From: Sattinss@aol.com
To: *COMM_Pipeline Comments
Subject: EIS Scoping Comments: Sandpiper Pipeline & Line 3 Replacement Projects
Date: Wednesday, May 11, 2016 12:25:20 AM

To: Ms. Jamie MacAlister, Environmental Review Manager
Minnesota Department of Commerce

From: Stan Sattinger
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The following is a written version of comments I offered verbally at the May 9, 2016 meeting in St. Paul, MN on the scoping of the Environmental Impact Statements for the Sandpiper and Line 3 Replacement projects. My comments pertain to both projects.

We need to have the EIS's consider the one environmental impact of the proposed projects that surpasses all others in importance: the expedited release of methane from melting permafrost formations in the earth's northern latitudes. Methane release would be a trans-boundary impact because it wouldn't matter where the release would occur; it would jeopardize life everywhere.

We've come to associate climate change with discharges of carbon dioxide into the atmosphere. But methane is a far more powerful greenhouse gas than carbon dioxide -- it's about 30 times more potent in warming the earth.[1]

The April 9, 2014 issue of the British publication, The Register, describes the methane risk as a "climate-feedback cycle of increasing temperature, which melts more permafrost, which releases more methane, which raises temperatures further, which melts more permafrost, et cetera."[2]

What's the upshot of this feedback cycle? Here's the forecast reported in a recent study published in the journal, New Scientist: "We are on the cusp of a tipping point in the climate. If the global climate warms another few tenths of a degree, a large expanse of the Siberian permafrost will start to melt uncontrollably."[3] By continuing in our daily lives to release unlimited emissions of carbon dioxide that accelerates this cycle, we are steadily pushing toward this irreversible tipping point.

Certainly these two proposed pipelines would not be the only sources of temperature-raising carbon dioxide emissions in the future. Nonetheless, their combined flow of over 1.1 million barrels of crude oil per day would be significant among the world's agents for these emissions.

As a safeguard, the EIS's for these projects should forecast the increase in global average temperature due to the carbon dioxide emissions to be generated by consumption of the conveyed crude oil over the lifetimes of these proposed pipelines. It should then use this projected warming to assess the projects' impacts on the initiation of permafrost melting.

Failure to include these forecasts in the EIS's could allow climatic conditions to be exacerbated such that our rights to life under stable climate conditions with predictable and dependable supplies of food and water would be at risk. I have a right and duty under law to see that my children's and grandchildren's futures and those of future generations are protected from this terminal outcome.

---

1. "Climate Change Indicators in the United States," U.S. Environmental Protection Agency, July 2, 2014, http://www.epa.gov/climate/climatechange/science/indicators/ghg/index.html

2. "Melting permafrost switches to nasty, high-gear methane release," Rik Myslewski, The Register, April 9, 2014,

http://www.theregister.co.uk/2014/04/09/melting_permafrost_switches_to_nasty_highgear_methane_release/

3. "Major methane release is almost inevitable," New Scientist/ Environment, February 21, 2013, http://www.newscientist.com/article/dn23205-major-methane-release-is-almost-inevitable.html#.VKjbYivF-Sq

From: Yvette Schultenover
To: *COMM_Pipeline Comments
Subject: Pipeline proposals for MN comments
Date: Wednesday, May 25, 2016 9:00:12 AM

Docket Numbers (Sandpiper: PL-6668/CN- 13-473 and PPL-13-474, Line 3: PL-9/CN-14-916 and PPL-15-137

It is my belief that the Enbridge proposed Sandpiper pipeline and the abandonment of line #3 are NOT in Minnesota's best interest. The Sandpiper will probably carry Bakken oil. This and the Tar Sands oil that will more than likely be in them are by far worse than any carried before. They are highly explosive. Our own Grand Rapids had a spill near the Community College some time ago and with that "ordinary" oil the wetlands will never, ever be the same. These oil spills cost communities not only environmental degradation but also is an economic for them . It appears the oil Companies escape the entire cost (indeed possibly only the initial cost) of these terribly caustic spills.

Our beautiful State NEEDS it's waterways to sustain it's tourism level, health level and beauty!

Also the #3 abandonment issue because of the aged pipeline needs to be VERY WELL scrutinized. These abandoned wells create their own set of problems. Did you know there are chemicals in them too? Are you aware that the pipeline does NOT restore the land and that it is up to the land owner to bear that expense if and when the land sinks, or chemicals and oil surface that have leaked that we are all unaware of at the moment? Think personal wells that we rural peoples' have. There are enough problems with waterways in MN at present. This doesn't even address the Native lands that are still, to this day, being ruined, ignored and disrespected even in our beloved MN.

These proposals are not even from US owned Companies which even exacerbates the problem. Canadian Companies are not responsible for restoring their lands, why would they care about MN as they increase sizes of lines.

Thank you for taking time to listen to the people who live and care about MN.

Yvette Schultenover 31167 Cimarron Trail Grand Rapids MN 55744

Public Comment – Sandpiper and Line 3
May 3, 2016

Today, the State of Minnesota is entering uncharted waters. An Environmental Impact Statement (EIS) on pipelines has never been done before. A precedent will be set that will affect the citizens of Minnesota for generations going forward. It is imperative that the process is done in a competent, objective, and thorough manner. No shortcut of the process can be tolerated.

The Department of Commerce (DOC) should not be the agency to launch the first oversight of an EIS on pipelines. It is difficult to imagine the DOC will be completely objective in exploring all elements contained in a robust EIS. The DOC is charged with promoting business in the State of Minnesota and that can get in the way of performing a fair and comprehensive EIS.

I believe the oversight of the EIS on Sandpiper and Line 3 should be placed in the hands of the Department of Natural Resources (DNR) and the Minnesota Pollution Control Agency (MPCA). I believe they have the skills and resources to conduct an EIS that will best serve the State of Minnesota. Selection of a route for pipelines cannot be based on economics, which has the clear potential of compromising the environment of our state. If Sandpiper and Line 3 are approved, the State of Minnesota will be a conduit for over a million barrels of crude oil per day. There will be no direct benefit to Minnesotans, as the oil is destined for points east and south. The State of Minnesota has no obligation to cater to the demands of a foreign company and approve a route to . Enbridge that is most economical to them. The interests of Minnesota and its residents must be placed first in any routing process.

Future generations are depending on us to get this right. If approved, the pipes will be in the ground and flowing crude oil for many years. It is incumbent on the State of Minnesota to get it right in performing a precedent setting EIS that will be a blueprint for any future projects.

Lowell Schellack
P.O. Box 628
Park Rapids, MN 56470

Steve Schulstrom

WE ARE HERE TODAY TO TALK ABOUT HOW TO DO SOMETHING THAT IS VERY DIFFICULT FOR HUMANS TO DO:

WE ARE GOING TO GO AGAINST OUR NATURAL TENDENCY TO MAKE THINGS EASIER, TO LOOK AT FEWER POSSIBLITES, TO WINNOW. WE ARE GOING TO EXPAND OUR POSSIBLITIES NOT NARROW THEM PREMATURLY. WE HAVE AGREED TO COMPLICATE OUR LIVES BECAUSE THIS IS AN IMPORTANT UNDERTAKING.

WHEN PIPELINES WERE FIRST BUILT IN NORTHERN MINNESOTA THE TECHNOLOGY THAT WE HAVE TODAY DID NOT EXIST. A PIPELINE BUILT TODAY IS VASTLY SAFER THAN ONE BUILT 50 YEARS AGO. THE TECNOLOGY HAS CHANGED. THE TECHNOLGY TO DETERMINE WHERE A PIPELINE SHOULD BE BUILT HAS ALSO CHANGED. WE NO LONGER NEED TO BE CONTENT WITH A SIMPLE CENSUS LISTING OF HOW MANY THINGS WILL BE DESTROYED. WE CAN EMPLOY MODERN GIS TECHNOLOGY TO FIND LESS IMPACTFUL ROUTES. CARLTON COUNTY LAND STEWARDS HIRED APPLIED ECOLOGICAL SERVICES, A COMPANY THAT WORKED WITH ENBRIDGE ON THE KALAMAZOO OIL SPILL, LOOK AT HOW ONE COULD APPROACH THE PROCESS OF DETERMINING WHERE A PIPELINE COULD BE PLACED.

WE USED GIS TO LOOK AT SEVERAL IMPORTANT PARAMETERS; SOIL CONDUCTIVITY, SLOPE FLOW ANAYSIS AND FOREST BLOCK FRAGMENTATION. THERE ARE MANY OTHER PARAMETERS ONE COULD LOOK AT WE IDENTIFIED 16.

I HAVE BROUGHT THIS ONE EXAMPLE OF HOW A SINGLE PARAMETER ANAYSIS – IN THIS CASE FOREST FRAGMENTATION--WILL APPEAR IN MAP FORM.

CARLTON COUNTY LAND STEWARDS IS NOT ENDORSING ANY OF THESE SYSTEM ALTERNATIVES AS BEING BETTER THAN ANY OTHER. ALL OF THESE SYSTEM ALTERNATIVE ROUTES ARE ALONG EXISTING PIPELINES EXCEPT FOR ONE. THIS IS AN ILLUSTRATIVE EXAMPLE OF WHAT CAN BE DONE IF ONE WISHES TO DO SO.

DISCUSSION OF MN MAP AND WHAT THEY REPRESENT

THERE ARE DIFFERENCES IN THE ROUTES AND THEY CAN BE QUANTIFIED

NEXT MAP IS THE ENTIRE PIPELINE FROM START TO FININISH. THAT SIMPLE STATEMENT IS ACTUALLY ONE OF THE MORE CONTENTIOUS POINTS OF THIS WHOLE PROCESS. ENBRIDGE SAYS THAT THE OIL NEEDS TO GO TO SUPERIOR BEFORE IT GOES ELSEWHERE. I ACCEPT THAT THIS IS DESIRED BY ENBRIDGE IN THE SAME WAY IT IS DESIRED BY AMERICAN AIRLINES THAT FOLKS TRAVELING TO THE EAST COAST FROM MINNEAPOLIS NEED TO GO TO DALLAS FIRST. THE BIG DIFFERENCE IS THAT AMERICAN AIRLINES IS NOT ASKING FOR THE POWER OF EMMINEINT DOMAIN IN THEIR BUSINESS MODEL.

ALSO, THE ENVIRONMENT DOES NOT END OR BEGIN AT THE NORTH DAKOTA –MINNESOTA BORDER. THE ENTIRE ROUTE MUST BE EXAMINED

WE ARE HERE TO MAKE OUR JOBS MORE DIFFUCULT. WE ARE HERE TO LOOK AT THE POSSIBILITY OF A THING. WE ARE HERE TO ADD TO OUR WORK LOAD. WE ARE HERE TO EXAMINE POSSIBLITIES THAT MAY BE DIFFICULT TO GRASP.

We are doing this because these pipelines will be here for a very long time

(1)

Steve Schulstrom

Points to consider:

There has been confusion expressed at many of these EIS scoping meeting regarding, if the Sandpiper project has been approved, why we are having additional meetings. [This question is usually asked by someone associated with pipefitters.] The process can be perplexing for those that are not following what has happened. I will attempt to explain why we are all here. The Department of Commerce broke Minnesota Environmental law when the Public Utility Commission approved the Sandpiper Certificate of Need. The PUC further erred by disregarding most of the public comment associated with the original rounds of public comment both at information sessions and those comments submitted to the Sandpiper docket directly. This happened for everyone that was involved. Pipefitters, chamber of commerce members, organic farmers, county officials, landowners, and tree huggers all submitted their views and they were mostly ignored or pigeon holed into "pro" or "con" vote tabulation. The courts determined that method as illegal. So we are here again to do the process in a legally proscribed way under Minnesota Environmental law.

Carlton County Land Stewards is pleased with the format, schedule and information that have been provided at these meetings.

There is, however, a potential problem. There have been hundreds of comments previously submitted in the original round of meetings. The folks that submitted those comments did so under the assumption that they would be duly considered. The fact that these comments have been previously ignored under a system that has been declared illegal would lead one to the conclusion that the prudent course of action would be to examine those comments that have already been submitted. Further, these comments need to be examined and dealt with using the standards of the EIS process not a simple tabulation.

This is would be true for all groups and all types of comments. There is no reason to not consider those prior comments other than expediency.

Points to consider: Steve Schulstrom

THERE ARE MANY PARAMETERS THAT NEED TO BE LOOKED AT WHEN CHOSING A ROUTE FOR A PIPELINE. ONE OF THEM WOULD BE ENVIRONMENTAL CONCERNS. WE CAN USE MODERN GIS TECHNOLOGY TO HELP THIS PROCESS.

I HAVE BROUGHT THIS ONE EXAMPLE OF HOW A SINGLE PARAMETER ANAYSIS – IN THIS CASE FOREST FRAGMENTATION--WILL APPEAR IN MAP FORM. THERE ARE MANY OTHER PARAMETERS ONE COULD LOOK AT.

CARLTON COUNTY LAND STEWARDS IS NOT ENDORSING ANY OF THESE SYSTEM ALTERNATIVES AS BEING BETTER THAN ANY OTHER. THIS IS AN ILLUSTRATIVE EXAMPLE OF WHAT CAN BE DONE IF ONE WISHES TO DO SO.

DISCUSSION OF MN MAP AND WHAT THEY REPRESENT

INTRODUCE MIDWEST MAP

THE NEXT MAP REPRENTS THE ENTIRE PIPELINE FROM START TO FININISH. THAT SIMPLE STATEMENT IS ACTUALLY ONE OF THE MORE CONTENTIOUS POINTS OF THIS WHOLE PROCESS. ENBRIDGE SAYS THAT THE OIL NEEDS TO GO TO SUPERIOR BEFORE IT GOES ELSEWHERE. I ACCEPT THAT THIS IS DESIRED BY ENBRIDGE IN THE SAME WAY IT IS DESIRED BY AMERICAN AIRLINES THAT FOLKS TRAVELING TO THE EAST COAST FROM MINNEAPOLIS NEED TO GO TO DALLAS FIRST. THE BIG DIFFERENCE IS THAT AMERICAN AIRLINES IS NOT ASKING FOR THE POWER OF EMMINEINT DOMAIN IN THEIR BUSINESS MODEL.

THE IMPORTANT POINT TO THESE MAPS IS THAT THERE ARE DIFFERENCES IN THE DIFFERENT ROUTES AND THEY CAN BE QUANTIFIED.

THERE ARE OTHER FACTORS THAN ENVIRONMENTAL. ONE OF THEM WOULD BE ECONMICAL. ANYTHING IN LIFE INVOLVES A BALANCING ACT. FOR EXAMLPE, IF A PIPELINE WERE TO HAVE SHUT-OFF VALVES AT EVERY WATER CROSSING IT MAY MAKE IT SAFER BUT IT WOULD ALSO MAKE THE ENTIRE PIPLINE PROHBITIVELY EXPENSIVE.

THESE SYSTEM ALTERNATIVES ONLY MAKE SENSE IF THEY ARE ECONOMICALLY VIABLE. THERE NEEDS TO BE A CONSIDERATION OF THE ECONOMICS OF THE POSSIBLE VARIOUS ROUTES. ^THERE NEEDS TO BE AN EXAMINATION BY A PIPELINE ECONIMIST HIRED BY THE RGU (IN THIS CASE THE DOC) THAT LOOKS AT THE ECONOMIC PARAMETERS FOR EACH SYSTEM ALTERNATIVE. THERE ALSO SHOULD BE AN ECONOMIC EXAMINATION OF HOW THE APPROVAL OF THE DAKOTA ACESS PIPLINE MAY HAVE CHANGED THE BUSINESS NEED FOR SANDPIPER AND LINE 3.

REFER TO MAP

DURING SANDPIPER DIRECT TESTIMONY AN ENBRIDGE ECONOMIST PUT THE FIGURE AT .05 BARREL BETWEEN SA-APPLICANT AND SA-03. I AM ONLY BRINGING THIS UP AS ILLUSTRATIVE. THIS TYPE OF INFORMATION IS AVAILABLE AND COULD PROVIDE IMPORTANT INSIGHT AS TO THE SUITABLITY OF THE System Alternatives .

My name is Eileen Shore. I live in Minneapolis. I am a retired environmental lawyer and have worked with environmental policy acts at various times in my career.

These laws were intended to give governments and citizens a way to independently examine and analyze projects before they were built. Before these laws were passed, governments were dependent on the company proposing the project, and citizens often didn't even know what was going to happen to their waters and lands until the project was a done deal.

Over the years these laws have been weakened and there has been a return to overreliance on company information, inadequate public participation and unrealistically short deadlines – deadlines added in the name of efficiency, but which are really a way to minimize citizen involvement and government oversight. All of these features have been obvious in the Sandpiper proceeding. However, this EIS process, if it is done right, can correct many of the worst mistakes that have been made.

At the heart of the EIS process is a thoughtful and thorough development of alternatives to industry proposals, and that is what my comments focus on.

Of course, companies like to keep the scope of an EIS as narrow as possible, as close as possible to their original corporate plans. In this case, Enbridge has claimed that a route that was established before any environmental laws were passed will protect Minnesota's environment just fine. So, for example, Enbridge has used its information table at these public meetings to offer a brochure entitled, *"Best proposed pipeline route for Minnesota."* Even now, they just don't seem very interested in exploring alternatives. That is why government's role is so essential.

In trying to keep the scope of the EIS as narrow as possible, Enbridge is continuing to urge that any pipeline that is proposed must end in Superior, WI. So far, the Department of Commerce has been willing to adopt that position, both in previous proceedings and in the Draft Scoping Decision Document. That must

change, if the resulting EIS is to have any hope of doing its job and of passing legal muster.

For the first time, the State of Minnesota must separate its process from the Company's preference, and look very carefully at other pathways this pipeline could follow, should the PUC ultimately find that it should even be built at all.

In this case, the state has a substantial head start in assuring a competent review of alternatives. We already have alternatives that have been offered and have received preliminary environmental review by the DNR and the PCA. One of the alternatives from Friends of Headwaters, known as SA-04, was suggested just about two years ago. Both DNR and PCA found it environmentally superior to the Company's preference, and even better than PCA's own early suggested alternative. Although this and other alternatives were mocked by the company, as crayon lines on a map, according to the state's environmental agencies, they show a viable way to avoid the state's ecologically fragile areas, which includes the source of my drinking water. This and other alternatives must be fully considered in the EIS.

There has never been an environmental impact statement prepared for oil pipelines in Minnesota. The environmental impact of the construction activity alone would be gigantic, even without considering the potential damage of spills that are sure to follow. Given the fierce political pressure the industry has brought to bear just in the last two years, it may well be the last oil pipeline EIS that is ever done here. If a pipeline is put into Minnesota ground and through its waters, it will be there a long time -- maybe fifty years, maybe longer. A full-hearted consideration that includes a genuine and detailed analysis of alternatives, with a full-hearted public participation process, using methods that bring in the best scientific and technical minds in the state and nation -- this is the least that citizens should be able to expect from their government. Thank you

Minnesota Department of Commerce
85 7th Place East, Suite 500
St. Paul, MN 55101

Wednesday May 25th, 2016

Dear Minnesota Department of Commerce,

Over the past month the Beyond Oil and Tar Sands Committee of the North Star Chapter of the Sierra Club have been talking to Minnesotans who are concerned about the Sandpiper and Line 3 pipelines. From our conversations we have collected 278 comments to be submitted for the open comment period on scoping.

As Minnesotans we are asking for you to ensure the Environmental Impact Statement is created in a robust and scientifically sound way that takes into account the effects on our communities, tribal lands, watersheds, lakes and rivers, and the climate; including its effects beyond our borders. We have witnessed how harmful spills can be, and we wish to protect our lands and communities. Specifically, as the DOC you must study the effects on spills in all major watersheds, and the impacts to our economy as well as the threat to our native communities.

We are grateful that we are given the opportunity to submit our comments, and we believe that it is essential that this process remains transparent and that we, as Minnesotans, are given a voice in this process. We have grave concerns over the safety of these pipelines. Ultimately, we do not believe that it will be in the best interest of Minnesotans to invest in this dirty infrastructure. We urge you to do your job wholly and complete a thorough and just Environmental Impact Statement.

Sincerely,

Isabel Watson
Co-Chair Beyond Oil and Tar Sands Committee
Sierra Club North Star Chapter
2327 East Franklin Ave, Ste 1
Minneapolis, MN 55406

STATE OF MINNESOTA
PUBLIC UTILITIES COMMISSION

Beverly Jones Heydinger	Chair
Nancy Lange	Commissioner
Dan Lipschultz	Commissioner
Matthew Schuerger	Commissioner
John A. Tuma	Commissioner

In the Matter of the Application of Enbridge Energy, Limited Partnership, for a Certificate of Need for the Line 3 Replacement Project in Minnesota From the North Dakota Border to the Wisconsin Border	**OAH 11-2500-32764** **MPUC PL-9/CN-14-916**
In the Matter of the Application of Enbridge Energy, Limited Partnership for a Routing Permit for the Line 3 Replacement Project in Minnesota From the North Dakota Border to the Wisconsin Border	**MPUC PL-9/PPL-15-137**

SCOPING COMMENTS

The Sierra Club submits the following comments in response to the Minnesota Department of Commerce's ("Department") "Notice of Availability of Scoping EAW and Draft Scope for Sandpiper Pipeline and Line 3 Replacement Projects and Schedule For EIS Scoping Meetings" ("Scoping Notice"), which notice established a scoping comment period ending on May 26, 2016, in the above captioned dockets. This comment period relates to the Line 3 Replacement Project ("Proposed Project") proposed by Enbridge Energy Partners, LP ("Enbridge"), which project involves construction of a new 36-inch diameter crude oil pipeline through northern Minnesota. The Sierra Club appreciates this opportunity to provide comments on the scoping process for the Proposed Project and urges the Department to develop a broad scope for the Proposed Project in accordance with law.

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I. BACKGROUND

Enbridge has proposed to abandon its existing Line 3 Pipeline and replace it with the Proposed Project, which would be an entirely new pipeline that would also be named "Line 3". The existing Line 3 Pipeline has a diameter of 34 inches, a capacity of approximately 390,000 barrels per day ("bpd"), and runs approximately 1,000-miles from Alberta, Canada, to Superior, Wisconsin, with a length in Minnesota of approximately 282 miles. Enbridge currently uses Line 3 to transport primarily light crude oils, but at prior times in its operational history this line has also transported primarily heavy crude oils.

The Proposed Project would differ from the existing pipeline in that it would have a length in Minnesota of 337 miles (approximately 20% greater length), a diameter of 36 inches (approximately 12% greater volume per unit length), and a capacity, alleged to be limited to 760,000 bpd (approximately a 95% increase in capacity). It would transport the types of crude oil historically transported by the existing Line 3 Pipeline. Although the Proposed Project could transport both conventional crude oil and crude oil extracted from the tar sands region of Canada, Canadian supply forecasts show that projected net future increases in crude oil supply available for export, that in turn allegedly justify an increase in export pipeline capacity, come only from Tar Sands operations. Thus, the increased capacity of the Proposed Project would be used to transport various forms of tar sands oils, including diluted bitumen, a heavy crude oil, and syncrude, a light crude oil, which are derived from mining and *in situ* extraction operations in the tar sands.

The extraction of tar sands derived crude oils creates substantially more climate change pollution than conventional crude oil, which pollution will impact Minnesota. Line 3 will therefore result in greater greenhouse gas emissions in Canada, which emissions will impact Minnesota's environment. Further, Line 3 may result in increased imports into Minnesota of products containing bitumen, including but not limited to dilbit, synbit, and dilsynbit. Transportation of these products creates spill impacts that differ fundamentally from the impacts of conventional crude oils. The refining of these products in larger amounts in Minnesota would result in the release of more conventional and climate change air pollution in Minnesota from Minnesota's refineries.

Enbridge has proposed to build the Proposed Project in a new right of way parallel to its existing Line 3 Pipeline between the North Dakota border and its terminal near Clearbrook, Minnesota, but to follow an entirely new route between the Clearbrook Terminal and the border with Wisconsin, which route does not parallel and is not adjacent to the existing Line 3 Pipeline.

Accordingly, it is inappropriate to describe the "Line 3 Replacement Project" as maintenance of the existing Line 3 Pipeline, because the Proposed Project does not "maintain" the existing pipeline. Instead, Enbridge plans to abandon the existing pipeline in place without repair.

Between the Clearbrook Terminal and the Wisconsin border, Enbridge plans to route its new pipeline parallel to the proposed Sandpiper Pipeline, which the Minnesota Public Utilities Commission ("Commission") is currently reviewing in docket Nos. CN-13-473 and PPL-13-474, related respectively to applications for a certificate of need and a routing permit ("Sandpiper

Project"). The Sandpiper Project comprises a proposal to construct a 612-mile crude oil pipeline from Tioga, North Dakota to terminals in Clearbrook, Minnesota, and Superior, Wisconsin. Approximately 300 miles of the proposed pipeline would cross northern Minnesota carrying between 225,000 and 375,000 barrels of oil per day. The Sandpiper Project was originally proposed by a subsidiary of Enbridge but Enbridge personnel were responsible for filing a revised application stating that the Proposed Project is now being developed by the North Dakota Pipeline Company, a joint venture between Enbridge and Marathon Petroleum Company. The Proposed Project would nonetheless be operated by Enbridge.

The Proposed Project and Sandpiper Pipeline are part of broader network of pipelines operated by Enbridge. The Proposed Project would be a part of the Enbridge Mainline System, an interconnected network that currently includes Lines 1, 2a, 2b, 3, 4, 5, 6a, 6b, 7, 65, 10, 11, 62, 14/64, 61, and 67. Enbridge controls and operates this system from a central control center in Alberta. The Mainline System connects to a larger network of downstream pipelines operated and jointly owned by Enbridge, including but not limited to the ChiCap, Mustang, and Seaway Pipelines, or owned by Marathon Petroleum Corporation, including its MAP pipeline system. If built, the Proposed Project would integrate into and impact the operation of other pipelines within the Enbridge pipeline network as well as pipelines operated by other companies, both within and outside Minnesota. Likewise, the Sandpiper Project would be under Enbridge's operational control and would connect to and impact the operations of Enbridge's Mainline System.

II. PROCEDURAL COMMENTS

A. Deficiencies in the Scoping Comment Notices

The Scoping Notice entirely fails to describe the purpose of the scoping meetings and comment period it purports to notice, such that it is confusing and deficient. The title of the scoping notice states: "Notice of Availability of Scoping EAW and Draft Scope for Sandpiper Pipeline and Line 3 Replacement Projects and Schedule for EIS Scoping Meetings." The title of the Scoping Notice does not state that it establishes a public comment period, but rather notices only the availability of the "Scoping EAW" and the "Schedule for EIS Scoping Meetings." Thus, the title of this document does not inform citizens that a comment period exists or that they have a right to comment.

The Scoping Notice includes a variety of types of information, including the following:

- Project descriptions for the Proposed Project and the Sandpiper Pipeline Project;
- A "Meeting Information" list containing schedules for and locations of meetings and a description of the procedures to be used at the meetings, but without any description of the purpose of the meetings;
- A notice of a written comment period and procedures for submitting comments, without any description of the purpose of such period except for the statement that

> "Each project will have its own scope and EIS, however, public meetings will address both projects."

- A link to the Department's website, which provides access to documents related to the Proposed Project, but that does not expressly describe the purpose of the public meetings or written comment period;
- A description to physical locations where "The Draft Scoping Decision Documents and Scoping EAWs will be available, and instructions for how to request a CD containing project documents;
- A description of the statutes and rules applicable to the Proposed Project; and
- A list of contacts related to the Proposed Project.

But oddly, the Scoping Notice contains no express statements that describe the legal purpose of a scoping period or a plain language description of the types of comments sought by the Department as they relate to scoping, the documents provided for the Proposed Project, or the project itself.

On or about April 11, 2016, the Department also published a "Newspaper Notice" in local newspapers. It includes all of the information in the Scoping Notice, but it also describes "scoping" and the environmental review process as follows:

> Scoping is the first step in the development of an EIS. The scoping process identifies the alternatives, issues, and analyses to be included in the EIS. The EIS will be used by the PUC in deciding whether to issue a certificate of need and a route permit for the projects. Commerce has published the Scoping Environmental Assessment Worksheet (EAW) and Draft Scoping Decision Document (DSDD) for each of the projects, referred to as the Sandpiper Pipeline and Line 3 Replacement Projects.

The Newspaper Notice also states that: "Twelve (12) public meetings are planned as part of the scoping process; meeting information is provided below. These public meetings will provide an opportunity for people to learn about the proposed projects, ask questions, and provide input." It describes the purpose of the written comment period (but not the public meetings) as follows: "Written comments on the Scoping EAW and DSDD will be accepted . . . ." The Newspaper Notice is also confusing with regard to the purpose of the public meetings and comment period. While it provides a very general description of the purpose of the scoping process, it does not expressly describe the types of comments sought from the public as part of this process. Further, the purpose of the public meetings is very vague (to "provide input") and different from the purpose of the written comment period (limited to commenting on the draft Scoping EAW and DSDD).

It appears that the Department believed that merely describing its Scoping Notice as relating to "scoping" is sufficient description of the purpose of the meetings and comment period. Even though the Newspaper Notice provided a minimalist description of the scoping

process, it did not describe the types of comments sought from the public other than to say that the scoping meetings were for "input" and the written comment period was to provide comments on the Draft Scoping EAW and DSDD. Nowhere did the Department expressly describe the types of comments it sought at the public meetings or with regard to its draft documents, and the minimalist descriptions it provided are inconsistent and confusing.[1]

While professional advocates understand the meaning of the term "scoping," the Sierra Club suggests that citizens should not be expected to know the meaning of this technical term, such that the Department should have included a plain language description of the purpose of the public comment period and public meetings at the beginning of the Scoping Notice, as well as a description of the types of comments sought from the public. The Department's failure to provide such description may have limited the right of citizens to prepare appropriately for the scoping meetings and/or to draft written comments that address all subjects that are legally cognizable within the scoping process. A review of the scoping comments actually submitted by the public may very well indicate significant public confusion about the purpose of the scoping period and then nature of the comments sought by the Department, particularly if the Department receives a large number of general or otherwise irrelevant comments about the merits of the Proposed Project. Such comments might serve as proof that the Department's Scoping Notice and Newspaper Notice were deficient in both practical terms and as a matter of law.

[1] The minimalist descriptions of the purpose of scoping and identification of the types of comments sought stand in contrast to the detailed description of the purpose of the comment period noticed by the Department in the "Notice of Application Acceptance – Public Information and Environmental Analysis Scoping Meetings" issued on July 20, 2015 ("Notice of Acceptance"). This documents includes an entire section entitled "Topics Open for Public Comment," which identified the following topics as being open for public comment:

1. What human and environmental impacts should be studied in the environmental analysis?
2. Are there any specific methods to address these impacts that should be studied in the environmental analysis?
3. Are there any alternative routes or route segments that should be considered? (Related to the Route Permit)

If proposing an alternative route or route segment, consider the following:

- Does the alternative address an unavoidable impact?
- Does the alternative offer significant environmental or socioeconomic benefits compared to the Proposed Project?
- Is the alternative feasible and prudent?
- Does the alternative meet the described need and purpose for the project?

4. Are there any alternatives to the project that should be considered? (Related to the Certificate of Need)

If proposing an alternative to the project, consider the following:

- Project size – can a smaller or larger sized project better meet the decision criteria?
- Project type – can a different method (for example, existing pipeline, rail, or truck) meet the need?
- Project timing – is the project needed now or in the future?
- Is the alternative feasible and prudent?
- Does the alternative meet the described need and purpose for the project?

III. THE SCOPE OF THE EIS UNDER MINNESOTA LAW

A. The EIS Must Define the Purpose and Need for the Project in Accordance with the Scope of Minn. Stat. § 216B.243 and Minn. R. Chapter 7853

This EIS presents the unusual situation where the EIS must support an agency's analysis of the purpose and need for a project, such that the EIS may not itself pre-define the purpose and need for the project. Instead, the EIS must define the purpose and need for the Proposed Project broadly enough to support the Commission's full analysis under Minn. Stat. § 216B.243 and Minn. R. Ch. 7853, including consideration of all alternatives that the Commission must or may consider under these laws.

In most state permitting processes, a permitting agency is not required within the substantive permitting process itself to determine whether or not the need for a project exists or the nature of this need. Thus, most permitting agencies are free to define the purpose and need for a project through the MEPA process. In contrast, Minn. Stat. § 216B.243 creates a unique situation vis-à-vis MEPA. The CON laws specifically require that the Commission determine the purpose and need for a project through the state's contested case hearing process. Since the legislature has required that the Commission use the Minn. Stat. § 216B.243 process to determine the purpose and need for a pipeline, neither the Commission nor the Department may use MEPA to define the purpose and need so narrowly that the EIS fails to include information on alternatives that the Commission must or may consider under the CON laws.

Specifically, the Department may not use the EIS process to pre-define the need for the Proposed Project, because:

- a determination of the existence of need and the nature of need for a pipeline project is reserved exclusively under law to the Commission;[2]
- MEPA is a procedural law such that it may not be used to make substantive decisions; and
- the MEPA process may not be used by the Department or the Commission to in effect predetermine the nature of the need for a project under review pursuant to Minn. Stat. §216B.243, Subd. 3, and Minn. R. 7853.0130 before the evidentiary hearing on need even begins.

Admittedly, this situation is unusual. It could be argued that it puts the Department in an untenable position because the Department cannot know the Commission's determination of the purpose and need at the time the EIS is prepared. However, these laws can be harmonized through adoption of a broad statement of purpose and need in the EIS, which recognizes that the EIS will provide environmental information to support the Commission's determination of the purpose and need for the Proposed Project. Also, the Department may exclude alternatives that are patently unreasonable or consolidate alternatives that are similar, provided that such actions

[2] Minn. Stat. § 216B.243, Subd. 2, Subd. 5.

do not have the effect of predetermining or limiting the scope of the purpose and need for the Proposed Project.

Regardless of the limited role of the Department and MEPA in defining the purpose and need for the Proposed Project, Section 3.1 of the Draft Scoping Decision Document ("DSDD") states that "Minnesota Rule 4410.2300(G) states that an alternative may be excluded from analysis in the EIS if: it would not meet the underlying purpose of the project, . . ." Since the EIS must support the Commission's determination of the purpose and need through the CON evidentiary hearing, the DSDD may not pre-judge this purpose and need and limit the EIS's environmental analysis without frustrating the purpose of the CON proceeding.

Section 3.1.1 of the DDSD states that each alternative considered under MEPA must meet the "underlying purpose of the project." Since the purpose and need for the project will be determined by the Commission in the CON docket, the Department may not arbitrarily define the purpose and need more narrowly than would be considered by the Commission pursuant to Minn. R. 7853.0120. Otherwise, the Department would illegally usurp Commission authority.

Section 3.1.1 of the DSDD states that the purpose of the Proposed Project is "to address safety and integrity concerns of the existing Line 3 pipeline." While this may be a purpose for the Proposed Project, it is not its only purpose. The Proposed Project is also intended to increase the volume of crude oil transportation from Canada through Minnesota to refineries in southern PADD 2 as well as other regions and overseas. If safety and integrity were its only purpose, Enbridge could simply build a smaller pipeline with the same capacity as the existing Line 3 Pipeline. In any case, the DSDD's adoption of such narrow definition would violate the Commission exclusive authority to determine the purpose and need for the Proposed Project.

B. The Scope of the EIS Must Encompass the Full Scope of Minn. Stat. § 216B.243 and Minn. R. 7853.0130

The scope of the EIS is defined not by MEPA alone, but also with reference to the substantive laws that triggered this MEPA review. Thus, the Department must consider at least the following laws with regard to scope:

- the Minnesota pipeline routing law, Minn. Stat. Ch. 216G and its implementing regulations at Minn. R. Ch. 7852 (together, "Routing Law");
- the Minnesota certificate of need for large energy facilities law, Minn. Stat. § 216B.243 and its implementing regulations at Minn. R. Ch. 7853 (together, "CON Law"); and
- the Minnesota Environmental Policy Act, Minn. Stat. Ch. 116D ("MEPA") and its implementing regulation at Minn. R. Ch. 4410.

MEPA does not operate in isolation from the permitting processes that trigger it. Here, the EIS is intended to inform the Commission's decision making under the routing and CON statutes and regulations. The scope of the EIS must include environmental information on matters that the

Commission is required by the Routing and CON laws to evaluate. In addition, the EIS must also accomplish the purpose and policy objectives of MEPA contained in Minn. Stat. § 116D.02, Subd. 1, and state agencies must also fulfill their responsibilities under Minn. Stat. § 116D.02, Subd. 2, and § 116D.03. Should the scope of an EIS exclude the types of environmental information that are required by MEPA with regard to specific elements of the Commission's analysis under the Routing and CON Laws, then such EIS would be deficient as a matter of law.

Both Minn. Stat. § 21b.243, Subd. 3, and Minn. R. Ch. 7853.0130 contain specific policy factors that the Commission is required by law to consider when evaluating the need for the Proposed Project. The Commission must evaluate and make a specific written finding[3] with regard to each of the policy factors in Minn. R. 7853.0130. These policy factors require consideration of a variety of environmental impacts, alternatives, and means to mitigate the adverse environmental impacts of the Proposed Project. Thus, the EIS must not categorically exclude environmental information related to any of the policy factors in these laws.

In relevant part,[4] Minn. Stat. § 216B.243, Subd. 3, requires that the Commission consider the following factors:

> (1) the accuracy of the long-range energy demand forecasts on which the necessity for the facility is based;
>
> (2) the effect of existing or possible energy conservation programs under sections 216C.05 to 216C.30 and this section or other federal or state legislation on long-term energy demand;
>
> (3) the relationship of the proposed facility to overall state energy needs, as described in the most recent state energy policy and conservation report prepared under section 216C.18 . . . ;
>
> (4) promotional activities that may have given rise to the demand for this facility;
>
> (5) benefits of this facility, including its uses to protect or enhance environmental quality, and to increase reliability of energy supply in Minnesota and the region;

[3] Minn. R. 7853.0100.

[4] The Minnesota Legislature repealed a pipeline-specific certificate of need statute and instead applied Minn. Stat. § 216B.243 to large interstate crude oil pipelines, but did so without substantially modifying this section even though it was written to apply only to high-voltage power lines. As a result, application of this section to pipelines is awkward and some of the policy factors in Subdivision 3 apply only to power lines. The Sierra Club asserts that the Department and Commission must apply the Subdivision 3 factors to pipelines for the same purposes for which they apply to power lines, particularly as they relate to the need for a pipeline and not its general advantages and disadvantages.

> (6) possible alternatives for satisfying the energy demand or transmission needs including but not limited to potential for increased efficiency and upgrading of existing energy generation and transmission facilities, load-management programs, and distributed generation;
>
> (7) the policies, rules, and regulations of other state and federal agencies and local governments; . . . .

Minn. R. 7853.0130 requires that the Commission evaluate the following factors:

> A certificate of need shall be granted to the applicant if it is determined that:
>
> A. the probable result of denial would adversely affect the future adequacy, reliability, or efficiency of energy supply to the applicant, to the applicant's customers, or to the people of Minnesota and neighboring states, considering:
>
> (1) the accuracy of the applicant's forecast of demand for the type of energy that would be supplied by the proposed facility;
>
> (2) the effects of the applicant's existing or expected conservation programs and state and federal conservation programs;
>
> (3) the effects of the applicant's promotional practices that may have given rise to the increase in the energy demand, particularly promotional practices that have occurred since 1974;
>
> (4) the ability of current facilities and planned facilities not requiring certificates of need, and to which the applicant has access, to meet the future demand; and
>
> (5) the effect of the proposed facility, or a suitable modification of it, in making efficient use of resources;
>
> B. a more reasonable and prudent alternative to the proposed facility has not been demonstrated by a preponderance of the evidence on the record by parties or persons other than the applicant, considering:
>
> (1) the appropriateness of the size, the type, and the timing of the proposed facility compared to those of reasonable alternatives;

> (2) the cost of the proposed facility and the cost of energy to be supplied by the proposed facility compared to the costs of reasonable alternatives and the cost of energy that would be supplied by reasonable alternatives;
>
> (3) the effect of the proposed facility upon the natural and socioeconomic environments compared to the effects of reasonable alternatives; and
>
> (4) the expected reliability of the proposed facility compared to the expected reliability of reasonable alternatives;
>
> C. the consequences to society of granting the certificate of need are more favorable than the consequences of denying the certificate, considering:
>
> (1) the relationship of the proposed facility, or a suitable modification of it, to overall state energy needs;
>
> (2) the effect of the proposed facility, or a suitable modification of it, upon the natural and socioeconomic environments compared to the effect of not building the facility;
>
> (3) the effects of the proposed facility or a suitable modification of it, in inducing future development; and
>
> (4) socially beneficial uses of the output of the proposed facility, or a suitable modification of it, including its uses to protect or enhance environmental quality; and
>
> D. it has not been demonstrated on the record that the design, construction, or operation of the proposed facility will fail to comply with those relevant policies, rules, and regulations of other state and federal agencies and local governments.

The foregoing policy factors have significant environmental and socioeconomic implications. They require consideration of certain types of lower impact alternatives, including but not limited to:

1) conservation and efficiency efforts as an alternative to new construction;
2) the enhancement of existing infrastructure rather than new construction;
3) alternatives related to the size and timing of the Proposed Project; and
4) alternatives related to the use of alternative forms of energy to that transmitted by the Proposed Project.

These factors also require consideration of a wide variety of environmental and socioeconomic impacts, including but not limited to the Proposed Project's environmental benefits, if any, and the effects of the Proposed Project on inducing future development, which development would also have environmental impacts.

The EIS must, in part, support the Commission's consideration of all relevant policy factors related to its determination of need for the Proposed Project. Accordingly, the scope of the EIS for the Proposed Project must not exclude information related to any of the foregoing factors. Otherwise, the EIS would not accomplish its purpose of describing the environmental impacts the Proposed Project, the environmental costs and benefits of alternatives to the Proposed Project, and the environmental costs and benefits of mitigation related to the Proposed Project, for the full scope of analysis required by Minn. Stat. § 216B.243, Subd. 3, and Minn. R. 7853.0130, which the Commission must under law perform.

DSDD Section 3.3 appears to violate Minn. Stat. § 216B.243, Subd. 3, and Minn. R. 7853.0130, to the extent that it limits alternative technologies to only rail and truck, without considering adoption of conservation and energy efficiency technologies as an alternative to the Proposed Project. Since both Minn. Stat. § 216B.243, Subd. 3(2) and Minn. R. 7853.0130(A)(2) require consideration of the use of conservation and energy efficiency as alternatives to a project, the EIS must consider them to be alternative technologies under section 3.3 or elsewhere in the DSDD.

DSDD Section 3.6 appears to violate Minn. R. 7853.0130(B)(1), which requires that the Commission consider "the appropriateness of the size" of a pipeline project. The DSDD's implied assertion that the federal government selects the capacity of a pipeline before it is constructed is not correct. Pipeline companies initially select the capacity of proposed pipelines based on a variety of commercial factors. Once a pipeline company determines its desired capacity for a proposed pipeline, it must then construct a pipeline of that capacity in compliance with federal law. While the "size" in terms of the diameter or thickness of the wall of a pipeline must be constructed in compliance with federal law, the "size" of a proposed pipeline in terms of its nominal design capacity is determined solely by the pipeline owner. Enbridge could certainly decide to replace Line 3 with a pipeline with an ultimate capacity of 100,000 bpd or 800,000 bpd, and this choice would determine the physical dimensions of the pipeline, but federal law does not dictate the initial capacity determination. Accordingly, to be consistent with the Commission's duty under Minn. R. 7853.0130(B)(1), the EIS must consider alternatives related to higher or lower capacity pipelines for which substantial evidence may be provided in the evidentiary hearing. Given the impact of low oil price on development of the tar sands region in Canada and the uncertainty of future expansions there, the EIS should consider whether a lower capacity pipeline would meet the need for the Proposed Project as this need would be determined by the Commission pursuant to Minn. Stat. § 216B.243.

C. The Scope of Alternatives Evaluated by the EIS May Not Be Defined to Exclude Consideration of Alternatives Allowed Under Minn. R. 7853.0120

Minn. R. 7853.0120 requires that the Commission consider all "alternatives proposed before the close of the public hearing and for which there exists substantial evidence on the record with respect to each of the criteria listed in part 7853.0130." Thus, the scope of alternatives considered under Minn. R. 7853 is not limited by reference to a definition of purpose and need for the Proposed Project, but rather by reference to whether a party has provided "substantial evidence on the record" for each of the criteria listed in Minn. R. 7853.0130. The Department and Commission may not arbitrarily limit consideration of alternatives to only those that meet the Applicant's definition of its purpose and need for the Project, because: (1) the CON laws requires that the Commission define for itself whether or not there is a need for the Proposed Project and what this need may be; and (2) the CON laws expressly require that the Commission consider a broad range of alternatives limited only by whether "substantive evidence" has been presented to support the alternative. This broad scope with regard to alternatives is consistent with the underlying duty of the Commission to independently evaluate and determine the purpose and need for the Proposed Project through an evidentiary hearing based on alternatives presented by intervenors.

Should the Department exclude information from the scope of the EIS that is relevant to "alternatives proposed before the close of the public hearing and for which there exists substantial evidence on the record with respect to each of the criteria listed in part 7853.0130," then the Department would use the MEPA "purpose and need" analysis to usurp and preempt the Commission's exclusive authority to determine the nature of the need for the Proposed Project.

Section 3.1 of the DSDD appears to be in violation of Minn. R. 7853.0120 to the extent that it identifies only the limited set of alternatives contained in its Table 1, all of which are route alternatives. On its face, this statement limits the range of alternatives that the EIS must consider more narrowly than allowed by Minn. R. 7853,0120, such that it predetermines the scope of the Commission's analysis within the CON docket. This section also states that the only applicable law related to identification of alternatives is Minn. R. 4410.2300(G). This statement is legal error because the alternatives that MEPA must consider include all alternatives that the Commission will consider pursuant to Minn. R. 7853.0120.

Section 3.2 of the DSDD related to "alternative sites" states: "Line 3 is an existing pipeline and is already transporting crude oil to Clearbrook, Minnesota, and Superior, Wisconsin; therefore, other alternative sites are not being considered as they will not address safety and integrity concerns." This statement appears to pre-judge the purpose and need for the Proposed Project, which is the sole responsibility of the Commission within the CON docket. As such, inclusion of this statement in the DSDD would violate Minn. Stat. § 216B.243 and Minn. R. Ch. 7853. In addition, the statement is illogical. It essentially argue that safety and integrity concerns can be addressed only by construction of a pipeline between the Clearbrook and Superior Terminals. This assertion is irrational. It is entirely possible to construct a pipeline that complies with federal pipeline safety and integrity requirements between any two terminals,

whether existing or new. In fact, federal pipeline safety law is by its nature applicable to any route that might be chosen by the Commission.

If Enbridge were planning to repair Line 3 rather than replace it in a new corridor, then the proposal of an entirely new pipeline would not relate to such intent to maintain an existing pipeline, but that is not the case. Since Enbridge itself has proposed to construct a significant portion of a new replacement pipeline in a new corridor, alternative sites should include all alternative routes and other alternatives that the Commission must consider pursuant to Minn. R. 7853.0120 (alternatives for which there is substantial evidence in the record).

IV. IDENTIFICATION OF ALTERNATIVES FOR CONSIDERATION IN THE EIS

The Sierra Club requests that the Commission consider the following alternatives pursuant to Minn. R. 7853.0130.B.

A. Repair of Existing Line 3 to Allow Expansion That Does not Require a Certificate of Need (No Action Alternative)

The Commission must consider the "no action" alternative, which would essentially result in Enbridge performing ongoing repair and maintenance of the existing Line 3. The Commission should not assume that this alternative would result in no capacity expansion, because Enbridge could perform incremental repair and maintenance to expand capacity. In a November 2009 presentation entitled, "Enbridge Response to CAPP Near Term System Optimization," (Attachment A), Enbridge stated that Line 3's ultimate capacity could be as high as 630,000 bpd if Enbridge repaired the line to allow its maximum flow and modified other equipment. In this same presentation it also discussed the possibility of increasing Line 3's capacity to 500,000 bpd, which would require fewer modifications. Enbridge alleges that it is more cost effective and safer to build a new pipeline. However, the industry has repeatedly said that pipelines have essentially unlimited life spans if they are properly maintained and repaired. The Commission should evaluate Enbridge's claims to ensure that repair is not a superior alternative, particularly in light of the increased environmental impacts and costs of constructing a new pipeline in a new corridor. Since the current Line 3 currently performs the same function as that of the Proposed Project, repairing Line 3 would meet Enbridge's alleged commercial need. The primary issues with this alternative appear to be the relative costs of this alternative and the preferred alternative assuming that Enbridge is able to repair Line 3 to the point that it meets federal safety standards.

B. Removal of Existing Line 3 and Construction of a New Pipeline in the Same Trench

In its application Enbridge proposed a variation of this alternative but rejected it due primarily to alleged cost and practical constraints. Regardless, the Commission should consider this alternative and estimate its costs to determine if increased costs are merited due to avoidance of environmental impacts and increased landowner benefits related to removal of the old pipe

and any associated contamination. Since a new pipeline in the same corridor would perform the same function as that of the Proposed Project, constructing a new pipeline in the same trench would meet Enbridge's alleged commercial need. The primary issues with this alternative appear to be its relative costs and benefits.

C. Partial or Complete Removal of Existing Line 3 and Construction in Existing Corridor

Enbridge's removal alternative does not consider the possibility that portions of the existing corridor offer sufficient width to allow construction, such that removal of the existing Line 3 pipe and placement of new pipe in the same trench may be needed only in limited portions of the route. The Commission should examine mile-by-mile maps showing the exact locations of all pipelines in the existing corridor to determine the length of the corridor that offers no capacity for additional construction, and then determine the cost of construction if pipe is removed only in locations that are in fact constrained. Since a new pipeline in the same corridor would perform the same function as that for the Proposed Project, it would meet Enbridge's alleged commercial need. The primary issues with this alternative appear to be its practicality and relative costs and benefits.

D. Construction of a New Pipeline on the Edge of the Existing Corridor

Enbridge states that one of the reasons that it would be difficult to construct a new pipeline in the trench dug after Line 3 would be removed is because Line 3 is generally in the middle of the right of way, and this makes construction more difficult and expensive. This suggests that replacing a pipeline on the edge of the corridor would be less expensive. Figure 6.6.1-2, Typical ROW Configuration, on Route Application page 6-9 shows that Line 2, an even older pipeline, is generally on the north side of the right of way. Further, it is smaller in diameter so would cost less to remove. The Commission should review the precise location of the pipelines to determine if replacement of Line 2 is practically viable in terms of construction, as well as financially viable. Since a new pipeline in the same corridor would perform the same function as that proposed for the new pipeline, constructing a new pipeline in the same corridor would meet Enbridge's alleged commercial need. The primary issues with this alternative appear to be its practicality and relative costs and benefits.

E. Expand Capacity of Lines 2A, 2B, LSr, and 4 Instead of Expansion of Line 3

In December 2015, Enbridge informed its investors that it intended to increase the capacities of Lines 2A, 2B, LSr (65), and 4, for a total increase of 220,000 bpd (Attachment B). The Commission should consider whether these expansions projects by themselves or in coordination with forecast conservation and efficiency programs, or in coordination with reactivation of the 250,000 bpd Wood River Pipeline alternative, could economically meet the alleged commercial demand for the Proposed Project, particularly if the current low oil price environment continues.

F. Reactivation of the Wood River Pipeline and Integration into Enbridge System

Minnesota currently hosts the Minnesota Pipeline, which runs from Clearbrook to the Twin Cities area, and the Wood River Pipeline,[5] which current runs from Hartford, Illinois (near Wood River), to the Twin Cities. Sierra Club understands that the Minnesota Pipeline will or has been expanded significantly, without corresponding increases in refinery demand. This suggests that it will have substantial excess capacity.

Sierra Club also understands that the 580 mile-long Wood River Pipeline is currently configured to run from Illinois to Minnesota, but that it is currently not in operation. As recently as 2013, Koch Pipeline Company investigated the possibility of incorporating the Wood River Pipeline into a project that would ship 250,000 bpd from North Dakota to Illinois.[6] Assuming that the maximum capacity of the Wood River Pipeline is 250,000 bpd, this capacity in combination with the existing Line 3 Pipeline's capacity would be 640,000 bpd, or almost as much capacity as the maximum capacity of Enbridge's Proposed Project.

Together, the Minnesota Pipeline and a reversed Wood River Pipeline could move Canadian crude oil from Clearbrook, Minnesota, all the way to Illinois, potentially with limited need for a new pipeline corridor through Minnesota. Thus, a possible alternative would follow the existing Line 3 corridor from the North Dakota border to Clearbrook, and from there through the Minnesota Pipeline to its closest point of contact with the Wood River Pipeline, at which point connecting infrastructure would be built to the Wood River Pipeline, and then through the Wood River Pipeline to its terminus in Illinois, from where a connector would be built to the nearest Enbridge pipeline terminal.

The Commission should explore full use of Koch-owned pipelines, instead of assuming that these existing assets have no further utility in crude oil transportation. Given that the potential use of this existing but unused pipeline capacity to transport oil to Illinois, which is an important destination for Enbridge shippers, would (1) result in much lower costs and much less environmental impact than Enbridge's Proposed Project, (2) could be constructed in an accelerated timeframe, and (3) would provide service to and from the Clearbrook Terminal to a terminal near Enbridge terminals in Illinois, the Commission should investigate: (1) the amount of unused capacity on the Wood River and Minnesota Pipelines; (2) the cost and practicality of integrating these underutilized resources into Enbridge's midcontinent pipeline network; (3) the reasons why the oil industry has chosen to not use these resources; and (4) the environmental impacts of fully using these pipelines relative to the environmental impacts of Enbridge's Proposed Project.

[5] Koch Pipeline website: http://www.kochpipeline.com/about-us/kpl-facts/
[6] Reuters, Koch Pipeline seeks shipper Interest in Bakken pipeline (Jun. 18, 2013) http://www.reuters.com/article/2013/06/18/koch-pipeline-bakken-idUSL2N0EU0OK20130618

G. All Route Alternatives Proposed in the Sandpiper Route Docket

By reference, the Sierra Club hereby incorporates into these comments the alternative routes proposed in the Sandpiper route docket and studied by the DOC in its July 16, 2014, analysis of alternative routes filed in Docket No. PPL-13-474. Since these routes are known by the Commission and Department and were filed with the Commission, the Sierra Club does not believe it is necessary to further describe them in these comments or to include the Department study as an attachment.

V. ENVIRONMENTAL IMPACTS THAT MUST BE ADDRESSED IN THE EIS

The Commission should use the MEPA process to study the environmental impacts of all of the route and non-route alternatives proposed above. The categories of impacts that should be studied include:

- all of the impact categories identified by the headings in Section 7.0 of the Route Application, not limited by Enbridge's discussion of these impacts;
- the impacts of abandonment of existing Line 3;
- potential cumulative impacts of the construction of additional pipelines in Enbridge's proposed corridor, including the proposed Sandpiper Pipeline and any other potential pipeline projects that may come to light during the hearing;
- the impacts of increased petroleum extraction in the tar sands region on Minnesota's climate and air quality;
- the impacts of refineries that would receive the additional crude oil to be transported by the Proposed Project;
- the risks of oil spills in light of Enbridge's safety record;
- the inadequacy of pipeline safety oversight;
- impacts to migratory species; and
- impacts to at-risk resources.

More information about a number of these potential impacts are discussed below.

A. The Impacts, Risks, and Mitigation Related to Abandonment of the Existing Line 3 Pipeline

Abandonment of the existing Line 3 Pipeline is a necessary part of the Proposed Project.[7] Thus, the EIS must consider the impacts of such abandonment. The Proposed Project may be the first time that the Commission has considered approval of abandonment of a major crude oil pipeline as part of certificate of need and routing permit applications. Since abandonment of the existing pipeline is a necessary element and would result from the Proposed Project, the Commission should consider mitigation related to abandonment of Line 3 under Minn. Stat. § 216B.243, Minn. R. § Ch. 7853, Minn. Minn. R. 7852.3600, and Minn. R. 4410.2300(G) (related

[7] CON Application at Section 11.0; Routing Permit Application at Section 8.0.

to the use of alternatives that incorporate reasonable mitigation measures); R. 4410.2300(H), (related to consideration of mitigation of specific impacts); and R. 4410.2300(I) (related to the required EIS mitigation section that must "identify those measures that could reasonably eliminate or minimize any adverse environmental, economic, employment, or sociological effects of the proposed project").[8]

Since the alternatives that would in whole or in part replace Line 3 in the same right of way would result in removal of some or all of the existing Line 3 Pipeline, and such removal would mitigate abandonment of the existing Line 3 Pipeline, the EIS must consider mitigation under Minn. R. 4410.2300(G). Since abandonment of the existing Line 3 creates a variety of environmental, economic, employment, and sociological impacts, the EIS must consider mitigation measures related to abandonment under Minn. R. 4410.2300(H). Since mitigation related to abandonment of the existing Line 3 "could reasonably eliminate or minimize any adverse environmental, economic, employment, or sociological effects of the proposed project," the EIS must consider mitigation measures related to abandonment under Minn. R. 4410.2300(I).

1. Impacts and Risks Related to Pipeline Abandonment

Abandonment of large crude oil pipelines creates a wide variety of risks and costs. A 1996 paper by the NEB Pipeline Abandonment Steering Committee entitled *Pipeline Abandonment, A Discussion Paper on Technical and Environmental Issues* ("NEB Abandonment Paper" Attachment C), in Section 3 identifies the following issues:

- land use management, including potential interference with future development, protection of natural lands, and ongoing productive use of property, including but not limited to interference with new building and infrastructure construction, agriculture operations, recreational uses, and property aesthetic values;
- ground subsidence resulting from sink holes caused by corrosion and collapse of pipe, together with potential transportation of silt into waterbodies and lower lands;
- soil and groundwater contamination, resulting from undetected leaks during operations that are not removed, release of hazardous materials remaining in pipe, and contamination resulting from the degradation of pipeline coatings;
- pipe cleanliness and methodology used to remove hazardous materials from inside abandoned pipe, including the standards applied to removal operations;
- water crossings, including the potential for corroded pipelines to drain waterbodies, contaminate waterbodies, and flood adjacent lands via water transport, as well as for abandoned pipes to be exposed by stream and riverbed erosion, leaving pipe suspended in or above water, and for empty pipe to float toward the surface in wet areas if buoyancy control mechanisms fail;
- erosion resulting from emerged pipe channeling runoff or exacerbating wind erosion, which effects are greater in highly erodible lands ;

[8] Sierra Club is not aware of any other Minnesota state laws that regulate abandonment of crude oil pipelines.

- utility and pipeline crossings, including the potential for abandoned pipelines to interfere with roadways, railways, other pipelines, powerlines, and communications lines;
- creation of water conduits that could lead to unnatural drainage and material transport from a variety of water bodies and wetlands, including but not limited to stock ponds, lakes, rivers, streams, bogs, and marshes, which impact becomes greater with increasing pipeline size;
- disconnection, removal, and disposal of associated apparatus, such as valve sites and manifolds; underground tanks; pipeline scraper trays; line heaters; drip pots; access culverts; access roads, gates and fences; cathodic test posts, fink stations, rectifier sites, and ground beds; anchor blocks and steel piles; and other miscellaneous equipment; and
- cost of abandonment, which potentially may be very high including the cost of mitigating the foregoing risks through removal, stabilization, plugging and filling, and temporarily maintaining abandoned pipe.

The foregoing issues put a wide variety private and public financial and natural resources and rights at risk, which risk should not be borne by landowners and government agencies.

2. Pipeline Abandonment Mitigation Options

The NEB Abandonment Paper summaries a wide variety of mitigation techniques that can effectively reduce the risks borne by landowners, other citizens, and local, state, and federal agencies. These include but are not limited to hazardous materials mitigation, pipe removal, pipe filling, plug installation, ground stabilization, and temporary maintenance through cathodic protection and monitoring. Since Enbridge is a member of CAPP and it participated in development of the Canadian abandoned pipeline program, it is aware of available techniques for mitigation of abandoned pipelines.

3. The Department Must Study Impacts, Risks, and Mitigation Related to Abandonment

One of the primary purposes of MEPA is to force state agencies to study and analyze not just knows environmental impacts and threats, but to also to assess and analyze new impacts and threats. In particular, MEPA directs that the Commission and Department "shall":[9]

- "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;"[10]
- "make available to the federal government, counties, municipalities, institutions and individuals, information useful in restoring, maintaining, and enhancing the quality of

[9] Minn. Stat. § 116D.03, Subd. 2.
[10] Minn. Stat. § 116D.03, Subd. 2(4).

the environment, and in meeting the policies of the state as set forth in Laws 1973, chapter 412;"[11]

- "initiate the gathering and utilization of ecological information in the planning and development of resource oriented projects;"[12]
- "undertake, contract for or fund such research as is needed in order to determine and clarify effects by known or suspected pollutants which may be detrimental to human health or to the environment, as well as to evaluate the feasibility, safety and environmental effects of various methods of dealing with pollutants."[13]

Enbridge has proposed a course of action related to abandonment of the existing Line 3, namely to leave it in place and to allow Enbridge itself to decide how to mitigate risks. Under MEPA, the Commission and Department through the EIS must "study, develop, and describe appropriate alternatives"[14] to Enbridge's proposed course of action. The agencies must do this in part because the state's "counties, municipalities, institutions and individuals"[15] have little understanding of the environmental impacts and risks of abandonment and do not have access to "information useful in restoring, maintaining, and enhancing the quality of the environment"[16] related to abandonment along the existing Line 3 route. As such, the Commission and Department must proactively "initiate the gathering and utilization of ecological information in the planning and development"[17] related to abandonment of the Proposed Project. Enbridge has made clear that the existing Line 3 Pipeline, which has operated since 1968, has thousands of defects. Therefore, there is a substantial risk that it has leaked crude oil from multiple locations. Moreover, it is also true that Enbridge's automated leak detection system is incapable of detecting or locating small leaks that nonetheless present a risk to the environment and the health and welfare of landowners, as well as create a risk of financial liability to landowners, and that would "be detrimental to human health or to the environment."[18] Therefore, the Commission and Department must "undertake, contract for or fund such research as is needed in order to determine and clarify effects by known or suspected pollutants" [19] related to the abandonment of the existing Line 3.

Because abandonment of Line 3 creates environmental impacts and risks that have not been previously studied by the State of Minnesota and are generally unrecognized by agency staff, policy makers, local governments, landowners, and potentially impacted citizens, MEPA requires that the Commission and Department study and research the actual on-the-ground impacts and risks of abandoning Line 3. Such studies should at a minimum include:

[11] Minn. Stat. § 116D.03, Subd. 2(6).
[12] Minn. Stat. § 116D.03, Subd. 2(7).
[13] Minn. Stat. § 116D.03, Subd. 2(8).
[14] Minn. Stat. § 116D.03, Subd. 2(4).
[15] Minn. Stat. § 116D.03, Subd. 2(6).
[16] *Id.*
[17] Minn. Stat. § 116D.03, Subd. 2(7).
[18] Minn. Stat. § 116D.03, Subd. 2(8).
[19] *Id.*

- a crude oil leak survey along the entire route, with particular attention paid to areas with significant numbers of pipe defects according to Enbridge surveys of the pipeline;
- a survey of water resources at risk along the abandoned pipeline that could be put at risk by breach of the abandoned pipeline and subsequent movement of water or contamination of water by residual contaminants within the abandoned pipeline;
- a survey of terrestrial resources at risk along the abandoned pipeline, including public roadways, utilities, railroads, private roads, agricultural operations, residences, and public facilities; and
- an assessment of mitigation techniques available to redress the impacts and risks of abandonment.

The proposed abandonment of Line 3 is exactly the type of circumstance that MEPA anticipated would require assessment, study, and analysis, not only for the use of the Commission in its decision making, but also for the use of private and public landowners with Line 3 easements and other potentially impacted Minnesota residents, businesses, local governments, and state government agencies. Therefore, the Department must independently study the impacts and risks of abandonment of the existing Line 3 Pipeline. A failure to do so would violate the language and spirit of MEPA.

In order to incorporate a study of the impacts and mitigation related to abandonment, the DSDD should be modified to as follows:

- DSDD Section 4.3 asserts that "[n]o field-level data collection will be performed for any of the route alternatives. Field data for the Applicant's preferred route has been completed by the Applicant." To the extent that the Department considers investigation of related to abandonment to be related to an alternative, it should modify this section to acknowledge that it will investigate the impacts and mitigation options related to abandonment of the existing Line 3.

- DSDD Section 4.5 should identify the need for a special study of abandonment impacts and mitigation.

In addition, once the impacts and mitigation related to abandonment have been assessed by a special study, DSDD Section 4.4 should be modified to include the potential social, environmental, and economic effects of abandonment, both as a separate section and with regard to the impacts of abandonment on Sections 4.4.1 (and all of its subsections); because the abandonment would impact the existing Line 3 right-of-way and all of the properties, jurisdictions, and interests related to it. Specifically, abandonment of the existing Line 3 could impact:

- the construction of new housing;
- property values;
- minority and low-income populations;

- employment and income related to abandonment mitigation activities;
- the development of land pursuant to local planning and zoning regulations;
- aesthetics, particularly with regard to the emergence of the gas-filled pipeline in wet soils or with regard to the creation of sinkholes or water drains;
- the discovery of sites that have been contaminated by leaks from the existing Line 3 Pipeline;
- public and private roadways and public utilities;
- agricultural operations, for example resulting from loss of cover, sinkholes, or disruption of drainage;
- tourism and the tourism industry;
- tribal property and cultural resources, including plants and wildlife in which tribal members have usufructory rights;
- water resources related to contamination and drainage of wetlands, creeks, rivers, ponds, and lakes;
- soils, particularly with regard to any removal of abandoned pipe as mitigation;
- threatened and endangered species; and
- natural heritage sites, and a variety of other state and local public lands through which the existing Line 3 passes.

4. Federal Law Does Not Preempt State Action to Regulate Pipelines Once Abandoned

Federal law does not regulate the disposition of abandoned pipelines beyond those actions required to cease operations. The federal Pipeline Safety Act, 49 U.S.C. § 60101 *et seq*. ("PSA"), contains only one requirement related to abandonment in 49 U.S.C. § 60108(c)(6), which states in relevant part: "The operator of a pipeline facility abandoned after October 24, 1992, shall report the abandonment to the Secretary in a way that specifies whether the facility has been abandoned properly according to applicable United States Government and State requirements." (Emphasis added.) This language implies that states may regulate abandoned pipelines.

With regard to federal regulations, 49 C.F. R. Part 195 implements the PSA and regulates the transportation of hazardous liquids by pipeline, including crude oil. Part 195 includes three provisions related to regulation of abandonment. First, 49 C.F.R. § 195.2 states that "Abandoned means permanently removed from service." Second, 49 C.F.R. § 195.59 requires that the last operator file a report upon abandonment, but only for onshore facilities that cross over, under, or through a commercially navigable waterway. These reports are minimal in nature and generally contain only the following information: "the date of abandonment, diameter, method of abandonment, and certification that, to the best of the operator's knowledge, all of the reasonably available information requested was provided and, to the best of the operator's knowledge, the abandonment was completed in accordance with applicable laws." Third, 49 C.F.R. § 195.402(c) states:

> (c) Maintenance and normal operations. The manual required by paragraph (a) of this section must include procedures for the following to provide safety during maintenance and normal operations:
>
> * * *
>
> (10) Abandoning pipeline facilities, including safe disconnection from an operating pipeline system, purging of combustibles, and sealing abandoned facilities left in place to minimize safety and environmental hazards. For each abandoned offshore pipeline facility or each abandoned onshore pipeline facility that crosses over, under or through commercially navigable waterways the last operator of that facility must file a report upon abandonment of that facility in accordance with § 195.59 of this part.

(Emphasis added.) Thus, federal law regulates safety while maintenance and normal operations are ongoing. When a company abandons a pipeline, federal regulation requires only that operators: (1) disconnect the abandoned pipeline from operating pipelines; (2) purge the pipeline of combustibles (but not liquid or solid hazardous wastes); and (3) seal abandoned pipelines to minimize safety and environmental hazards. These minimal steps define the final federal regulation of a pipeline and are intended to ensure that it is no longer in operation and therefore no longer subject to ongoing federal oversight.

Once a pipeline is formally abandoned, the PSA and 49 C.F.R. Part 195 no longer regulate it. Therefore, federal law does not regulate:

- salvage of pipe after abandonment, which may be considered personal property and not real estate under state law, to allow reclamation of pipe steel, productive uses of land such as construction of new buildings and infrastructure, agricultural operations, and other forms of land use;
- termination of pipeline easements, especially because such easements are granted via state and not federal law;
- cleanup of hazardous materials that may be in or have already leaked from pipelines;[20]
- permanent and temporary ongoing mitigation measures, such as removal, plugging, filling, and maintaining of abandoned pipe, which actions are similar in nature to construction mitigation that may be ordered by a state during construction; and
- liability for damages caused by abandoned pipelines.

[20] Federal hazardous materials laws such as the Resource Conservation and Recovery Act, 42 U.S.C § 6901 *et seq.* ("RCRA") and the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9601 *et seq.* ("CERCLA") may impose standards, but these are generally delegated to states. The Pipeline Safety Act, 49 U.S.C. § 60101

Consistent with federal law, Minnesota's regulation of pipeline safety pursuant to Minn. Stat. Ch. 299J, which authorizes limited state regulation pursuant to federal delegation of certain PSA requirements, does not regulate pipeline abandonment. Just as federal law allows states to grant easements, determine route, and regulate construction mitigation for new pipelines, federal law correspondingly also allows states to regulate the fate of pipelines once they are formally abandoned and therefore are no longer in operation. What the state gives, the state may also take away.

Other jurisdictions have ordered removal of pipelines without conflict with federal pipeline safety laws. The State of Iowa promulgated Iowa Code § 479B.32, which regulates abandoned pipelines.[21] The County of Santa Barbara California has regulated abandoned oil pipelines since at least 2004,[22] to the Sierra Club's knowledge without legal challenge. Also, the State of Michigan found that its underground storage tank law allowed it to remove a 17-mile long pipeline that was constructed from a bulk storage facility in Kalamazoo County to a former crude oil refinery in the City of Kalamazoo.[23] According to the Michigan Department of Environmental Quality (MDEQ) interpretation of Michigan environmental regulations the pipeline was considered an "Abandoned Container" as defined in Part 201 (Environmental Remediation) of Public Act 451 (Natural Resources and Environmental Protection Act, as amended) and owners of abandoned containers are required to conduct interim response activities to mitigate potential releases. The industry cannot challenge the foregoing state actions, because they do not conflict with the PSA or its implementing regulations in 49 C.F.R. Part 195, which laws authorize federal jurisdiction over only operating pipelines.

In light of the foregoing, the DSDD statements in Section 3.5.1 related to 49 C.F.R. Part 195 implies that federal law regulates the disposition of pipelines once they are taken out of operation by a pipeline owner and are formally abandoned. Federal jurisdiction over a pipeline terminates upon the federal actions identified in Section 3.5.1, but thereafter a pipeline is no longer in operation and therefore is no longer regulated by federal law. Since nothing in federal law regulates the disposition of a pipeline following abandonment, an assertion that the State of Minnesota could not regulate pipelines once they are formally abandoned would create the illogical result that no jurisdiction, federal or state, has authorization under existing law to order the removal or mitigation of an unsafe abandoned pipeline.

The DSDD's reference to American Society of Mechanical Engineers' (ASME's) B31.4-2012, paragraph 457 guidelines on abandoning a piping system likewise cites standards related only to termination of operations and not to the disposition or management of a pipeline after such termination.

[21] Other sections of Iowa Code Ch. 479B have been challenged in federal court, but to the Sierra Club's knowledge, the pipeline industry has not challenged § 479B.32.
[22] County of Santa Barbara Inland Zoning Ordinance, Art. III of Ch. 35, Div. 8 – Energy Facilities and Related Ordinances, Sec. 35-323.
[23] J. Valkenburg, H. Johannes, M. Hatton, J. Shurell, Crude Oil Pipeline Abandonment Case Study Kalamazoo County, Michigan (Attachment E).

5. The Commission Has Authority to Require Mitigation of Abandoned Pipelines

The Commission's authority to order mitigation related to abandonment of a crude oil pipeline derives from three sources.

First, Minn. Stat. § 216B.243, Subd. 5, gives the Commission authority to impose modifications on applications without express limitation, and Minn. R. 7853.0800, Subp. 1, states: "Issuance of a certificate may be made contingent upon modifications required by the commission." This broad statutory and regulatory discretion means that the Commission may impose reasonable modifications necessary to protect public health and welfare. Since Enbridge's Application for a Certificate of Need in Section 11.0 discusses abandonment and proposes mitigation related to abandonment, consideration of modification of the Application as it regards abandonment is within the Commission's jurisdiction. As a result, the EIS must also consider impacts and mitigation related to abandonment of the existing Line 3 Pipeline.

Second, Minn. R. 7852.3600 provides the Commission with authority to impose conditions on pipeline rights-of-way. This rule is not expressly limited to only the right-of-way proposed by an applicant. Enbridge's Routing Permit Application in Section 8.0 discusses mitigation related to abandonment of Line 3, which implies that the Commission has discretion to consider mitigation related to abandonment as a factor in its decision on route. Since the Commission could order the reuse of the existing Line 3 right-of-way, logically it must have jurisdiction over existing rights-of-way, including authority to order mitigation terms related to such right-of-ways.

Third, MEPA requires that an EIS must "explore[] methods by which adverse environmental impacts of an action could be mitigated." Minn. Stat. § 116D.04, Subd. 2a. Consistent with this requirement, the EQB's alternative review approval regulations require that it may approve such reviews only if the alternative requires that "measures to mitigate the potential environmental impacts are identified and discussed." Minn. R. 4410.3600, Subp. 1.D. Thus, MEPA requires that all environmental reviews of any form consider mitigation to address the impacts of proposed pipeline projects. Since abandonment of the existing Line 3 Pipeline would create environmental impacts and such impacts clearly can be mitigated, the Commission must include consideration of such mitigation in its environmental review. Further, given that the Commission apparently has not previously considered the abandonment of a major crude oil pipeline, the EIS must include a study of the risks of abandonment and mitigation measures for such abandonment. Such consideration would be pointless if the Commission found that it could not adopt such mitigation measures under, Minn. Stat. § 216B.243, Minn. Stat. Ch. 216G, or MEPA itself. Therefore, the Commission must conclude that it has authority to order mitigation measures related to abandonment of the existing Line 3 Pipeline.

A key policy concern for the Commission should be the right of landowners to determine which mitigation techniques are appropriate on their land, relative to the right of Enbridge or the Commission to make this decision for them. Enbridge has asserted that abandonment in place

with ongoing cathodic protection and monitoring is the best abandonment practice for almost all of the existing pipeline route. This being said, Enbridge has a substantial self-interest in minimizing its costs and discounting future adverse impacts and costs to landowners. Therefore, landowners should have the right to evaluate and choose between various mitigation techniques and should be trusted to do what's best for their land. If Enbridge's mitigation approach is in fact the best option for landowners and their land, then landowners should be trusted to see its merits. On the other hand, if landowners have a reasonable belief that Enbridge's approach would externalize costs and risks onto them that should in fairness be borne by Enbridge and its customers, then the Commission should carefully analyze the efficacy of Enbridge's abandonment plans as they impact landowner interests. A Commission approval of the project that allows by Enbridge in practice to determine mitigation, or that expressly approves Enbridge's abandonment mitigation plan, risks benefitting Enbridge at the expense of Minnesota landowners, both public and private.

6. Mitigation Related to Abandonment of the Existing Line 3 Pipeline Is Practical

Enbridge participated in the National Energy Board of Canada's ("NEB") multi-year nation-wide process to determine whether to require pipeline abandonment plans and required resources, called the Land Matters Consultation Initiative ("LMCI"), which ultimately required that pipeline companies develop pipeline abandonment plans and provide the financial resources needed to assure compliance with these plans.[24] The NEB undertook this process because Canadian federal law required consideration of pipeline abandonment costs.

As part of the LMCI process, Enbridge prepared abandonment plans for each of its pipelines. Enbridge's Application for Approval of Abandonment Costs – Preliminary Estimate, and Appendix H thereto showing the costs of for individual pipelines including the existing Line 3 in Canada, are included in Attachment D. The total estimated cost of Enbridge's abandonment plan for Line 3 is over CA$122 million for approximately 1,030 kilometers or approximately an average of CA$188,000 per kilometer. This equals approximately US$142,000 per mile. However, this assumes removal of the pipe for only 3 kilometers of the entire route, and applies other forms of mitigation beyond cathodic protection to only a very limited degree.

Enbridge's applications propose to abandon almost all of the existing Line 3 in place.[25] However, the applications do not discuss all available mitigation options, but rather frames mitigation in terms of either same trench replacement, which would require removal of all pipe, or abandonment in place with cathodic protection and monitoring. The Canadian LMCI process provides ample evidence that a variety of mitigation techniques exist between the extremes presented by Enbridge. The Commission should consider a full range of mitigation options for abandonment to ensure that landowners are treated fairly and to ensure that public lands owned by the state also receive proper mitigation.

[24] A description of this process and access to NEB documents may be found at https://www.neb-one.gc.ca/prtcptn/pplnbndnmnt-eng.html .
[25] Route Application at Sections 6.6.1 and 8.4.

Although the NEB process required a substantial amount of time to complete, it should be noted that it developed a new regulatory process for the entire country of Canada applicable to all crude oil and natural gas pipelines. Here, the need for analysis is limited to just the existing Line 3 Pipeline and only within Minnesota. Therefore, it should not be assumed that analysis of the impacts of abandonment and mitigation appropriate for this particularly pipeline will require years of effort. Moreover, Enbridge, at least, is fully aware of the potential impacts and forms of mitigation and has the internal capacity develop an abandonment plan for the existing Line 3 Pipeline, because it has already done this for many thousands of miles of pipeline in Canada, including the segment of Line 3 in Canada, which is much longer than the segment through Minnesota.

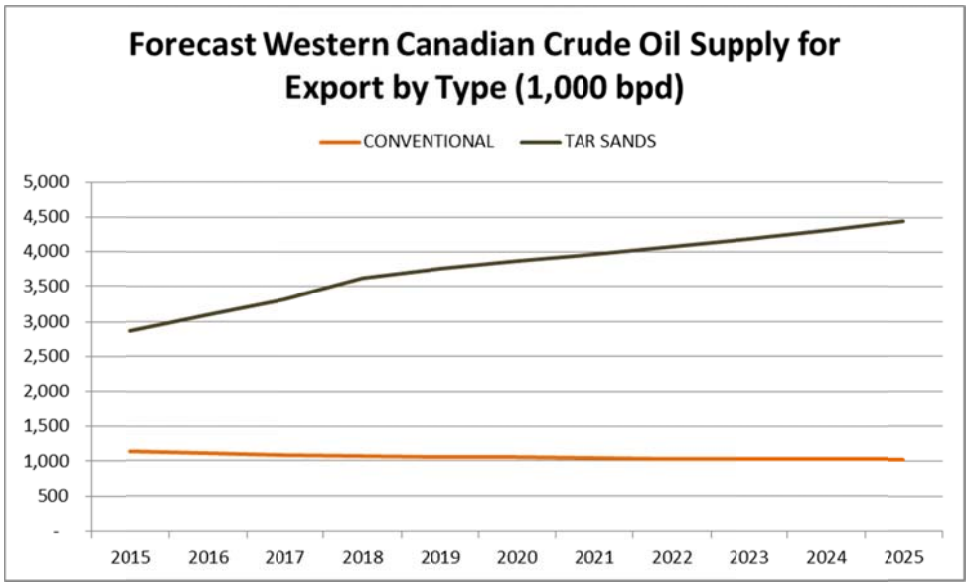
The fact that study and analysis of abandonment related issues will require time and effort is not cause under MEPA to avoid doing so. Section 116D.02, Subd. 2, of MEPA does not permit the Commission and Department to avoid their responsibilities related to abandonment merely because doing so would be inconvenient. A failure by the Commission and Department to study this new, critical issue would violate the express language of Minn. Stat. § 116D.02, as well as the spirit of MEPA.

B. The Impacts and Risks of Climate Change

Minn. R. 4410.0200, Subp. 65, defines the term "project," in relevant part, as "a governmental action, the results of which would cause physical manipulation of the environment, directly or indirectly." Minn. R. 34410.2300(H) states that an EIS must consider the effects of a project, including its "potentially significant adverse or beneficial effects generated, be they direct, indirect, or cumulative." Therefore, MEPA requires that the Commission and the Department consider the indirect impacts of the Proposed Project.

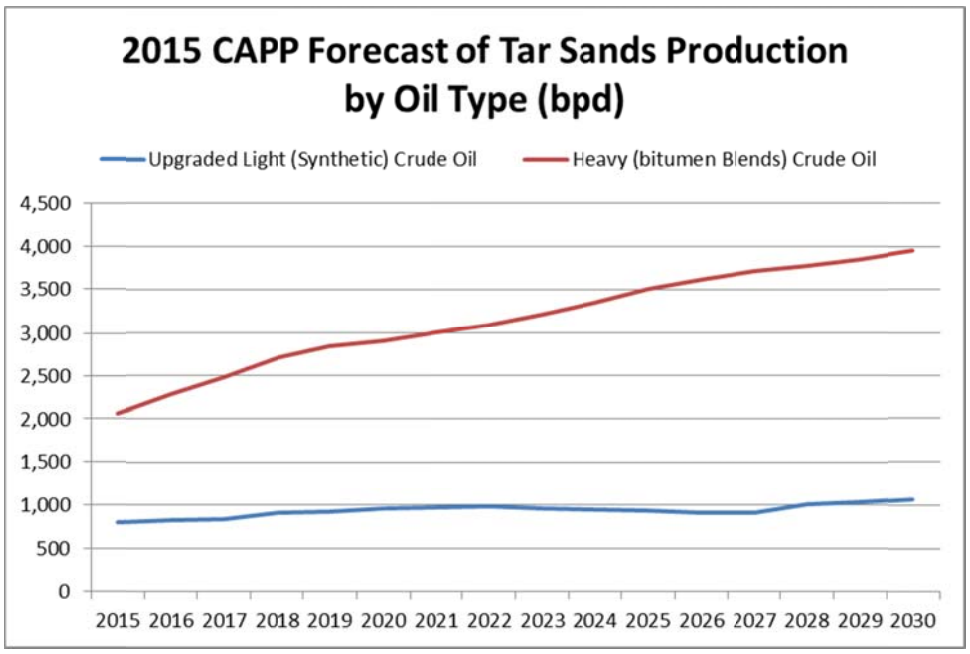
Minn. R. 4410.0200, Subp. 11, defines "cumulative impact" as the impact on the environment that results from incremental effects of the project in addition to other past, present, and reasonably foreseeable future projects regardless of what person undertakes the other projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time."

The Proposed Project would allow for an additional 390,000 bpd of crude oil to be shipped through Minnesota. According to the Canadian Association of Petroleum Producers 2015 report entitled, Crude Oil, Forecast, Markets & Transportation, Canadian production of conventional crude oil is forecast to decline whereas production from the tar sands is expected to increase.



Therefore, the new incremental pipeline capacity through Minnesota that would be provided by the Proposed Project would allow increased extraction of oil from the tar sands and not increased conventional oil extraction.

Moreover, CAPP also forecasts that the vast majority of new tar sands supply would be of heavy diluted bitumen crude oil and not synthetic crude oil. It forecasts that by 2030, heavy oil supply would increase by 1,887,000 bpd, whereas light synthetic crude oil supply would increase by 273,000, which is less than the incremental pipeline capacity provided by the Proposed Project.



Also, Enbridge has proposed to expand its Lines 2 and 65 across the border into Minnesota, both of which transport light crude oil, such that they would presumably be used to transport some or all of any increase in light oil supply in Canada. As a consequence, it seems probable that the Proposed Project would be used in substantial part to transport heavy crude oil. Heavy crude oil is more difficult and energy intensive to refine, such that an increase in consumption of heavy crude oil also results in an increase in both conventional and greenhouse gas air pollution.

Since extraction of crude oil from the tar sands results in greater greenhouse gas emissions than conventional crude oil, construction of the Proposed Project would result in an increase in greenhouse gas emissions in Canada. These increased greenhouse gas emissions would change the concentration of greenhouse gases in Minnesota's atmosphere, as well as the atmosphere for the entire planet. Increased greenhouse gas emissions would increase the temperature of Minnesota's climate and have a wide variety of adverse impacts on Minnesota's natural and human environment.

The increase in heavy crude oil availability to Minnesota's two refineries creates the potential that construction of the Proposed Project would result in higher consumption of heavy crude oil by these refineries, which increased consumption would result in increased conventional and climate change emissions in Minnesota from these refineries.

An increased supply of crude oil to US and global markets would tend to lower oil price and increase combustion of petroleum fuels in Minnesota as well as in other locations. This increased combustion would also increase greenhouse gas and conventional air pollution concentrations in Minnesota.

Thus, the indirect impacts of the Proposed Project include:

- exacerbation of the impacts of climate change on Minnesota resulting from extraction and processing in Canada;
- an increase in the proportion of bitumen blends processed by Minnesota refineries, and a corresponding increase in both conventional and greenhouse gas emissions in Minnesota; and
- an increase in combustion of petroleum fuels in Minnesota and elsewhere, which combustion would increase the emissions and concentrations of greenhouse gas and conventional air pollutants within Minnesota.

In addition, the Proposed Project would result in cumulative impacts with regard to its incremental direct and indirect impacts on greenhouse gas and conventional air emission, within and outside Minnesota. Due to the magnitude of global greenhouse gas emissions, individual emissions of greenhouse gases are always proportionally small relative to total global emissions, regardless of the size of a project. Yet, such emissions are cumulatively significant. Since this pipeline is a major crude oil pipeline that would allow significant increases in extraction and combustion of oil, the Proposed Project's cumulative direct and indirect greenhouse gas emissions are significant.

MEPA requires consideration of indirect and cumulative impacts; therefore, the scope of the EIS must include consideration of both the direct impacts of construction and operation of the Proposed Project on climate change, as well as the indirect and cumulative impacts of its construction and operation on climate change. The Proposed Project's indirect and cumulative impacts on Minnesota's environment include increased emission of greenhouse gas and conventional air pollution from the extraction, processing, transportation, refining, and combustion of the crude oil that would be transported by the Proposed Project. A failure to consider these critical indirect and cumulative impacts would violate MEPA.

Because climate change is such an important and far-reaching issue, we suggest that the EIS include a separate section on GHG and climate change impacts. The EIS cumulative impacts analysis should address GHG emissions and the resulting climate change impacts that are foreseeable from the expanded extraction, refining, and end use of the tar sands as fuel.

Over its entire lifecycle, the synthetic crude oil produced from tar sands emits at least 17% more global warming pollution than conventional oil. Furthermore, because Tar Sands oil is a heavier crude, the U.S. refineries that process it will produce higher levels of pollutants that damage human health and lead to more smog, haze, and acid rain. These aspects of the project must be given a thorough analysis in the EIS.

According to the Intergovernmental Panel on Climate Change ("IPCC"), a group of over 2000 of the world's preeminent climate scientists, climate change is a fact. The IPCC concludes that "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level." Most of the observed increase in global average temperatures since the mid-20th century is "very likely due to the observed increase in anthropogenic greenhouse gas concentrations."[26] According to the IPCC's assessment of the latest scientific literature, evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases.[27]

Tar Sands crude oil production generates almost triple the GHG pollution as conventional oil production because of the massive amounts of energy needed to extract, upgrade, and refine the oil.[28] The EIS should take into consideration the cumulative increase in GHG emissions (methane, CO2, black carbon, etc.) that will result from each stage of the Proposed Project life cycle. This includes, but is not limited to, GHG emissions from the increased extraction of raw Tar Sands crude oil in Canada, the increased refinement of tar sands crude in the U.S., and the increased domestic and foreign combustion of tar sands oil.

[26] *Id*. at 17.
[27] *Id*. at 9.
[28] Dan Woynillowicz, "Oil Sands Fever: The Environmental Implications of Canada's Oil Sands Rush," (The Pembina Institute, November, 2005) p. 22. Information gathered from Canadian Association of Petroleum Producers on conventional oil and from the Pembina Institute for oil sands mining and in situ drilling. Actual numbers are 28.6 conventional oil average GHG intensity/barrel of oil as compared to 85.5 oil sands average GHG intensity/barrel of oil.

If quantification of these GHGs cannot be made by the Commission, then it should identify what additional information would be necessary to make that determination. In addition, the impact of these GHGs on climate change should be analyzed. If the Commission believes it cannot make that determination, it should identify what additional information would be necessary to do so.

The WCSB tar sands lie beneath approximately 149,000 square kilometers of Alberta's northeastern boreal forest. The destruction of the boreal forest due to open pit mining and intensive drilling is eliminating an extensive carbon sink, thereby releasing carbon back into the global atmosphere. Tar Sands extraction is also destroying peat bogs, the single best carbon sink of any habitat in terms of tons of carbon captured.

Black carbon, second only to CO_2 in total atmospheric heat-trapping power, is emitted by diesel trucks, earth moving equipment, processing plants, and other extraction-related equipment and operations that burn fossil fuels, biofuels, and biomass. In addition to trapping heat like CO_2, black carbon also deposits black soot on ice and in clouds, which increases absorption of sunlight and further contributes to atmospheric warming.

Carbon dioxide, black carbon, and other GHGs like methane released in Canada contribute to global atmospheric concentrations of GHGs, which in turn causes climate change impacts in the U.S. Therefore, the EIS should include these significant GHG contributions from increased Canadian tar sands extraction in its environmental impact analysis of the Proposed Project.

Refining tar sands crude oil results in more GHG emissions than refining conventional oil because the tar sands refining process is more energy-intensive. The requisite additional energy is most likely to come from sources that emit large quantities of GHGs, such as coal-fired power plants. It follows that the Proposed Project will cause both an increase in emissions from the refineries themselves and an increase in emissions from plants that power the refineries. Therefore, the EIS should account for the aggregate GHG emissions that will be released by expanding refinery capacity, including the increase in GHG emissions from all refining-related processes.

End use combustion of refined tar sands oil also contributes to climate change impacts by emitting GHGs. The EIS should quantify and include cumulative GHG emissions released from the increased combustion of tar sands oil on both in the US and abroad. Climate change impacts in the U.S. are affected by the aggregate amount of GHGs released globally and as such, foreign end-use emissions should be included alongside domestic end-use emissions.

The EIS should adopt a GHG accounting methodology that is broad in scope and satisfies the MEPA directive for a cumulative analysis of impacts. The EIS calculations should include GHG emissions generated from all activities related to the increased extraction, upgrading, refining, transport, and combustion of tar sands oil resulting from the Proposed Project.

This is of immense concern as GHG emissions contribute to climate change and a wide range of related adverse ecological and human health effects, including water shortages, coastal flooding, increased risk of wildfires and stronger hurricanes, new pests and insect-borne diseases, and disruption of habitats. The EIS should consider the direct, indirect, and cumulative climate change impacts of the Proposed Project. It is especially important that the EIS address cumulative climate change impacts from the resulting intensification of tar sands development.

In sum, the EIS should analyze the impacts on climate by determining how many tons of GHGs will be emitted, what mitigating measures will be implemented, and by how many tons of GHGs each mitigating measure will reduce emissions, for each of the following stages of the Proposed Project: the extraction (and processing to crude oil) of the tar sands in Canada, including the resulting clear-cutting of forests, destruction of peat bogs and other ecosystems, and mining and drilling activities; the construction and modification of any Tar Sands-related facilities (including pump stations and terminals); the refinement of tar sands crude oil, including the projected increase in refinery capacity; the distribution and transport of tar sands crude oil to and from refineries; and the end-use combustion of the refined tar sands oil.

C. Impacts of Related and Connected Infrastructure Projects

The Proposed Project will impact the entire current pipeline infrastructure for the Great Lakes region and beyond – most notable are the expansions of pipelines found within the Lakehead System, which would connect to Proposed Project in Superior, Wisconsin. Currently, Line 3 connects directly with Lines 5, 6A, and 61, all of which run through the Great Lakes region. Also being expanded, and part of the Lakehead System, is Line 6B, which also is the line that tragically ruptured in July, 2010 sending approximately a million gallons of tar sands into Talmadge Creek and the Kalamazoo River. That spill, as detailed below, has caused likely permanent environmental damage, severe health problems for many affected residents, and led to a major evacuation of hundreds of homes. In the wake of the Kalamazoo spill, Enbridge has now replaced Line 6B with a larger pipe that can carry as much as 33.6 million gallons per day, which is about three times more than the existing Line 6B was running at when it ruptured.[29] Also, Enbridge has expanded the capacity of Line 5, a 60 year-old line running four miles along the bottom of the Great Lakes through the Straights of Mackinaw.

Enbridge recently completed construction of a major new pipeline from Flanagan, Illinois to Cushing, Oklahoma, called the Flanagan South Pipeline, which would allow large quantities of tar sands crude oil to flow to the Gulf Coast for refinement and export.[30] This line would cross both the Mississippi River and Missouri River. Additionally, Enbridge recently increased the capacity of Line 9 to 300,000 bpd and reversed its flow to allow additional crude oil to be

[29] David Hasemyer and Lisa Song, *Little Oversight for Enbridge Pipeline Route that Skirts Lake Michigan*, INSIDE CLIMATE NEWS, Dec. 27, 2012, http://insideclimatenews.org/news/20121227/indiana-enbridge-pipeline-6B-lake-michigan-rivers-dilbit-oil-spill-wetlands.

[30] Market News, *$15B Enbridge Pipeline Network Aims to Move One Million Barrels of Oil to Market*, KLEENINDUSTRIES, Feb. 1, 2013, http://www.kleanindustries.com/s/environmental_market_industry_news.asp?ReportID=568829.

transported to Montreal.[31] Line 9 flows on the northern side of Lake Ontario, cutting across tributaries of that lake. From Montreal, tar sands would likely travel to port in Portland, Maine along the Exxon-owned Portland-Montreal Pipe Line ("PMPL"). The PMPL threatens many treasured New England resources such as the Connecticut River, New England's longest river, the Sebago Lake watershed, one of the purest lakes in the country and a major drinking water supply, and Casco Bay, a key driver for Maine's economy. All of these projects will almost certainly be fed and enabled by tar sands oil from this expansion, making the indirect and cumulative impacts of this project massive.

Thus, all of the direct, indirect, and cumulative impacts of the Proposed Project – including, but not limited to, increases in mining and/or drilling, additions to pump stations, new or upgraded refineries, increased oil transport, and effects on end use – must be examined in the cumulative analysis, particularly on climate change impacts. A valid cumulative impacts analysis should address upstream extraction as well as downstream refining and combustion.

D. Impacts of Refineries

The Proposed Project will increase the volume of crude oil supply to Minnesota and the U.S., thus requiring increased refinery capacity. The EIS should identify and quantify increases in refinery capacity to process the increased amount of tar sands crude oil that would be imported into the U.S. by building a new pipeline with a capacity of 760,000 bpd. The EIS should investigate which refineries in Minnesota, neighboring states, and elsewhere in the U.S. are expected to receive crude oil from the Proposed Project. The environmental impacts of increasing refinery capacity and adding upgraders must be considered in the EIS.

Refining heavy sour (sulfurous) crude oil extracted from tar sands crude oil requires more energy inputs than refining conventional crude because of the energy needed to crack the heavy, long hydrocarbon molecules into final products and remove the high levels of sulfur contaminants. This process yields significant increases in emissions of pollutants, including heavy metals such as mercury, conventional air pollutants (in particular sulfur dioxide and carbon monoxide), and carbon dioxide. In evaluating the reasonable and foreseeable environmental effects of increased refinery capacity, the EIS analysis of impacts should include, but not be limited to, local air quality and public health, loss of animal and marine habitat, potential discharge of air and water pollutants, and increase in GHG emissions.

The EIS should not discount GHG emissions from increased refinery capacity based on the unjustified claim that crude oil transported by the Proposed Project would replace oil from other sources.[32] The Proposed Project EIS should quantify the real GHG emissions that will be released by expanding refining capacity – including GHG emissions from the refining process,

[31] *See*, National Energy Board: Enbrige Pipelines Inc.- Line 9B Reversal and Line 9 Capacity Proposed Project, http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/nbrdgln9brvrsl/nbrdgln9brvrsl-eng.html (last visited April 26, 2013).
[32] U.S. Department of State, *Final Environmental Impact Statement for the Alberta Clipper Project* (June 5, 2009) at 4-394.

itself – as doing otherwise would fall short of the *cumulative* impacts analysis required by MEPA.

The increased crude oil supply and increased refinery capacity that will accompany the Proposed Project will also require an expanded distribution system. The EIS should take into account the direct, indirect, and cumulative environmental impacts of transporting and distributing fuel derived from tar sands crude oil after it reaches Enbridge's Superior Terminal. This includes, but is not limited to, impacts on the local environment, economy, and communities along various crude oil transportation routes. As detailed above, this expansion and the connecting projects traverse a great swath of the country and most immediately place at risk resources in the Great Lakes region.

The EIS should also address the impacts of the end use of refined tar sands crude oil, whether burning in automobiles or elsewhere, as that will have the direct or indirect impact of contributing to GHG emissions and hence, to climate change, which will increasing impact Minnesota – regardless of where the crude oil that would be transported by the Proposed Project is burned. Increased access to tar sands oil will support refining and keep petroleum prices lower than without it, with the obvious impact of continuing to allow the increase of petroleum use.[33] Further, the result of increased access to crude oil is increased use of oil-based liquid fuels. Thus, the likely and foreseeable environmental effects of burning more liquid fossil fuels must also be included in the EIS.

In sum, this expansion represents not only potentially the largest Tar Sands crude oil infrastructure project in the country, but part of other major Tar Sands projects that present climate, safety and other impacts that need to be carefully examined. These impacts are contrary to energy policy objectives that seek to reduce carbon pollution, tackle climate change, and protect communities from the direct threats of disasters like spills that harm the environment and public health. Therefore, the Department's review under MEPA must be viewed through this broad lens.

E. Risks of Spills in Light of Enbridge's Poor Safety Record

The release of tar sands crude oil poses a significant threat to the natural and human environment, and cleanup of crude oil spills presents a greater challenge than the cleanup of conventional oil spills. The EIS should analyze the oil spill risks and potential impacts of building a new 760,000 bpd pipeline through northern Minnesota, including many of its most pristine lakes, rivers, streams, and wetlands.

The EIS should reevaluate and review both Enbridge's facility response plan ("FRP"), which is required by both the federal Oil Pollution Act and Minnesota's spill response law, Minn. Stat. Ch. 115E, and its Integrity Management Program ("IMP"), which are the primary mitigation measures to ensure the safe operation of the Proposed Project and to ensure that

[33] See Mid-States Coalition for Progress, 345 F.3d at 549.

Enbridge properly cleans up any spills. Since Minnesota has its own oil spill response law and has a federally delegated pipeline safety program, the Commission should prepare a comprehensive risk analysis of the Proposed Project.

MEPA requires a thorough analysis of environmental impacts considering on-the-ground circumstances in an effort to anticipate and mitigate for the certainty that spills and leaks will occur from the Proposed Project. It further requires analysis of the limits and measures in place to prevent or mitigate the harm that will result to environmental and human communities. Thus, the EIS should not only analyze the FRP and IMP for prevention and mitigation measures, but also evaluate the likelihood of spills of varying size and their potential impacts on different resources such as aquifers and wetlands. Additionally, the Commission should coordinate with the Minnesota Office of Pipeline Safety to analyze the safety risks of the Proposed Project. Defects in this risk analysis and mitigation plan could have catastrophic impacts on the environment and human health.

The EIS also must consider Enbridge's full pipeline operating history in the U.S., as well as in Canada. The scope of examination of Enbridge's pipeline incident history should be expanded geographically and updated temporally. The Proposed Pipeline's FRP would be subsumed within Enbridge's regional FRP; therefore, the EIS should consider the entirety of Enbridge's incident history to accurately assess Enbridge's ability to respond to spills and leaks from the Proposed Project. This includes all "accidents", as defined in 49 C.F.R. § 195.50, that have occurred at Enbridge-owned and/or Enbridge-operated crude oil pipelines in the U.S. and Canada since the company's founding as Lakehead Pipeline Company, Inc., in 1950.

A compilation of Enbridge's own data reveals that between 1999 and 2010, there were 804 spills on Enbridge pipelines that released a total of 161,475 barrels (6.8 million gallons) of hydrocarbons into the environment.[34] As a frame of reference, this quantity is approximately half the amount of oil released from the Exxon Valdez oil tanker spill in 1988. The Commission should examine this troubling history of Enbridge spills and update the totals with data from 2010 to the present.

In addition to Enbridge's incident history, the EIS should consider the full history of Enbridge's safety violations in the U.S. and Canada. PHMSA investigations that were conducted in response to incidents at Enbridge pipelines have uncovered numerous safety violations and resulted in significant fines. For example, in 2010, following a crude oil pipeline explosion that killed two workers in Minnesota, PHMSA imposed a $2.4 million fine against Enbridge for violations of federal pipeline safety regulations.[35] PHMSA also identified violations on Enbridge pipelines in North Dakota and Wisconsin after two separate crude oil spills in 2007,

[34] http://www.tarsandswatch.org/files/Updated%20Enbridge%20Profile.pdf.
[35] http://www.phmsa.dot.gov/portal/site/PHMSA/menuitem.ebdc7a8a7e39f2e55cf2031050248a0c/?vgnextoid=1a0387e16584a210VgnVCM1000001ecb7898RCRD&vgnextchannel=8fd9f08df5f3f010VgnVCM1000008355a8c0RCRD&vgnextfmt=print.

resulting in a $105,000 and $100,000 fine, respectively.[36] The EIS must take a hard look at Enbridge's comprehensive safety record, including its history of incidents and violations.

Recent inspections conducted by the Canadian National Energy Board revealed long-standing and serious violations at Enbridge pump stations in Canada. Of Enbridge's 125 pump stations, 117 lack an alternate source of power capable of operating the emergency shut down systems and 83 lack an emergency shut-down push-button.[37] These are violations of safety regulations that have been in place for more than a decade.[38] The Proposed Project EIS must acknowledge that Enbridge's disregard for Canadian pipeline regulations raises the plausibility of Enbridge's noncompliance with U.S. regulations. By failing to comply with the aforementioned safety measures, Enbridge put the people and environment of Canada at greater risk for spills in the event of an emergency and/or power outage. The EIS must consider the possibility that Enbridge's Proposed Project will put the people and environment of the Minnesota at greater risk for spills given Enbridge's poor safety record.

Enbridge's Line 6B Pipeline is a 30-inch-diameter pipeline that transports tar sands crude oil as a segment of Enbridge's Lakehead System. The Line 6B rupture occurred in a wetland in Marshall, Michigan, during a planned shutdown. Enbridge failed to discover or address the rupture for *over 17 hours*, during which time additional oil was pumped into Line 6B during two startups. The total release was estimated to be 843,444 gallons (20,082 barrels) of tar sands crude oil, which saturated the surrounding wetlands and flowed into the Talmadge Creek and Kalamazoo River.

The resulting Tar Sands crude oil discharge severely damaged the environment and caused local residents to self-evacuate from their homes. Public health was also negatively affected by this accident, with about 320 people reporting symptoms consistent with crude oil exposure. As of the writing of these comments, cleanup efforts continue and costs exceed $1 billion.[39] The U.S. Environmental Protection Agency ("EPA") issued an order on March 14, 2013, requiring Enbridge to perform additional dredging in the Kalamazoo River, where the tar sands crude oil travelled 35 miles downstream.

The Sierra Club strongly urges that the EIS address the findings of NTSB's Accident Report on the 2010 Marshall, Michigan, accident (hereafter, "the Report"). The Report notes that from 1986 to 2011, Enbridge incidents comprised 3 of the top 15 largest onshore crude oil spills in the U.S., with the 1991 Grand Rapids, Minnesota, release of 1.7 million gallons (40,476 barrels) in second place and the 1989 Pembina, North Dakota, release of 1.3 million gallons (30,952 barrels) in fifth place.

[36] http://primis.phmsa.dot.gov/comm/reports/enforce/documents/320075022/320075022_FinalOrder_06022009.pdf?nocache=2855; http://primis.phmsa.dot.gov/comm/reports/enforce/documents/320095006/320095006_Final%20Order_10132011.pdf.
[37] http://www.neb-one.gc.ca/clf-nsi/rsftyndthnvrnmnt/sfty/brdrdr/nbrdg_rft2013_001-eng.html.
[38] http://www.cbc.ca/news/politics/story/2013/05/05/pol-enbridge-breaks-neb-safety-rules.html.
[39] *Id.*

Almost two years, to the date of the 2010 Marshall, Michigan, release, Enbridge had another release on their Lakehead System, this time in Grand Marsh, Wisconsin, where Line 14 shot a geyser of oil into the air coating livestock and a farm house. This disaster resulted in PHMSA issuing a rare system-wide corrective action order on the Lakehead System, stating "PHMSA has communicated its longstanding concerns about this pattern of failures with Respondent over the past several years. Given the nature, circumstances, and gravity of this pattern of accidents, additional corrective measures are warranted."[40] This Corrective Action Order remains active on the entire Lakehead System even while Enbridge has been granted the authority to expand this same network of lines, bringing into question gaps in our regulatory structure.

The Report also notes that the entire Enbridge pipeline system is controlled from a single Supervisory Control and Data Acquisition ("SCADA") control center in Edmonton, Alberta, Canada. Thus, pipeline monitoring and emergency response for the Proposed Pipeline originates from Enbridge's centralized Edmonton Control Center. This is further reason why the EIS should reevaluate Enbridge's general pipeline FRP and analyze Enbridge's comprehensive operating history.

The Proposed Project EIS should specifically address the determination made by NTSB's investigation that "pervasive organizational failures at Enbridge" made the Line 6B Pipeline rupture and prolonged release possible. These pervasive organizational failures include deficient integrity management procedures, inadequate training of control center personnel, and insufficient public awareness and education. Particularly worrisome is the Report's identification of safety issues, such as the inadequacy of Enbridge's integrity management program to accurately assess and remediate crack defects, the failure of Enbridge's control center staff to recognize abnormal conditions related to ruptures, and the inadequacy of Enbridge's facility response plan to ensure adequate training of the first responders and sufficient emergency response resources allocated to respond to a worst-case release.

In addition, there was a leak on Enbridge's Line 2 pipeline on April 23, 2013, at the Viking, Minnesota, pump station.[41] Line 3 also runs through the Viking, Minnesota, pump station. The EIS analysis should update Enbridge's incident history to include these and all other accidents that have occurred at Enbridge-owned and/or Enbridge-operated crude oil pipelines since 2008. This includes, but is not limited to, the 2010 Enbridge releases of 316,596 gallons (7,538 barrels) of crude oil in Romeoville, Illinois, and 158,928 gallons (3,784 barrels) of crude oil in Neche, North Dakota.

In evaluating the safety risks of the Proposed Project, the EIS should consider the overall safety of pipelines carrying tar sands by looking at all incidents that have occurred on tar sands

[40]Letter from Jeffrey Wiese, Associate Administrator for Pipeline Safety at PHMSA, to Richard Adams, Vice President of U.S. Operations at Enbridge (Aug. 1, 2012), *available at* http://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Press%20Release%20Files/320125017H_Amended%20Corrective%20Action%20Order_08012012.pdf.
[41] http://enbridgeus.com/Viking/.

pipelines in the U.S. and Canada. This includes, but is not limited to, release events on pipelines owned and/or operated by TransCanada, ExxonMobil, and Kinder Morgan. The safety record of tar sands pipelines in general should be examined alongside Enbridge's safety record as part of the EIS spill risk analysis.

In addition to the danger of spills to human communities, the EIS must take a hard look at the impacts of spills to plant and animals. In particular, the EIS should study and analyze the potential impact of oil spills on wild rice, a staple of the Ojibwe peoples in northern Minnesota. Such study should consider the impact of spilled tar sands crude oil, including heavy crude oil, on the viability and productivity of impacted rice beds. Wild rice is well knows to be very sensitive to sulfur compounds, which are contained in heavy and light sour crude oils. The impact of oil spills on wild rice is not known but of critical importance to Minnesota's tribes; therefore, the EIS must study and analyze these impacts. Often not considered but of particular significance to Minnesotan are the impact of an oil spill on fisheries, both in terms of the loss of fish, loss of fish habitat, and potential contamination of fish used for human consumption.

A look at the types of wildlife primarily suffering the adverse impacted by the 2010 Kalamazoo diluted bitumen spill and the recent Mayflower diluted bitumen spill reveals that these spills primarily hurt reptiles, amphibians, and birds such as ducks and geese that rely on aquatic habitat. Approximately 4,000 animals were treated for injuries as a result of the Kalamazoo spill and many required significant care before being released back into the environment.[42] Responders estimated that, "whatever the final tally of dead wildlife is, the real number will be almost three times higher because some oil in hard-to-get-to floodplain areas is being allowed to break down over time — oil that could potentially contaminate animals."[43] The Binder Zoo veterinarian who cared for many of the reptiles and amphibians harmed by the Kalamazoo spill reported taking in 1,795 animals including eight varieties of turtles, two types of snakes, two frog varieties, and one toad species.[44] According PHMSA, about 2,500 animals were treated, but the overwhelming impact was to turtles.[45] Some of these turtles were badly enough injured that they still required the full time care of a veterinarian 15 months later.[46]

The recent and much smaller Mayflower diluted bitumen spill impacted 509 animals, with 44 birds and 34 reptiles and amphibians found dead upon arrival, 27 animals dying at the rehabilitation facility, and over 200 animals, mostly snakes, euthanized. From these two incidents it is clear that spills of diluted bitumen have especially significant impacts on reptiles

[42] National Transportation Safety Board, Enbridge Incorporated Hazardous Liquid Pipeline Rupture and Release (July 25, 2010), available at http://www.ntsb.gov/doclib/reports/2012/PAR1201.pdf at 63 (A wildlife response center was established with the cooperation of Enbridge, the U.S. Fish and Wildlife Service, and the Michigan Department of Natural Resources and the Environment. The response center cared for and released about 3,970 animals—of 196 birds treated, 52 were not released).
[43] http://www.mlive.com/news/kalamazoo/index.ssf/2010/10/wildlife_rehab_continues_after.html.
[44] http://www.binderparkzoo.org/kalamazooriver/.
[45] *See* www.pstrust.org/docs/Kilian.ppt.
[46] http://www.battlecreekenquirer.com/article/20111104/OILSPILL/111040320/Tainted-turtles-still-suffering-15-months-after-river-oil-spill?odyssey=tab%7Ctopnews%7Ctext%7CFrontpage&nclick_check=1.

and amphibians. In addition, it seems likely that these spills also have significant impacts on invertebrates, crustaceans, and species that rely on aquatic habitat, although these impacts are less apparent to wildlife rescuers for obvious reasons. However, this does not diminish the significance of these impacts and they must be considered in the EIS. Special emphasis should be given to sensitive, endemic, culturally significant, threatened, endangered, and otherwise protected wildlife species but should not preclude analysis of impacts to all potentially impacted wildlife species.

In light of the foregoing, the Department should amend DSDD Section 4.6.1 to conduct large volume spill modeling for all significant waterbodies, rather than at "seven representative sites" chosen by Enbridge, which should not be delegated the responsibility to select sites for spill modeling, since slight variations in location may have dramatically different spill footprints.

F. Inadequacy of Federal Pipeline Oversight

The EIS should also directly address the weaknesses of PHMSA regulations including, but not limited to, PHMSA's lack of regulatory guidance for pipeline facility response planning, PHMSA's ineffective oversight of pipeline IMPs, and PHMSA's limited oversight of pipeline emergency preparedness.

The EIS should consider the findings and recommendations listed in Section 3.1 and 4.1, respectively, of the NTSB Accident Report. The EIS should also investigate to what degree Enbridge and PHMSA have remedied these serious issues and implemented the Report's recommendations. The Line 6B Pipeline spill in Marshall, Michigan, revealed significant flaws that could lead to a spill of similar magnitude from the Proposed Project. It is imperative that the EIS complete a comprehensive risk analysis in view of this new information.

Another issue in regards to safety is catastrophic events. The EIS should examine, for example, the danger of damage to the pipeline as a result of pipe corrosion, outside forces such as damage during third-party excavation, equipment failure, incorrect operation, failed welds, pipe failure, or natural forces such as flooding, lightning, landslides, or earthquakes, or other accidents including possible terrorist attacks. This analysis should include the potential impacts if crude oil is released into soil, bodies of water, agricultural lands, wetlands, forested areas, or near population centers.

Tar Sands crude from Alberta is known to contain higher amounts of sulfur as well as increased sediment/particles. Tar sands crude is also more corrosive than conventional crude and, as a result, the standard regulatory requirements related to maintenance and leak detection may not be sufficient to address the increased risk of leaks due to corrosion. NTSB identified corrosion fatigue cracks as the probable cause of the Marshall, Michigan, rupture. An analysis of these issues should include the likelihood of an accident occurring, the range of oil quantities that could potentially spill before containment, the impacts resulting from such range of potential spill amounts, and what methods will be used to detect leaks or other failures.

In addition, increased development and use of tar sands presents public health issues. According to a 2007 U.S. Geological Survey report, the type of oil extracted from Canadian tar sands contains eleven times more sulfur, six times more nitrogen, eleven times more nickel, and five times more lead than conventional oil.[47] Refining tar sands crude transported through the Proposed Pipeline will likely result in higher air emissions of harmful pollutants such as sulfur dioxide, hydrogen sulfide, sulfuric acid mist, and nitrogen oxides, as well as toxic metals such as lead and nickel compounds. According to the EPA, the human health effects of these pollutants may include premature death; cancer; permanent lung damage; reproductive, neurological, developmental, respiratory, and immunological problems; cardiovascular and central nervous system disorders; bio-mutations; respiratory illness, including bronchitis and pneumonia; and aggravation of heart conditions and asthma. The environmental damage caused by these pollutants includes acid rain; concentration of toxic chemicals up the food chain; creation of ground-level ozone and smog; visible impairments that migrate to sensitive areas such as National Parks; and depletion of soil nutrients. All of this should be considered in the EIS to be prepared as direct or indirect impacts of the Proposed Project.

G. Migratory Species Issues of Pipeline Oversight

In addition to its contributions to climate change impacts, increased tar sands extraction also has a direct impact on migratory species. The boreal forest in the WCSB is home to many species that both migrate across the Minnesota-Canada border and are sensitive to industrial development. The extraction of tar sands through open pit mining is destroying acres of forest habitat, while the construction of wells, roads, and pipes is permeating the forest with industrial intrusion.

For instance, the tar sands operations destroy wide areas of critical habitat for migratory birds of importance to Minnesotans, both birdwatchers and hunters. The boreal forest of northeast Alberta is an important breeding area for over 292 species of birds, at least 130 of which use the tar sands area and are protected by the Migratory Bird Convention.[48] One square mile of forest in the northeast Alberta can support as many as 500 breeding pairs of migratory birds, some of the highest densities anywhere within Canada's boreal forest.[49] Between 22 million and 170 million birds breed each year in the tar sands area.[50] A 2009 study estimated that the impacts of tar sands operations on habitat have caused the loss of 58,000 to 402,000 birds.[51] Because the industrial footprint of the tar sands may double in the next 15 years, habitat

[47] Heavy Oil and Natural Bitumen Resources in Geological Basins of the World. 14, available at http://pubs.usgs.gov/of/2007/1084/OF2007-1084v1.pdf.
[48] Wells et al. 2008 at 2, 4-5; Migratory Bird Treaty Act List, http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html; Migratory Bird Convention, Protocol updating Article I at http://www.treaty-accord.gc.ca/text-texte.asp?id=101587.
[49] *Id.* at iv, 2.
[50] *Id.* at iv.
[51] Timoney, K.P. and P. Lee, *Does the Alberta Tar Sands Industry Pollute? The Scientific Evidence*, The Open Conservation Biology Journal (2009) at 71, available at http://westcoastclimateequity.org/wp-content/uploads/2010/04/Timoney-and-Lee-2009-Does-the-Alberta-Tar-Sands-Industry-Pollute-The-Scientific-Evidence.pdf.

loss will continue to increase mortality rates of migratory birds.[52] The effects of tar sands mining and drilling on bird habitat are projected to reduce the forest-dependent bird population by between 10 to 50 percent.[53] Strip mining of the 1,200 square miles allocated for mines will destroy habitat for an estimated 480,000 to 3.6 million adult birds.[54] Drilling infrastructure could eliminate or fragment another 19,000 square miles of migratory bird habitat.[55] Tar sands operations will also reduce bird births, with one estimate ranging from 9.6 million to 72 million fewer birds being born over a 40-year period.[56]

Tar sands extraction also reduces viable bird habitat by reducing water available to natural ecosystems, as very little of the water used in operations is returned to the natural cycle.[57] Most of the water used in tar sands mining operations comes from the Athabasca River.[58] Up to 15 percent of the river's weekly flow can be taken,[59] causing concerns that low-flow periods will increase mortality of fish and other aquatic organisms that are a source of food for birds.[60] Low flows may also increase concentrations of pollutants and eliminate the annual floods that are critical for nutrient deposition in the floodplain.[61] Mining also "dewaters" areas surrounding the mines by diverting streams from the mineable area, draining adjacent wetlands, and lowering the water table to keep water out of the open pit.[62] As mining operations change regional wetlands, rivers, and underground reservoirs, they threaten hundreds of thousands of birds dependent on these wetlands.[63]

Fragmentation of forests from tar sands drilling and transportation infrastructure leaves fewer areas of closed forest canopy and more forest "edges," where forests meet clearings.[64] Fragmented forests have different microclimates than intact forests, as well as more frequent habitat disturbances, an increase in bird predators and parasites, and invasions of introduced plants and animals. [65] Forest fragmentation also leads to changes in bird social structure and mating success, which decrease survival and reproduction of breeding birds.[66] Isolated bird

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[52] Timoney, K.P. and R.A. Ronconi, *Annual bird mortality in the bitumen tailings ponds in northeastern Alberta, Canada*, The Wilson Journal of Ornithology (2010) at 574.
[53] Wells et al. 2008 at 13.
[54] *Id.* at iv.
[55] *Id.* at 12.
[56] *Id.* at 8.
[57] M. Griffiths et al., *Troubled Waters, Troubling Trends: Technology and Policy Options to Reduce Water Use in Oil and Oilsands Development in Alberta*, The Pembina Institute, (2006) at 85.
[58] Government of Alberta, *Facts About Water in Alberta* (2010) http://environment.gov.ab.ca/info/library/6364.pdf at 42 (hereinafter Government of Alberta 2010 Water).
[59] Government of Alberta 2010 Water at 42.
[60] Wells et al. 2008 at 14.
[61] *Ibid*.
[62] Shlumberger Ltd., *Water Management for Oil Sands mining operations* (2011), http://www.heavyoilinfo.com/feature_items/water-management-for-oil-sands-mining-operations#dewatering-of-theopen (accessed August 1, 2011).
[63] Wells et al. 2008 at vi.
[64] *Id.* at 12.
[65] *Id.*
[66] *Id.* at 12-13, citing 16 studies between 1995 and 2008.

populations in forest patches are more vulnerable to catastrophic weather or human disturbances.[67]

Noise pollution from compressor stations also impacts bird breeding success. The 5,000 existing compressor stations may have reduced local bird populations in Alberta by 27,000 birds due to habitat loss, and an additional 85,000 birds from noise effects.[68] Expansion of drilling as planned could eliminate another 425,000 birds from the noise effects of compressor stations alone.[69]

Further, the extraction of bitumen from oil sands produces large volumes of wastewater contaminated with polycyclic aromatic hydrocarbons ("PAH"), naphthenic acids, and salt, which is stored in wastewater reservoirs or "tailings ponds" and reclaimed in aquatic systems.[70] Water in Lake Athabasca downstream from the tar sands has shown levels of arsenic, total mercury, and PAHs sufficient to pose a threat to wildlife or humans.[71] This contamination of waterways and wetlands, and the creation of toxic tailings ponds threaten the habitat and health of migratory birds and other wildlife.[72] The EIS should address these environmental impacts on migratory species as a result of increased tar sands development in the WCSB.

H. Natural Resources at Risk

The Proposed Project would passes through many of Minnesota's most pristine waters, including the Mississippi River headwaters, the watershed of Lake Superior, the largest and remotest of the Great Lakes, and myriad smaller lakes, rivers, streams and wetlands. In addition, the Proposed Project would adversely impact a substantial amount of farmland and sensitive undeveloped upland areas. The intervenors and public commenters in the Sandpiper dockets provided substantial descriptions of the natural resources at risk along the route for the Proposed Project, as well as along other routes. The Sierra Club hereby incorporates all of those comments on resources at risk by reference into this comment letter and requests that the Commission fully consider those comments in its consideration of the scope here.

Since the Proposed Project would also create impacts along the existing Line 3 corridor west of Clearbrook, the Commission should also identify and analyze the resources that are at

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[67] *See, e.g.*, E. Bayne *et al*., *Modeling and field-testing of Ovenbird (Seiurus aurocapillus) responses to boreal forest dissection by energy sector development at multiple spatial scales*, 20 Landscape Ecology 2, 203 (2005).
[68] E. Bayne et al, *Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest*, 22 Conservation Biology 5, 1186 (2008) at 1192.
[69] Wells et al. 2008 at 13.
[70] Dixon, G., R. Smith, B. Greenburg, L. Lee, G. Van Der Kraak, and M. Power. Undated. "Assessing the Cumulative Impacts of Oil-Sands Derived Chemical Mixtures on Aquatic Organisms in Alberta," Health Canada, available at http://www.hc-sc.gc.ca/sr-sr/finance/tsri-irst/proj/cumul-eff/tsri-144_e.html.
[71] Kevin P Timoney, *"A Study of Water and Sediment Quality as Related to Public Health Issues, Fort Chipewyan, Alberta*," Treeline Ecological Research, (November 2007), available at http://www.borealbirds.org/resources/timoney-fortchipwater-111107.pdf.
[72] Jeff Wells, "Danger In the Nursery: Impact on Birds of Tar Sands Oil Development in Canada's Boreal Forest," at 8, (December 2008), available at http://www.nrdc.org/wildlife/borealbirds.pdf.

risk along that route. Further, the Commission should identify and analyze natural resources at risk along route alternatives not considered in the Sandpiper dockets.

VI. CONCLUSION

In closing, the Sierra Club thanks the Department and its staff for your time and attention to these important matters. We look forward to reviewing and commenting on the Draft Environmental Impact Statement when it is prepared. In the meantime, if the Sierra Club can provide any further information please do not hesitate to contact me.

Date: May 26, 2016

Respectfully submitted,

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ATTACHMENT A

Exhibit ___ (DDA-5)

Enbridge Response to CAPP Near Term System Optimization

Canadian Association of Petroleum Producers

Enbridge Committee

November 2009

ENBRIDGE

Line 3 Conversion to Light Project Stage 2 – 500kbpd Option

Exhibit ___ (DDA-5)

There are several modifications required to achieve flow rates beyond 390kbpd up to 500kbpd

- reversing some pump modifications installed during Stage 2 of Line 3 Conversion to Light
- Additional maintenance and integrity work would be necessary
- DRA

Exhibit ___ (DDA-5)

Line 3 – Ultimate Capacity

ENBRIDGE

Ultimate capacity of Line 3 is 100,000m3/d (630kbpd) annual in Synthetic Light service

- Assumes that all pressure restrictions are removed (conditional on regulatory approval)
- Requires reversing all pump modifications under Line 3 Stage 2 scope
- DRA
- New booster pump and manifold upgrade required
- Definitive scope and cost are unknown at this time

ATTACHMENT B

Pillar #2: Expansion & Extension Opportunities

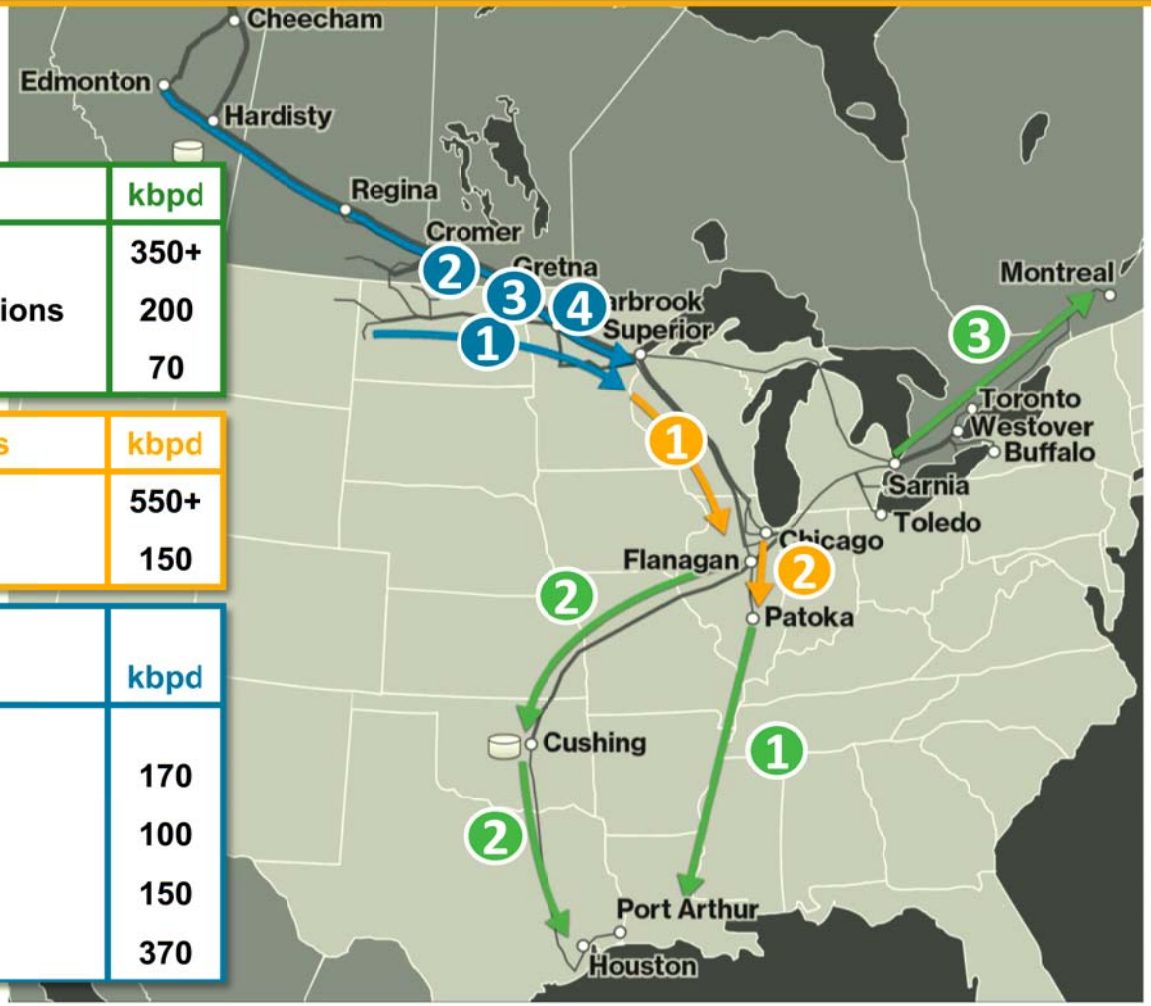
EEP LISTED NYSE EEQ LISTED NYSE

Well positioned to pursue additional expansions to meet shipper needs; Phased expansions are attractive in a low crude price environment

Market Access Opportunities		kbpd
1	Eastern Gulf Coast Access	350+
2	Flanagan South / Seaway Expansions	200
3	Line 9 Expansion	70

Ex-Superior Expansion Opportunities		kbpd
1	Line 61 Twin	550+
2	SAX Expansion	150

Upstream of Superior Expansion Opportunities		kbpd
1	Sandpiper Expansion/ Bakken Interconnect Idle	170
2	Line 2A/LSR Expansion	100
3	Line 2B/4 Capacity Recovery	150
4	Line 3 at 760	370



ENBRIDGE

ATTACHMENT C

National Energy Board | Office national de l'énergie

Canada

Pipeline Abandonment - A Discussion Paper on Technical and Environmental Issues

Prepared for the Pipeline Abandonment Steering Committee (comprised of representatives from the Canadian Association of Petroleum Producers, the Canadian Energy Pipeline Association, the Alberta Energy and Utilities Board, and the National Energy Board)

November 1996

Visit the Alberta Energy Utilities Board (EUB) Web site (www.ercb.ca/portal/server.pt?) to view the companion document entitled "Pipeline Abandonment Legal Working Group Report". You can log in as a guest and search for the words "pipeline abandonment".

Disclaimer

This Discussion Paper was prepared under the auspices of the Pipeline Abandonment Steering Committee, a Committee comprised of representatives and employees of the Canadian Association of Petroleum Producers (CAPP), the Canadian Energy Pipeline Association (CEPA), the Alberta Energy and Utilities Board (EUB), and the National Energy Board (NEB). While it is believed that the information contained herein is reliable, CAPP, CEPA, the EUB, and the NEB do not guarantee its accuracy. This paper does not necessarily reflect the views or opinions of CAPP, CEPA, the EUB, or the NEB, or any of the member companies of CAPP and CEPA. In particular, the paper cannot be taken to represent the regulatory policy of the EUB or the NEB and may not be relied on for such purpose. The use of this report or any information contained will be at the user's sole risk, regardless of any fault or negligence of CAPP, CEPA, the EUB, or the NEB.

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Executive Summary

The Canadian oil and gas industry and federal and provincial regulatory authorities recognize the need to develop guidelines that companies can follow in order to abandon oil and gas pipelines in an environmentally sound, safe, and economical manner. To meet this objective, the Canadian Association of Petroleum Producers and the Canadian Energy Pipeline Association (through their industry participants) have participated along with the National Energy Board and various departments of the Government of Alberta in the development of this discussion paper.

This paper reviews the technical and environmental issues associated with pipeline abandonment and is intended to provide a basis for further discussion on the issue. In order to complete the assessment of this issue, a review of the legal and financial aspects of pipeline abandonment need to be undertaken. More particularly, the core issues of long-term liability and funding need to be addressed both in the context of orphaned pipelines and those with an identifiable owner/operator.

This paper is intended to assist a company in the development of an abandonment plan through the recognition of the general issues which result from the abandonment of a pipeline and by providing the means to address those issues. Land use management, ground subsidence, soil and groundwater contamination, erosion, and the potential to create water conduits are among the topics addressed.

Some follow-up may be required in respect of the technical analysis presented on the issue of ground subsidence. It is suggested that tolerance criteria be developed and that the industry survey referred to in the paper be complemented with a field investigation program. Scale modelling could also be performed to confirm the theoretical ground subsidence calculations.

As illustrated by the diagram on the following page, the pipeline abandonment planning process is a multi-dimensional exercise that requires wide stakeholder input. The abandonment project schedule should also provide an opportunity for meaningful input into the planning process by the affected public, as defined by the scope of the project. It is especially important that landowners and land managers have a central role in this process.

In practice, the decision to abandon in place or through removal should be made on the basis of a comprehensive site-specific assessment. In this context, the analysis presented in this paper has limitations in that all site specifics could not possibly be addressed, particularly in relation to potential environmental impacts or impacts on land use.

The development and implementation of a pipeline abandonment plan that will both minimize impacts to the environment and land use and be cost-effective requires many activities similar in scope to the planning or installation of a new pipeline. For any large-scale abandonment project, it is unlikely that any one abandonment technique will be employed. Rather, a project will usually involve a combination of pipe removal and abandonment-in-place along the length of the pipeline. A key factor influencing the choice between the two options is present and future land use.

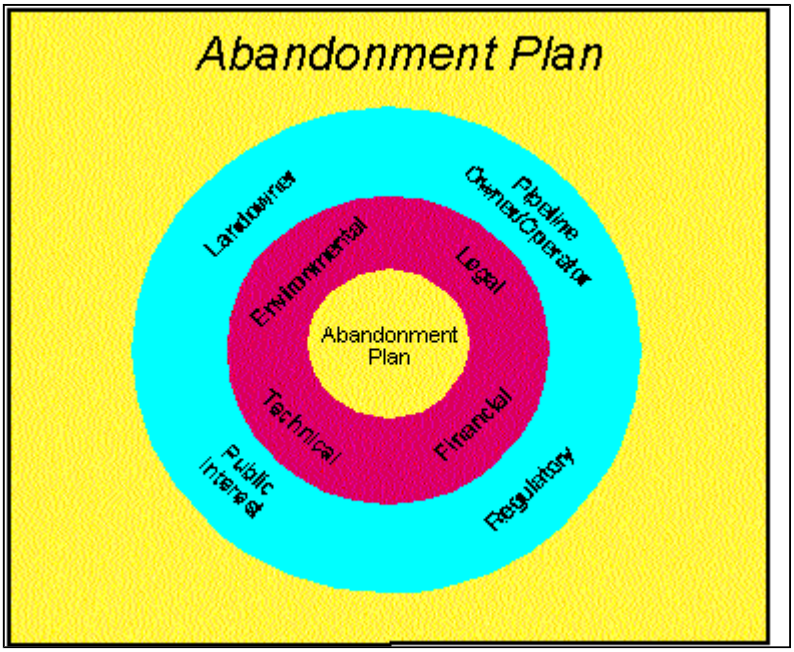
In summary, the key features of a proper abandonment plan are

(i) that it be tailored to the specifics of the project,

(ii) that an early and open opportunity be provided for public and landowner input, and

(iii) that it comply with current regulatory requirements. It is also necessary that the plan be broad in scope and encompass post-abandonment responsibilities in the form of right-of-way monitoring and remediation of problems associated with the abandonment.

A major issue still to be addressed is the question of who would assume responsibility if the owner/operator becomes insolvent. In this regard, industry has established a fund in Alberta to cover the cost of reclamation and abandonment of orphaned oil and gas wells and certain associated pipeline facilities.



Committee Representative Lists

Steering Committee

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Ken Sharp	Alberta Energy and Utilities Board
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Jim Anderson	National Energy Board
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Abbreviations

AEP	Alberta Environmental Protection
C&R	Conservation and Reclamation
CAPP	Canadian Association of Petroleum Producers
CEPA	Canadian Energy Pipeline Association
EPEA	*Environmental Protection and Enhancement Act* (Alberta)
EUB	Alberta Energy and Utilities Board (formerly the Alberta Energy Resources Conservation Board)
H_2S	hydrogensulphide
km	kilometre
mm	millimetre
NEB	National Energy Board
O.D.	outside diameter
PCB	polychlorinated biphenyl
ROW	right-of-way

Glossary of Terms

Abandonment	Refers to the permanent removal from service of the pipeline. A section of pipeline can be abandoned in place or removed. In theformer case, it is assumed that cathodic protection of the pipeline is discontinued and that no other measures are taken to maintain the structural integrity of the abandoned pipeline (other than the potential use of solid fill material at roadway and railway crossing sites or other locations sensitive to ground subsidence).
Associated Apparatus	All apparatus associated with a pipeline system, both above and below the ground surface, including pipeline risers, valve assemblies, signage, pig traps, culverts, tanks, and sumps.
Cathodic Protection	A technique to prevent the corrosion of a metal surface by making the surface the cathode of an electrochemical cell.

Corrosion	The deterioration of metal as a result of an electrochemical reaction with its environment.
Deactivation	Refers to the temporary removal from service of the pipeline. In the context of this paper, it is assumed that corrosion control measures are maintained.
Decontamination	The removal or neutralization of chemical substances or hazardous material from a facility or site to prevent, minimize, or mitigate any current or future adverse environmental effects.
Decommissioning	One of the steps of pipeline abandonment, generally involving the physical removal of all above-ground appurtenances.
Discontinued	See "deactivation".
Erosion	The process of wearing away the earth's surface through the action of wind and water.
Groundwater	All water under the surface of the ground.
Land Surface Reclamation	The stabilization, contouring, maintenance, conditioning, or reconstruction of the surface of the land to a state that permanently renders the land with a capability that existed just prior to the commencement of abandonment activities, and as close as circumstances permit to that which existed prior to pipeline installation.
Negative Salvage	The net cost of abandoning a pipeline through removal, calculated as the cost of removal less salvage revenue generated from the sale of the removed material for scrap or use by others.
Orphaned	Pipelines and associated facilities for which the licensee and successors are insolvent or non-existent.
Owner /Operator	The individual, partnership, corporation, public agency, or other entity that owns and/or operates the pipeline system.
Pipe Cleaning	The removal of all substances (solid, liquid, or gaseous) and build-ups within the pipeline to a pre-determined level.
Pipeline	All metallic onshore pipelines within the scope of the CSA Z662-94 "Oil and Gas Pipeline Systems" standard, including associated appurtenances such as valve assemblies, drip pots, cathodic protection beds, signage, and headers, but not including station facilities such as pump or compressor stations.
Pipeline System	The combination of pipelines, stations, and other facilities required for the measurement, processing, storage, and transportation of oil, gas, or other hydrocarbon fluid.
Reclamation	Any one of the following: • the removal of equipment or buildings or other structures or appurtenances; • the conducting of investigations to determine the presence of substances; • the decontamination of buildings or other structures or other appurtenances, or land or water; • the stabilization, contouring, maintenance conditioning, or reconstruction of the land surface; or • any other procedure, operation, or requirement specified in the regulations (as defined in the Alberta *Environmental Protection and Enhancement Act*)
Removal	The pipeline is completely removed from the right-of-way.

Roach	Excess soil placed over the ditch line to compensate for soil settlement.
Road or Railway Crossing	The crossing by a pipeline of a highway, road, street, or railway.
Sight Block	A mechanism to restrict the visual impact of a pipeline right-of-way.
Soil	The naturally occurring, unconsolidated mineral or organic material at least 10 centimetres thick that occurs at the earth's surface and is capable of supporting plants. It includes disturbance of the surface by human activities such as cultivation and logging but not displaced materials such as mine spoils.
Spoil	Soil materials other than topsoil excavated from the trench. In most cases, the excavated soil is suitable for return to the pipeline trench, and allows for re-contouring of the right-of-way.
Subsoil	Although a common term it cannot be defined accurately. It may be the B horizon of a soil with a distinct profile. It can also be defined as the zone below the plowed soil in which roots normally grow.
Surface Water	Water in a watercourse and water at a depth of not more than 15 metres beneath the surface of the ground.
Suspension	The cessation of normal operation of a pipeline pursuant to its licensed use. The pipeline need not be rendered permanently incapable of its licensed use, but must be left in a safe and stable state during this period of suspension, as prescribed by the applicable regulations and guidelines. See also "deactivation".
Topsoil	The organo-mineral suface "A", organic surface "O" horizon, or dark coloured surface soil materials, used synonymously with first lift. First lift materials are usually removed to the depth of the first easily identified colour change, or to specified depth where colour change is poor, and contain the soil Ah, Ap, O, or Ahe horizon. Other horizons may be included in the first lift if necessary.
Water	All water on or under the surface of the ground.
Water Conduit	A channel for conveying water. In the context of pipeline abandonment, refers to a pipeline that has become corroded and perforated and transports ground or surface water to a different location.
Watercourse	(i) The bed and shore of a river, stream, lake, creek, lagoon, swamp, marsh, or other natural body of water; or (ii) a canal, ditch, reservoir, or other man-made surface feature, whether it contains or conveys water continuously or intermittently.

Section 1 - Introduction

1.1 Background

Approximately 540,000 km of operating oil and gas pipelines currently exist in Canada, about 50 percent of which are located in Alberta. Ultimately, all oil and gas pipelines will reach the end of their useful lives, and will be abandoned. The issue of pipeline abandonment should therefore be reviewed by all stakeholders.

The Alberta Energy and Utilities Board (EUB) estimates that about 17,000 km of pipeline were abandoned or discontinued in Alberta as of April 1994. This number includes an estimated 3 600 km of orphaned abandoned pipelines. The majority of abandoned pipelines in Alberta are gathering lines 168.3 mm or less in outside diameter.

Regulatory requirements for pipeline abandonment vary across jurisdictions in Canada, and in many cases do not completely address associated long-term issues.

1.2 Review Initiatives

In 1984, several parties at a National Energy Board (NEB) hearing into the tolls of a major natural gas transmission pipeline company showed an interest in addressing the issue of negative salvage as it related to pipeline abandonment. As a result, the NEB issued a background paper in September 1985 addressing the negative salvage impacts of pipeline abandonment. The issue was not pursued again until 1990, when industry, the Alberta Energy Resources Conservation Board (now the EUB), and Alberta Environmental Protection (AEP) discussed the issue of pipeline abandonment while considering amendments to the pipeline regulations issued pursuant to the *Pipeline Act* (Revised Statutes of Alberta 1980). The issue was not resolved at that time, and was again raised in 1993 by the Alberta Pipeline Environmental Steering Committee, an industry, government, and public stakeholder group established to address pipeline related issues.

In October 1993, the Canadian Association of Petroleum Producers (CAPP) received the endorsement of the Alberta Petroleum Industry Government Environment Committee to establish a steering committee to oversee the issue of pipeline abandonment. Shortly thereafter, the EUB requested that CAPP and the Canadian Energy Pipeline Association (CEPA) organize a steering committee to resolve the concerns surrounding abandonment.

In April 1994, representatives from CAPP, CEPA, the EUB, and the NEB met to establish a pipeline abandonment steering committee. It was also decided at that time that separate subcommittees be struck to address the technical, environmental, legal, and financial aspects of pipeline abandonment. The technical and environmental subcommittees were the first to be formed and, together with the steering committee, were responsible for this discussion paper. The legal and financial subcommittees have not yet been struck.

1.3 Scope

This discussion paper is intended to apply to all buried metallic pipeline facilities falling within the scope of the CSA Z662-94 "Oil and Gas Pipeline Systems" standard, except for offshore pipelines. Many of the same issues and concepts (such as those relating to land use and pipe cleanliness) also apply to plastic and fibreglass pipelines. It addresses pipeline abandonment only (i.e. permanent removal from service), and does not consider pipeline deactivation (i.e. temporary removal from service). Likewise, this document does not address the abandonment of aboveground facilities associated with pipelines, such as stations or tank farms, or specific facilities such as underground vaults.

This paper addresses the technical and environmental aspects of pipeline abandonment. In order to complete the assessment, a review of the legal and financial aspects of pipeline abandonment needs to be undertaken. More particularly, the core issues of long-term liability and funding need to be addressed both in the context of orphaned pipelines and those with an identifiable owner/operator.

1.4 Abandonment Options

The two basic options that are considered in this paper are (i) abandonment-in-place and (ii) pipeline removal. In the former case, it is assumed for the purposes of this paper that cathodic protection of the pipeline is discontinued and that no other measures are taken to maintain the structural integrity of the abandoned pipeline (other than the potential use of solid fill material at roadway and railway crossing sites or other locations highly sensitive to ground subsidence).

As noted in Section 2, for any large-scale abandonment project it is unlikely that only one of these options will be employed. Rather, a project will usually involve a combination of pipe removal and abandonment-in-place along the length of the pipeline. A key factor influencing the choice between the two options is present and future land use.

It is further noted that the abandonment techniques presented are confined to those possible using currently available technology. While developments in pipeline removal and abandonment technologies were evaluated, no major improvements to the methods currently in use were discovered. However, as pipeline abandonments become more prevalent, improved abandonment methods will likely be developed.

1.5 Objective

The objective of this discussion paper is to assist the user in the development of a pipeline abandonment plan, a framework for which is provided in Section 2 of this paper. More particularly, the paper is meant to assist parties in making an informed decision between abandoning in place or through removal. Section 3 outlines the general technical and environmental issues that should be considered when abandoning a pipeline, while Section 4 elaborates on post-abandonment responsibilities. Site-specific issues should be addressed on a case-by-case basis.

The objective of creating an abandonment plan is to ensure that identified issues have been addressed and that the pipeline is abandoned in a way that provides a forum for meaningful stakeholder input and ensures that public safety and environmental stability are maintained.

1.6 Regulatory Requirements

The NEB is responsible for regulating interprovincial and international pipeline systems in Canada, while the individual provinces are responsible for regulating intraprovincial pipeline systems. Within each province, gathering, transmission, and distribution pipelines may be regulated by different agencies. For example, in Alberta the EUB regulates gathering and transmission lines as well as higher-pressure distribution lines (greater than 700 kPa), while lower-pressure distribution lines are regulated by Alberta Transportation and Utilities. AEP, through the *Environmental Protection and Enhancement Act* (EPEA), regulates conservation and reclamation activities for all three categories of pipelines.

In addition to the primary regulators, there may be other governmental agencies within each of the respective jurisdictions that may have an interest in the abandonment and reclamation of a pipeline. These other agencies may include local governments, especially in populated areas where pipeline abandonment may impact upon land uses.

In Alberta, the EUB sets the requirements for the abandonment of gathering and transmission lines. In addition to meeting the EUB's abandonment requirements, the pipeline right-of-way must be reclaimed to AEP standards. Reclamation certificates are issued by inspectors designated under EPEA. For removal projects that are classified as Class I projects,[1] the operator is required to obtain an approval under EPEA from AEP to ensure that proper conservation and reclamation occurs. For smaller projects, AEP's *Environmental Protection Guidelines for Pipelines* are to be followed during construction.

[1] A Class I pipeline is defined by the Activities Designation Regulation (AR 110/93) under EPEA as any pipeline that has an index of 2690 or greater, determined by mutiplying the diameter of the pipeline in millimetres by the length of the pipeline in kilometres (e.g. 168.3 mm x 16 km = 2693).

For federally regulated pipelines, approval to abandon a pipeline must be granted by the NEB and pipelines must be abandoned in accordance with the requirements of the NEB's *Onshore Pipeline*

Regulations. These regulations are in the process of being revised, and future regulations will likely require that applications for pipeline abandonment be treated on a case-by-case basis.

A summary of the current regulatory requirements for pipeline abandonment across Canada has been included as Appendix A.

Section 2 - Developing an Abandonment Plan

This paper addresses the common issues that pipeline abandonment plans should address regardless of regulatory jurisdiction. It is intended to assist a company in the development of an abandonment plan through the recognition of the general issues which result from the abandonment of a pipeline and by providing the means to address those issues.

In practice, the decision to abandon in place or through removal should be made on the basis of a comprehensive site-specific assessment. In this context, the analysis presented in this paper has limitations in that all site specifics could not possibly be addressed, particularly in relation to potential environmental impacts or impacts on present and future land use.

The development and implementation of a pipeline abandonment plan that will minimize impacts to the environment and land use and be cost-effective requires many activities similar in scope to the planning or installation of a new pipeline. For any large-scale abandonment project, it is unlikely that any one abandonment technique will be employed. Once the principal technique has been chosen, therefore, the owner/operator should assess on a site-specific basis whether an alternate approach should be followed for selected segments of line.

The abandonment project schedule should provide an opportunity for meaningful input into the planning process by the affected public, as defined by the scope of the project. It is especially important that landowners and land managers have a central role in this process.

The development of an abandonment plan should be initiated by reviewing the general requirements of the regulatory jurisdiction(s) under which the pipeline is operated. Beyond the requirements of the principal regulatory agencies, other legislation may affect the particular abandonment project. For example, municipal requirements and federal legislation such as the federal *Navigable Waters Protection Act* or the *Fisheries Act* may affect the abandonment options.

It is also critical that easement agreements be reviewed, as their terms and conditions may bear on the abandonment decision-making process.

The development and implementation of an abandonment plan consists of at least the following seven steps:

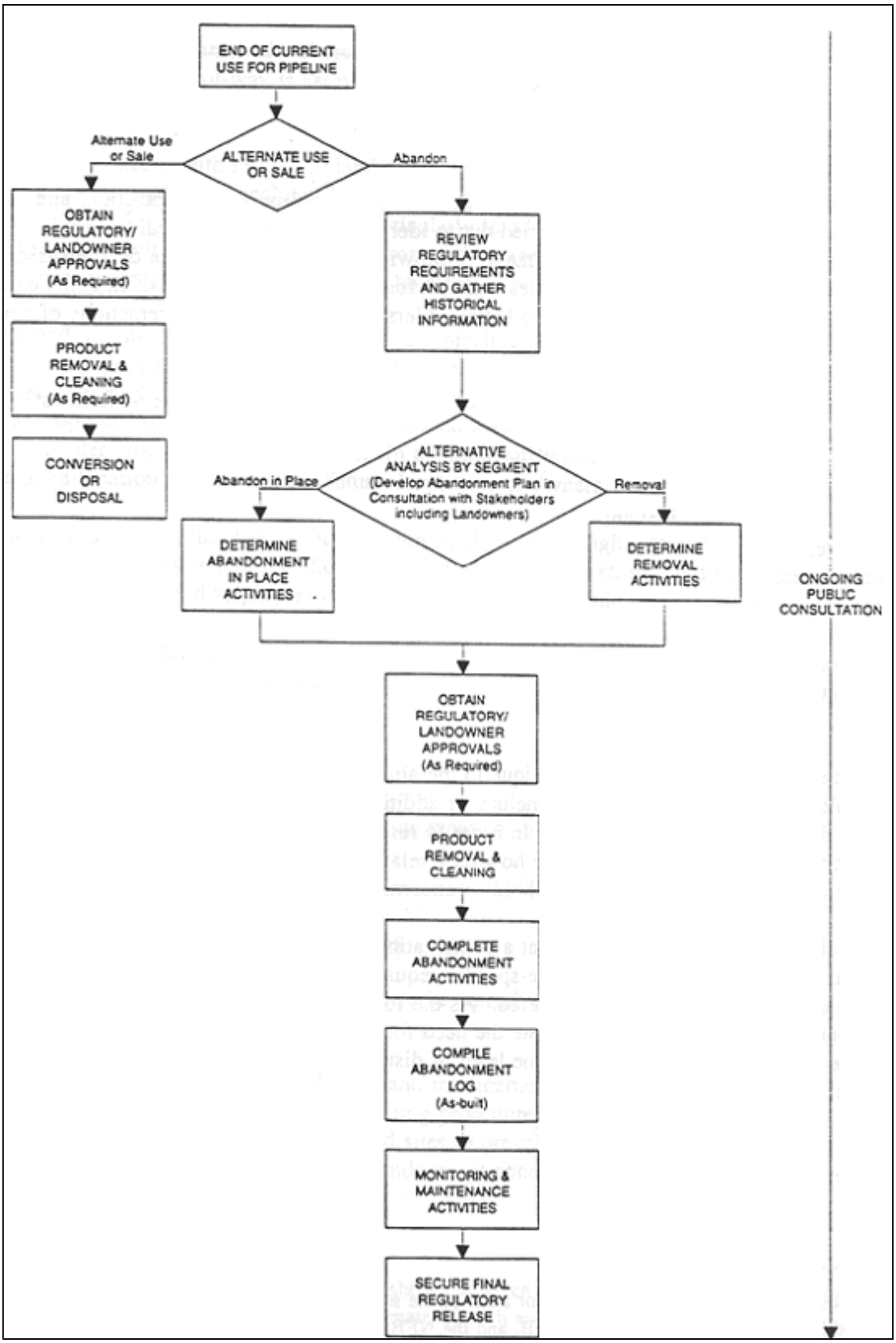
1. review prevailing regulatory requirements applicable to the abandonment project;
2. compile all relevant information on the pipeline system, including easement agreements;
3. analyze by segment taking into account the factors addressed in Section 3 of this paper, including present and future land use;
4. develop the abandonment plan in consultation with stakeholders (such as landowners, government authorities, and other directly affected parties), incorporating the information compiled in the above steps;
5. secure regulatory and landowner approvals as required for the pipeline abandonment and site reclamation;

6. implement the abandonment plan, the scope of which should include post-abandonment responsibilities (addressed in Section 4); and
7. secure final regulatory release.

A proponent undertaking an abandonment plan should follow these six steps, recognizing that site-specific conditions may require additional steps in the development of the plan.

Please refer to the next page for a flowchart of the abandonment planning process and to Appendix B for a detailed abandonment checklist.

Figure 2-1
Diagramme illustrant la cessation d'exploitation d'un pipeline


END OF CURRENT USE FOR PIPELINE
ALTERNATE USE OR SALE
Alternate Use or Sale
Abandon
OBTAIN REGULATORY/ LANDOWNER APPROVALS (As Required)
PRODUCT REMOVAL & CLEANING (As Required)
CONVERSION OR DISPOSAL
REVIEW REGULATORY REQUIREMENTS AND GATHER HISTORICAL INFORMATION
ALTERNATIVE ANALYSIS BY SEGMENT (Develop Abandonment Plan in Consultation with Stakeholders including Landowners)
Abandon in Place
Removal
DETERMINE ABANDONMENT IN PLACE ACTIVITIES
DETERMINE REMOVAL ACTIVITIES
ONGOING PUBLIC CONSULTATION
OBTAIN REGULATORY/ LANDOWNER APPROVALS (As Required)
PRODUCT REMOVAL & CLEANING
COMPLETE ABANDONMENT ACTIVITIES
COMPILE ABANDONMENT LOG (As-built)
MONITORING & MAINTENANCE ACTIVITIES
SECURE FINAL REGULATORY RELEASE

Section 3 - Technical and Environmental Issues

3.1 Issue Identification

Abandonment issues arise from the need to address public safety, environmental protection, and future land use. An initial scoping exercise was carried out to identify the various technical and environmental issues associated with abandonment. Following the development of a detailed issues list, field studies of existing abandoned facilities were performed to verify the issues. In some cases, detailed studies were commissioned in order to better understand the effects and interactions of certain issues.[2]

[2] (Refer to the Bibliography in Appendix E for a list of the studies, copies of which are available for public viewing in the libraries of CAPP, CEPA, the EUB, and the NEB.)

The primary issues that were identified, and which are addressed in this section, are as follows:

- land use management;
- ground subsidence;
- soil and groundwater contamination;
- pipe cleanliness;
- water crossings;
- erosion;
- utility and pipeline crossings;
- creation of water conduits;
- associated apparatus; and
- cost of abandonment.

It was determined that most issues are not unique to the abandonment phase of the pipeline life-cycle, but could involve an altered scope, varied timeline, or additional stakeholders when compared to the issues of pipeline installation and operation. In order to responsibly abandon a pipeline, the operator must consider all of the issues and determine how they relate to the specific pipeline under consideration, in addition to addressing stakeholder concerns and incorporating collected input.

In any abandonment project, it is possible that a combination of both the abandonment-in-place and removal options would be used, based on site-specific requirements. Thus, it is important that all aspects of the abandonment issues be considered. As the following discussion illustrates, the abandonmen-in-place option does not eliminate the need for land disturbance or field activity, while pipeline removal need not encompass the same level of disturbance or activity as that of pipeline construction.

3.2 Land Use Management

Land use is the most important factor to consider in determining whether a pipeline section should be abandoned in place or removed. Therefore, an understanding of the current and potential land uses along the pipeline right-of-way is essential to making informed decisions on available abandonment options.

Of particular concern with respect to land use management are areas sensitive to land disturbance, such as native prairie, parks and ecological reserves, unstable or highly erodible slopes, areas susceptible to severe wind erosion, and irrigated land, particularly flood irrigation systems. Additionally, land improvement activities such as the installation of drainage tile or other drainage systems, landscaping, and permanent structure installations could be affected by a proponent's decision to abandon a line.

Future land use should be considered because a pipeline abandoned in place could become a physical obstruction to development, such as excavation for foundations, pilings, or ongoing management practices such as deep ploughing or the installation of sub-drains. It is critical that input be gathered from appropriate sources such as landowners, land managers, lessees, and municipal agencies to support the decision to abandon in place. In addition, sufficient documentation must be kept to allow for detailed location information for future developers or owners.

As noted in Section 2, the decision to abandon in place or through removal should be made on the basis of a comprehensive site-specific assessment. In this context, the land management characteristics that may be better suited to pipeline abandonment-in-place include, but are not limited to:

- parks and natural areas;
- unstable or highly erodible surfaces;
- water crossings;
- flood irrigated fields;
- road and railway crossings;[3]
- foreign pipeline crossings;
- extra depth burial of pipe (i.e. depth well in excess of one metre);
- native prairie and native parkland;
- forest cut blocks;
- designated waterfowl and wildlife habitat; and
- areas exhibiting poor and/or limited access.

[3] (as detailed in Section 3.8, consideration should be given to filling pipeline sections abandoned in place underneath roadways and railways with a solid material such as concrete in light of potential ground subsidence impacts.)

The key environmental protection measures to be considered when a pipeline is to be abandoned in place are as follows:

- minimal disruption to ongoing or future land management activities;
- a complete and documented pipeline cleaning procedure;
- the clean-up of any spills or contaminated sites to prevailing regulatory requirements;
- a revegetation strategy to achieve pre-abandonment conditions, keeping erosion control and soil stability as a priority;
- topsoil conservation for all areas disturbed during the abandonment process;
- reclamation of all site access roads, including those which had been developed for the operational phase of the pipeline and any opened or developed for abandonment activity;

- documented as-built information for future reference;
- application of sight blocks where appropriate (e.g. recreational areas and wildlife habitat); and
- a monitoring program acceptable to all affected parties to ensure a process to complete remediation.

Proper environmental protection measures should be implemented, including appropriate soil handling procedures, timber management, contingency plans (e.g. for spills and wind or water erosion), protection of cultural features, weed control, and site reclamation. For example, in Alberta, a Conservation and Reclamation (C&R) report may be required by AEP for pipelines which were constructed before the C&R regulations came into effect.

Prior to the commencement of field activity, reclamation criteria should be agreed upon by the owner/operator, regulatory authority, and landowner. The reclamation program will normally be designed to ensure that the condition of the right-of-way land surface is made at least equivalent to that existing just prior to the commencement of abandonment activities, and as close as circumstances permit to the condition of the land that existed prior to pipeline installation, and may entail:

- removing, storing, and replacing topsoil;
- soil contamination analysis and-clean up, if required;
- contouring disturbed land to control drainage;
- seeding affected areas to prevent erosion and establish vegetation;
- removal of all structures to a minimum depth of one metre below final contour elevation;[4]
- roaching and/or compacting excavated areas to compensate for future settlement; and
- site-specific environmental requirements (e.g. reforestation).

[4] (In areas where circumstances such as special farming practices or nearby urban development exist, consideration should be given to removing structures more than one metre below the final contour elevation.)

As noted in Section 4, a right-of-way monitoring plan should be developed to ensure that reclamation efforts are successful and that no problems arise.

3.3 Ground Subsidence

3.3.1 General

The long term structural deterioration of a pipeline abandoned in place may lead to some measure of ground subsidence. This is a primary issue to consider for larger-diameter pipelines because of potential environmental and safety concerns. More particularly, ground subsidence could create the potential for water channelling and subsequent erosion, lead to topsoil loss, impact on land use and land aesthetics, and/or pose a safety hazard.

The acceptable subsidence limits and the potential factors affecting those limits are significant areas requiring attention in the development of any abandonment plan. Erosion may cause direct siltation to a watercourse, or cause slope failures and subsequent siltation. Where potential siltation is an issue, proponents must be prepared to deal with fisheries protection measures to remain in compliance with provincial and federal legislation.

The rate and amount of ground subsidence over time is difficult to predict as it depends on a complex combination of site-specific factors, such as the corrosion mechanics in the vicinity of the pipeline, the thickness and diameter of the pipeline, the quality of the pipeline's coating, burial depth, soil type, the failure mechanics of the pipeline material, and soil failure mechanics.

Given the absence of previously documented research, studies were commissioned on corrosion and soil mechanics in an attempt to establish the connection between pipeline corrosion, the structural deterioration of pipe, and the resultant ground subsidence that might be observed. Summaries of these studies and the conclusions that were reached follow.

3.3.2 Pipeline Corrosion

The corrosion consultant's report addressed the mechanism of corrosion leading to ultimate structural failure of a pipeline. The report stated that the rate of corrosion of an abandoned pipeline can vary significantly due to the many factors which must be present for corrosion to take place. Corrosion of buried pipelines occurs through an electrochemical reaction that involves the loss of metal in one location (called the anode) through the transfer of the metal ions to another location on the pipeline (called the cathode). The rate of metal transfer depends on a number of factors such as the quality of the pipeline coating, soil aeration (which supplies oxygen to the pipe to allow the corrosion process to occur), types and homogeneity of soils, soil moisture, and electrical factors which create the potential differences for a corrosion cell to be established.

The corrosion of a coated pipeline is normally restricted to those isolated areas where there are defects in the coating or where the coating has become disbonded from the pipe. Corrosion can be expected to be almost negligible in areas where the coating integrity is intact. Based on his experience, the consultant observed that coating holidays or disbondment occur on less than one percent of the length of most pipelines. Pipeline corrosion in most cases occurs as localized pits, or spiral corrosion areas, which eventually result in random perforations throughout the length of the pipeline. It is extremely rare for corrosion to cover large areas of pipeline, rendering a long segment of the pipeline susceptible to sudden and complete structural failure.

To illustrate typical corrosion rates, the consultant used an example of a 323.9 mm O.D. pipeline in soils commonly found throughout Alberta and estimated that penetrating pits would occur in the range of 13 to 123 years. Based upon the slow rate of pitting corrosion that would occur in most cases, complete structural failure is not likely to occur for decades or even centuries. Furthermore, given the non-uniform nature of the corrosion process, it can be concluded that it is highly unlikely that significant lengths of the pipeline would collapse at any one time.

3.3.3 Soil Mechanics

The soil mechanics report indicated that there has been no documented incidence of ground subsidence due to pipeline structural failure. In order to predict soil reaction to pipeline structural failure, the consultant modelled its review on shallow mining and tunnelling research and documented case histories. The focus of the study was to estimate possible surface subsidence that could be attributed to the complete failure of tunnels of equal diameter and depth as the pipelines being modelled. This represented a worst-case scenario, since as noted earlier a complete pipeline collapse of any significant length is considered highly improbable.

The report employed two different theoretical soil modelling techniques, the Rectangular Soil Block and the Active Soil Wedge, to reflect the most common types of soils that may be encountered. The ranges of subsidence calculated for varying sizes of pipelines provided an approximation of the impacts that a significant pipeline collapse would have on soils. The analysis indicated that ground subsidence associated with the collapse of pipelines up to 323.9 mm in diameter at typical burial depths would be negligible. The analysis further indicated that while

there would be some degree of subsidence associated with larger pipeline sizes, it may be of sufficiently small scale so as to be in a tolerable range.

3.3.4 Field Investigation Program

In order to validate the conclusions of the technical reports, the subcommittees undertook to document the ground subsidence of known abandoned pipelines.

As a first step, the subcommittees searched the EUB's records and identified pipelines 168.3 mm or larger in diameter that had been abandoned in place. Questionnaires were forwarded to the owners/operators of some of those lines, requesting information on pipeline diameter, coating type, year abandoned, whether cathodic protection had been removed, and ground subsidence observations (reference Appendix C for copy of questionnaire). The responses to the survey, as well as industry discussions, did not reveal any instances of observed subsidence.[5]

[5] (As indicated in Appendix C, all of the survey results gathered by the subcommittees are available for public viewing in the libraries of CAPP, CEPA, the EUB, and the NEB.)

3.3.5 Summary of Findings

The analyses indicated that the structural failure of an abandoned pipeline due to corrosion may take many decades, and that significant lengths of the pipeline would not collapse at any one time due to the localized nature of the pitting process. Furthermore, the analyses indicated that, even if the worst-case scenario of uniform and total structural collapse was realized, ground subsidence would be negligible for pipelines up to 323.9 mm in diameter.

The degree of subsidence associated with larger-diameter pipelines is highly dependent on pipeline diameter, depth of cover, and local soil conditions, but can be expected in many cases to be in a tolerable range. It should be noted that tolerance to soil subsidence is in itself a site-specific issue, as it depends on land use and the local environmental setting. Any pipeline owner/operator considering the abandonment-in-place of a larger-diameter pipeline should therefore conduct a site-specific analysis in order to evaluate both the degree and tolerability of any long-term subsidence that might be expected. Such analyses should take into account the potential for heavy vehicular loadings (e.g. farm equipment or logging trucks).

On the basis of the foregoing, it is suggested that ground subsidence associated with the structural failure of pipelines abandoned in place will not usually be a critical issue. This conclusion was corroborated by the industry survey referred to in Section 3.3.4. In areas where no settlement is allowed, either by regulation or agreement (such as at highway crossing sites, as further explained in Section 3.8), the option would exist to fill the pipeline with an approved solid material such as concrete or sand.

In terms of follow-up on this issue, it is suggested that tolerance criteria be developed and that the industry survey referred to in this paper be complemented with a field observation program. Scale modelling could also be performed to confirm the theoretical ground subsidence calculations.

3.3.6 Subsidence as a Result of Pipeline Removal

The physical act of removing a pipeline is essentially the reverse operation of pipeline construction and involves topsoil removal, backhoe excavation of the subsoil to a depth at least even with the top of the pipe, pipe removal, backfilling and compaction of the trench, replacement of the topsoil, and revegetation measures.

During pipeline construction, a roach consisting of subsoil overlaid with topsoil is usually employed to compensate for the settlement that will occur as the ditch line settles. The same strategy can be employed at the abandonment stage to avoid the need for reclamation in future years due to settlement and erosion. In general, if extra topsoil or soil materials are required for this operation, it could be recovered from areas immediately adjacent to the pipeline right-of-way. For older pipelines built before mandatory soil conservation, this is where extra topsoil or soil materials may have been disposed. Further surveys or examinations of topsoil depths and soil volumes may be required to identify these potential borrow areas.

Without the concern of compaction damaging the pipeline, a company may undertake a more rigorous compaction of the soil being replaced in the ditch following pipe removal than after backfilling for new construction. Additional compaction may also result in less topsoil handling and, therefore, fewer impacts due to the decreased need to strip topsoil to accommodate the feathering out of subsoil material caused by the excavation.

3.4 Soil and Groundwater Contamination

The abandonment plan should address the potential for contamination associated with the abandonment activities, as well as the need to eliminate any contamination that may already exist, and include the appropriate pipe cleaning or pigging procedure. Any contamination noted prior to abandonment activity should be cleaned up to the applicable regulatory standards prior to full project disturbance, unless it is more economically efficient to include the cleanup in the scope of abandonment activity and it can be demonstrated that environmental damage will not be amplified.

In order to gain additional insight into the issue of contamination, a study was commissioned into the types and quantities of contaminants that might be released from pipelines abandoned in place.

The potential sources of contamination were identified as:

- the substances produced from the reservoir in the hydrocarbon stream and deposited on the walls of the pipeline;
- treatment chemicals which could enter the pipeline and be deposited;
- the line pipe and associated facilities;
- pipeline coatings and their degradation products;
- historical leaks and spills of product that were not cleaned to current standards; and
- possible PCB contamination, if PCBs were used in the pump or compressor lubricants at some point in the history of the pipeline.

The quantity of residual contaminants can be expected to decrease as the product moves from the wellhead through the gathering, processing, and distribution systems. Traditionally, oil pipelines contain a greater volume of wax and scale than do natural gas pipelines, but this is dependent on the circumstances of the particular production field. The study concluded that the effectiveness of pipeline pigging and cleaning procedures prior to abandonment was the most critical determinant of the potential quantities of residual contaminants.

The subject of pipeline cleaning is addressed at length in Section 3.5 and Appendix D. An operator should become familiar with prevailing regulatory standards for soil and groundwater, as these standards may dictate the minimum acceptable level of pipe cleanliness. Sound environmental protection practices should be observed throughout the pipeline cleaning process, such as the use of properly engineered containment and storage for all collected material, proper labelling, disposal processes conforming to local regulations, and effective spill contingency

plans. Detailed documentation should be recorded on the results of the cleaning process or the clean-up of a contaminated site.

Operators should also have an understanding of the composition of pipe coatings and their associated characteristics to assess any potential risk that may be derived from abandoning the pipeline in place. For example, pipeline coatings containing asbestos should be handled through special means by trained personnel. It has been suggested that if pipe coating compounds would be accepted at local landfills, then abandoning a pipeline with the same compounds in place may not be a concern, depending on site conditions and concentration levels. Presently, limited information exists regarding the long-term decomposition of pipeline coatings. However, it can be assumed that as the coating adhesive degrades, or is consumed by soil organisms, coatings will eventually disbond and contribute to the corrosion process.

Many of the same contamination prevention measures to be employed for abandonment-in-place also come into play in the context of pipeline removal. Of prime importance is the need to clean the pipeline to accepted standards prior to the commencement of the removal operation, and the employment of measures to prevent spills of the substances collected as a result of the cleaning process. Collection trays should be used during the pipe cutting operation to catch any residual fluids.

During pipe removal, proper soil handling measures must be implemented to ensure topsoil conservation.

In addition to the pipeline itself, the dismantlement of any connected facilities should be carried out such that the potential for contamination is controlled by proper containment and storage for disposal at an approved facility.

3.5 Pipe Cleanliness

3.5.1 Cleanliness Criteria

In light of potential contamination concerns, the cleanliness of the pipeline is an issue for both abandonment techniques. Although responsible cleaning procedures have been defined and are discussed in detail in Section 3.5.2 and Appendix D, the question of "how clean is clean" has not been resolved. In addition, the question remains as to whether pipe that will be removed should be subject to the same cleanliness criteria as pipe that will be left in place. It should be assumed that pipe that is to be removed should be cleaned to a level where any remaining residues will not cause harm in any future intended use of the pipe. Removed pipe that may eventually be put to some alternative use (e.g. pilings) may require more study to determine the appropriate cleanliness requirements for the future use. For pipe that is targeted for disposal, existing disposal or landfilling guidelines will determine the required cleanliness of the pipe.

For pipe that will be abandoned in place, the issue of pipe cleanliness is related to corrosion and the creation of water conduits. Eventually the pipe will corrode until perforated and, aided by the destructive forces of the freeze-thawing of infiltrated water, the structural integrity of the pipe will suffer. Whether the rate of deterioration will be greater than the life of the contaminants left as internal residue of the pipe is unclear. Similarly, an issue remains over the rate and structural location of any corrosion, in that it may allow water to infiltrate the abandoned pipe and transport pipe residues to some other exit point.

3.5.2 Cleaning Procedures

The pigging procedure used during the final operating stages and during evacuation of the pipeline is critical in preparing the line for abandonment. The study on contaminants concluded

that the small quantities of hydrocarbons left in the line after a concerted pig cleaning effort will not result in any significant environmental concerns.

The factors impacting the effectiveness of any pig cleaning procedure will vary with each pipeline. Cleaning programs must therefore be customized to the specific circumstances of the pipeline under consideration for abandonment. For guidance purposes, Appendix D sets out general cleaning considerations and describes typical cleaning methods for an oil pipeline in a medium duty service [6] or for a pipeline carrying relatively dry natural gas. Operators planning a pigging program for a specific line should consider these guidelines as a starting point only. The abandonment of pipelines carrying products other than the two noted above require customized pigging procedures to ensure proper cleaning. Care should be taken in all cases to properly contain and dispose of pigged effluent.

[6] Medium duty service refers to relatively wax and direct free operation with a scraping program undertaken occassionally to move along anything collected or adhering to the pipe wall.

A pipeline to be abandoned in place should be left such that no solids or waxy build-up are visible at any point along the pipeline as observed through standard pipe openings such as opened flange or sample connections and the contents have been cleaned out to the extent that no more than a thin oily film on the inside pipe wall surface can be detected by feel or sight. Sour liquid or natural gas pipelines should be checked to confirm that H2S levels are below acceptable limits.

Pipe cleaning is also of critical importance in the context of pipeline removal, given the desire to minimize the risk of soil and groundwater contamination during the removal process and the hazards associated with pipe removal (e.g. health and flammability hazards of exposed vapours). Cleanliness considerations relating to the future intended use or disposal of the pipe should also be taken into account, bearing in mind that supplementary cleaning techniques may be employed once the pipe has been removed from the ground.

Cleaning effectiveness can be determined by taking pipe coupons and swabs of any film found on the inside of the pipe and analyzing them for contamination, using cutout means such as hot tapping or line cutouts.

After allowing some time for the collection of remaining liquids in low areas (minimum one week suggested), the pipeline should be excavated at random low areas. A minimum of one excavation site per scraper trap or 80 km interval is suggested. However, in undulating areas multiple excavation sites may be required. Excavation sites should be chosen to avoid environmentally sensitive areas and to minimize clearing associated with the opening of access roads. If the examination of the inside wall shows that the cleanliness criteria has been met, the cleaning task can be considered complete.

3.6 Water Crossings

The effect of pipelines on water crossings is an important issue at any stage of a pipeline project. This issue is a significant social consideration due to the visibility of crossing activities, the importance of fisheries resources, public use of waterways, the sensitivity of the resource, and the fact that waterways are an important cultural and historical feature of the land.

There are many factors to consider in deciding whether a section of pipeline crossing a water body or wetland (e.g. muskeg, swamp, or flood plains) should be abandoned in place or removed. More specifically, the risks associated with abandoning the pipeline in place, including the potential for contamination and pipe exposure, have to be weighed against the cost and environmental impact of removal.

These trade-offs should be assessed on a site-specific basis, taking into account the size and dynamics of the water body, the design of the pipeline crossing, soil characteristics, slope

stability, and environmental sensitivities. While these issues must be evaluated, in most cases it can be expected that abandonment-in-place will be the preferred option.

If the pipeline crossing is to be abandoned in place, the pipe should be left in as clean a state as possible to minimize the potential for contamination of the waterbody should the eventual perforation and failure of the pipe allow any internal residues to escape. As described in Section 3.9, the strategic placement of caps and plugs will also help mitigate this concern by interrupting the movement of potential contaminants through the abandoned pipe.

The risk of pipe exposure is two-fold. First, the pipeline could become exposed if the overlying soil is gradually eroded or washed away because of the dynamics of the water body (e.g. stream bank migration, scour, or flood conditions). Secondly, an empty pipeline crossing a water body or wet area could float toward the surface if buoyancy control mechanisms fail (e.g. if concrete saddle weights slide off). In either case, the owner/operator should assess the probability that the pipeline could become exposed and the impacts that exposure would entail. If the risk of flotation is a concern, it could be addressed by either perforating the line following an appropriately sensitive line cleaning program to allow it to fill with water or by filling the line with concrete or some other solid material. In the case of the former option, plugs and caps should be used to prevent water migration through the pipeline.

If applicable, the risks associated with abandoning a pipeline in place which runs parallel to an operating pipeline at a water crossing should also be assessed.

If the pipeline is to be removed in whole or in part, the issues would be similar in many ways to those associated with initial construction across the water body or wetland. More specifically, many of the same construction techniques and environmental protection measures would apply. Aspects to address include fisheries resource timing sensitivities, habitat protection, sediment control, vehicle and equipment crossing methods, backfill material specifications and source, erosion control measures (both short term and long term), and bank restoration. Damage to any existing bank stabilization structures or destabilization of previously stable banks should be considered.

It is crucial that the pipe be as clean as possible prior to excavation to minimize the potential for contamination of the waterbody should the pipe be damaged and a spill occur during the removal procedure. Blinding off the ends of the section being removed is recommended to prevent contamination by any remaining traces of material.

3.7 Erosion

Soil erosion is a concern during all phases of the pipeline life-cycle, particularly as it relates to slope stability. Leaving a pipeline in the ground may entail a certain amount of activity along the right-of-way to ensure responsible abandonment, such as excavations to confirm cleaning quality and the installation of caps or plugs. The potential impact of the ensuing right-of-way disturbance will vary greatly with the geographic location of the activity. For example, a forest area "duff" layer may not be as susceptible to erosion and slope instability as a region of native prairie topsoil.

If the pipe is to be removed, erosion and slope stability concerns will be similar to those for pipeline construction. For example, traffic, soil compaction, and the wind and water erosion of disturbed soil may be of concern. In addition, the pipeline may have become a structural support to many slopes over time, and its removal may affect the integrity of the slope.

When developing an abandonment plan, the pipeline owner/operator should review any erosion remediation that had occurred over the operating life of the pipeline. If erosion control measures have been regularly required at specific locations, the owner/operator should determine if it would be appropriate to implement longer term erosion control measures.

If the abandonment activities necessitate disturbing erosion-prone areas including slopes, protection measures designed to current standards should be implemented. In addition, the integrity and effectiveness of any existing ditch plugs, sub-drains, berms, or other installations should be reviewed.

It is usually more appropriate to abandon pipe at unstable slopes in place, due to the potential requirement for extensive remediation if the pipeline is removed. On sensitive slopes, the use of sight blocks or other measures should be considered to discourage use of the right-of-way. In areas where the right-of-way has been traditional access for recreational users or hunters, the operator should attempt to reach an agreement with the land manager for ongoing remediation, if necessary.

In areas where slope movement was being monitored during the pipeline's operating life, the monitoring program should be re-evaluated and continued, if warranted. Temporary access roads to slopes should be reclaimed as appropriate.

Protective measures to be considered when removing a pipeline from a slope would be similar to those used during pipeline construction. The integrity of the slope must be maintained during the removal activities, as well as after the line is removed. If the removal calls for spot excavations (bellholes) instead of an open ditch removal, the stability of the entire slope, as well as the region surrounding the bellholes, should be evaluated. Re-installation of diversion berms and ditch plugs to prevent water channelling may be required.

Development of the abandonment plan should include consultations with other pipeline owners/operators that may be affected by right-of-way disturbances on the slope. In addition, regulators and landowners should be consulted in order to determine an appropriate period for right-of-way monitoring after the pipeline is removed. A typical monitoring period would be two years. Revegetation programs should consider the inclusion of a species that is quick to establish in the revegetation mixture, as this may help to provide short term erosion control; however, the environmental effect of introducing a non-native species must be considered. Regulatory/landowner approval of the seeding mixture would likely be required. A weed control plan should be initiated during the pipe removal process to address potential concerns immediately following surface disturbance.

3.8 Road, Railway, and Utility Crossings

All crossings associated with a pipeline that is being abandoned must be addressed in an appropriate manner. Of particular importance are the agreements relating to the crossings of railways, primary and secondary highways, roads, other pipelines, power lines, and communication lines, and the constraints they may place on the abandonment process.

The parameters to be considered in selecting an abandonment technique for a crossing site include the line diameter, installation details (including burial depth), subsidence tolerance, impact of excavation, impacts on other cathodic protection systems (e.g. for crossings of other pipelines), and long term development plans. Special consideration should be given to the sensitivity of roadway and railway crossings to slight ground depressions that could result from any abandonment related subsidence. The potential may also exist for disruption to crossing traffic, both during and as a result of the pipeline abandonment. As a result, more stringent abandonment requirements may be imposed, such as filling the pipeline at the crossing site with concrete or other approved material. Similarly, cased crossings may require a solid fill even if the carrier pipe is removed.[7]

[7] If the carrier pipe remains in situ, both it and the casing annulus may require a solid fill (need should be assessed on a site-specific basis.)

The proper notification and location of the pipeline or utility being crossed is essential to maintaining a safe working environment. Operators of utilities and other pipelines may have established plans or expectations that may affect the design and timing of the abandonment. Utility crossing or pipeline crossing locations may be of concern when a pipeline is removed, due to the loss of support for the remaining facility, or the interference of the abandonment operation or the abandoned pipeline with the operation of the crossed utility or pipeline. Thus, discussions with utility and other pipeline companies will add value to the resulting abandonment plan and initiate protection planning.

The main steps of the abandonment evaluation and implementation process for any particular crossing site are as follows:

- review the existing crossing agreement and determine if there are any terms and conditions relating to abandonment-in-place or pipeline removal;
- establish communications with the utility or pipeline being crossed and negotiate terms and conditions (both technical and legal) to abandon the pipeline in place or remove the pipe;
- amend the existing crossing agreement to address the terms and conditions of the abandonment plan;
- notify all affected parties about abandonment activities and responsibilities;
- ensure that necessary approvals (e.g. from regulatory authorities, the utility being crossed, and the landowner) are obtained and kept on record;
- obtain proper location and identification of pipelines and utilities in the area using agencies such as Alberta First Call prior to commencing removal activities, and alert landowners to the activities taking place;
- file the necessary permanent records of the pipeline abandonment plan with interested parties (including pipeline regulatory authorities, provincial one-call systems, environmental groups, land titles, pipeline registers, and the affected crossing parties); and
- in the case of abandonment-in-place, ensure that the inspection requirements for the crossing are part of the post-abandonment monitoring plan.

3.9 Creation of Water Conduits

The potential to create water conduits as a result of the abandonment process is of concern as it could lead to unnatural drainage and material transport. This issue is primarily of concern when a pipeline is abandoned in place, since water will eventually infiltrate the pipe through perforations in the pipe wall caused by corrosion.

Unless water pathways through the pipeline are interrupted, this could lead to the unnatural drainage of areas such as muskegs, sloughs, or marshes, thus affecting the natural balance of the ecosystem. Likewise, a previously stable low area could be flooded by volumes of water exiting from a perforated pipeline. This issue can be related to the concern for contamination and the protection of wetland systems. If water infiltrates the pipeline, the potential exists for that water to carry any residual contaminants left in the abandoned pipeline to some point of exit. The point of exit could be a watercourse, thereby contaminating the watercourse if contaminant levels are sufficiently great in volume and concentration at the point of exit. The possibility of soil contamination may also exist, depending on the nature of the contaminant transported through the pipeline.

Plugs should be installed at appropriate spacings to ensure that changes in surface and ground water conditions will not result in water flow through the pipeline. When identifying locations for the plugs, consideration should be given to pipeline access during the placement of the plugs and the resulting effects of the ground disturbance. Where the pipeline crosses a wet area, a plug

should be placed just downstream of the wet area, to prevent its drainage, and also at an appropriate location upstream of the wet area, to prevent the wet area contamination by water flowing along the pipeline. The plugs should be long enough so that corrosion downstream of the plug will not result in water entering the pipe.

On slopes, water could seep into the pipeline through perforations and exit at unacceptable locations such as agricultural areas or areas where excessive erosion would result. The water should be allowed to exit at frequent intervals and at preferred locations in order to minimize potential impacts from the flow of water and the disruption to natural drainage patterns. Typical locations for plugs are provided in the following table.

Table 3-1
Recommended Plug Locations

Terrain Feature	Plug Locations
waterbodies/watercourses	above top of bank
long inclines (>200m), river banks	at top and bottom of slope and at mid-slope for long inclines
flood plains	at boundaries
sensitive land uses (e.g. natural areas, parks)	at boundaries
near waterfalls, shallow aquifers, groundwater discharge and recharge zones, marshes, sloughs, peatlands, highwater table areas	at boundaries and should include an adequate buffer zone
cultural features (population centres)	at boundaries

The plugs should adhere to the pipe, be impermeable and non-shrinking, and able to resist deterioration. Examples of suitable materials are concrete grout or polyurethane foam. The use of impermeable earthen plugs may also be a viable option.

In the case of pipeline removal, water pathways through the uncompacted pipeline trench material must be prevented or interrupted. The principles governing the locations of trench breakers are the same as those governing the locations of plugs for pipelines abandoned in place.

3.10 Associated Apparatus

The development of any abandonment plan should also give consideration to the disconnection, removal and disposal of apparatus associated with the pipeline, including:

- aboveground valve sites and manifolds;
- underground valve sites and manifold piping, as well as protruding elements such as valve topworks;
- underground tanks;
- pipeline scraper traps;
- pipeline risers;
- line heaters;
- drip pots;
- pipeline access culverts (e.g. for tie-ins, valves, liners, etc.);
- cathodic test posts, fink stations, rectifier sites, and ground beds (to a depth of one metre);

- aboveground tanks and containment berms;
- access roads, gates, and fences;
- anchor blocks and steel piles; and
- miscellaneous apparatus such as radio antennae, buildings, fencing, wiring, electrical equipment, and slope monitoring equipment.

It is recommended that all surface and subsurface apparatus (including signage) along the route of a pipeline that is to be abandoned through removal also be removed as part of the abandonment process.

For pipeline sections that are to be abandoned in place, it is recommended that all surface apparatus as well as subsurface apparatus to a depth of at least one metre be removed, with the notable exception of signage identifying the location of the buried line pipe (i.e. line markers and aerial markers). This applies to apparatus located on operator owned land as well as apparatus located on pipeline-specific surface leases on public or private land.

Any apparatus that is left in place should be secured and properly marked and recorded, and should not pose a hazard to people, equipment, or wildlife and livestock.

3.11 Cost of Abandonment

The cost of abandoning a pipeline may be quite significant. There is a broad scope of costs to consider, from the traditional costs associated with abandonment to more intangible items such as a company's public image and the costs of environmental consequences. In order to make responsible decisions regarding abandonment, all of these costs must be considered.

The cost of abandoning a pipeline will depend on the resources required to complete the work, the value of any salvaged material, the extent of remediation and reclamation work required (as well as any associated security requirements [8]), and many other factors. Proponents should also consider the costs associated with monitoring a site and potential future remediation, as well as the consequences of the abandonment activities and any legal issues that may arise. Changes in the regulatory environment may also give rise to unanticipated abandonment costs to ensure "no responsibility by the owner/operator" after a prescribed monitoring period.

[8] For example, in Alberta, if an approval under EPEA is required for the abandonment of a Class 1 pipeline, security is to be provided to AEP before the approval is issued. The security amount is determined using an estimate of the cost of reclamation.

Section 4 - Post-Abandonment Responsibilities

Once a pipeline has been abandoned, the owner/operator may retain a number of responsibilities. More particularly, the owner/operator may be responsible for ensuring that the right-of-way and any facilities left in place remain free of problems associated with the abandonment. For that reason, a right-of-way monitoring program should be included in the post -abandonment plan and accounted for in the abandonment budget.

Monitoring plans will vary from case to case, depending on the location and size of the pipeline, the land use, and the features of the terrain traversed by the right-of-way (such as water crossings or slopes). When developing a monitoring plan, the effects of each abandonment issue described in Section 3 should be thoroughly examined for each specific segment of the pipeline being abandoned. Specific monitoring requirements should be included for potentially sensitive areas.

Right-of-way maintenance should also be considered in the post-abandonment monitoring plan and factored as necessary into the abandonment budget. As noted in Section 3.2, the reclamation program will normally be designed to ensure that the condition of the right-of-way is made at least equivalent to that existing just prior to the commencement of abandonment activities, and as close as circumstances permit to the condition of the land that existed prior to initial pipeline installation. The degree to which the right-of-way has to be maintained in that state depends largely on land use and environmental sensitivities. For pipe left in place, the owner/operator would normally remain responsible for the maintenance of signage.

Additionally, the owner/operator may be responsible for maintaining post-abandonment information about the pipeline. This information should be recorded in a post-abandonment log book, so that it is available when needed and can be turned over to an alternate responsible authority if required by future regulations. The post-abandonment log book should contain:

- any regulatory permits and conditions attached to permits (including reclamation certificates);
- full particulars on any pipeline facilities abandoned in place, including a physical description, location and depth of cover, plug locations, and details of any sections filled with a solid material;
- copies of all past crossing agreements;
- records of post-abandonment aerial surveillances;
- records of any slumping over the pipe, or water flow through the pipe, that was noted during post-abandonment monitoring;
- records of any changes in pipeline state from the original abandonment plan (e.g. if pipe sections abandoned in place are subsequently removed);
- records of any remedial work performed on the pipeline after abandonment; and
- records of any areas that become contaminated after the abandonment and reclamation work is complete.

The owner/operator will also be responsible for notifying landowners, municipal authorities, and other affected parties (such as one-call associations) of the abandonment of the pipeline. Any input provided by these groups should be recorded in the post-abandonment log book.

Finally, any pipeline abandoned in place should remain part of any provincial one-call program, so that third parties can be advised whether the lines they wish to have located are active or abandoned.

In closing, a major issue still to be addressed is the question of who would assume responsibility if the owner/operator becomes insolvent. In this regard, industry has established a fund in Alberta to cover the cost of reclamation and abandonment of orphaned oil and gas wells and certain associated pipeline facilities.

Appendix A - Current Regulatory Requirements

Refer to the following three tables for an outline of the current regulatory requirements for pipeline abandonment across Canada.

REGULATORY REQUIREMENTS FOR PIPELINE ABANDONMENT[1]

JURISDICTION	AGENCY	LAW	SCOPE	ABANDONMENT/ REMOVAL CLAUSE	ACTION REQUIRED
FEDERAL	National Energy Board	*National Energy Board Act*	All pipelines	Part V, Para. 74(d)	Leave of the Board
Onshore Pipeline Regulations	All pipelines	Sec. 55	For abandoned facilities left in place, disconnect from operating facilities, fill with approved medium, seal ends, empty storage tanks then purge of hazardous vapours, and maintain cathodic protection.[2]		
YUKON	National Energy Board	*Canada Oil and Gas Operations Act* (COGOA)	All pipelines	none specified	none specified
N.W.T.	National Energy Board	*Canada Oil and Gas Operations Act* (COGOA)	All pipelines	none specified	none specified
BRITISH COLUMBIA	*Employment and Investment (Energy and Minerals Division)*	*Pipeline Act*	All pipelines	Part II, Sec. 9	Approval of Minister. Removal of structures which may be likely to menace public safety or create a fire hazard

[1] This table lists current regulatory requirements for pipeline abandonment only and does not address the abandonment of stations or other above-ground facilities. Similarly, it does not address the requirements for pipeline deactivation or discontinuance.
[2] The NEB is in the process of amending its *Onshore Pipeline Regulations* and has proposed that these specific requirements be revoked, on the basis that abandonment applications will be treated on a case-by-case basis pending the outcome of the industry/government review into the matter.

REGULATORY REQUIREMENTS FOR PIPELINE ABANDONMENT (continued)

JURISDICTION	AGENCY	LAW	SCOPE	ABANDONMENT/ REMOVAL CLAUSE	ACTION REQUIRED
ALBERTA	Alberta Energy and Utilities Board	*Pipeline Act*	All pipelines	Part IV, Sec. 33	Consent of the Board
		Pipeline Regulations	All pipelines	Secs. 66-69	For facilities abandoned in place, disconnect abandoned pipeline from operating facilities, clean and purge with approved medium, cap all open ends and advise the Board when work is complete.[3]
	Alberta Environmental Protection	*Environmental Protection and Enhancement Act (Alta. Reg. 115/93)*	All pipelines on private land & Green Area	Sec. 122	Reclamation Certificate from AEP
	Alberta Agriculture, Food & Rural Development	Environmental Protection and Enhancement Act (Alta. Reg. 115/93)	Class I & II lines on White Area public lands		Reclamation Certificate from AFRD (responsibility delegated under EPEA)
SASKATCHEWAN	Department of Energy and Mines	*Pipelines Act*	All pipelines	none specified	none specified
MANITOBA	Oil and Gas Conservation Board	*The Oil and Gas Act*	All pipelines	Part 14, Sec. 171	Application to an inspector. Responsible for any repairs required within six years from the day of issuance of the Certificate of Abandonment in respect of the oil and gas facility site.
ONTARIO	Ministry of Consumer and Commercial Relations[4]	*The Energy Act*	All pipelines	none specified	none specified

		Gas Pipeline Systems Regulations	Gas pipelines	none specified	none specified
		Oil Pipeline Systems Regulations	Oil pipelines	none specified	none specified

[3] Presently the EUB does not require the removal of an abandoned pipeline; however, in most cases it will expect a notification to the landowners, occupants, and those affected by sour gas setback distances of the abandonment. This is to ensure that affected parties are made aware of the abandonment and that their land will no longer be impacted by the pipeline.
[4]Starting in May 1997, Ontario's pipeline safety regulation program will be administered by the Technical Standards and Safety Authority, a private non-profit organization.

REGULATORY REQUIREMENTS FOR PIPELINE ABANDONMENT (continued)

JURISDICTION	AGENCY	LAW	SCOPE	ABANDONMENT/ REMOVAL CLAUSE	ACTION REQUIRED
QUEBEC	Regie du Gaz Naturel	*Gas Distribution Act*	Gas pipelines	none specified	none specified
		Regulations Respecting Gas and Public Safety	Gas pipelines	none specified	none specified[5]
NOVA SCOTIA	Energy and Mineral Resources Conservation Board	*Pipeline Act*	All pipelines	Sec. 20	Consent of the NSEMRCB
NEW BRUNSWICK	Natural Resources and Energy	*Pipeline Act*	All pipelines	none specified	none specified[6]
		Pipeline Regulations	All pipelines	Sec. 85	Consent of Minister and approval of Board. For facilities abandoned in place, disconnect abandoned pipeline from operating facilities, purge with approved medium, cap open ends and advise Minister when work is complete.[7]
PRINCE EDWARD ISLAND	Department of Energy and Forestry	No applicable legislation	N/A	N/A	N/A
NEWFOUNDLAND	Canada-Newfoundland Offshore Petroleum Board	*The Petroleum and Natural Gas Act*	Offshore pipelines[8]	none specified	none specified

[5] Sec. 3(2) of the *Regulations Respecting Gas and Public Safety* states that the construction, installation, repair, maintenance, replacement or removal of any gas distribution piping shall be in accordance with Code CAN1-B149.1-78 "Installation Code for Natural Gas Burning Appliances and Equipment".
[6]Sec. 28 of the Pipeline Act states that no pipeline shall be taken up or removed without consent of the Minister and subject to his conditions.
[7]Secs. 83-84 of the Pipeline Regulations list the application requirements and criteria for the take up and removal of a pipeline, namely that it must be physically isolated from operating facilities, purged with an approved medium, and that the Board must be advised when the work is complete.
[8]Newfoundland does not at present have any legislation applicable to onshore pipelines.

Appendix B - Abandonment Checklist

1.0	**Alternate Use Analysis** a. ___Review alternate uses within company or corporate family b. ___Determine if asset can be sold to another company for continued or alternate use c. ___Decision that pipeline should be abandone

2.0

Product Removal & Cleaning

2.1 Liquids Pipeline

a. ___Pre-Abandonment pigging for cleaning
b. ___Temporary piping modifications
c. ___Temporary product measurement, storage & transportation
d. ___Product removal pigging, propellant
e. ___Post removal cleaning, solvents
f. ___Product toxicity analysis
g. ___Pipe testing for contaminants
h. ___Waste disposal

2.2 Gas Pipeline

a. ___Pre-abandonment pigging for cleaning/liquid removal
b. ___Liquids disposal
c. ___Temporary piping modifications
d. ___Pressure reduction by operating facilities
e. ___Pressure reduction by pulldown compression
f. ___Sour/toxic product analysis
g. ___Blowdown, Flaring
h. ___Post removal cleaning using pigging, solvents
i. ___Pipe testing for contaminants

3.0

Information Required for Planning/Approvals

3.1 Facility Description/History

a. ___Lineal Description of the Pipeline
___pipe specification
___coating
___appurtenances
___connections to other facilities
___road, highway, railroad crossings (obtain crossing agreements)
___pipeline/utility crossings (obtain crossing agreements)
___water crossings
___topography/terrain
___soil information
___weed/vegetation information
___environmentally sensitive areas
___land use/developed areas
___parallel pipelines, connections

___slope instabilities
___road accesses

b. ___Operating History
___all products
___potential contamination
___operating failures/spills/clean-up
___slope movement monitoring

3.2 Regulatory Jurisdictions/Approvals

a. ___Operating Authority: Liaison, Application and Approvals (Federal and/or Provincial)

b. ___Environmental Authority: Liaison, Application and Approvals (Federal and/or Provincial)

c. ___Public Lands Disposition (e.g. Land Administration Branch of AEP)

d. ___Other Authorities: DFO, Coast Guard, etc.

e. ___Municipal Authorities: Permits/Bylaws

3.3 Landowner/Public Contact Activities

a. ___Title Search

b. ___Landowner/Tenant Contact, Survey Clearance

c. ___Abandonment Rights in Pipeline Easement/Disposition Documents

d. ___Landowner/Tenant Contact/Negotiations

e. ___Public Lands Managers Contact/Negotiations

f. ___Release of Land Rights/Warranties/Setback Requirements

g. ___Public Participation/Stakeholder Contacts (for federally regulated facilities, early public notification as per NEB's guidelines)

h. ___Damage Negotiation/Payment

3.4 Environmental Assessment

a. ___Soil conservation, stability (possible C&R report)

b. ___Fish & Wildlife population, habitat

c. ___Groundwater

d. ___Erosion, stream sedimentation potential

e. ___Natural Areas, Native Prairie and Native Parkland

f. ___Archaeological study

4.0

Identify Abandonment Activities (Develop Abandonment Plan)

a. ___Identification of activities required to meet regulatory requirements

b. ___Identification of activities required to meet environmental conditions

c. ___Economic analysis and decision regarding activities where remove/salvage andabandon in place alternatives are available.

4.1 Appurtenances Removal/Modifications

a. ___Valve Assemblies, Line Heaters, Drip Pots
b. ___Cathodic Protection Facilities
c. ___Warning Signs, Aerial Markers, Fence Posts
d. ___Access Roads, Bridges, Culverts
e. ___Fences, Power lines, Antennas, Buildings
f. ___Aerial Crossings
g. ___Slope Monitoring Equipment
h. ___Sumps and Tanks
i. ___Any facility/equipment buried less that 1 m deep

4.2 Crossings

a. ___Review of appropriate measures to prevent settlement/collapse and/or disturbance
b. ___Liaison with Crossed Facility Operator
c. ___Road, Highway Crossings
d. ___Railway Crossings
e. ___Water Crossings (Minor, River, Lake, Swamp)
f. ___Foreign Pipeline Crossings
g. ___Utility Crossings
h. ___Drainage Crossings

4.3 Environmental Protection/Reclamation Activities

a. ___Remediation of Historical Spill Sites
b. ___Gravel Removal, Topsoil Replacement at sites
c. ___Topsoil conservation
d. ___Surface Stone Removal
e. ___Erosion control, Ditch Plugs, Slope/Soil Stabilization
f. ___Revegetation
g. ___Weed Control
h. ___Reforestation (if required)
i. ___Access Road Reclamation
j. ___Timing windows
k. ___Fish and Wildlife Habitat

4.4 Pipe Removal

a. ___Right-of-Way Boundary and Pipe Location Survey
b. ___Access Development
c. ___Grading
d. ___Trenching
e. ___Coating removal if required (precautions if asbestos containing)
f. ___Pipe cutting and removal
g. ___Pipe loading, transportation, storage
h. ___Backfill/Compaction
i. ___Clean-up

4.5 Salvage Analysis

a. ___Sale of pipe for structural or piling applications
b. ___Sale of pipe, valves, fittings for remelting scrap
c. ___Sale or reuse of valves, pipe fittings
d. ___Sale of fencing and other minor materials
e. ___Sale of Land and/or Land Rights

4.6 Pipe Abandoned In Place

a. ___ Filling to eliminate settlement/collapse risks
b. ___Pipe cuts or pipeline plugs for groundwater stability
c. ___Soil conservation/stability measures at excavation sites
d. ___Measures to prevent floating pipe
e. ___Slopes, erosion control

5.0

Monitoring/Maintenance Activities

a. ___Aerial Patrol
b. ___Specific site visits
c. ___Weed Monitoring/Control
d. ___Liaison with landowners, tenants, public land managers
e. ___"First-Call" response and location of underground pipe
f. ___ Crossings
g. ___Erosion Control Maintenance

Appendix C - Industry Questionnaire

ABANDONMENT INFORMATION

Refer to the following two pages for a copy of the abandonment questionnaire that was used for the industry survey conducted in autumn 1995.

Background Information

Owner/Operator: _____

Name of Pipeline: _____ Construction date: _____

Location (Legal Description) From: _____ To: _____

Length: _____ Outside Diameter: _____ Wall Thickness: _____ Grade: _____

Substance(s) transported : _____

Coating Type: External: _____ Internal: _____

Cathodic protection during operation: Impressed Current: _____ Anodes : _____

Depth of Pipe Burial: _____

Was the pipeline constructed through wet areas: Yes: _____ No: _____

Are you aware of any adverse soil conditions (i.e. salinic, acidic): Yes: _____ No: _____

If Yes, What Types:
_____

Did the pipeline have any crossings (i.e. road, railway, water): Yes: _____ No: _____

If Yes, What Types:
_____

Abandonment

Abandonment date: _____

Reason(s) for Abandonment: _____

Pipe Condition at Abandonment:

External Corrosion: None _____ Some _____ Significant _____
Internal Corrosion: None _____ Some _____ Significant _____

Abandonment Activity:

When answering the items below, please note whether the answer refers to the entire pipeline or to specific parts of the pipeline.

Cleaning Procedure: _____

Cleanliness Criteria: _____

Capping (Weld Caps): Yes: _____ No: _____

If Yes: Frequency: _____

Number of Pipe Segments: _____

Filling (i.e. N_2, Concrete, Grout, etc.): Yes: _____ No: _____

If Yes: Fill Type: _____

Road/Railway Crossings: Yes: _____ No: _____

If Yes: How was Pipe Abandoned: _____

Water Crossings: Yes: _____ No: _____

If Yes: How was Pipe Abandoned: _____

Slopes: Yes: _____ No: _____

If Yes: How was Pipe Abandoned: _____

Plugging: Yes: _____ No: _____

If Yes: How was Pipe Abandoned: _____

Cathodic Protection: Retained: _____ Not Retained: _____

Monitoring After Abandonment

Type of monitoring: _____

Frequency of Monitoring: _____

Summary of Monitoring Findings: _____
_____

Has an abandonment study ever been done on the pipeline to determine the effectiveness of the abandonment? _____
_____

Are alignment sheets and drawings available to help identify potential dig sites?
Yes: _____ No: _____

Since abandonment, are you aware of any:

a) Surface settlement over the pipe? Yes: _____ No: _____

If Yes, please provide details: _____

b) Water flow through the pipe? Yes: _____ No: _____

If Yes, please provide details: _____

c) Pipe exposure? Yes: _____ No: _____

If Yes, please provide details: _____

d) Environmental contamination? Yes: _____ No: _____

If Yes, please provide details: _____

e) Any other problems? Yes: _____ No: _____

If Yes, please provide details: _____

Have any additional abandonment measures been completed since the initial abandonment? Yes: _____ No: _____

If Yes, please provide details: _____
_____

Other Comments: _____
_____
_____
_____

Is your company planning any type of excavation on or near this abandoned pipeline this summer? Yes: _____ No: _____

If Yes, please provide details: _____
_____

For further information contact :

Name: _____
Title: _____
Tel.: _____ Fax: _____

Appendix D - Cleaning Guidelines

D.1 General Considerations

The operating history of the pipeline to be abandoned should be reviewed to enable the planning of the specific cleaning procedures required for abandonment. Information such as oil/gas analysis, piping modifications, operating flow records, records of anomalies, and maintenance records may provide some insight into additional work needed to develop an effective pipeline cleaning plan.

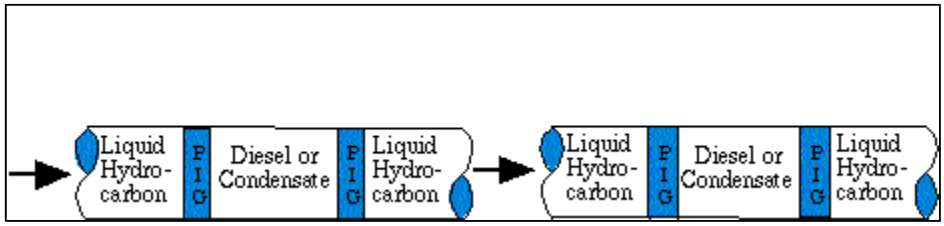
The owner/operator should ensure that there are adequate sending and receiving traps in place. This may require the use of temporary assemblies. If the pipeline in question is part of a larger system, the section to be abandoned should be physically disconnected upon completion of the cleaning process.

Safety precautions appropriate to the in-service product hazards (i.e. flammability and explosivity of hydrocarbons, toxicity of sour products) must be established throughout the activity.

For gas pipelines, any residual gas should be vented or flared once the pressure in the pipeline has been reduced to the extent possible using operating facilities or a pull down compressor. The residual gas should be monitored for signs of liquid.

For liquid pipelines, before line flow ceases, a sufficient number of scraper pigs should be run through the line to remove the bulk of any solids or waxy build-up. As illustrated by the figure below, a batch of solvent-type hydrocarbons such as diesel fuel or condensate inserted between two scraper pigs is recommended as an effective method of reducing solids or waxy build-up. This process should be repeated until solids can no longer be detected on the pigs as they are removed from the receiving trap.

Figure D-1
In-Service Initial Cleaning for Liquid Pipelines



Specialized chemical cleaning may be required if the routine cleaning method described is not successful, if the pipeline is known to have an unusually high contamination level, or if unusually high cleanliness standards are to be met. Special precautions must be exercised when the pipeline is opened up to control vapour hazards of flammability, explosiveness, and toxicity (e.g. hazardous compounds such as benzene).

D.2 Cleaning Methods for Natural Gas Pipelines

A stiff rubber scraping pig should be pushed through the pipeline (at a constant speed consistent with the pig manufacturer's recommendation) using nitrogen or some other inert gas to prevent explosive mixtures. Free liquids pushed ahead of the pig may be either pushed into the downstream pipeline section or collected in a containment tank designed and isolated according to prevailing local guidelines, for disposal in accordance with area legislation or local by-laws. This process should be repeated until free liquids are no longer evident by visual inspection. Low areas of the pipeline should be checked for the collection of liquids or other contaminants.

After these initial pigging runs, the pipeline should be checked for cleanliness. If contamination is evident, the pigging procedure should be repeated using a slug of solvent between two pigs. As with the free liquids, the solvent should be collected in a containment tank and disposed of in accordance with area legislation or local by-laws. Solvent fumes should be purged with nitrogen or a similar inert gas.

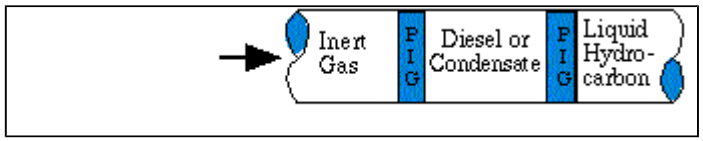
D.3 Cleaning Methods for Liquid Pipelines

Following completion of the initial in-service cleaning efforts, a final cleaning step should be done in conjunction with line evacuation. The following procedure is commonly used, although many variations exist which should be considered. Consultants specializing in the cleaning of contaminated facilities can advise and provide plans for both normal and unusual circumstances.

A slug of liquid hydrocarbons having solvent properties such as condensate or diesel fuel is pushed through the pipeline between two stiff rubber scraper pigs at a constant speed by an inert gas such as nitrogen. Other additives or treatment chemicals may be added if desired. As a rule of thumb, the volume should be calculated to maintain a minimum pipe wall contact time by the fluid ranging from five to ten minutes (or longer), depending on the effectiveness of the initial in-service cleaning process.

For lines having encrusted or high paraffin build-up, an additional volume of solvent preceding the first pig can be considered. All contact times should be increased for excessive lengths of line as the solvent may become saturated with hydrocarbons before completion of the run. The following diagram illustrates the pipeline sequence of movement. At the endpoint, the solvent and hydrocarbons are pushed into another section of pipeline or collected in a containment tank for disposal.

Figure D-2 - Final Cleaning and Evaluation for Liquid Pipelines



A repeat run of the pig train described above should be conducted if there are any indications of liquids or contaminants remaining on the pipe wall in excess of the established cleanliness criteria. The effectiveness of the cleaning process can be gauged by either obtaining samples of the solvent near the tail end of the passing batch, at approximate 25 km intervals, and analyzing the samples for hydrocarbon content, or by monitoring the quality and quantity of the solvent hydrocarbons expelled from the line and comparing it with that injected.

Appendix E - Bibliography

The documents that were used in the preparation of this discussion paper are listed below. Copies of the studies that were commissioned by the Pipeline Abandonment Steering Committee are available from the Canadian Association of Petroleum Producers, the Canadian Energy Pipeline Association, the Alberta Energy and Utilities Board, and the National Energy Board.

Studies Commissioned by the Pipeline Abandonment Steering Committee

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Correspondence with Abandonment Committees

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Date Modified: 2009-07-10

ATTACHMENT D

File: ADV-PE-LandMC 03

NATIONAL ENERGY BOARD

LAND MATTERS CONSULTATION INITIATIVE – STREAM 3

ENBRIDGE PIPELINES INC.
APPLICATION
FOR
APPROVAL OF ABANDONMENT COSTS – PRELIMINARY ESTIMATE

NOVEMBER 29, 2011

INTRODUCTION AND RELIEF REQUESTED

1. Enbridge Pipelines Inc. ("Enbridge") makes this Application pursuant to the National Energy Board ("Board" or "NEB") RH-2-2008 Reasons for Decision dated May 26, 2009.

2. Enbridge hereby requests approval of the estimated cost of the future abandonment of its facilities as provided in this Application.

BACKGROUND

3. In its RH-2-2008 Reasons for Decision, the Board set out a timeline for the Land Matters Consultation Initiative ("LMCI") Stream 3 process. An Action Plan was presented, which included deadlines for various submissions. On March 7, 2011, the NEB issued a letter stating that in order to allow additional time for consultation, the deadline for Group 1 physical plans (not for approval) remained at May 31, 2011, but the deadline for the cost estimates and updates to physical plans was changed to November 30, 2011. The deadline to submit the filings of proposed collection and set aside mechanisms remains as November 30, 2012.

4. Enbridge filed its physical plans for abandonment with the NEB on May 25, 2011. With one exception, those plans served as the basis for determining the preliminary estimates of abandonment costs for which Enbridge seeks approval by the Board in this Application. At the time that the Enbridge physical plans for abandonment were filed, it was understood that sections of Line 1 and Line 13 deactivated pipeline had been transferred to the Enbridge Southern Lights Pipeline. In fact, those facilities remain as part of the Enbridge pipeline system. Enbridge has therefore amended the description of deactivated lines, as found in paragraph 8 below, and is filing as Appendix A to this Application, revisions to its May 25, 2011 filing as follows: revised Tables 2a, 2b and 2c and a Revised Appendix C (Stantec Report entitled "Land Matters Consultation

Initiative"). This resulted in a slight change to the percentage of total pipeline length respecting abandonment methods as follows:

- 90.7% - abandonment in place;
- 8.7% - abandonment in place with special treatment; and
- 0.6% - removal.

The estimated future abandonment costs included in this Application have been determined based on the revised abandonment physical plans.

5. Enbridge remains committed to basing any decision that it will make regarding the actual method of abandonment – including removal versus abandonment in place – on the most current sound scientific studies and accepted industry practice at the time such abandonment is contemplated.

ENBRIDGE PIPELINES

6. The Enbridge pipeline system and the Lakehead System in the United States together transport liquid petroleum eastbound for delivery primarily to markets in the U.S. Midwest and in Ontario. Appendix B to this Application is a map illustrating the routes of the Enbridge pipeline system and the Lakehead System.

7. The Enbridge pipeline system includes:

- Lines 1, 2, 3 and 4 (all originating in Edmonton, Alberta), Line 67 (Alberta Clipper, originating in Hardisty, Alberta), and Line 65 (LSr Pipeline – Light Sour Capacity Replacement, originating in Cromer, Manitoba). All of these lines extend to the Canada/U.S. border near Gretna, Manitoba where they connect with the Lakehead System.
- The Canadian sections of Line 5 and Line 6B extend from connections with the Lakehead System on the Canada/U.S. border under the St. Clair River to Sarnia, Ontario.

- Line 7 extends from Sarnia to Westover (Hamilton), Ontario where it connects with Line 10 and Line 11. These two pipelines in turn extend from Westover to, respectively, the Canada/U.S. border under the Niagara River near Chippawa, Ontario and to Nanticoke, Ontario on the north shore of Lake Erie.
- Line 8 extends from Sarnia to Millgrove Junction in Hamilton, Ontario.
- Line 9 extends from Montreal, Quebec to Westover, Sarnia and Corunna, Ontario.
- The Shell lateral and Suncor lateral extend from takeoff points on Enbridge Lines 5, 6B and 9 to the associated refineries in Sarnia, Ontario.

8. In addition to its active pipelines, Enbridge has a number of deactivated pipeline segments and terminals, all of which are included in the overall scope of the physical plans for abandonment that form the basis of the cost estimates reflected in this Application. These include:

- Line 1– Ten sections of medium diameter pipe located in Alberta, Saskatchewan and Manitoba (totaling 25.1 kilometres) as per Board Order XO-E101-12-2002;
- Line 7 – Westover Junction, Hamilton, Ontario to Bronte Junction, Oakville, Ontario as per Board Order MO-11-2006;
- Line 8 – Millgrove Junction, Hamilton, Ontario to Bronte Junction, Oakville, Ontario as per Board Order MO-J1-24-95;
- Line 12 and Bronte Lateral - Bronte Terminal, Oakville, Ontario to Clarkson Terminal, Oakville, Ontario as per Board Order MO-11-2006;
- Line 13 – One section of medium diameter pipe located in Manitoba (totaling approximately 72 kilometres);
- Line 22 – Ninth Line Junction, Mississauga, Ontario to Clarkson Terminal, Oakville, Ontario as per Board Order MO-11-2006; and

- 20" (508 mm) mainline pipe lying between Clarkson Terminal, Oakville, Ontario and Port Credit, Oakville, Ontario as per Board approval D1793-J1-20.

STAKEHOLDER CONSULTATION

9. Consultation with stakeholders (i.e., landowners, landowner associations, government representatives and shippers) preceded preparation of this Application. Enbridge considers such consultation to be important and it will continue in the future. More particularly, in-depth consultation with stakeholders will be conducted when an application for abandonment of a pipeline facility is being prepared.

10. Enbridge conducted two workshops for landowners, landowner associations and government representatives. The first workshop occurred in Edmonton on July 13 and 14, 2011. Moving Forward Limited prepared a report of the workshop; a copy of the report, along with the workshop presentation, is attached as Appendix C to this Application. The second workshop was conducted in Montreal on September 20 and 21, 2011. A report of the workshop was prepared by Groupe CETU Inc. and a copy of the report (in both official languages, although the workshop was conducted primarily in French), along with the workshop presentation, comprise Appendix D to this Application.

11. The results of the workshops were considered by Enbridge in developing the preliminary cost estimates that are discussed below. For example, as explained in paragraphs 23 through 25**,** the cost assumptions related to the provision for post-abandonment activities reflect landowner input received through the workshops.

12. In addition, the Canadian Energy Pipeline Association ("CEPA"), through its consultant The Praxis Group ("Praxis"), conducted a landowner survey on behalf of CEPA member companies in 2011. Praxis has prepared a summary of the results of the CEPA survey as they pertain to pipeline abandonment. Praxis also provided a summary of Enbridge-specific results. The survey summaries are provided in Appendix E to this Application.

13. Finally, Enbridge hosted a shipper consultation session on November 10, 2011. A copy of the invitation to shippers, a list of attendees, the presentation that was made at the session, and a summary of questions and answers are attached as Appendix F.

PRELIMINARY COST ESTIMATES

14. For the purposes of this Application, Enbridge has adopted the definition of "abandonment" that appears in the Glossary of the NEB Discussion Paper for LMCI – Stream 3, i.e., "to permanently cease operation such that the cessation results in the discontinuance of service".

15. With two exceptions, the preliminary cost estimates included in this Application were prepared utilizing the assumptions and methods set out in Appendix A to the Board's March 4, 2010 letter[1]. The 80/20 abandon in place/removal assumption was not applied. Instead, the cost estimates provided in this Application are based on the physical abandonment plans that were set out in the Enbridge Pipelines Inc. Abandonment Physical Plans submission that was filed with the NEB on May 25, 2011, as amended in this filing. Further, for applicable cost categories, the cost estimates have been determined on a diameter-inch basis. The diameter-inch method was selected because, in Enbridge's view, it yields more accurate cost estimates within a pipe size category – an important factor given the range of pipe sizes within the Enbridge pipeline system. For example, within the large diameter category established by the Board of greater than 26" (660.4 mm), Enbridge has four pipe sizes: 30" (762 mm), 34" (863.6 mm), 36" (914.4 mm) and 48" (1219.2 mm).

16. Table A-3 from the RH-2-2008 Decision incorporating Enbridge's pipeline specific unit costs for each category of pipeline abandonment activities is provided in Appendix G. Each category of abandonment activity is discussed further below.

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[1] Table A-3 as modified by the Board's December 21, 2010 letter.

Cost Estimation Assumptions and Methods by Activity Category

17. A discussion of the methods and assumptions utilized by Enbridge in estimating the costs of each category of abandonment activity and explanations of any departures from the Board's Base Case assumptions and cost ranges follows.

Category 1 – Engineering and Project Management

18. Enbridge has utilized the NEB Base Case assumptions.

Category 2a and 2b – Abandonment Preparation

19. Enbridge has utilized the NEB Base Case scope and developed Enbridge-specific cost estimates based on the pipeline terrain (flat) and product shipped (liquid hydrocarbons). The Enbridge estimate is presented as cost per diameter-inch-kilometre. Given that Enbridge's system is primarily comprised of 36" and 48" pipe, the unit cost factors for this category are at the high end, or above the high end, of the NEB Base Case range.

20. The Cleaning Guidelines found in an appendix to the CEPA document entitled "Technical and Environmental Consideration for Development of Pipeline Abandonment Strategies, September 2006 – April 2007" provided detail for the scope of work.[2] The Guidelines are consistent with the NEB Base Case scope.

21. Nitrogen pipeline purge cost estimates were obtained from a third party supplier, Trican Well Service Ltd., on a dollar per diameter-inch-kilometre basis. A bottom-up cost estimate was produced using standard estimating practices for the remaining scope items on a dollar per diameter-inch-kilometre basis.

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[2] A copy of the CEPA document was filed as Appendix D to the Enbridge May 25, 2011 submission.

Category 3a – Basic Pipeline Abandonment in Place

22. The activities in this category, as described by the Board, are intended to segment a pipeline to prevent water movement. Categories 4 and 6 include segmentation activities and related costs. The installation of plugs at valve sites, the majority of special treatment locations, and stations results in an average pipeline segmentation of 2.5 kilometres. Enbridge is of the view that this general spacing assumption is reasonable for preliminary cost estimation purposes. Therefore, no further costs for this category have been included. Final pipeline segmentation decisions will be determined at the time of actual abandonment and will be based on the results of site specific risk assessments.

Category 3b – Provision for Post-Abandonment Activities

23. Enbridge's stakeholder workshops reinforced for Enbridge the importance to landowners and others of post-abandonment activities. Landowners emphasized a multi-generational view towards land stewardship as well as the need for both long-term monitoring of facilities that are abandoned in place and a corresponding ability to address any issues that may arise in the future.

24. In response to the input received during the workshops, Enbridge estimated costs for activities in this category on the basis of the NEB method. However, the Enbridge unit cost factor for removal as determined in Category 5a was substituted for the NEB Base Case unit cost factor for removal.

25. The cost estimates contemplate periodic monitoring and reflect contingencies such as future removal or contamination clean-up. Enbridge has implemented programs for the detection, remediation and restoration of hydrocarbon contamination. These programs will reduce the potential for residual contamination clean-up requirements during the post-abandonment phase.

Category 4 – Special Treatment

26. The Enbridge estimate is presented as cost per diameter-crossing. The unit cost factors range from below the low end to the low end of the NEB Base Case range. Enbridge has utilized the low end of the cost factor range provided for road, rail and utility crossings. This is consistent with the Board's direction in Table A-3, dated December 21, 2010. While the Board provided a range of costs for small to large diameter pipelines the differences are less material for this activity category than for some others, therefore Enbridge's costs are closer to the costs set out by the Board for small diameter pipelines.

27. The following general process was used to estimate unit costs for this activity category:

    (1) A bottom-up estimate was developed using a combination of Enbridge historical dig program costs and Enbridge's proprietary Dig Estimating Tool[3].

    (2) A typical crossing scope was developed, consisting of a 50 metre average length and 10 metre bell hole for working space and line access on each side of the crossing.

    (3) 20" and 36" pipes were used to develop a cost per diameter-inch factor.

    (4) The costs were developed for each of a cut and cap scenario and a cut, cap, and fill scenario.

28. In order to determine the number of crossings requiring fill and the number of crossings not requiring fill, the following process was used:

    A. Road Crossings:

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[3] The Tool, which has been consistently treated as confidential information by Enbridge, has been developed over time, capturing the company's knowledge, experience and confidential economic data. As a result, the Tool is proprietary. Disclosure of the Tool could reasonably be expected to result in a material loss to Enbridge or prejudice Enbridge's competitive position.

1. Standard Road Crossing (2-lane gravel, dirt, alley) – the cost estimate assumes that 25% of standard road crossings will be cut, capped and filled. The 25% factor was determined as follows:

    a. Sample portions of the right of way along the Enbridge pipeline system in the provinces of Alberta, Saskatchewan, Manitoba, Ontario and Quebec were analyzed.

    b. A total count of standard crossings was determined for the sample sections.

    c. Each crossing was reviewed to determine whether synergies exist with other crossings (such as railway or water crossings), valve sites, or stations. It was determined that 50% of the standard crossings have such synergies.

    d. A review was completed of the remaining 50% of the crossings to determine the probability and the consequence of a remediation event occurring. Enbridge considered such factors as thicker wall pipe, mechanical protection and roadway use.

    From this information, it was determined that 50% of the remaining standard crossings would be candidates for the cut, cap and fill method.

    As a result, a 25% factor (50% from d of the 50% in c) was applied to the total number of standard crossings for each line.

2. Highway (paved 2 or 4 lane) road crossing – all highway road crossings cut, capped and filled.

B. Railway Crossings – all railway crossings cut, capped and filled.

C. River and Creek Crossings – all cut and capped with no fill.

D. Utility Crossings – all utility crossings are assumed to be located within the road allowance right of way and are accounted for in the crossings discussed above.

E. Environmentally Sensitive Areas – no additional costs have been included for crossing environmentally sensitive areas. Pipeline segmentation is planned for valve sites, crossings as discussed above, and stations. Enbridge is of the view that this general spacing assumption is reasonable for preliminary cost estimation purposes. Therefore, no further costs for this category have been included. Final pipeline segmentation decisions will be determined at the time of actual abandonment and will be based on the results of site specific risk assessments.

29. In order to validate the assumptions developed for Standard Road Crossings, Enbridge surveyed the entire Vector pipeline. The survey confirmed that cutting, capping and filling would be required to abandon the pipeline at approximately 25% of the standard road crossings.

30. Table 1 below provides the estimated number of crossings that will require fill and the estimated number of crossings that will not require fill.

Table 1: Special Treatment Summary – Category 4

(Number of Crossings)

Line	1	1 (D)	2	3	4	5	6B	7	7 (DS)	8	8 (DS)	9 (20")	9 (30")	10 (12")	10 (20")	11	12	L13 (D)	22	65	67
Standard Crossings (Total)	1065	21	1065	1065	1065	27	28	98	16	84	6	27	304	5	9	14	84	61	4	237	797
Standard Crossings (25%)	266	5	266	266	266	7	7	25	4	21	1	7	76	1	2	4	21	15	1	59	199
Highway Crossings	85	2	85	85	85	0	0	1	0	1	0	0	2	1	0	1	1	5	0	15	81
Railway Crossings	43	1	43	43	43	0	0	12	2	11	1	0	16	0	1	1	11	2	1	5	22
Total with Fill	394	8	394	394	394	7	7	38	6	33	2	7	94	2	3	6	33	23	2	79	302
River Crossings	6	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	7
Creek Crossings	31	1	31	31	31	1	1	1	0	1	0	1	4	0	0	0	1	2	0	21	44
Total without Fill	37	1	37	37	37	1	1	1	0	1	0	1	4	0	0	0	1	2	0	24	51
Note: Zero special treatment areas for the Suncor Lateral, Shell Lateral and Clarkson to Port Credit pipeline																					
Note: DS means Deactivated Section and D means Deactivated																					

Category 5a – Pipeline Removal (Pipeline Removal and Backfilling)

31. The Enbridge estimate is presented as cost per diameter-kilometre. Enbridge's unit cost factors are below the NEB Base Case range. The general process followed for estimating pipeline removal costs was as follows:

(1) Actual construction cost data was obtained from the Enbridge Line 67 (Alberta Clipper) project (2008 to 2010 construction). The Line 67 (Alberta Clipper) project scope consisted of the installation of a 36" pipeline from Hardisty, Alberta to Superior, Wisconsin largely within the existing Enbridge right of way.

A second estimate from Enbridge's proprietary Cost Estimating Tool[4] was developed in order to validate the Line 67 (Alberta Clipper) project data. New construction costs were developed from the bottom-up in the Cost Estimating Tool.

(2) Scope items not applicable to pipeline removal or items that were captured elsewhere within Table A-3 were removed from both the (Line 67) Alberta Clipper actual costs and the Cost Estimating Tool results. Line pipe and welding are two of the significant examples of such excluded costs.

(3) Items that are either smaller in scope, such as tree removal and mobilization/demobilization, or less demanding, such as material handling, were assumed to be 50% of such costs for construction due to the removal nature of the activity in the abandonment context.

(4) Items that are similar in nature regardless of removal or installation, such as grading and top soil management, were assumed to be 100% of such costs for construction.

(5) The average of the resulting per kilometre cost estimates (from the Line 67 (Alberta Clipper) project and the Enbridge Cost Estimating Tool)) was used as the Enbridge pipeline removal unit cost factor.

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[4] The Tool, which has been consistently treated as confidential information by Enbridge, has been developed over time, capturing the company's knowledge, experience and confidential economic data. As a result, the Tool is proprietary. Disclosure of the Tool could reasonably be expected to result in a material loss to Enbridge or prejudice Enbridge's competitive position.

In addition, a synergy factor of 85% of the unit cost factor for removal was applied to all pipes after the first pipe within the same right of way. This factor was determined by removing the mobilization/demobilization, right of way clearing and right of way access scope from the removal estimate of the second pipe as these tasks are only required to be completed once. The Enbridge factor of 85% differs from the NEB Base Case factor of 25% because multiple trenches would be required for removal of Enbridge facilities as each Enbridge pipe is physically separated from the other. A summary of the application of the synergy factor (by Enbridge pipe line number) is provided in Table 2 below.

Table 2: Synergy Summary – Category 5a

First Pipe (Line)	Synergy Pipe (Line)
1	1 (D), 2, 3, 4, 13(D), 65, 67
5	6B, 9 (20")
9 (30")	7, 8

32. Enbridge's experience suggests that the estimates provided in the Board's Base Case for pipeline removal and backfilling are more reflective of the cost of constructing a pipeline than its abandonment. As explained above, for the purposes of preparing the cost estimates provided in this Application, Enbridge has removed or reduced elements that are unique to construction activities. Although the resulting cost estimates are below the Board's Base Case range, Enbridge is of the view that the rigor used to establish its cost estimates justifies the departure from the Board's cost range.

Category 5b – Pipeline Removal (Land Restoration)

33. The unit cost to restore the terrain once removal activities are completed is included in the Category 5a estimate. Further, the Enbridge system does not traverse rough or mountainous terrain; hence no costs for this Category were included.

Category 6 – Above Ground Facilities

34. The Board's Base Case provided unit cost estimates for block valve assemblies, meter stations and pump stations. Enbridge's unit cost estimate for block valve assemblies –

developed through the processes discussed in paragraph 38 below – is higher than the Board's Base Case range. The Enbridge cost estimate for meter station abandonment is at the mid-point of the Board's Base Case range and the cost estimate for pump station abandonment is at the low end of the Board's Base Case range. Since the Board did not provide a method for determining pump station abandonment costs, Enbridge has derived cost estimates on a dollar per horsepower basis, taking into account the factors specified by the Board. In Enbridge's view, horsepower is a better indicator of the costs of abandoning pump stations than is the number of pump stations. This is consistent with the Board's notes in Table A-3 regarding abandonment of compressor stations.

Historical Removal Costs

35. The first source of Enbridge data used to estimate this category was historical removal costs. Enbridge performs numerous maintenance replacement projects each year and as a result, has collected cost data for three of the activities identified within this category. The historical cost data was retrieved from the Enbridge financial system and escalated to 2011 dollars for the following items:

- Electrical Buildings;
- Maintenance Buildings; and
- Sump Tanks.

Cost Estimating Tool

36. In the case of activities for which historical cost data was not available, the Enbridge proprietary Cost Estimating Tool was applied according to the following general process:

(1) New construction costs were developed from the bottom-up in the Cost Estimating Tool.

(2) Scope items not applicable to pipeline removal or items that were captured elsewhere within Table A-3 were removed from the Cost Estimating Tool results.

Structural steel and valves are two of the significant examples of such excluded costs.

(3) Items that are either smaller in scope, such as mobilization/demobilization, or less demanding, such as material handling, were assumed to be 50% of such costs for construction due to the removal nature of the activity in the abandonment context.

(4) Items that are similar in nature regardless of removal or installation, such as grading, were assumed to be 100% of such costs for construction.

(5) In order to determine unit costs for various sizes of equipment, steps 1 to 4 were repeated for different sizes of equipment and the results were plotted as a scatter diagram.

(6) A linear trend line was applied to the scatter diagram in order to determine a cost factor for the facilities to be abandoned.

37. The Enbridge Cost Estimating Tool and the process described above were utilized for the following items:

- Above Ground Tanks;
- Booster Pump Stations;
- Meter Manifolds;
- Valve Manifolds; and
- Pump Stations.

Bottom-up Estimate

38. The Enbridge Cost Estimating Tool was not designed to provide estimates for certain facilities. For such items, and if historical cost data was not available, a bottom-up cost estimate was produced using standard estimating practices. This approach was used to estimate the costs of abandoning the following facilities:

- Mainline Valve (Remote Control);
- Mainline Valve (Manual Control);
- Mainline Instrumentation Building; and
- Pig Trap Assembly.

Category 7 – Contingency

39. Although the Board's Base Case contemplated a contingency of 25%, details of the derivation of that contingency factor were not provided. Therefore, Enbridge applied its proprietary Systemic Contingency Estimating Tool[5] to determine a contingency amount for its abandonment cost estimates. A 13% contingency, with a 50% probability of under-run or over-run, resulted.

40. Enbridge considers that applying the Enbridge Systemic Contingency Estimating Tool is appropriate and reasonable given the consistency in Enbridge's approach between construction and abandonment. In particular, activities such as general scoping, planning, engineering and construction are similar in nature in both the construction and abandonment contexts. Enbridge's substantial experience in estimating and executing projects confirms that 13% with P50 is a reasonable and appropriate contingency and confidence range for the purposes of this Application.

Cost Estimate Summary

41. Enbridge estimates the overall cost for the future abandonment of its facilities to be $779.7 million ($2011). Table 3 provides a summary of estimated costs by NEB Cost Category.

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[5] The Tool, which has been consistently treated as confidential information by Enbridge, has been developed over time, capturing the company's knowledge, experience and confidential economic data. As a result, the Tool is proprietary. Disclosure of the Tool could reasonably be expected to result in a material loss to Enbridge or prejudice Enbridge's competitive position.

Table 3: Total Cost Estimates by NEB Cost Category

	NEB Cost Category	Cost Estimate
1	**Engineering and Project Management**	**$ 21,298,906**
2	**Abandonment Preparation**	
a	Land Access and Cleanup	
b	Pipeline Purging and Cleaning	$ 115,647,880
3	**Pipeline Abandonment-in-Place**	
a	Basic Pipeline Abandonment-in-Place	$ -
b	Provision for Post Abandonment Activities	$ 284,301,969
4	**Special Treatment**	
a	With Fill	$ 86,612,350
b	Without Fill	$ 6,900,011
5	**Pipeline Removal and Backfilling**	
a	Pipeline Removal and Backfilling	$ 9,222,309
b	Pipeline Removal - Land Restoration	$ -
6	**Above-Ground Facilities**	
a	Meter Manifolds	$ 9,954,000
b	Valve Manifolds	$ 7,300,000
c	Electrical Buildings	$ 11,020,000
d	Maintenance Buildings	$ 9,000,000
e	Above Grade Tanks	$ 53,963,000
f	Booster Pump Stations	$ 10,712,000
g	Below Grade Sump Tank	$ 754,000
h	Mainline Valve (Remote Control)	$ 25,844,000
i	Mainline Valve (Manual Control)	$ 15,624,000
j	Mainline Instrumentation Building	$ 3,268,000
k	Pig Trap Assembly	$ 9,328,000
h	Pump Station	$ 44,377,200
7	**Contingency**	$ 54,538,478
	Total Preliminary Cost Estimate	**$ 779,666,104**

42. The tables in Appendix H provide a breakdown, by line and terminal, of the costs shown in Table 3 above using the format set out in the Board's Table A-4. The pipe size for each line is indicated in each table along with the average cost for the line.

COLLECTION PROCESSES AND SET-ASIDE MECHANISM

43. Subject to any further directions by the Board, Enbridge will file the collection and set-aside mechanism application on or before November 30, 2012. If any updates to either the physical abandonment plans or the preliminary cost estimates should be required, they will be included in that filing.

CONCLUSION

44. Enbridge submits that the cost estimates provided in this Application were established on the basis of careful, reasonable, and appropriate assumptions and analysis. Enbridge respectfully requests approval of its cost estimates as filed.

Appendix H
Enbridge Pipelines Inc.
NEB Table A-4
By Pipeline Diameter Category (by Line) and By Terminal

1. Pipeline Diameter Category (Small)
    - Table 1 – Cost Estimate - Line 10 (12")

2. Pipeline Diameter Category (Medium)
    - Table 2 – Cost Estimate - Line 1
    - Table 3 - Cost Estimate – Line 1 (Deactivated)
    - Table 4 – Cost Estimate - Line 2
    - Table 5 - Cost Estimate – Line 7
    - Table 6 – Cost Estimate – Line 7 (Deactivated Section)
    - Table 7 – Cost Estimate – Line 8
    - Table 8 – Cost Estimate – Line 8 (Deactivated Section)
    - Table 9 – Cost Estimate – Line 9 (20”)
    - Table 10 - Cost Estimate – Line 10 (20”)
    - Table 11 – Cost Estimate – Line 11
    - Table 12 – Cost Estimate – Line 12 (Deactivated)
    - Table 13 – Cost Estimate – Line 13 (Deactivated)
    - Table 14 – Cost Estimate – Line 22 (Deactivated)
    - Table 15 – Cost Estimate – Line 65
    - Table 16 – Cost Estimate – Suncor Lateral
    - Table 17 – Cost Estimate – Clarkson to Port Credit Lateral

3. Pipeline Diameter Category (Large)
    - Table 18 – Cost Estimate - Line 3
    - Table 19 – Cost Estimate – Line 4
    - Table 20 – Cost Estimate – Line 5
    - Table 21 – Cost Estimate – Line 6B
    - Table 22 – Cost Estimate – Line 9 (30”)
    - Table 23 – Cost Estimate – Line 67
    - Table 24 – Cost Estimate - Shell Lateral

4. Table 25 - Table A-4 by Terminal

Table 1 - Cost Estimate – Line 10 (12")

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (12")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 69,497
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	34	$ 6,000	$ 201,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	34	$ 16,400	$ 563,604
4	Special Treatment					
a	With Fill	A+	n/a	2	$ 15,972	$ 35,937
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	6	$ 71,000	$ 426,000
i	Mainline Valve (Manual)	n/a	R	3	$ 56,000	$ 168,000
j	Mainline Instrument Building	n/a	R	2	$ 76,000	$ 152,000
k	Pig Trap Assembly	n/a	R	2	$ 88,000	$ 176,000
h	Pump Station (2 Stations)	n/a	R	5500	$ 42	$ 231,000
7	Contingency	A	R	n/a	13%	$ 180,692
	Total Cost Estimate - Line 10 (12")					***$ 2,203,730***

Table 2 – Cost Estimate - Line 1

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 1,927,294
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1246	$ 10,000	$ 12,460,000
b	Pipeline Purging and Cleaning	A	R			$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a			$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1243	$ 23,533	$ 31,045,201
4	Special Treatment					
a	With Fill	A+	n/a	394	$ 26,620	$ 10,494,935
b	Without Fill	A+	n/a	37	$ 19,780	$ 731,860
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	3	$ 145,460	$ 392,742
b	Pipeline Removal - Land Restoration	n/a	R	3	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	65	$ 71,000	$ 4,615,000
i	Mainline Valve (Manual)	n/a	R	38	$ 56,000	$ 2,128,000
j	Mainline Instrument Building	n/a	R	6	$ 76,000	$ 456,000
k	Pig Trap Assembly	n/a	R	9	$ 88,000	$ 792,000
h	Pump Station (18 stations)	n/a	R	171600	$ 42	$ 7,207,200
7	Contingency	A	R	n/a	13%	$ 5,106,106
	Total Cost Estimate - Line 1					***$ 77,356,338***

Table 3 - Cost Estimate – Line 1 (Deactivated)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost**	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 22,965
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	25	$ 9,928	$ 249,200
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0		$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	25	$ 23,533	$ 626,747
4	Special Treatment					
a	With Fill	A+	n/a	8	$ 26,434	$ 210,104
b	Without Fill	A+	n/a	1	$ 19,642	$ 14,651
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 61,614
	Total Cost Estimate - Line 1 (Deactivated)					***$ 1,185,281***

*93% (23.3 km) of 20" and 7% (1.8 km) of 18"

Table 4 – Cost Estimate - Line 2

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost**	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 2,135,758
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1245	$ 12,000	$ 14,940,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0		$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1242	$ 23,533	$ 31,017,734
4	Special Treatment					
a	With Fill	A+	n/a	394	$ 31,944	$ 12,593,922
b	Without Fill	A+	n/a	37	$ 23,736	$ 878,232
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	3	$ 148,369	$ 415,434
b	Pipeline Removal - Land Restoration	n/a	R	3	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	32	$ 71,000	$ 2,272,000
i	Mainline Valve (Manual)	n/a	R	83	$ 56,000	$ 4,648,000
j	Mainline Instrument Building	n/a	R	6	$ 76,000	$ 456,000
k	Pig Trap Assembly	n/a	R	11	$ 88,000	$ 968,000
h	Pump Station (22 stations)	n/a	R	152900	$ 42	$ 6,421,800
7	Contingency	A	R	n/a	13%	$ 5,667,140
	Total Cost Estimate - Line 2					***$ 82,414,020***

*0.2% (2.5km) of 26" and 99.8% (1242.5km) of 24"

Table 5 - Cost Estimate – Line 7

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 277,514
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	194	$ 10,000	$ 1,943,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	192	$ 23,533	$ 4,784,252
4	Special Treatment					
a	With Fill	A+	n/a	38	$ 26,620	$ 998,250
b	Without Fill	A+	n/a	1	$ 19,780	$ 19,780
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	3	$ 123,641	$ 333,831
b	Pipeline Removal - Land Restoration	n/a	R	3	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	6	$ 71,000	$ 426,000
i	Mainline Valve (Manual)	n/a	R	9	$ 56,000	$ 504,000
j	Mainline Instrument Building	n/a	R	4	$ 76,000	$ 304,000
k	Pig Trap Assembly	n/a	R	2	$ 88,000	$ 176,000
h	Pump Station (3 Stations)	n/a	R	20600	$ 42	$ 865,200
7	Contingency	A	R	n/a	13%	$ 724,108
	Total Cost Estimate - Line 7					***$ 11,355,935***

Table 6 – Cost Estimate – Line 7 (Deactivated Section)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 29,886
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	31	$ 10,000	$ 311,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	31	$ 23,533	$ 776,567
4	Special Treatment					
a	With Fill	A+	n/a	6	$ 26,620	$ 159,720
b	Without Fill	A+	n/a	0	$ -	$ 3,165
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ 7,273	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	1	$ 71,000	$ 71,000
i	Mainline Valve (Manual)	n/a	R	1	$ 56,000	$ 56,000
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 78,115
	Total Cost Estimate - Line 7 (Deactivated Section)					***$ 1,485,453***

Table 7 – Cost Estimate – Line 8

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 227,560
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	210	$ 10,000	$ 2,101,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	208	$ 23,533	$ 5,186,269
4	Special Treatment					
a	With Fill	A+	n/a	33	$ 26,620	$ 878,460
b	Without Fill	A+	n/a	1	$ 19,780	$ 19,780
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	2	$ 123,641	$ 296,738
b	Pipeline Removal - Land Restoration	n/a	R	2	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	6	$ 71,000	$ 426,000
i	Mainline Valve (Manual)	n/a	R	9	$ 56,000	$ 504,000
j	Mainline Instrument Building	n/a	R	2	$ 76,000	$ 152,000
k	Pig Trap Assembly	n/a	R	1	$ 88,000	$ 88,000
h	Pump Station (1 Station)	n/a	R	2500	$ 42	$ 105,000
7	Contingency	A	R	n/a	13%	$ 594,227
	Total Cost Estimate - Line 8					***$ 10,579,035***

Table 8 – Cost Estimate – Line 8 (Deactivated Section)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 16,034
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	15	$ 10,000	$ 145,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	14	$ 23,533	$ 352,077
4	Special Treatment					
a	With Fill	A+	n/a	2	$ 26,620	$ 61,492
b	Without Fill	A+	n/a	0	$ -	$ 1,385
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ 145,460	$ 58,184
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	1	$ 56,000	$ 56,000
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 41,868
	Total Cost Estimate - Line 8 (Deactivated Section)					***$ 732,040***

Table 9 – Cost Estimate – Line 9 (20")

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 23,884
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	9	$ 10,000	$ 85,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	9	$ 23,533	$ 212,245
4	Special Treatment					
a	With Fill	A+	n/a	7	$ 26,620	$ 179,685
b	Without Fill	A+	n/a	1	$ 19,780	$ 19,780
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	3	$ 71,000	$ 213,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 64,670
	Total Cost Estimate - Line 9 (20")					***$ 798,265***

Table 10 - Cost Estimate – Line 10 (20")

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 106,326
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	73	$ 10,000	$ 732,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	73	$ 23,533	$ 1,827,804
4	Special Treatment					
a	With Fill	A+	n/a	3	$ 26,620	$ 86,515
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					$ -
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	12	$ 71,000	$ 852,000
i	Mainline Valve (Manual)	n/a	R	5	$ 56,000	$ 280,000
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	2	$ 88,000	$ 176,000
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 276,447
	Total Cost Estimate - Line 10 (20")					***$ 4,337,092***

Table 11 – Cost Estimate – Line 11

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (16")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 128,426
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	75	$ 10,000	$ 751,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	72	$ 23,533	$ 1,787,852
4	Special Treatment					
a	With Fill	A+	n/a	6	$ 26,620	$ 146,410
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	4	$ 145,460	$ 509,110
b	Pipeline Removal - Land Restoration	n/a	R	4	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	6	$ 71,000	$ 426,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	4	$ 76,000	$ 304,000
k	Pig Trap Assembly	n/a	R	3	$ 88,000	$ 264,000
h	Pump Station (1 Station)	n/a	R	4000	$ 42	$ 168,000
7	Contingency	A	R	n/a	13%	$ 333,908
	Total Cost Estimate - Line 11					***$ 4,818,706***

Table 12 – Cost Estimate – Line 12 (Deactivated)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (16")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 60,198
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	25	$ 8,000	$ 203,200
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	25	$ 23,533	$ 634,238
4	Special Treatment					
a	With Fill	A+	n/a	33	$ 21,296	$ 702,768
b	Without Fill	A+	n/a	1	$ 15,824	$ 15,824
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	1	$ 88,000	$ 88,000
h	Pump Station (1 Station)	n/a	R	5000	$ 42	$ 210,000
7	Contingency	A	R	n/a	13%	$ 158,573
	Total Cost Estimate - Line 12 (Deactivated)					***$ 2,072,801***

Table 13 – Cost Estimate – Line 13 (Deactivated)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost(16")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 62,080
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	72	$ 8,000	$ 574,400
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0		$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	72	$ 23,533	$ 1,792,846
4	Special Treatment					
a	With Fill	A+	n/a	23	$ 21,296	$ 484,200
b	Without Fill	A+	n/a	2	$ 15,824	$ 33,765
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	1	$ 71,000	$ 71,000
i	Mainline Valve (Manual)	n/a	R	2	$ 56,000	$ 112,000
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 165,798
	Total Cost Estimate - Line 13 (Deactivated)					***$ 3,296,089***

Table 14 – Cost Estimate – Line 22 (Deactivated)

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (24")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 19,614
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	14	$ 12,000	$ 164,400
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	14	$ 23,533	$ 342,089
4	Special Treatment					
a	With Fill	A+	n/a	2	$ 31,944	$ 63,888
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	1	$ 76,000	$ 76,000
k	Pig Trap Assembly	n/a	R	1	$ 88,000	$ 88,000
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 50,997
	Total Cost Estimate - Line 22 (Deactivated)					***$ 804,989***

Table 15 – Cost Estimate – Line 65

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 408,132
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	288	$ 10,000	$ 2,875,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	288	$ 23,533	$ 7,178,875
4	Special Treatment					
a	With Fill	A+	n/a	79	$ 26,620	$ 2,109,635
b	Without Fill	A+	n/a	24	$ 19,780	$ 474,720
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	24	$ 71,000	$ 1,704,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	1	$ 88,000	$ 88,000
h	Pump Station (3 Stations)	n/a	R	33000	$ 42	$ 1,386,000
7	Contingency	A	R	n/a	13%	$ 1,122,856
	Total Cost Estimate - Line 65					***$ 17,347,218***

Table 16 – Cost Estimate – Suncor Lateral

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (24")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 1,200
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	2	$ 12,000	$ 24,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	2	$ 23,533	$ 49,940
4	Special Treatment					
a	With Fill	A+	n/a	0	$ -	$ -
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 3,120
	Total Cost Estimate - Suncor Lateral					***$ 78,260***

Table 17 – Cost Estimate – Clarkson to Port Credit Lateral

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (20")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 2,650
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	5	$ 10,000	$ 53,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	5	$ 23,533	$ 132,341
4	Special Treatment					
a	With Fill	A+	n/a	0	$ -	$ -
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 6,890
	Total Cost Estimate - Clarkson to Port Credit Pipeline					***$ 194,881***

Table 18 – Cost Estimate - Line 3

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (34")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 2,758,831
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1245	$ 17,000	$ 21,166,700
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0		$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1242	$ 40,833	$ 55,596,652
4	Special Treatment					
a	With Fill	A+	n/a	394	$ 45,254	$ 17,841,390
b	Without Fill	A+	n/a	37	$ 33,626	$ 1,244,162
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	3	$ 210,190	$ 588,531
b	Pipeline Removal - Land Restoration	n/a	R	3	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	33	$ 71,000	$ 2,343,000
i	Mainline Valve (Manual)	n/a	R	69	$ 56,000	$ 3,864,000
j	Mainline Instrument Building	n/a	R	2	$ 76,000	$ 152,000
k	Pig Trap Assembly	n/a	R	11	$ 88,000	$ 968,000
h	Pump Station (19 stations)	n/a	R	196500	$ 42	$ 8,253,000
7	Contingency	A	R	n/a	13%	$ 7,334,702
	Total Cost Estimate - Line 3					***$ 122,110,967***

Table 19 – Cost Estimate – Line 4

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost**	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 3,544,239
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1249	$ 19,800	$ 24,732,180
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1245	$ 40,833	$ 55,717,485
4	Special Treatment					
a	With Fill	A+	n/a	394	$ 52,708	$ 20,779,971
b	Without Fill	A+	n/a	37	$ 39,164	$ 1,449,083
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	4	$ 296,738	$ 1,216,627
b	Pipeline Removal - Land Restoration	n/a	R	4	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	50	$ 71,000	$ 3,550,000
i	Mainline Valve (Manual)	n/a	R	46	$ 56,000	$ 2,576,000
j	Mainline Instrument Building	n/a	R	8	$ 76,000	$ 608,000
k	Pig Trap Assembly	n/a	R	40	$ 88,000	$ 3,520,000
h	Pump Station (22 Stations)	n/a	R	331000	$ 42	$ 13,902,000
7	Contingency	A	R	n/a	13%	$ 9,403,402
	Total Cost Estimate - Line 4					***$ 140,998,987***

*30% (374.7 km) of 48" and 70% (874.4km) of 36"

Table 20 – Cost Estimate – Line 5

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (30")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 49,301
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	12	$ 15,000	$ 175,500
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	12	$ 40,833	$ 523,610
4	Special Treatment					
a	With Fill	A+	n/a	7	$ 39,930	$ 269,528
b	Without Fill	A+	n/a	1	$ 29,670	$ 29,670
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	3	$ 71,000	$ 213,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	2	$ 76,000	$ 152,000
k	Pig Trap Assembly	n/a	R	2	$ 88,000	$ 176,000
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 132,041
	Total Cost Estimate - Line 5					***$ 1,720,650***

Table 21 – Cost Estimate – Line 6B

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (30")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 46,176
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	12	$ 15,000	$ 174,000
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	12	$ 40,833	$ 519,135
4	Special Treatment					
a	With Fill	A+	n/a	7	$ 39,930	$ 279,510
b	Without Fill	A+	n/a	1	$ 29,670	$ 29,670
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	2	$ 71,000	$ 142,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	2	$ 76,000	$ 152,000
k	Pig Trap Assembly	n/a	R	2	$ 88,000	$ 176,000
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 123,913
	Total Cost Estimate - Line 6B					***$ 1,642,404***

Table 22 – Cost Estimate – Line 9 (30")

NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (30")*	*Cost Estimate*
Engineering and Project Management	A	R	n/a	5%	$ 1,383,427
Abandonment Preparation					
Land Access and Clean up	A	R	832	$ 15,000	$ 12,477,000
Pipeline Purging and Cleaning	A	R	0		$ -
Pipeline Abandonment-in-Place					
Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
Provision for Post Abandonment Activities	A and A+	n/a	807	$ 40,833	$ 36,115,671
Special Treatment					$ -
With Fill	A+	n/a	94	$ 39,930	$ 3,753,420
Without Fill	A+	n/a	4	$ 29,670	$ 118,680
Pipeline Removal and Backfilling					
Pipeline Removal and Backfilling	n/a	R	25	$ 218,190	$ 5,411,112
Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
Above-Ground Facilities					
Meter Manifold	n/a	R	0	$ 158,000	$ -
Valve Manifold	n/a	R	0	$ 73,000	$ -
Electrical Building	n/a	R	0	$ 190,000	$ -
Maintenance Building	n/a	R	0	$ 90,000	$ -
Above Grade Tank	n/a	R	0	$ 4	$ -
Booster Pump Station	n/a	R	0	$ 200	$ -
Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
Mainline Valve (Remote)	n/a	R	45	$ 71,000	$ 3,195,000
Mainline Valve (Manual)	n/a	R	13	$ 56,000	$ 728,000
Mainline Instrument Building	n/a	R	4	$ 76,000	$ 304,000
Pig Trap Assembly	n/a	R	9	$ 88,000	$ 792,000
Pump Station (5 Stations)	n/a	R	24000	$ 42	$ 1,008,000
Contingency	A	R	n/a	13%	$ 3,612,338
Total Cost Estimate - Line 9 (30")					***$ 68,898,647***

Table 23 – Cost Estimate – Line 67

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (36")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 2,194,671
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1061	$ 18,000	$ 19,099,800
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1061	$ 40,833	$ 47,487,408
4	Special Treatment					
a	With Fill	A+	n/a	302	$ 47,916	$ 14,482,611
b	Without Fill	A+	n/a	51	$ 35,604	$ 1,815,804
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	69	$ 71,000	$ 4,899,000
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	9	$ 88,000	$ 792,000
h	Pump Station (9 Stations)	n/a	R	110000	$ 42	$ 4,620,000
7	Contingency	A	R	n/a	13%	$ 5,942,198
	Total Cost Estimate - Line 67					***$ 101,333,492***

Table 24 – Cost Estimate - Shell Lateral

	NEB Cost Category	*Method*		*Pipeline Features*	*Average Cost (30")*	*Cost Estimate*
1	Engineering and Project Management	A	R	n/a	5%	$ 525
2	Abandonment Preparation					
a	Land Access and Clean up	A	R	1	$ 15,000	$ 10,500
b	Pipeline Purging and Cleaning	A	R	0		$ -
3	Pipeline Abandonment-in-Place					
a	Basic Pipeline Abandonment-in-Place	A	n/a	0	$ -	$ -
b	Provision for Post Abandonment Activities	A and A+	n/a	1	$ 40,833	$ 31,327
4	Special Treatment					
a	With Fill	A+	n/a	0	$ -	$ -
b	Without Fill	A+	n/a	0	$ -	$ -
5	Pipeline Removal and Backfilling					
a	Pipeline Removal and Backfilling	n/a	R	0	$ -	$ -
b	Pipeline Removal - Land Restoration	n/a	R	0	$ -	$ -
6	Above-Ground Facilities					
a	Meter Manifold	n/a	R	0	$ 158,000	$ -
b	Valve Manifold	n/a	R	0	$ 73,000	$ -
c	Electrical Building	n/a	R	0	$ 190,000	$ -
d	Maintenance Building	n/a	R	0	$ 90,000	$ -
e	Above Grade Tank	n/a	R	0	$ 4	$ -
f	Booster Pump Station	n/a	R	0	$ 200	$ -
g	Below Grade Sump Tank	n/a	R	0	$ 26,000	$ -
h	Mainline Valve (Remote)	n/a	R	0	$ 71,000	$ -
i	Mainline Valve (Manual)	n/a	R	0	$ 56,000	$ -
j	Mainline Instrument Building	n/a	R	0	$ 76,000	$ -
k	Pig Trap Assembly	n/a	R	0	$ 88,000	$ -
h	Pump Station	n/a	R	0	$ 42	$ -
7	Contingency	A	R	n/a	13%	$ 1,365
	Total Cost Estimate - Shell Lateral					***$ 43,717***

Table 25 - Table A-4 by Terminal

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering and Project Management	n/a	5%	$ 2,003,987
6	Above-Ground Facilities			
a	Meter Manifold	26	$ 158,000	$ 4,108,000
b	Valve Manifold	41	$ 73,000	$ 2,993,000
c	Electrical Building	19	$ 190,000	$ 3,610,000
d	Maintenance Building	14	$ 90,000	$ 1,260,000
e	Above Grade Tank	5710000	$ 4	$ 19,985,000
f	Booster Pump Station	16524	$ 200	$ 3,304,800
g	Below Grade Sump Tank	8	$ 26,000	$ 208,000
7	Contingency	n/a	13%	$ 4,610,944
	Total Cost Estimate - Edmonton Terminal			***$ 42,083,731***

NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
Engineering & Project Management	n/a	5%	$ 836,115
Above-Ground Facilities			
Meter Manifold	12	$ 158,000	$ 1,896,000
Valve Manifold	14	$ 73,000	$ 1,022,000
Electrical Building	4	$ 190,000	$ 760,000
Maintenance Building	12	$ 90,000	$ 1,080,000
Above Grade Tank	2027000	$ 4	$ 7,094,500
Booster Pump Station	13950	$ 200	$ 2,790,000
Below Grade Sump Tank	6	$ 26,000	$ 156,000
Contingency	n/a	13%	$ 1,923,805
Total Cost Estimate - Hardisty Terminal			***$ 17,558,420***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 281,879
6	Above-Ground Facilities			
a	Meter Manifold	4	$ 158,000	$ 632,000
b	Valve Manifold	1	$ 73,000	$ 73,000
c	Electrical Building	4	$ 190,000	$ 760,000
d	Maintenance Building	14	$ 90,000	$ 1,260,000
e	Above Grade Tank	306000	$ 4	$ 1,071,000
f	Booster Pump Station	5575	$ 200	$ 1,115,000
g	Below Grade Sump Tank	3	$ 26,000	$ 78,000
7	Contingency	n/a	13%	$ 648,570
	Total Cost Estimate - Kerrobert Terminal			***$ 5,919,449***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 45,144
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	0	$ 73,000	$ -
c	Electrical Building	1	$ 190,000	$ 190,000
d	Maintenance Building	2	$ 90,000	$ 180,000
e	Above Grade Tank	66000	$ 4	$ 231,000
f	Booster Pump Station	200	$ 200	$ 40,000
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 103,870
	Total Cost Estimate -Stoney Beach Take-off			***$ 948,014***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 19,662
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	0	$ 73,000	$ -
c	Electrical Building	1	$ 190,000	$ 190,000
d	Maintenance Building	0	$ 90,000	$ -
e	Above Grade Tank	0	$ 4	$ -
f	Booster Pump Station	0	$ 200	$ -
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 45,240
	Total Cost Estimate - Milden Take-Off			***$ 412,902***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 378,697
6	Above-Ground Facilities			
a	Meter Manifold	6	$ 158,000	$ 948,000
b	Valve Manifold	6	$ 73,000	$ 438,000
c	Electrical Building	6	$ 190,000	$ 1,140,000
d	Maintenance Building	13	$ 90,000	$ 1,170,000
e	Above Grade Tank	650000	$ 4	$ 2,275,000
f	Booster Pump Station	3268	$ 200	$ 653,600
g	Below Grade Sump Tank	3	$ 26,000	$ 78,000
7	Contingency	n/a	13%	$ 871,338
	Total Cost Estimate - Regina Terminal			***$ 7,952,635***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 800,424
6	Above-ground facilities			
a	Meter Manifold	8	$ 158,000	$ 1,264,000
b	Valve Manifold	18	$ 73,000	$ 1,314,000
c	Electrical Building	8	$ 190,000	$ 1,520,000
d	Maintenance Building	8	$ 90,000	$ 720,000
e	Above Grade Tank	2180000	$ 4	$ 7,630,000
f	Booster Pump Station	8074	$ 200	$ 1,614,800
g	Below Grade Sump Tank	4	$ 26,000	$ 104,000
7	Contingency	n/a	13%	$ 1,841,684
	Total Cost Estimate - Cromer Terminal			***$ 16,808,908***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 211,920
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	1	$ 73,000	$ 73,000
c	Electrical Building	5	$ 190,000	$ 950,000
d	Maintenance	12	$ 90,000	$ 1,080,000
e	Above Grade Tank	336000	$ 4	$ 1,176,000
f	Booster Pump Station	1049	$ 200	$ 209,800
g	Below Grade Sump Tank	4	$ 26,000	$ 104,000
7	Contingency	n/a	13%	$ 487,604
	Total Cost Estimate - Gretna Terminal			***$ 4,450,324***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 789,475
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	12	$ 73,000	$ 876,000
c	Electrical Building	6	$ 190,000	$ 1,140,000
d	Maintenance Building	10	$ 90,000	$ 900,000
e	Above Grade Tank	3030000	$ 4	$ 10,605,000
f	Booster Pump Station	1470	$ 200	$ 294,000
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 1,816,490
	Total Cost Estimate - Sarnia Terminal			***$ 16,578,965***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 257,075
6	Above-Ground Facilities			
a	Meter Manifold	0	$ 158,000	$ -
b	Valve Manifold	4	$ 73,000	$ 292,000
c	Electrical Building	2	$ 190,000	$ 380,000
d	Maintenance Building	7	$ 90,000	$ 630,000
e	Above Grade Tank	868000	$ 4	$ 3,038,000
f	Booster Pump Station	1050	$ 200	$ 210,000
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 591,500
	Total Cost Estimate - Westover Terminal			***$ 5,398,575***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 62,630
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	1	$ 73,000	$ 73,000
c	Electrical Building	2	$ 190,000	$ 380,000
d	Maintenance Building	3	$ 90,000	$ 270,000
e	Above Grade Tank	5000	$ 4	$ 17,500
f	Booster Pump Station	1050	$ 200	$ 210,000
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 144,105
	Total Cost Estimate - Montreal Terminal			***$ 1,315,235***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 24,691
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	1	$ 73,000	$ 73,000
c	Electrical Building	0	$ 190,000	$ -
d	Maintenance Building	2	$ 90,000	$ 180,000
e	Above Grade Tank	0	$ 4	$ -
f	Booster Pump Station	0	$ 200	$ -
g	Below Grade Sump Tank	1	$ 26,000	$ 26,000
7	Contingency	n/a	13%	$ 56,810
	Total Cost Estimate - Bronte Terminal			***$ 518,501***

	NEB Cost Category	*Pipeline Features*	*Average Cost*	*Cost Estimate*
1	Engineering & Project Management	n/a	5%	$ 91,022
6	Above-Ground Facilities			
a	Meter Manifold	1	$ 158,000	$ 158,000
b	Valve Manifold	1	$ 73,000	$ 73,000
c	Electrical Building	0	$ 190,000	$ -
d	Maintenance Building	3	$ 90,000	$ 270,000
e	Above Grade Tank	240000	$ 4	$ 840,000
f	Booster Pump Station	1350	$ 200	$ 270,000
g	Below Grade Sump Tank	0	$ 26,000	$ -
7	Contingency	n/a	13%	$ 209,430
	Total Cost Estimate - Clarkson Terminal		Total	***$ 1,911,452***

ATTACHMENT E

CRUDE OIL PIPELINE ABANDONMENT CASE STUDY
KALAMAZOO COUNTY, MICHIGAN

John Valkenburg, Hans Johannes, Marc Hatton and Joe Shurell
Malcolm Pirnie, Inc.
1500 Abbott Road, Suite 210
East Lansing, Michigan 48823

ABSTRACT

A 17-mile long crude oil pipeline originates at a bulk storage facility in rural Kalamazoo County and ends at a former crude oil refinery in the City of Kalamazoo. The pipeline was left abandoned still containing crude oil, posing a threat to several environmentally sensitive areas it crosses. Increasing development pressure along the entire length of the predominantly rural pipeline increased the threat of unfortunate, potentially release-causing encounters with the pipeline.

The Michigan Department of Environmental Quality (MDEQ) interpretation of Michigan environmental law was to consider the pipeline an abandoned container. The MDEQ made the commitment to address that threat using both state and federal funding. After draining and cleaning using conventional techniques, over 97% of the pipeline length was grouted in situ to protect environmentally sensitive areas. Less than 1% was left ungrouted while approximately 2% of the pipeline was physically removed. Approximately 100,000 gallons of crude oil were recovered from the pipeline and recycled. The fieldwork was accomplished with a minimal number of releases to the environment (Figure 1).

Figure 1. Crude Oil Release near the Southern Terminus

The project represents a number of 'firsts'. It is the largest crude oil pipeline abandonment to have been conducted in Michigan. It is the first crude oil pipeline abandonment conducted by the MDEQ. It is the first project in Michigan where USEPA has directly reimbursed MDEQ for having performed work under OPA funding mechanisms.

Project success can be attributed to strategic public relations planning, interagency cooperation between USEPA, MDEQ and local units of government, and stringent contractor qualification requirements. The pipeline affected approximately 140 parcels of properties. Property transactions and development can now occur in the area without fear of causing a release of crude oil to the environment (Figure 2).

Figure 2. Post-restoration photo in a public park

This unique, orphaned site presented challenges to safely mitigating a potentially catastrophic release. Refinery operators are presently required to remove containerized product (such as that in the pipeline) as part of facility closure. This pipeline sat idle and unused for nearly 20 years.

The project team used a uniquely cooperative approach to problem solving. When the pipeline condition was found to be worse than originally believed (Figure 3), the owner and engineer worked closely with the contractor to cooperatively develop improved procedures. The engineer then incorporated contractor-recommended, owner-approved solutions to site-specific technical problems (Figure 4). This maximized the use of a highly qualified contractor's skills and abilities.

Figure 3. Pipeline leak area prior to live-tap

Figure 4. Multi-disc cleaning pig in use

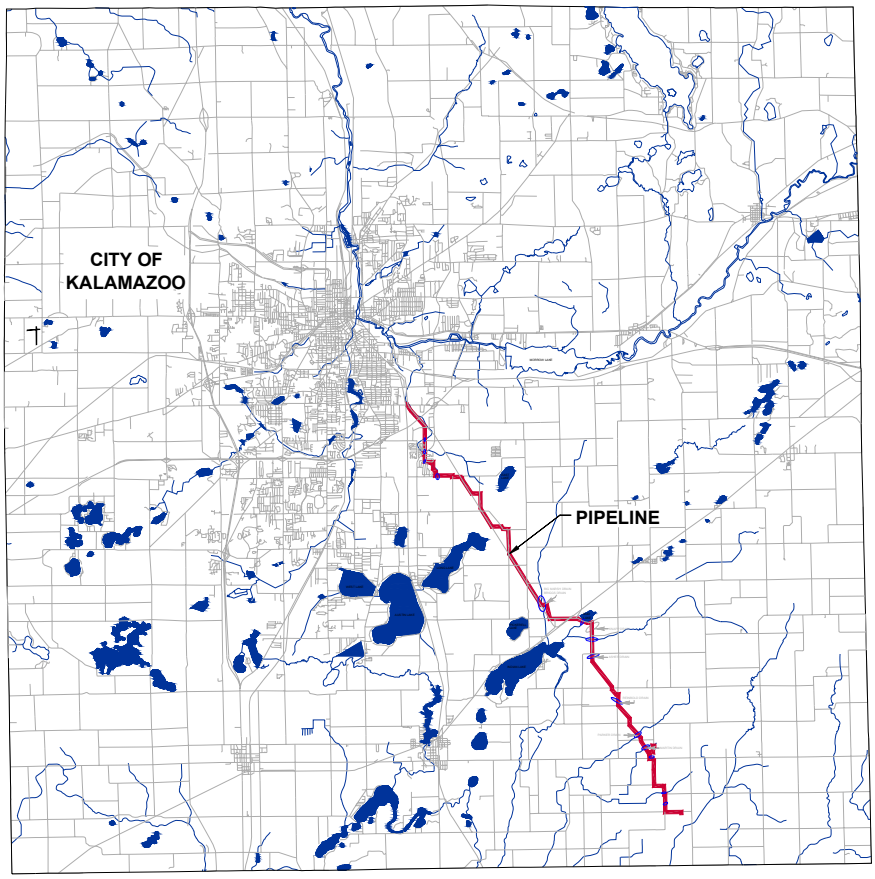
In addition to mitigating a potentially catastrophic release to the environment and improving local property values and development potential, the cooperative interagency nature of the project funding mechanisms represented a significant savings to the state of Michigan. USEPA

designated $1.2 million dollars in OPA funding for this project, representing the majority of project funding.

INTRODUCTION

The 17-mile long pipeline **(**Figure 5**)** was constructed in the early 1970s and was used to transfer crude oil from a bulk storage facility in rural Kalamazoo County to a former crude oil refinery in the City of Kalamazoo. Refinery production ceased in 1986, but storage of petroleum products on-site in the aboveground storage tanks continued into the early 1990s. When the refinery closed, the pipeline was abandoned without being drained or properly decommissioned.

Figure 5. Pipeline Location Map



In the 1990s, USEPA used Oil Pollution Act (OPA) funds to conduct removal actions at the refinery that included pipe and bulk storage tank removal and placement of interceptor trenches for floating hydrocarbon removal. Following completion of USEPA removal activities, the site was transferred to the Michigan Department of Environmental Quality (MDEQ). As part of interim responses completed by MDEQ, 1,252 gallons of crude oil were vacuum drained from the north terminus of the pipeline. The vacuum draining was completed in order to remove pressure from the pipeline while work was being conducted on a nearby landfill.

More recently, the declining condition of the pipeline and increasing development pressure has increased the threat of a release to the surrounding community or the numerous environmentally sensitive areas along the length of the pipeline, which include several navigable watercourses.

According to the Michigan Department of Environmental Quality (MDEQ) interpretation of Michigan environmental regulations the pipeline was considered an "Abandoned Container" as defined in Part 201 (Environmental Remediation) of Public Act 451 (Natural Resources and Environmental Protection Act, as amended) and owners of abandoned containers are required to conduct interim response activities to mitigate potential releases.

PROJECT DEVELOPMENT AND PLANNING

Stakeholder Involvement and Planning

During the planning phase of the project, multiple discussions were held with agency representatives involved in earlier removal actions, former refinery employees, a number of state agency groups, local regulatory agencies, and local community representatives. Groups represented in the planning process included:

- MDEQ Remediation and Redevelopment (formerly Environmental Response) Division
- MDEQ Waste and Hazardous Materials (formerly Waste Management) Division
- MDEQ Geological and Land Management (formerly Land and Water Management) Division
- MDEQ Water (formerly Surface Water Quality) Division
- United States Environmental Protection Agency
- United States Coast Guard
- Michigan Department of Transportation
- Kalamazoo County Road Commission
- Kalamazoo County Drain Commission
- City of Kalamazoo and City of Portage
- Wakeshma Township, Brady Township, and Pavilion Township
- Canadian National Railway Company

Involvement of these parties led to a greater mutual understanding of the intended project goals, development of implementation and restoration procedures, and ensured that all necessary regulatory requirements were met.

Project Funding Sources

The pipeline decommissioning project was funded by MDEQ with Clean Michigan Initiative (CMI) funds. However, a portion of the project cost was reimbursed from Oil Pollution Act (OPA) of 1990 funds. In 1990, Congress passed the Oil Pollution Act of 1990 (33 U.S.C. 2701-2761) to help address a wide range of issues associated with preventing, responding to, and paying for oil pollution. Title I of OPA established oil spill liability and compensation requirements, including the Oil Spill Liability Trust Fund (OSLTF), to help facilitate cleanup

activities and compensate for damages from oil spills. In 1991, the United States Coast Guard created the National Pollution Funds Center (NPFC) to implement Title I of OPA, administer the OSLTF, and ensure effective response and recovery. MDEQ sought and obtained approval for reimbursement of a portion of the project costs from OSLTF funds administered by the US Coast Guard (USCG). OPA funding was applied to this project because the pipeline contents posed an imminent and substantial threat to navigable waters. The USEPA and its contractor, Tetra Tech/EM Inc., provided project oversight and reviewed project cost documentation for the USCG.

Property Title Search

Prior to the start of the Work, professional title search services were subcontracted for all properties traversed by the pipeline, including the single parcel previously owned in fee by the former Lakeside Refining Company at the southern terminus of the Pipeline in Section 30 of Wakeshma Township, Kalamazoo County.

The professional title search included identification and documentation of the following:

- All recorded easements, rights-of-way, licenses, agreements, or other recorded instruments memorializing all interests transferred to Lakeside for access, installation, maintenance, or other pipeline-related activities.
- Current fee owner of record.
- Evidence of unrecorded instruments issued by or for Lakeside, which may affect MDEQ's ability to access the pipeline.

Property Access Agreements

A private investigation firm that was experienced in obtaining voluntary property access via the MDEQ standard access agreement was retained to contact the owners of the properties along the path of the pipeline, distribute MDEQ standard access agreements to the property owners, and photo-document the parcels for which access was obtained.

Construction Documents and Contractor Procurement

Project technical specifications (Divisions 2 through 16) were prepared in Construction Specification Institute (CSI) format. The use of this standard format provided a well-recognized and well-organized structure for the contractors, engineers, and owners. CSI-format construction documents enable the parties involved in the project to readily locate project-specific and relevant information (CSI, 1996). The CSI-format technical specifications in conjunction with the State of Michigan Department of Management and Budget (MDMB) Model Contract Documents (MICHSPEC) were assembled into the Project Manual that was used to procure a contractor to decommission the pipeline. Subsequently, MDEQ procured a decommissioning contractor through the State of Michigan public bid process.

Cost Documentation

During the pipeline decommissioning, project costs were carefully documented and tracked in a database compliant with USCG and USEPA cost tracking requirements. This enabled federal review of costs incurred during the course of the project and provided for expedited approval of cost documentation submittals.

CONTRACTOR MEANS AND METHODS

This section describes and shows how the contractor was required to or elected to perform some elements of the work.

Work Sequencing

The contractor was required to meet the following sequencing requirements to limit the potential for loss of crude oil to the surrounding community, surface water, or environmentally sensitive areas:

- Start work in less environmentally sensitive areas.
- Start work in areas with easier access.
- Work from higher elevation to lower elevation.
- Limit the length of working sections to approximately 1 mile.
- Isolate working sections from the rest of the pipeline.
- Drain the majority of pipeline contents before cleaning.
- Apply vacuum concurrently with application of compressed gas.
- Carefully control and monitor application of compressed gas.
- Carefully monitor pipeline path for evidence of leaks.
- Maintain emergency response equipment on site during the work.
- Install and maintain appropriate environmental controls

Careful sequencing and implementation helped minimize the potential for a catastrophic release.

Pipeline Access

The Contract Documents originally scheduled the use of fourteen pipeline access locations. As the result of the very poor condition of the pipeline near the southern terminus, releases occurred during initial decommissioning activities April 2002. Although the released product was recovered, it was immediately recognized that careful reconsideration of decommissioning procedures was needed prior to proceeding with the work.

MDEQ, Malcolm Pirnie, and the contractor cooperatively developed improved procedures to limit the potential for future releases to the environment. These procedures required the use of additional pipeline access locations. In total, 33 locations were used to access the pipeline or subsurface utilities related to the pipeline.

Pressure-Enhanced Pipeline Draining

Based on anecdotal information, historical drawings, and field observations, it appeared that a portion of the pipeline was constructed with materials scavenged from the decommissioning of another pipeline and was in considerably worse condition than the remainder of the pipeline. Consequently, the pressure-enhanced draining procedure was used to remove the majority of the pipeline contents before cleaning and grouting were initiated. After the releases in April 2002, the pipeline draining, cleaning, and grouting procedures were revised to further decrease the working section lengths and fluid pressures to minimize the potential for future releases.

Pressure enhanced vacuum draining consists of vacuum draining pipeline contents from one end of each short (less than one mile) working section. This initial vacuum draining removed the majority of the pipeline contents before the higher cleaning pressure was applied to the pipeline. Pressure enhanced vacuum draining continued by simultaneously vacuum draining one end of each shorter section while driving a swabber pig with lower pressure nitrogen from the other end. A swabber pig (Figure 6) consists of a 6-inch diameter, 12-inch long foam cylinder with a reinforcement coating. A swabber pig is also softer than a cleaning or scraping pig so it is less likely to get stuck at bends, valves, or other obstructions in the pipeline.

Figure 6. Swabber Pig in Use

Compressed nitrogen gas was applied behind the swabber pig to drive it and the pipeline contents to the next tap or access location where vacuum draining was being conducted. The nitrogen gas flow was turned off when the vacuum tanker operator communicated via radio that liquid was being recovered from the pipeline. The flow of nitrogen gas was only turned back on when it was needed to drive the pig and pipeline contents toward the taps and access locations. This safety precaution was used to minimize the pressure that was applied to the pipeline to help prevent leaks and, in the event that a pipeline leak was encountered, minimize the size of a release.

Vacuum was also applied to the pipeline via taps at intermediate access locations to help recover pipeline contents and reduce the pressure on the pipeline during pressure-enhanced vacuum draining process. The contractor used a vacuum tanker to apply the vacuum at the section ends and at the pipeline taps. The vacuum tanker was connected to the taps by a drop pipe and flexible hoses. A fitting was used to seal the drop pipe to the ball valve fitting on the tap. The

end of the drop pipe was beveled to allow it to be inserted to the bottom of the pipeline without forming a seal. After the pig arrived at a tap or access location, the vacuum tanker was moved to the next tap or access location to repeat the procedure while proceeding towards the end of that section. At the end of each section of the pipeline, a flanged pig receiver was attached to the pipeline.

Pipeline Cleaning

After the pressure-enhanced vacuum draining was completed, several passes with a multi-disc cleaning pig were performed until no additional liquid was drained from the pipeline. The multi-disc pipeline cleaning pig (Figure 4) consisted of a 6-inch diameter, 12-inch long, high-density foam cylinder. The multi-disc pipeline cleaning pigs were manufactured to have a series of alternating ridges and grooves a half inch deep and thick to form multiple discs. The grooves had a polyurethane coating to reinforce the leading and trailing edges of each disc. In addition, the top and bottom sides of the cylinder had a polyurethane coating for reinforcement. The multi-disc pipeline cleaning pig was driven with nitrogen gas in the same manner as the foam swabber pig.

Pipeline Decommissioning

The pipeline was originally scheduled to be decommissioned by blind flanging the ends of empty sections of pipe that did not have the potential for becoming a pathway for contaminant migration or grouting sections of pipe that could not be excavated but needed to be filled with a structurally stable material. Based on requests from local stakeholders and recommendations from local and state agencies, one 1,231-foot section of pipe was excavated and removed (Figure 7) to allow future ditch modifications. The remainder of the pipeline was filled with grout (Figure 8).

Figure 7. Removed Pipeline Section

Figure 8. Pipeline Grouting Equipment

Spill Response

During the draining, cleaning, and grouting of the pipeline, several crude oil and grout leaks were observed. The leaks in the pipeline were typically small holes (Figure 9) caused by localized stresses on the pipe.

Figure 9. Pinhole Leaks in Pipeline

Consequently, spill response typically consisted of collecting liquids (Figure 10) from the ground surface and excavating shallow soils that were contaminated.

Figure 10. Release of Crude Oil at the Surface

Surface Restoration

After grouting was completed, the contractor backfilled and compacted each of the pipeline access locations. The backfill consisted of existing materials that were not visibly contaminated, including gravel, sand, silt, clay, and peat. The majority of the selected access locations were in areas that were not in the vicinity of surface water, were not subject to erosion, and were not structurally sensitive so they were restored to match surrounding conditions. One location, however, was located in the median of Interstate 94 on the western embankment of the overpass. After compaction and density testing was completed to the satisfaction of the Michigan Department of Transportation, the Contractor sowed grass seed and installed erosion control matting.

Two other access locations were in the immediate vicinity of surface water or were subject to intermittent surface water flow, so erosion control measures were also implemented in those areas.

Pipeline Contents Recycling and Disposal

During the work, the contractor maintained daily records of the quantity of pipeline contents drained by measuring the volume of liquid in the vacuum tanker with a dipstick. The contractor used a colorimetric indicator paste on the dipstick and an electronic oil/water interface probe to estimate the quantity of water recovered with the pipeline contents. Approximately 7,500 gallons of water and 79,000 gallons of crude oil were recovered. The pipeline contents that were removed were heat and chemical treated to demulsify the oil and water interface. The water drained from the bottom of the storage tank was disposed in a deep injection well permitted for injection of oilfield waters. A subcontractor completed additional heat and chemical treatments of the crude oil to settle out additional solids and make it suitable for recycling at a crude oil refinery.

Contaminated Soil Disposal

The soil from the spill response access locations and contaminated soil that was observed at the access locations was excavated and disposed as non-hazardous waste soil. Additionally, grout and soil from the four grout leak locations was excavated and disposed as non-hazardous waste soil. Approximately 175 cubic yards of contaminated soil and 3 cubic yards of hardened grout were excavated and disposed off-site.

CONCLUSIONS

Due to careful planning and close coordination with the regulators and stakeholders, the project was completed ahead of schedule and under budget, despite the numerous technical challenges.

ACKNOWLEDGEMENTS

Many thanks to the Michigan Department of Environmental Quality for funding this work. The MDEQ Project Managers through the course of this work were Wim van Leeuwen, Trisha Peters, and Jeff Spruit. The project would not have been possible without their direct involvement. The project also owes its successful implementation to the input of many agencies and individuals. Additionally, numerous MDEQ Divisions, the USEPA, and the USCG all provided invaluable input to the process.

REFERENCES

CSI (1996). Manual of Practice, the Construction Specifications Institute.

Malcolm Pirnie (2001). Work Plan for Pipeline Abandonment, Former Lakeside Refinery Site, Kalamazoo, Michigan. Prepared for Michigan Department of Environmental Quality.

Malcolm Pirnie (2004). Contract Work Summary Report, Former Lakeside Refinery Site, Kalamazoo, Michigan. Prepared for Michigan Department of Environmental Quality.

National Oceanic and Atmospheric Administration, Damage Assessment and Restoration Program, Northwest Region, NRDA Guidance Under Oil Pollution Act of 1990.

Sandra Skinaway

Boozhoo:

My name is Sandra Skinaway and I am the Chairwoman of the Sandy Lake Band of Mississippi Ojibwe. We are located just north of McGregor. Our reservation at Sandy Lake encompasses Big Sandy Lake and the Mississippi River runs along our reservation's boundaries. My family has been here for centuries and we continue to hunt, fish, and gather here as our ancestors once did.

Our ancestors entered into treaty agreements with the United States and the effect of these treaties was the transfer of millions of acres of aboriginal land in exchange for a guarantee of certain portions of the land to be reserved, the payment of annual annuities, and the guarantee of the ability to conduct hunting, fishing, and gathering activities in the ceded territories.

Speaking on behalf of the Ojibwe people and my family at Sandy Lake, we voice our opposition to the construction of any pipeline that will endanger or threaten our way of life and the lives of our future generations yet to come.

I have voiced our concerns many times in past hearings. Here in Aitkin County, it's one big swamp, with many aquifers that are present and connected. At my home, we have a pristine water well. And there are other areas where natural water springs still exist. Pipelines will destroy all that as well our life sustaining Manoomin, also known as Wild Rice. Also impacted will be our medicinal plants, the trees that give us oxygen and filters out bad toxins, the wildlife, the fish and other forms of life.

Wild rice and Water are the life blood of the Anishinaabe people. We have a responsibility to protect these for our future generations as we must look to the next seven generations into the future.

And this future looks bleak already with the annual climate changes and water shortages occurring in California and in other countries. Recently, a town in Wisconsin is requesting to divert Lake Michigan water due to problems with their drinking water. The Great Lakes are the largest interconnected fresh water lakes on earth. We all have a responsibility to protect what we now have.

In the United Nations Declaration on the "Rights of Indigenous Peoples", which was adopted by the General Assembly on September 13, 2007;

Article 37, states: Indigenous peoples have the right to the recognition, observation and enforcement of treaties, agreements, and other constructive arrangements concluded with States or their successors, and to have States honour and respect such treaties, agreements, and other constructive arrangements.

Article 29 states "that Indigenous peoples have the right to the conservation and protection of the environment and the productive capacity of their land or territories and resources.

Pipelines have a track record and are known to leak, as a matter of fact, they are pretty much guaranteed to leak. Replacing Enbridge's line 3 and placing it within 25 feet of another pipeline going through our water rich lands is completely absurd.

Now the Aitkin County Board of Commissioner have already placed their rubber stamp on this pipeline and we are here to say they do not speak for us. No one speaks for the Sandy Lake Band of Mississippi Ojibwe but ourselves.

The proposed construction route, as is, will have devastating effects on our culture and our way of life. To avoid this threat, we recommend that Enbridge REROUTE their Line 3 replacement pipeline and their Sandpiper pipeline to the other proposed routes that have been submitted for consideration that are far from the Wild Rice and the Waters.

Miigwech for the opportunity to speak our opposition.

by a majority of 144 states in favour, 4 votes against (Australia, Canada, New Zealand, and the United States) and 11 Abstentions. (Azerbaijan, Bangladesh, Bhutan, Burundi, Colombia, Georgia, Kenya, Nigeria, Russian Federation, Samoa, and Ukraine)

Yesterday, Canada officially removed its objector status to the UN Declaration on the Rights of Indigenous Peoples, almost a decade after it was adopted by the General Assembly.

MINNESOTA DEPARTMENT OF COMMERCE

Comment Form: Scoping
Energy Environmental Review and Analysis

Please provide your contact information. This information and your comments will be publicly available.

Name: M. Cathy Smith Phone: 612-558-0807

Street Address: 712 3rd Ave

City: Excelsior State: MN ZIP: 55331

Email: csmith@cord.edu.

My comments pertain to:

- [x] **Sandpiper Pipeline Project**
- [ ] **Line 3 Replacement Project**
- [ ] **Both Projects**

I oppose the sandpiper pipeline project.

- The pipeline will destroy needed wildlife areas.
- The quality of the oil is low.
- It will pose a threat of leakage.
- We do not need to supply Canada with oil.
- We should be investing instead in alternative power sources such as wind & solar.
- This is not something MN should be a part of or investing in.
- We are more forward thinking & progressive

Thank you for considering my point of view.

Sincerely,

Cathy Smith

If including additional pages please number them and tell us how many you are providing: _____ pages

From:	Mike Smith
To:	*COMM_Pipeline Comments
Subject:	Scoping EIS comment for Sandpiper (13-473 & 13-474) and Line 3 Replacement (14-916 & 15-137)
Date:	Wednesday, April 27, 2016 9:50:08 AM

Dear Ms. MacAlister,

Please consider the following items when determining the scope of this EIS:
- Current proposed route directly impacts the least amount of the population
- Following currently established right of ways also impacts the fewest landowners
- Transportation of oil via pipeline is the most cost effective and safest mode of delivery available
- Following the alternative of "No build" is actually decreasing the reliability of transporting oil and increasing the likelihood of harming the environment
- The economies of many businesses rely on the construction and maintenance of these pipelines. Following the "No build" option will be a strain on the economies and future of many families and business across the region
- Not allowing the construction/replacement of these pipelines will also have a dramatic impact on the state revenues via tax dollars generated through their operation
- The scope needs to maintain focus on its underlying purpose: Finding a working route for the delivery of oil from the Clearbrook facility

On a personal note, I have done work for Enbridge as an outside source and am extremely impressed by their processes and procedures for constructing and operating an oil pipeline network that most individual don't even realize exists. The reason most people are unaware of it existence is because of the pipeline's continued reliability and Enbridge's commitment to maintaining its integrity. Until I provided services for them I had no idea of the amount of oil that is transported through our area. I consider myself well informed and I attribute my lack of knowledge to the fact that the environmental stewardship that is followed within Enbridge is second to none. Yes, I realize that there are mishaps and spills can occur, but Enbridge does everything within its power to minimize these episodes. Environmental stewardship is one of their main core values and they are committed to achieving a zero spill rate from top to bottom within the organization.

In closing I urge you to stay focused on your task at hand and find an acceptable route for the construction/replacement of these two pipelines. It is imperative that you are diligent and quick acting to move this process along. The future of our economies and the environment are in your hands.

Sincerely,

Mike Smith
302 Sitka St
Duluth, MN 55811
mikefsmith@aol.com

From:	Charles Sonnier
To:	*COMM_Pipeline Comments
Subject:	Scoping EIS comment for Sandpiper (13-473 & 13-474) and Line 3 Replacement (14-916 & 15-137)
Date:	Friday, May 06, 2016 12:30:05 PM

Dear Ms. MacAlister,

I think it's a great project and would bring good jobs to the area.

Sincerely,

Charles Sonnier
663 Highway 472
Winnfield, LA 71483
sonnier_charles@yahoo.com

Hello, my name is Mahyar Sorour and I am a Campus Organizer with the Minnesota Public Interest Research Group (MPIRG) from Saint Paul, and I am here today to express my concerns with the Enbridge Sandpiper and Line 3 replacement tar sands pipeline routes as stated in the draft scoping document.

It is crucial to have a robust and thorough Environmental Impact Statement that considers alternatives to the current pipeline route that would not pass Minnesota's pristine lakes and rivers. The Sandpiper pipeline and the replacement of Line 3 (which would be a new pipeline) would carry a maximum of 1.4 million barrels of oil per day (bpd) across Minnesota. The proposed route would cross major Minnesota watersheds, such as those of the Mississippi River and St. Louis river, posing a great risk to the drinking water, the wild rice beds, and the indigenous communities that live along the proposed route. An increase in oil transported through our state carries an increase in risk, and these risks must be comprehensively evaluated along with the need for this pipeline through the scoping period.

A recent report from the National Academy of Sciences found that cleaning up a tar sands spill in a waterway is significantly more difficult and potentially up to 14.5 times more expensive that cleaning up a non-tar sands oil spill. The 2010 Enbridge Line 6B tar sands spill in Kalamazoo, Michigan made it clear that we can can not afford pipeline leaks on any scale, especially one that would cross the Mississippi River, potentially devastating the entire watershed. The Line 6B tar sands spill was the largest and most toxic inland oil spill in our nation's history. Since 2005, Enbridge has been responsible for at least 763 spills, totaling 93,852 barrels of both light and heavy crude, including tar sands crude that has spilled and devastated local waterways. As a young person, I am concerned with the detrimental effects these potential pipeline spills will have on my community, and for future generations who will have to live with the permanent damage done. We must pay attention to these pipeline spills, as we do not want our pristine lakes and rivers to be irreversibly harmed like those in Kalamazoo. The Department of Commerce needs to scrutinize how spills would be cleaned up, the permanent damage to waterways, the impacts to Minnesota's economy, and its threat to indigenous culture and wild rice rights.

I call on the Minnesota Department of Commerce to ensure a robust and equitable scoping process to be conducted in a way that takes into account the risks and potential impact of these pipeline expansions on our drinking water, our communities, and our climate.

Hello, my name is Carolyn Spangler

You're probably tired of hearing about the Kalamazoo oil spill, but I have a story about that incident to make a point.

This winter, I was on an airplane on my way to Indianapolis via Chicago. I don't always talk to people I'm sitting next to, but started a conversation with a woman who was traveling to her home state of Michigan. When she told me she was from Kalamazoo, Michigan, my ears perked up and my visual image became one of oil floating on top of a lake and oil mixed with dry leaves and brush washed up on a beachfront. I asked her about the oil spill into the river and how affected her. She doesn't live there anymore but said her father who worked with environmental cleanup was upset with Enbrige because they never finished cleaning it up. My thoughts were oh, yah, that's what I've heard, but yet, Enbridge claims they're done with the cleanup.

I did some research and found that her father was right. The cleanup was not complete. I also learned about the national study on dilbit, and the potential and horrible dangers of tar sands polluting our lakes and rivers, and it dawned on me that the reason that it wasn't completely cleaned up is because it's not possible to completely clean tar sands out of the water.

When spilled dilbit travels into the water it goes every direction—into the air, with the current, to the bottom of the river—at the same time. A half-decade later, some of the oil still does still remains.

I want to remind you today as you're designing the scoping of the EIS that you include the Dilbit study recently published by the National Academy of Science. This is a risk that can't be taken lightly and should be strongly considered when granting a CON or Route Permit to Enbridge and NDPC.

Why would the great State of Minnesota allow a foreign company to build a pipeline under one of the most important rivers and waterways in the world?

Carolyn Spangler

Minnesota Public Utilities Commission
Draft Scoping Decision Document for Sandpiper (and Line 3 Revision) Pipeline Project
PUC Docket No. PL-6668/CN-13-473
PUC Docket No. PL-6668/PPL-13-474

To whom it may concern:

I have reviewed the DSDD and my comments are as follows:

My main concern is that in sections 4.6.1, 4.6.1.1 and 4.6.2 there is no mention of the recent National Academy of Sciences, Engineering and Medicine's report on "Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects and Response (2016). This DSDD is primarily about the Sandpiper proposed pipeline but it is stated in section 2.1 that "Relevant information from the L3R record is also included due to the co-location of L3R and Sandpiper east of Clearbrook." The proposed L3R pipeline will be carrying tar sands oil from Alberta and spills of this type of oil is what the NAS study entails.

I hope this is simply an oversight and not an indication of lackadaisical methods in proceeding with the EIS. The PUC chair specifically said in a hearing that I attended she wanted this EIS to be robust and comprehensive. I certainly hope it will be so.

I am enclosing the summary of the NAS study with my comments. In essence the NAS study concluded that because of the unique composition of diluted bitumen (tar sands) oil and its penchant for sinking to the bottoms of water bodies, adhering to structures in the water and becoming extremely difficult to remove, spills of diluted bitumen must be addressed immediately to prevent permanent pollution problems.

I believe the proposed Sandpiper/L3R route has a number, perhaps up to 28, water crossings that would require construction of roads to the site of the spill, if one should occur at those water crossings, in order for the oil to be removed. Roads cannot be constructed immediately at any time and especially in winter.

Pipeline spills occur despite Enbridge's public relations campaign saying that spills are minimal and can be easily mitigated. This didn't happen in 2010 near Kalamazoo, MI, when a huge volume of tar sands oil gushed forth over 17 hours.

Any EIS of this project must include expert analysis of potential oil spills from either pipeline on each water crossing. Expert analysis must be independent of Enbridge, preferably from someone acquainted with the NAS study, or from the MPCA and/or DNR. A spill of tar sands oil into our beautiful lakes, rivers, aquifers or wetlands would be devastating to our lives and to our tourism economy.

I also believe that a robust and comprehensive EIS must consider system alternatives to the proposed Enbridge route, alternatives that would possibly be less likely to contaminate our waters if there is an oil spill, but that would satisfy the need and purpose of the project. As to the need and purpose, I also believe that an EIS must consider what these are are with respect to public interest, not only the interest of Enbridge/NDPC.

The World Economic Forum reports that oil consumption in the US was lower in 2014 than in 1997. The US exports an amount of oil equal to about half of what it imports. Minnesota oil consumption has also been declining. Why does Enbridge want to dramatically increase the amount of oil flowing through Sandpiper and Line 3 if oil consumption is declining nationally and in Minnesota? Is most of this oil destined to be exported? The EIS must look into the state, regional and national oil needs as part of its investigation of the need and purpose of this project. Minnesota must not bear the brunt of water contamination just to enhance the profitability of oil companies.

The EIS must consider why Enbridge wants to have its oil flow on the proposed routes between Clearbrook and Superior and why this oil could not just as easily flow on more direct routes from North Dakota and Alberta to destination hubs in Illinois. If this oil is destined for export, why does it need to flow through lake country?

The EIS must also look into the larger picture of CO2 production and climate change. How do new and larger pipelines fit into transforming our energy sources to solar and wind? How does rail transport fit in? Rail transport of oil will not cease if these pipelines are built. Rail safety has to be addressed regardless of oil pipeline construction. Pipelines through lake country are not the solution.

This year Governor Dayton is emphasizing water quality in Minnesota—both cleaning up contaminated waters and prevention of contamination of waters that are clean. We in northern Minnesota are blessed with the cleanest waters in the state. Keeping them clean by preventing oil spills is much preferred to cleaning them up once contaminated. The EIS must take this into consideration.

Thank you, Maurice Spangler
Park Rapids, MN
May 3, 2016

P.S. I understand that Canada requires that abandoned pipelines must be removed. Pipeline abandonment must also be considered in any EIS. Abandoned pipes that are not removed can serve as conduits for contamination among water bodies & aquifers.

MS

Summary

In January 2012, Congress tasked the Secretary of Transportation to "determine whether any increase in the risk of release exists for pipelines transporting diluted bitumen."[1] In response to the congressional request, the U.S. Department of Transportation (USDOT) asked the National Academies of Sciences, Engineering, and Medicine (the Academies) to study the likelihood of release of diluted bitumen from crude oil transmission pipelines. The Academies released a report in 2013 concluding that "[t]he committee does not find any causes of pipeline failure unique to the transportation of diluted bitumen."[2] Following the 2013 release of *Effects of Diluted Bitumen on Crude Oil Transmission Pipelines*, Congress subsequently charged USDOT to "investigate whether the spill properties [of diluted bitumen] differ sufficiently from other liquid petroleum products to warrant modifications to the spill response plans, spill preparedness, or cleanup regulations and report on those findings to the House and Senate Committees on Appropriations within 180 days of enactment."[3]

USDOT returned to the Academies in 2014 with a request to form an ad hoc committee to help address this concern. Specifically, this committee was tasked[1] to review the available literature and data to examine the current state of knowledge, and to identify the relevant properties and charac-

teristics of the transport, fate, and effects of diluted bitumen and commonly transported crude oils when spilled in the environment from U.S. transmission pipelines. Based on a comparison of the relevant

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[i] The committee's full statement of task can be found in Box 1-1.

properties of diluted bitumen and of a representative set of crude oils that are commonly transported via pipeline, the committee was asked to determine whether the differences between properties of diluted bitumen and those of other commonly transported crude oils warrant modifications to the regulations governing spill response plans, preparedness, and cleanup.

STUDY APPROACH

In order to answer the questions outlined in the statement of task, the committee analyzed information in a variety of forms. Part of the committee's data gathering included hearing presentations, meeting with stakeholders, and reviewing the literature. A detailed list of the individuals the committee met with can be found in the Acknowledgments section of this report. In the early phases of the study, an opportunity for public comment was provided. After considering all of the available data and information, the history of the study, and the sponsor's request, the committee focused on environments that would most likely be affected by an oil spill from a transmission pipeline–that is, the contiguous U.S., including the near-shore coastline with far offshore not being considered. The report also focuses on spills from transmission pipelines and does not explicitly address other modes of transportation (e.g., rail, barge, truck, and tanker). It is likely that many of the topics covered in this report, and many of the conclusions and recommendations, will be applicable to these other transportation modes because many aspects of environmental impact are independent of mode of transportation.

The committee's task requires a comparison between diluted bitumen and "crude oils commonly transported in U.S. transmission pipelines." After an analysis of the total volumes of crude oil transported by U.S. pipelines (see Chapter 1), a set of light and medium crudes was chosen as representative of

those "commonly transported" and likely to be encountered in a response scenario. The committee's approach is described in greater detail in Chapter 1.

KEY FINDINGS AND CONCLUSIONS

The starting point for assessing the **Chemical and Physical Properties of Crude Oils** (Chapter 2) was the intrinsic complexity of crude oils as mixtures of hydrocarbons with diverse structures and widely varying molecular weights. Mixtures of these compounds combine to make up the bulk properties of any particular crude oil. The bitumen fraction, in particular, is associated with reservoirs of recalcitrant and immobile crude oils. Unconventional extraction methods are required to access bitumen

reservoirs and addition of a diluent is needed to transport the bitumen product through unheated transmission oil pipelines. In comparison to other commonly transported crude oils, many of the chemical and physical properties of diluted bitumen, especially those relevant to environmental impacts, are found to differ substantially from those of the other crude oils. *The key differences are in the exceptionally high density, viscosity, and adhesion properties of the bitumen component of the diluted bitumen that dictate environmental behavior as the crude oil is subjected to weathering (a term that refers to physical and chemical changes of spilled oil).*

Immediately following a spill, the **Environmental Processes, Behavior, and Toxicity of Diluted Bitumen** (Chapter 3) are similar to those of other commonly transported crudes. Beginning immediately after a spill, however, exposure to the environment begins to change spilled diluted bitumen through various weathering processes. The net effect is a reversion toward properties of the initial bitumen. An important factor is the amount of time necessary for the oil to weather into an adhesive, dense, viscous material. For any crude oil spill, lighter, volatile compounds begin to evaporate promptly; in the case of diluted bitumen, a dense, viscous material with a strong tendency to adhere to surfaces begins to form as a residue. *For this reason, spills of diluted bitumen pose particular challenges when they reach water bodies. In some cases, the residues can submerge or sink to the bottom of the water body.*

Importantly, the density of the residual oil does not necessarily need to reach or exceed the density of the surrounding water for this to occur. The crude oil may combine with particles present in the water column to submerge, and then remain in suspension or sink.

These factors are important to consider for **Spill Response Planning and Implementation (Chapter 4)**. Spills of diluted bitumen into a body of water initially float and spread while evaporation of volatile compounds may present health and explosion hazards, as occurs with nearly all crude oils. It is the subsequent weathering effects, unique to diluted bitumen, that merit special response strategies and tactics. For example, the time windows during which dispersants and in situ burning can be used effectively are significantly shorter for diluted bitumen than for other commonly transported crudes. In cases where traditional removal or containment techniques are not immediately successful, the possibility of submerged and sunken oil increases. *This situation is highly problematic for spill response because (1) there are few effective techniques for detection, containment, and recovery of oil that is submerged in the water column, and (2) available techniques for responding to oil that has sunk to the bottom have variable effectiveness depending on the spill conditions.*

When **Comparing Properties Affecting Transport, Fate, Effects, and Response (Chapter 5)**, several key properties emerge. Figure S-1 illustrates the properties relevant to transport, fate, and effects and the

potential environmental outcomes following a crude oil spill. Based on the similarities and differences between diluted bitumen (in pipeline and weathered forms) and other commonly transported crudes, the comparative levels of concern associated with these properties are highlighted. *The majority of the properties and outcomes that differ from commonly transported crudes are associated not with freshly spilled diluted bitumen, but with the weathering products that form within days after a spill.* Given these greater levels of concern for weathered diluted bitumen, spills of diluted bitumen should elicit unique, immediate actions in response.

Based on the differences identified previously, a review of the **Regulations Governing Spill Response Planning (Chapter 6)** was conducted. Of particular focus was Part 194 of the Pipeline and Hazardous Materials Safety Admin-

istration (PHMSA) regulations, which governs the planning of responses to spills from transmission pipelines. In addition, because the scope of the task was broadly defined to address "regulations governing spill response plans, spill preparedness, or cleanup," relevant U.S. Environmental Protection Agency (USEPA) and U.S. Coast Guard (USCG) regulations were reviewed, primarily for comparison to PHMSA regulations. It is clear that PHMSA takes a substantially different approach from USEPA and USCG when setting expectations for and reviewing spill response plans. Notably, PHMSA reviews plans for completeness in terms of the regulatory requirements only, while USEPA and USCG review plans for both completeness and adequacy for response. *Broadly, regulations and agency practices do not take the unique properties of diluted bitumen into account, nor do they encourage effective planning for spills of diluted bitumen.*

In light of the aforementioned analysis, comparisons, and review of the regulations, it is clear that **the differences in the chemical and physical properties relevant to environmental impact warrant modifications to the regulations governing diluted bitumen spill response plans, preparedness, and cleanup.** The concern associated with these differences is summarized in Figure S-1 for both diluted bitumen and weathered diluted bitumen. Each property that is relevant to environmental transport, fate, and effects is identified with the potential outcomes and a qualitative level of concern compared to other commonly transported crudes. The most notable changes observed are in the comparison between diluted bitumen and weathered diluted bitumen. For example, the level of concern goes from the same to more (or less) concern between the weathered and non-weathered material for ten of the properties in Figure S-1 and all techniques identified in Figure S-2.

	Property	Potential Outcomes	Level of Concern Relative to Commonly Transported Crude Oils	
			Diluted Bitumen	Weathered Diluted Bitumen
Transport	Density	• Movement in suspension or as bedload	SAME	**MORE**
	Adhesion	• Movement in suspension or as bedload (oil particle aggregates)	**MORE**	**MORE**
	Viscosity	• Movement as droplets • Spreading on land • Groundwater contamination	SAME	LESS
	Solubility	• Mobility and toxicity in water	SAME	LESS
	BTEX	• Toxicity (water and air emissions)	**LESS**	LESS
Fate	Density	• Sinking • Burial	SAME	**MORE**
	Adhesion	• Sinking after sediment interaction • Surface coating	SAME	MORE
	Viscosity	• Penetration	**LESS**	LESS
	Percentage of light fraction	• Air emissions	SAME	LESS
	Flammability	• Fire or explosion risk	SAME	LESS
	Biodegradability	• Persistence	**MORE**	**MORE**
	Burn residue	• Quantity of residue • Residue sinking	**MORE**	**MORE**
Effects	Density	• Impaired water quality from oil in the water column and sheening	SAME	**MORE**
	Adhesion	• Fouling and coating	**MORE**	**MORE**
	BTEX components	• Contaminated drinking water • Respiratory problems/disease	SAME	LESS
	HMW components	• Trophic transfer/food web • Aquatic toxicity	**UNKNOWN**	
	LMW components	• Aquatic toxicity • Taste/odor concerns in drinking water	**UNKNOWN** SAME	LESS

The relative level of concern for diluted bitumen is

Less Same More

when compared to commonly transported crudes.

FIGURE S-1 Spill hazards: diluted bitumen relative to commonly transported crude oils. Acronyms: BTEX: benzene, toluene, ethylbenzene, xylenes; HMW: high molecular weight; LMW: low molecular weight.

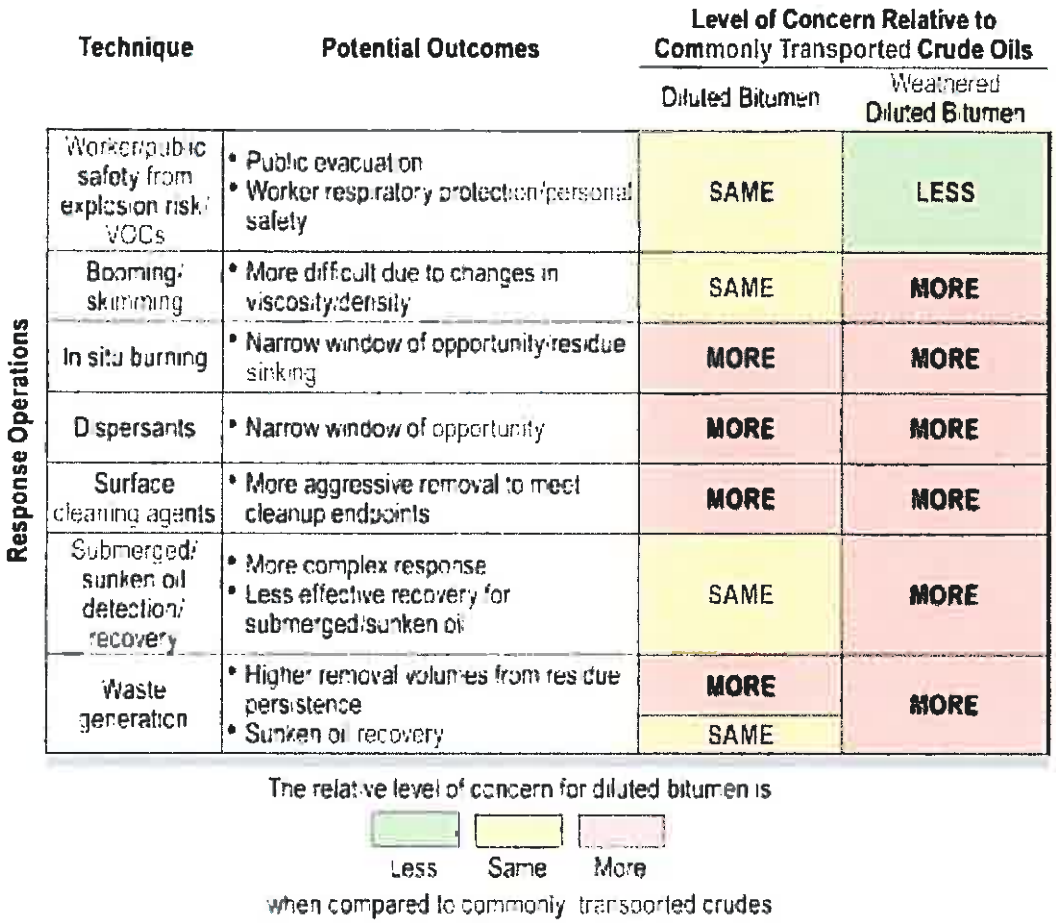

FIGURE S-2 Response operations: diluted bitumen relative to commonly transported crude oils. Acronym: VOCs: volatile organic compounds.

RECOMMENDATIONS

Diluted bitumen has unique properties, differing from those of commonly transported crude oils, which affect the behavior of diluted bitumen in the environment following a spill. This behavior differs from that of the light and medium crudes typically considered when planning responses to spills. Of greatest significance are the physical and chemical changes that diluted bitumen undergoes during weathering. A more comprehensive and focused approach to diluted bitumen across the oil industry and the relevant federal agencies is necessary to improve preparedness for spills of diluted bitumen and to spur more effective cleanup

and mitigation measures when these spills occur. The recommendations

presented here are designed to achieve this goal.

Oil Spill Response Planning

Recommendation 1: To strengthen the preparedness for pipeline releases of oil from pipelines, the Part 194 regulations implemented by PHMSA should be modified so that spill response plans are effective in anticipating and ensuring an adequate response to spills of diluted bitumen. These modifications should

a. Require the plan to identify all of the transported crude oils using industry-standard names, such as Cold Lake Blend, and to include safety data sheets for each of the named crude oils. Both the plan and the associated safety data sheets should include spill-relevant properties and considerations;
b. Require that plans adequately describe the areas most sensitive to the effects of a diluted bitumen spill, including the water bodies potentially at risk;
c. Require that plans describe in sufficient detail response activities and resources to mitigate the impacts of spills of diluted bitumen, including capabilities for detection, containment, and recovery of submerged and sunken oil;
d. Require that PHMSA consult with USEPA and/or USCG to obtain their input on whether response plans are adequate for spills of diluted bitumen;
e. Require that PHMSA conduct reviews of both the completeness and the adequacy of spill response plans for pipelines carrying diluted bitumen;
f. Require operators to provide to PHMSA, and to make publicly available on their websites, annual reports that indicate the volumes of diluted bitumen, light, medium, heavy, and any other crude oils carried by individual pipelines and the pipeline sections transporting them; and
g. Require that plans specify procedures by which the pipeline operator will (i) identify the source and industry-standard name of any spilled diluted bitumen to a designated Federal On-Scene Coordinator, or equivalent state official, within 6 hours after detection of a spill and (ii) if requested, provide a 1-L sample drawn from the batch of oil spilled within 24 hours of the spill, together with specific compositional infor-

mation on the diluent.

Oil Spill Response

Recommendation 2: USEPA, USCG, and the oil and pipeline industry should support the development of effective techniques for detection, containment, and recovery of submerged and sunken oils in aquatic environments.

Recommendation 3: USEPA, USCG, and state and local governments should adopt the use of industry-standard names for crude oils, including diluted bitumen, in their oversight of oil spill response planning.

USCG Classification System

Recommendation 4: USCG should revise its oil-grouping classifications to more accurately reflect the properties of diluted bitumen and to recognize it as a potentially nonfloating oil after evaporation of the diluent. PHMSA and USEPA should incorporate these revisions into their planning and regulations.

Advanced Predictive Modeling

Recommendation 5: NOAA should lead an effort to acquire all data that are relevant to advanced predictive modeling for spills of diluted bitumen being transported by pipeline.

Improved Coordination

Recommendation 6: USEPA, USCG, PHMSA, and state and local governments should increase coordination and share lessons learned to improve the area contingency planning process and to strengthen preparedness for spills of diluted bitumen. These agencies should jointly conduct announced and unannounced

exercises for spills of diluted bitumen.

Improved Understanding of Adhesion

Recommendation 7: USEPA should develop a standard for quantifying and reporting adhesion because it is a key property of fresh and weathered diluted bitumen. The procedure should be compatible with the quantity of the custodial sample collected by pipeline operators.

RESEARCH PRIORITIES

Although many differences between diluted bitumen and commonly transported crudes are well established, there remain areas of uncertainty that hamper effective spill response planning and response to spills. These uncertainties span a range of issues, including diluted bitumen's behavior in the environment under different conditions, its detection when submerged or sunken, and the best response strategies for mitigating the impacts of submerged and sunken oil. These research priorities, discussed in Chapter 7, apply broadly to the research community.

Major topics for future research include

- *Transport and fate in the environment,*
- *Ecological and human health risks of weathered diluted bitumen,*
- *Detection and quantification of submerged and sunken oil,*
- *Techniques to intercept and recover submerged oil on the move, and*
- *Alternatives to dredging to recover sunken oil.*

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WILLIAM M. STALPES & ASSOCIATES
Project Director
William M. Stalpes
29015 County Road 3
Merrifield, MN 56465
Real Estate Transfer
Environmental Assessments

Attn:

Sandpiper Pipeline and Line 3
Replacement Projects

Having spent my entire life and having been invited to speak throughout the United States on Conservation Issues; it is my heartfelt belief that any delays on the Sandpiper Pipeline Project encourages a step closer to a truly collosal catastrophe!

Sincerely,

William M. Stalpes

APPENDIX A

Working Copy
February 1, 1971

A PROPOSED MASTER PLAN FOR ENVIRONMENTAL EDUCATION FOR THE CITIZENS OF MINNESOTA

Prepared at the Request of the:

Commissioner, Department of Natural Resources

Commissioner, Department of Education

Prepared by:

Mr. William Stalpes
Wheaton Van Lines

Mrs. Marilyn Feser, Chairwoman
MECCA Education Committee

Dr. William Miles
Extension Forester
University of Minnesota

Mr. Gilbert Keyes
Public Use Specialist
Bureau of Sport Fisheries and Wildlife

Dr. Roger Johnson
College of Education
University of Minnesota

Dr. John Coulter
Biology Department
St. Cloud State College

Mr. Joseph Premo
Consultant in Science (K-6)
Minneapolis Public Schools

Mr. Timothy Sawyer
Social Studies Department
Robbinsdale Public Schools

Mr. Merill Fellger
Administrative Assist. for Inst.
Minnetonka Public Schools

*Mr. Robert Collins
Director
Environmental Science Center

* Committee Chairman

With the Assistance of:

Mr. Richard J. Myshak
Executive Director
Mn. Environmental Sciences Foundation, Inc.

Mr. John Miller
Environmental Education Consultant
State Department of Education

Mr. Roger Grosslein
Environmental Education Consultant
Department of Natural Resources

Mr. Roger Schoenecker, Chief
Bureau of Information and Education
Department of Natural Resources

RATIONALE*

Environmental education is a life-long process. It is a way of looking at life, fostering awareness of other life and of inter-relationships, learning to recognize the effects (good and bad) we have on physical surroundings and the responsibilities we must accept for the mere fact of our presence and of our activities in our environment. It should enable us to make sound ecological decisions and foresee their consequences; to make value judgments, and act accordingly. It is acceptance of life values and ways of living which minimize destruction and maximize those relationships that enhance life. It is learning how to contribute to the quality of life, and the constructive use, rather than exploitation, of the environment.

It is important to understand that EE is more than a schoolhouse approach to ending the degradation of man-made surroundings and the pollution and destruction of the natural world. Environmental education will not simply provide an understanding of pollution problems and provide the Nation with skills to meet or solve those problems. It is not merely a course in school or a curriculum combining elements of the natural and physical sciences into a new department or specialty. Nor is it just another name for outdoor education, resource management, or conservation education.

Environmental education provides alternate ways of thinking. It is a synthesis which colors and affects the humanities, languages, social sciences, history, economics, and religion as dramatically as it does the natural sciences. It will give an ecological perspective for every aspect of learning and living.

* Environmental Education. A publication of the U.S. Office of Education.

THE NEED

A CITIZENRY THAT UNDERSTANDS ENVIRONMENTAL MECHANICS AND EXHIBITS RESPONSIBLE BEHAVIOR IN THEIR INTERACTION WITH THE ENVIRONMENT.

OBJECTIVES

....TO ASSESS EXISTING, AND DEVELOP NEW INSTRUCTIONAL MATERIAL DESIGNED TO PREPARE ENVIRONMENTALLY LITERATE CITIZENS, AND, TO EFFECTIVELY DEMONSTRATE AND EVALUATE THE USE OF SUCH MATERIALS.

Such a program will emphasize the interrelated nature of environmental elements. To do so, it will integrate concepts and methodology from a wide variety of disciplines and professions, i.e., social sciences, physical sciences, natural sciences, arts and humanties, resource management, etc.

Problem solving will be the major avenue by which courses of action and their consequences will be examined. The very nature of the content requires that the entire community with its attendant environmental problems serve as a laboratory for the identification and investigation of relevent issues and problems.

Instructional materials should be first used experimentally under a wide variety of conditions with particular emphasis upon schools, kindergarten through twelfth grade, teacher preparing institutions, and adult programs. Careful, formal evaluation must be continuous throughout the program and should be managed by an outside evaluation audit agency.

....TO PROVIDE COMPREHENSIVE ENVIRONMENTAL EDUCATION TRAINING PROGRAMS FOR EDUCATORS AS WELL AS LEADERS IN PUBLIC SERVICE, BUSINESS AND INDUSTRY, GOVERNMENTS AND ORGANIZATIONS.

LANDFILL SERVICE CORP.

104 BLACK HAWK STREET BOX 'GB' REINBECK, IOWA 50669 319-345-6316
9755 89TH AVE. NORTH OSSEO, MINNESOTA 55369 612-425-9500

WASTE EXCHANGE

NATIONAL SOLID WASTES MANAGEMENT ASSN. NSWMA

RESOURCE RECOVERY

Statement on Proposed Rules for Disposal of Hazardous Wastes
by William M. Stalpes
Vice-President of Marketing
Landfill Service Corp.

Dear Mr. Examiner:

In the past 20 years we have become a chemically dependent nation! Our "Wonder Drugs" have lost their miraculous punch because of over-use! Many orchards must now be pollinated by hand because we have over-zealously poisoned even our honeybees. The whales in Hudson Bay are contaminated with Mercury, ~~contamination~~. The Mississippi River has been nicknamed the "Colon" of Mid- America. When we think of the Mighty-Missippi we think of Atrazine... When we think of New Orleams we think of Chloroform... Cheseapeake Bay-Kepone... Lake Ontarion-Myrex... Lake Michigan and the Hudson River-P.C.B's.... Some of the fish tested had 680 ppm of various insecticides. If you are bothered with insects in your stomach, you should eat one. We are now told that P.C.B's will penetrate the gill-cover of a fish and contaminate the organism in a 20-billionth of a second. We now also have learned that asbestos fibres are capable of binding to other compounds such as P.C.B's and hitchhiking into an organsim. Consequently, I have come to the conclusion that ~~on~~ one could seriously doubt the need for good management of chemical waxtes, at least no sober person.

Therefore, if chemical wastes are being cared for properly under the existing regulations- then there is absolutely no need for new regulations. However if chemical wastes are not being properly cared for, then the alternatives seem to be to either enforce present regulations or enforce present regulations and add some new ones. The chemical waste management problem is not only extremely complex, but also is viewed from a kaleidoscope of perspectives by the problem-solvers. On the one hand, rigid environmentalists will not be satisfied until once again 100-million buffalo pound over the sod. Their's is a non-negotiable position. On the other hand, equally inflexible industrialists hold that anything that is economically right is also morally right. Their's is also a non-negotiable position. Somewhere in-between probably lies the more equitable concept that reasonable men strive for. To arrive at it we must exercise a maturity that permits us to make decisions that are not necessarily best for our own selfish interests.

MAN, AN ENDANGERED SPECIES - WE MUST ADOPT AN ETHIC THAT TEACHES AVOIDENCE OF WASTE

DATE : June 6, 1961

DEPARTMENT Conservation - Game & Fish

STATE OF MICHIGAN

Office Memorandum

TO : William Stalpos, Game Warden

FROM : James W. Kimball, Director

SUBJECT: Commendation

The purpose of this memo is to commend you for the excellent work you are doing as a game warden. The very important part you played in bringing to justice the deer slayers in the St. Peter-Ledeuc area is most commendable. This work has benefited not only you, but has been of substantial benefit to the entire Warden Service as well as the Division of Game and Fish and the Department of Conservation.

In addition to this, I have heard some very complimentary statements concerning your work from other wardens in your vicinity. There are no better men from whom you could receive a compliment. Please add mine to theirs.

JWK:lr

cc: Clarence Prout, Commissioner
F. W. Johnson
Robert J. Brown - Personnel File
Dale Peterson

My name is Claire Steen and I have a residence on Upper Hay Lake which is north of Pequot Lakes. During my teaching career of 39 years, I had the privilege of being a teacher at Pequot Lakes High School for 32 years.

When I first began teaching at Pequot Lakes, I was struck by the number of families whose livelihood depended on the tourist industry. Many parents had seasonal or full time employment at the local resorts. Their children, my students, were employed during the summer working as waitresses, bus boys, dock hands, cabin cleaners and many other jobs. If you have ever traveled to the Pequot Lakes area, you know that it is brimming with visitors during the summer enjoying our beautiful lakes and activities that they offer.

If the Sandpiper pipeline is built in the current proposed route, it will stretch across Minnesota's most beautiful and natural resourceful areas, including lakes, wetlands and forests. It will transport oil across our most precious resource which is water to very little value for local residents. My fear is that if there is an oil spill, there is absolutely no 100% guarantee that our water will not be polluted. I have attended several pipeline meetings and understand that 25% of the pipeline valves, which are used to turn off sections of pipeline in the case of a spill, would be located in the Brainerd lakes area. Even so, the number of pipeline valves is no guarantee that when our water is contaminated with oil it will be totally removed. With the 28 water crossings identified by the Minnesota Pollution Control Agency, we also know that it would be very difficult or take some time to reach an oil spill should it occur. Any amount of oil in our precious water would be an economic disaster for our lake area.

I believe that our "lake country" of the north central Minnesota needs to be fully protected from oil pipeline construction because of the history of Enbridge that is a very real danger to our lakes, wetlands, plants, wildlife and forests. I also urge the state of Minnesota to develop a long-range plan on dealing with pipelines so that our state is always known as the "land of 10,000 lakes". It is my hope that my grandchildren and future generations will be able to fish and enjoy our beautiful lakes as I have been able to do.

MINNESOTA DEPARTMENT OF COMMERCE

Comment Form: Scoping

Energy Environmental Review and Analysis

Please provide your contact information. This information and your comments will be publicly available.

Name: Claire Steen Phone: 218-829-3757

Street Address: 29 Kingswood St

City: Brainerd State: MN ZIP: 56401

Email: claire.steen@charter.net

My comments pertain to:

- ☐ **Sandpiper Pipeline Project**
- ☐ **Line 3 Replacement Project**
- ☒ **Both Projects**

I am very disappointed that Governor Dayton is in favor of the Sandpiper when he claims to be an advocate of clean water.

I believe we should avoid Minnesota altogether in pipeline building. It makes no sense to me to have the Sandpiper going from North Dakota, through Minnesota to elsewhere. I don't see a benefit in this and I think the state of Minnesota should take a strong stand on this.

Minnesota needs to develop a long-range plan regarding pipelines so that we can protect our most precious resource which is water.

If including additional pages please number them and tell us how many you are providing: _____ pages

MINNESOTA DEPARTMENT OF COMMERCE

Comment Form: Scoping

Energy Environmental Review and Analysis

Please provide your contact information. This information and your comments will be publicly available.

Name: Eric Stenquist Phone: 763-234-3484

Street Address: 1557 8th Ave

City: Anoka Mn State: Mn ZIP: 55303

Email: Chigger024@Gmail.Com

My comments pertain to:

- ☐ **Sandpiper Pipeline Project**
- ☐ **Line 3 Replacement Project**
- ☒ **Both Projects**

I would be very happy if the Sandpiper line would be built and put in Service to eliminate the excess crude oil trains that travel thrue the Fedral Cartrige Ammunition plant in Anoka Mn. this poses a very large Safety Concern to nearly all the residences in the City.

If including additional pages please number them and tell us how many you are providing: _____ pages