a cleanup deadline in September, and then missed another deadline at the end of October. In some areas, it appeared, the process of removing the bitumen could be more damaging then leaving it in place.

One three-acre area above a dam, for example, was heavily contaminated and was dredged for weeks. "However, that brutal but efficient operation wasn't an option elsewhere on the oiled river. All of that gouging would destroy fish habitat and ruin underwater beds where mussels feed and breed. … Ripping out oil-coated islands and oil-ravaged logs and plants deprived fish of vital shelter. And the steady beat of waves caused by so many boats on the water eroded the banks where muskrats and beavers burrowed for shelter." (*The Dilbit Disaster)*

The clean-up process carried over into the spring of 2011, and then the spring of 2012. In March of 2013 Enbridge was ordered by the EPA to return once again, to remove more submerged oil and contaminated sediment.

"In the spring of 2011, teams of scientists continued the tedious process of mapping the submerged oil. The digital snapshot that emerged confirmed their fears. Tar balls the size of marbles were still piling up in low spots on the river bottom. Roughly 200 acres, an area about the size of 150 football fields, were still tainted with oil. Three landmarks were identified as 'oil magnets.'"

Gradually a clean-up method was worked out. "Instead of trying to scour the entire river bottom, they would let the tar balls roll into the three spots the scientists had pinpointed as oil

magnets. As the tar balls accumulated, they'd go in and extract them. It was frustrating to have to wait out the oil, but the evolving science supported their patience." *(The Dilbit Disaster)*

The spill in Michigan raises many issues which must be addressed in the Line 9 context. Obviously, a dilbit spill can have drastic effects on a local environment. These effects can drive people out of their homes, close recreational areas for years, and necessitate tedious and painstaking clean-up efforts which cannot be rushed. As to the effects of spilling diluent into rivers, or the effects on biotic communities when bitumen remains on river or lake bottoms for years, it may be too early to adequately judge.

As a resident living near Line 9, it is important to me that the proper authorities are well informed, well prepared, and have considered the potential impacts of a dilbit spill in our area.

I write from the municipality of Port Hope, one of numerous communities along the north shore of Lake Ontario which might be impacted by a spill from Line 9. Many of these communities share the following characteristics: their geomorphology includes local watersheds formed by small rivers and creeks, these streams intersect Line 9 just a short distance from Lake Ontario, and there are typically significant wetlands along the Lake Ontario shoreline, just a short distance downstream from Line 9.

These communities have many recreational areas in these watersheds and on the Lake Ontario shoreline, a short flow distance away from Line 9. Both naturalistic pursuits and the enjoyment of beaches are major parts of recreation and major contributors to the quality of life. The streams and wetlands also support diverse fish populations, which have rebounded partly due to concerted conservation efforts in recent decades. These areas are also very important to migratory birds, who fly over Lake Ontario and are attracted to natural areas with healthy and diverse plant communities.

Port Hope's main public beach, immediately east of the mouth of the Ganaraska River, Aug 2013

Most of my remarks in the remainder of this paper will address the specific context of Port Hope, but many of the same factors would apply to a substantial degree in discussions of other Line 9 communities.

Port Hope was founded at the mouth of the Ganaraska River, and this river runs through the heart of the municipality. While the river, and the harbour at its mouth, were once the key economic impetus for town-building, today the river is of key importance for recreational and ecological reasons.

There are parks and hiking trails along much of the Ganaraska River, from its mouth upstream through the built-up area of the town, and north into the countryside beyond the intersection of the river's branches and Line 9. One of the major forms of recreation is fishing, and the Ganaraska River is widely known as one of the best streams on the eastern Great Lakes. Here's what various publications say about fishing in the Port Hope area:

"Located in the heart of Port Hope Ontario, the Ganaraska river is considered the best steelhead and Salmon fishery in Ontario. Flowing from the Sylvan Glen Conservation Area

Parkland in the flood plan of the Ganaraska River, near downtown Port Hope, August 2013

in Canton Ontario, it makes its way south through the Town of Port Hope, emptying out into Lake Ontario. Through the efforts brought forth by the Ganaraska River Conservation Authority and the Ontario Ministry of Natural Resources, the fishery has flourished due to protected areas and The Fish Ladder located at the south end of Port Hope Conservation Area. The ladder was built to allow pre spawned fish to access river pools north of the 401 Highway.

"During the fall run, the port hope area is over run with people from all over. I have personally spoken with fisherman from as far away as Nova Scotia, and Northern Ontario such as Thunder Bay. As the people that come to the area at this time are from different areas and many different ethnic backgrounds, some enjoy taking a fish or two for the table. ("Fishing The Ganny", on www.worldfishingnetwork.com)

"Ganaraska is not a particularly big river but has been known for its large fish, one of which held the Ontario steelhead record with its 29Lbs+. … On the Friday before the opening day a lot of anglers swarm on the little community of Port Hope, starting their day of fishing with luminescent floats at 12 o'clock at night, once a gun shot is fired." (www.troutsalmonchar.com)

Fishing charter boats at the mouth of the Ganaraska, with Lake Ontario in background, August 2013

"Often referred to as the premier steelhead river in Ontario, the 'Ganny', boasts annual steelhead and salmon runs and a healthy resident brown trout fishery. … Home of the ontario steelhead record with a fish that tiped the scales at a monstrous 29.1 pounds, this river holds a special place in the hearts of all steelheaders." (www.thefishingguide.com)

"Given the importance of the Ganaraska River to healthy populations of trout and salmon, the Ganaraska fish ladder plays an important role in a healthy fishery not only to the river, but also Lake Ontario." (*Northumberland Today,* July 14, 2013, "Corbett's Dam walkway to be expanded") *Note: The fish ladder referred to here is a short distance downstream from several intersections of Line 9 with branches of the Ganaraska.*

"Every year, the Great Ontario Salmon Derby takes place from the second week of July until the end of August. A main weigh-in station is located at the Port Hope Marina. Also offered in Port Hope is a fish cleaning station. With approximately 20,000 participants in previous years, this tournament continues to be the largest in Ontario." (Northumberland Tourism) *This Salmon Derby is important on the recreational calendar not only of Port Hope, but of many other Lake Ontario communities.*

That's what the Ganaraska means to the sport fishing community. In more formal language, "The fisheries are supported by a sustainable habitat of cold to cool water within the upper two-thirds of the watershed, with a diverse and migratory community in the lower Main Branch of the watershed. … The Ganaraska River supports a fish community dominated by Brook Trout (*Salvelinus fontinalis*), Brown Trout (*Salmo trutta*), Rainbow Trout (*Oncorhynchus mykiss*), sculpins (*Cottidae* species), darters (*Etheostoma* species), and cyprinids. Migratory Chinook Salmon (*Oncorhynchus tshawytscha*) spawns in the lower reaches." (*Ganararaska River Background Report: Abiotic, Biotic and Cultural Features*, Ganaraska Region Conservation Authority, October 2009; page v)

The Ganaraska generally appears as a placid stream, flowing through mixed farmlands, woodlands, wetlands and then the small urban area of Port Hope. "Contrary to other Lake Ontario watersheds in this area, most reaches of the Ganaraska River flow from west to east. This means that the river flows over a longer distance, with a similar elevation drop compared to other watersheds, causing the overall slope to be gradual. As a result, the river meanders greatly through

broad valleys and does not cut as deeply into the aquifer below." (*Ganaraska River Background Report*, page 60)

The area has seen very damaging floods, most recently in 1980. In response "The river was widened and deepened over a distance of approximately 1,000 metres to allow for a greater capacity of flow to move through the town. Since channelization has occurred, the town has not experienced significant flood events, although localized seasonal flooding does occur throughout the watershed." (*Ganaraska River Background Report,* page 15) The river runs over solid bedrock through much of the built-up area of the town, and there are few major obstacles to flow in this area, though eddies form immediately downstream of the "steps" in the rock.

The river is under baseflow conditions approximately 70% of the time. But the flow rate varies dramatically, often within a single day in response to a heavy rainfall or sudden snowmelt.

Table 3.8 from the Ganaraska River Background Report shows flow rates under a variety of storm conditions. Of particular interest are the flow rates near Dale Road, as Dale Road is just downstream of the intersection of Line 9 and the main branch of the Ganaraska River.

The top figure in the column shows flow in a 2-Year event, which is defined as a flow rate which has a 50% probability of occurring in a given year. More typical flows vary from month to month and from year to year, but tend to be in the range of about 10% of the flow during a 2-Year storm, and about 3% – 4% of the flow in a 100-Year flood.

If we think about the consequences of a spill of bitumen with these flow rates in mind, it is clear that many scenarios are plausible when it comes to dispersal of the diluent and the bitumen. To adequately assess the risks of a spill in this environment, the NEB and other agencies must

Table 3.8: Hydrology model result summary

Event	Flow (m^3/s)		
	Ganaraska River West of Osaca (7,200ha)	Ganaraska River Near Dale Road (26,480ha)	Ganaraska River Outlet to Lake Ontario (27,690ha)
2-Year	13.4	50.7	64.3
5-Year	20.5	73.2	91.2
10-Year	22.1	77.9	96.6
25-Year	32.6	110.6	134.0
50-Year	39.5	131.2	157.6
100-Year	43.7	143.9	171.7
Regional (Hurricane Hazel)	201.0	669.3	747.1
Probable Maximum Flood	393.2	1296.6	1453.0

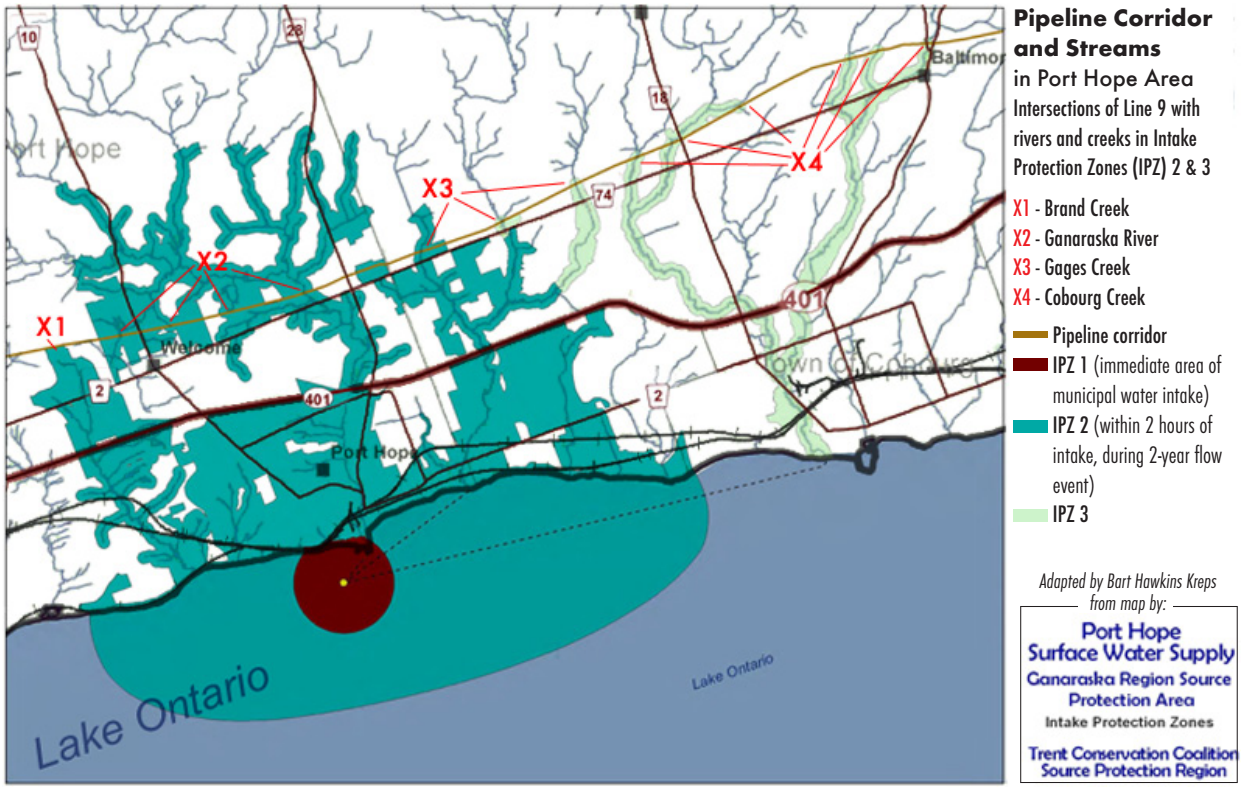
Source: Ganaraska River Background Report, 2009

consider a wide range of initial conditions, and must consider the possibility that spilled bitumen may move slowly right after the spill, and then move rapidly at a later time in response to a sudden increase in water flow – or vice versa.

It is also clear that a dilbit spill from Line 9 near Port Hope could quickly contaminate the downstream sections of the Ganaraska River or other area streams all the way to their mouths, and could also contaminate the Lake Ontario shoreline and/or near-shore areas.

I refer to the map labelled Pipeline Corridor and Streams. Of most significance for our purposes is the teal-coloured area indicating "Intake Protection Zone 2". IPZ2 is defined as those areas which could carry a flow to the municipal water intake, which is off-shore in Lake Ontario, *within two hours*, during a 2-Year flow event.

While I will not discuss the specific issue of the degree of vulnerability of the Port Hope municipal water intake, I draw attention to this map because it illustrates clearly that a spill from Line 9 could contaminate a watershed down to and then into Lake Ontario within a very short time, possibly before the appropriate emergency response teams could even mobilize to the site. Recall that the Enbridge's ruptured Line 6B in Michigan spurted dilbit for eighteen hours; in Port Hope, a dilbit spill could contaminate a stream right to its mouth in only 1/9th that length of time.



If a dilbit spill were carried by stream flow into Lake Ontario, it might then travel out into the lake, or be carried in an easterly or a westerly direction along and onto the shore. Near-shore lake currents change frequently due to factors including flow rate at the mouth of the Ganaraska, and wind and wave direction. These changes in flow are clearly evident to residents who watch the Port Hope shoreline during and immediately after storms, which can bring all sorts of detritus ashore, wash detritus off the beach, or move large quantities of sand either onto or away from the beach. It seems entirely plausible that bitumen blobs could be washed into the near-shore waters, where they might remain hidden until a sudden shift in current would wash the bitumen onto the beaches or other nearby shore areas.

Bitumen and/or diluent washing down to the stream mouths could clearly have significant impact not only on fish populations and movements, but also on the many other animals and plants in these waters. Enbridge should be required to address these risks adequately before being granted permission to pipe dilbit through Line 9.

A substantial section of the Gages Creek watershed is also within the IPZ 2. This creek flows directly into Lake Ontario at the east edge of the municipality of Port Hope. At its mouth is the Alice King Sculthorpe Woodland Marsh, consisting of open marsh as well as forested wetland. The varied conditions in this marsh make the area home to a wide variety of plants and animals, and also make this location a favourite for area walkers, birders, naturalists, and photographers. The same varied conditions would present huge challenges to clean-up crews trying to respond to a dilbit spill, which might contaminate the marsh within two hours of a pipeline leak.

The Alice King Sculthorpe Woodland Marsh, on the west side of Gages Creek, can be recharged during high-water wind tides by water washing across the trail from Lake Ontario (at right). August 2013

In summary, a major dilbit spill in the Port Hope area would likely have extensive effects on the local environment, from the immediate vicinity of Line 9, downstream to the lake shore. A spill could impact not only a stream and stream banks, but also the lake shore including Port Hope's public beach, and/or significant wetland areas at the mouth of streams. The cleanup of a spill might take months or years, as in the Kalamazoo River spill, during which recreational fishing might be prohibited or simply discouraged. If the spilled diluent or bitumen proved damaging to the health of aquatic animal or plant communities, then recovery of the ecosystems and the associated recreation could take many years.

As noted above, many characterstics of the Port Hope environment are shared by other communities along the Line 9 route. It is only reasonable, therefore, that a thorough environmental assessment of the Line 9 proposal be done to protect the interests of many communities. Furthermore, local emergency responders and environmental protection authorities must be notified in advance whether dilbit is being shipped through Line 9, what the chemical constituents of the

Gages Creek, about 100 metres from its mouth. The creek frequently spills over its banks to inundate the forested wetland on its east flank, shown here, August 2013.

diluent are and in what proportion, and these responders should be provided appropriate training in how best to respond to a dilbit spill. If this is done, at least responders to a spill along Line 9 will not be left guessing, as they were after the Michigan spill in 2010.

Conclusions

On the level of national environmental goals:

Enbridge's Line 9 Reversal proposal meets an urgent goal for Canada's petroleum sector, which is to facilitate greater extraction and consumption of tar sands product. However, this purpose is in conflict with Canada's official stated backing of the Copenhagen Accord, which commits participants to immediate and continuing carbon emissions reductions in order to forestall global warming of more than 2° Celsius.Therefore the National Energy Board should reject this proposal. Alternatively, the National Energy Board should defer the decision on this project pending an unambiguous public policy directive from the Government of Canada to the NEB, making clear that Canada either: 1) will participate in the international effort to slow down climate change by discouraging greater exploitation of high-carbon fuel sources; or, 2) will not participate in the international effort to slow down climate change, and instead will actively encourage greater exploitation of high-carbon fuel sources.

On the level of local environmental protection:

Enbridge seeks approval to ship diluted bitumen through Line 9. This product presents particular dangers to the local ecosystem, and presents particular difficulties to clean-up efforts in the event of a significant spillage. Accordingly the NEB should insist that Enbridge provide evidence that they have developed effective, timely and safe methods to clean a dilbit spill in diverse environments, including but not limited to rivers, creeks, open and wooded wetlands, Lake Ontario shoreline, and near-shore waters of Lake Ontario. Enbridge should also be required to provide local health and environmental protection authorities with advance notice if and when dilbit will be shipped through Line 9, and with information about the specific chemical constituents of the diluent, so that local authorities can also be prepared for informed and timely action in the event of a spill.