



Protecting the Common Waters of the Great Lakes Basin
Through Public Trust Solutions

**BEFORE THE MICHIGAN PIPELINE SAFETY ADVISORY BOARD,
MICHIGAN ATTORNEY GENERAL WILLIAM SCHUETTE, AND
MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY DIRECTOR DAN WYANT**

**ELIMINATING THE LINE 5 OIL PIPELINES' UNACCEPTABLE RISK TO
THE GREAT LAKES THROUGH A COMPREHENSIVE ALTERNATIVES
ANALYSIS AND SYSTEMS APPROACH**

December 14, 2015

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**NEW STUDY ANSWERS “NO” TO THE QUESTION: DO WE NEED LINE 5 IN THE STRAITS?
EXPERTS TAKE COMPREHENSIVE LOOK AT ENBRIDGE’S RISKY PIPELINES AND OUR
ENERGY INFRASTRUCTURE**

EXECUTIVE SUMMARY

December 14, 2015

Governor Rick Snyder’s Executive Order 2015-12 created and directed the Michigan Pipeline Safety Advisory Board (“Advisory Board”) to implement the recommendations of the Michigan Petroleum Pipeline Task Force Report (“Task Force”) on the future of oil transport through the Line 5 pipeline in the Straits of Mackinac and pipelines throughout the State of Michigan.

The July 2015 Task Force Report concludes that Line 5 in the Straits presented the “most acute potential threat” of a catastrophic oil spill given the location if this 62-year old pipeline resting on Great Lakes bottomlands. The Task Force Report accordingly calls for an independent alternatives analysis, including as an alternative the decommissioning of Line 5 in the Straits for oil transport. Other reports, including FLOW’s (For Love of Water) September 2015 Expert Report, have substantiated that the transport of oil through Line 5 in the Straits constitutes an unacceptable high-level risk and imminent harm to our waters for drinking, recreation, commerce, navigation, tourism, and our *Pure Michigan* way of life. Immediate action therefore is necessary, including the orderly completion of the alternatives and risk analyses and interim actions to eliminate imminent harm.

FLOW now submits this report titled, *Eliminating the Line 5 Oil Pipelines’ Unacceptable Risk to the Great Lakes through a Comprehensive Alternatives Analysis and Systems Approach*, to the Advisory Board to assist in implementing a comprehensive alternatives analysis to Line 5 in the Straits per the recommendations of the Task Force Report. This report and attached technical reports also are intended to help the public better understand the nature and scope of a proper alternatives analysis and to demonstrate that decommissioning of Line 5 in the Straits is a viable option given the existing capacity and supply-and-demand needs of the overall pipeline system around the Great Lakes. A preliminary review of the existing pipeline capacity and regional refinery demands affirms that Line 5 in the Straits is not vital energy infrastructure to Michigan’s economy and energy security. This report makes the following conclusions:

- 1. All alternative options must be considered. A comprehensive and full range of options is needed to comply with the Michigan Petroleum Pipeline Task Force recommendations and the Governor’s Executive Order establishing the Michigan Pipeline Safety Advisory Board.** Alternatives explored must not

be limited solely to options for transporting liquid petroleum currently carried by Line 5 in the Straits. A comprehensive alternatives analysis should review the transport of crude oil through the lens of the entire Great Lakes region's system of oil pipelines, routes, capacity and ability to deliver liquid petroleum currently carried by Line 5 in the Straits. Without a comprehensive pipeline systems view, state and federal decision-makers are unable to identify and evaluate the best alternative to Enbridge's Line 5 twin pipelines in the Straits of Mackinac.

2. **Preliminary findings in the FLOW report show that Line 5 through the Straits of Mackinac is not vital energy infrastructure to Michigan's economy. The overall pipeline system is flexible enough to meet existing demand if Line 5 through the Straits were decommissioned.** Realistic alternatives to Line 5 in the Straits could be met without disrupting distribution of natural gas liquids, including propane, to Michigan's Upper Peninsula. Alternatives to the Line 5 segment in the Straits would eliminate unacceptable harm to the Great Lakes and Michigan communities while still meeting our energy needs.
3. **Decommissioning Line 5 in the Straits is the best option.** FLOW's report concludes that decommissioning Line 5 in the Straits is the best option because it would eliminate or avoid the unacceptable and imminent harm and high risk to the Straits and Great Lakes. Moreover, the dynamic pipeline system serving Michigan, the Great Lakes region, and elsewhere meets the purposes of the larger regional system of petroleum distribution and Enbridge could continue transporting substantial volumes of crude oil.
4. **Segment-by-segment, Enbridge has effectively built its own version of the now rejected "Keystone XL Pipeline" through the center of the Great Lakes and across Michigan without public, state, and federal consideration and evaluation of the full range of existing alternatives.** In Michigan, following its 2010 Kalamazoo oil spill disaster, Enbridge applied for "maintenance and integrity" measures for Line 6B before the Michigan Public Service Commission, when in fact, it built a brand new Line 6B that more than doubled its capacity to as much as 800,000 bpd. Had Enbridge disclosed its larger project intentions, a more properly scoped alternative analysis would have evaluated Line 5, Line 6B, other pipelines, needs of users, and the pipeline system as a whole, and the imminent and unacceptable harm to the Straits could and would have been addressed.
5. **Immediate interim measures should be imposed on Enbridge, including the shutoff of oil through Line 5 in the Straits given the imminent harm and risk and the stated inability of Enbridge and the U.S. Coast Guard to clean up a catastrophic oil spill in the open waters of the Great Lakes.**



Detroit/Toledo Crude Oil Supply Pipelines



Source: Enbridge, MPC



I. OVERVIEW

FLOW (For Love of Water) submits this report titled, *Eliminating the Line 5 Oil Pipelines' Unacceptable Risk to the Great Lakes through a Comprehensive Alternatives Analysis and Systems Approach*, to assist the state officials and the Michigan Pipeline Safety Advisory Board (“Advisory Board”) in the implementation and completion of the alternatives analysis regarding crude oil transport in, through, and out of the Great Lakes Basin and Michigan, including Line 5 in the Straits of Mackinac.¹ This report consists of two parts, followed by appendices:

- Part I** The legal framework and principles for the alternatives analysis of the transport of crude oil in the pipeline system into, through, and out of the Great Lakes Basin.
- Part II** The key findings of three technical reports (attached as appendices to this report) that show:
- (A) The dynamic nature of the evolving crude oil pipeline system in the Great Lakes region (Appendix A: R. Kane Report);
 - (B) The capacity and flexibility within the crude oil pipeline system in Michigan and the Great Lakes region to achieve and provide adequate alternatives to Line 5 in the Straits of Mackinac to transport oil to users (Appendix B: G. Street Report); and
 - (C) An example of an alternatives analysis within this crude oil pipeline system and a credible option for the “decommissioning of Line 5 in the Straits segment”² that reasonably meet the basic overall purpose and objective of transporting crude oil to the various refineries within and beyond the Great Lakes region (Appendix C: R. Kane Report).

This report then concludes with (1) a summary of the legal framework for the overall system, nature, scope and stands for a proper alternatives analysis, (2) the dynamic and evolving nature of the Great Lakes crude oil pipeline system and its capacities and opportunities, and (3) a demonstration of one alternative – decommissioning Line 5 in the Straits segment – as a model and viable option that would continue to support Michigan’s energy needs *and* eliminate the catastrophic risk of an oil spill in the Great Lakes.

¹ This report is authored by James Olson, President, Liz Kirkwood, Executive Director, Kelly Thayer, Project Communications Consultant, FLOW (For Love of Water), which is based on three attached technical reports authored by members of FLOW’s scientific and legal policy advisors: Richard J. Kane, QEP, CHMM, CPP and Gary L. Street, P.E., formerly Director of Engineering, DOW Environmental (Eastern Operations). For a more complete description of the authors’ qualifications and experience, see paragraph 2., p. 7, FLOW Composite Summary of Expert Comments, Findings and Opinions on Enbridge Line 5, submitted to Michigan Petroleum Pipeline Task Force, April 30, 2015 (hereinafter “FLOW April 2015 Expert Report”).

² “Decommissioning Line 5” as used in this report includes (a) retiring use of the Line 5 in the Straits segment, or others if deemed proper as part of the overall analysis, and/or (b) prohibiting the use of Line 5 in the Straits segment for the transport of crude oil. It follows that if option (a) is viable because of overall system and infrastructure capacity, options, adjustments or changes, then (b) is viable.

II. BACKGROUND

The 1953 Easement

The 1953 Easement between the State of Michigan and Enbridge to construct and operate a petroleum pipeline in the Straits of Mackinac (a segment of Line 5 consisting of two 20-inch 4.5 mile pipelines) is subject to the authority of Act 10 and the reserved rights and interests of the state as owner and trustee of the waters and bottomlands of the Great Lakes.³ The public trust imposed on the waters and bottomlands of the Great Lakes establishes a paramount and specially protected interest in citizens, as recognized beneficiaries, for preferred uses that cannot be subordinated to other private purposes and cannot be significantly impaired; public trust uses include navigation, commerce, drinking water, fishing, boating, swimming, and similar public uses and recreational activities.⁴ As such, these waters and bottomlands have a rare, unique status, dedicated to the public in perpetuity.⁵

In the 1953 Easement, Enbridge also recognized the paramount public trust interest of the State in these waters and bottomlands. Enbridge (through Lakehead, its former company) expressly covenanted that it “*at all times shall exercise the due care of a **reasonably prudent person** for the safety and welfare of all persons and of all *public* and private property, and shall comply with all laws of the State of Michigan and the Federal Government.*”⁶ Enbridge expressly recognized that the duty to protect public and private property and to comply with state and federal law was continuing, and not fixed as to time, and that its obligation extended to public trust waters and bottomlands as “public property” of the State of Michigan.

Affirmative Public Trust Duty and Principles

The State of Michigan must manage and protect the Great Lakes and bottomlands, and these public uses, as a public trust, and in this sense, these special water and aquatic features are similar to, but perhaps more stringently protected than parklands dedicated to the public for park purposes.⁷ Specifically, any alternative analysis and assessment of petroleum pipelines necessarily must be conducted within the context of the solemn duty and protective standards

³ *Illinois Central R Rd v Illinois*, 146 US 387, 454-455 (1892); *Obrecht v. Nat'l Gypsum Co.*, 105 N.W.2d 143, 149-151 (Mich. 1960) and *Collins v. Gerhardt*, 237 Mich 38; 211 NW 115 (1926); Act 10 of 1953, Part 322, NREPA, MCL 324.32201.

⁴ *Id.*, *Collins v. Gerhardt*, supra note 32, at 49. See generally Bertram C. Frey and Andrew Mutz, *The Public Trust in the Surface Waters and Submerged Lands in the Great Lakes*, 4 U. Mich J. L. Reform 907-993 (2007).

⁵ The public trust covers “property of a special character like navigable waters, such as the Great Lakes. *Illinois Central*, supra note 2, 146 US at 453-454.

⁶ 1953 Easement, paragraph A; Michigan Petroleum Pipeline Task Force Report, July 14, 2015, p. 42 (hereinafter “Task Force Report”) https://www.michigan.gov/documents/deq/M_Petroleum_Pipeline_Report_2015-10_reducedsize_494297_7.pdf

⁷ See also James Olson and Liz Kirkwood, *A Scientific and Legal Policy Report on the Transport of Oil in the Great Lakes*, September 21, 2015 (submitted to Attorney General William Schuette, DEQ Director Dan Wyant, et al. as follow up to the Task Force Report), footnotes 63 and 64, and accompanying text (hereinafter “FLOW September 2015 Expert Report”).

imposed by the public trust in the Great Lakes. As stated by the Michigan Supreme Court, “the state has the constitutional power to insist that its natural advantages remain unimpaired.”⁸

The Michigan Petroleum Pipeline Task Force Report Demands a “Comprehensive” and “Full-Range” Alternatives Analysis for Line 5.

According to University of Michigan researchers, a spill or release in the Straits is the “worse possible place” in the Great Lakes.⁹ In reviewing important scientific studies like this, the Task Force determined that the consequences of a crude oil spill or release from Line 5 in the Straits of Mackinac would be “very significant”¹⁰ with Task Force members unanimously agreeing that there should never be a release of crude oil from Line 5 in the Straits.¹¹ The Task Force Report soundly rejected Enbridge’s assertion that “the existing 61-year-old Straits Pipelines can be operated indefinitely and that it neither has, nor needs to consider, a plan to replace them.”¹² The report criticized this reasoning: “This is not a reasonable position.”¹³

Accordingly, the Task Force Report concluded that an alternatives analysis and assessment is critical for preventing the high-level risk and unacceptable harm of a spill or release in the Straits¹⁴ and is based in law. “Thus, from a legal perspective, decisions about the future operation of the Straits Pipelines must be informed by careful consideration of the full range of alternatives available.”¹⁵ The Report went on to say: “there is a need for, and importance of, a comprehensive alternatives analysis,”¹⁶ and “[F]or all these reasons, a comprehensive analysis of alternatives to the existing Straits pipelines is needed.”¹⁷

The Task Force Report for the Straits Pipelines thus recommended that the state:

3. Require an Independent Analysis of Alternatives to the Existing Straits Pipelines. These alternatives should include:
 - a. Constructing alternative pipelines that do not cross the open waters of the Great Lakes and then decommissioning the existing pipelines;
 - b. Utilizing alternative transportation methods and decommissioning the existing pipelines;

⁸ Obrecht, *supra* note 3, 361 Mich at 414-415; *State v Venice of America Land Co.*, 125 N.W. 770, 772 (Mich. 1910); *State v. Lake St. Clair Fishing & Shooting Club*, 127 Mich. 580, 586, 87 N.W. 117 (1901); *Lincoln v. Davis*, 53 Mich. 375, 388, 19 N.W. 103 (1884). The Michigan Supreme Court has characterized the states and all three branches of government as the “sworn guardians” of this “solemn and perpetual” duty. Obrecht, *supra* note 3, 105 NW2d at 149-151; Collins, *supra* note 3, 237 Mich at 49.

⁹ Task Force Report, p. 17 fn 56.

¹⁰ *Id.* at p.43.

¹¹ Proceedings, Michigan Petroleum Pipeline Task Force, December 15, 2014.

¹² Task Force Report, pg. 47.

¹³ *Id.*

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ Task Force Report, p. 48.

¹⁷ *Id.*

- c. Replacing the existing pipelines using the best available design and technology;
- d. Managing the status quo, including an analysis of the effective life of the existing pipelines.

The report states only that the analysis “should include,” and is not meant to be all inclusive. As noted above, the Task Force Report reasoned that the analysis must be “comprehensive” and consider a “full range” of alternatives. Decommissioning and/or removing oil from Line 5 in the Straits segment, for example, would also include the alternative that would prohibit oil transport in the Straits segment, since it is a reasonable alternative for purposes of analysis, given the fact that Line 6B in lower Michigan has been recently doubled in capacity.¹⁸ Indeed, reading the list as all inclusive or limited to the literal reading of the listed alternatives a. through d. would be contrary to the legal perspective behind the recommendation, and violate basic legal requirements for “full” range and thorough evaluation of alternatives, as described in Part I of this Report.

Despite Line 5’s unacceptable high risk of catastrophic harm to the Straits and public trust, alternative routes and capacity, or new routes, to oil transport through this pipeline in the Straits were never considered in 1953. Since then, laws in the past 60 years governing everything from public safety, hazardous materials, and public lands, parklands, and the environment all uniformly required alternative analyses.¹⁹ And yet, neither Enbridge nor the State, through its review and approval of significant pipeline improvements, expansion, or replacements, such as Line 6B after the Kalamazoo River disaster, have submitted or conducted any alternative analyses or studies to the pipeline system and its capacities within Michigan or the Great Lakes region.

For example, when Enbridge decided to build a new Line 6B and obtain approval from the Michigan Public Service Commission (“MPSC”) over a period of years from 2011 to 2013, it applied for permits in piecemeal fashion. Enbridge applied for and obtained approval of smaller segments of a new 36-inch Line 6B that doubled its capacity for transporting crude oil, by characterizing in applications the project was for “maintenance and integrity.” In effect, Enbridge’s actions avoided and the MPSC failed to conduct, an alternative study for transport of crude oil through Michigan and its pipeline systems connected outside of the Great Lakes region. In fairness, Enbridge is not in a position to challenge the missing comprehensive, “full-range” alternative analysis directed by the Task Force, when it carefully avoided it to double its capacity to transport crude oil in the Great Lakes region, including Michigan; in effect, it appears that Enbridge has built its own “Keystone XL” pipeline through the center of the Great Lakes without full disclosure or consideration by the state of this fundamental objective and purpose.²⁰

The Michigan Petroleum Pipeline Task Force Report Bans “Heavy Crude Oil,” Reasoning that Spills of Heavy Crude Oil Into Open Water Cannot Be Effectively Cleaned Up.

The Task Force Report’s first recommendation bans heavy crude oil transport through Line 5 based on the following rationale:

¹⁸ See Part II, *infra*, p.18.

¹⁹ Part I, *infra*, p.16.

²⁰ See R. Kane Report, Appendix A, p. 6.

The U.S. Coast Guard has publicly stated that spills of heavy crude oil into open water cannot be effectively cleaned up. Transporting such material through the Straits Pipelines would unreasonably risk environmental and economic harm. The 1953 Straits Pipeline Easement requires Enbridge at all times in operating the Pipelines to “exercise the due care of a reasonably prudent person for the safety and welfare of all persons and of all public and private property.”²¹

In short, the Task Force Report concluded that the risks associated with diluted bitumen or “heavy” crude oil from the “tar sands” in Alberta, transported by Enbridge and other pipeline companies constitute an “unreasonable risk of harm,” because a release of “heavy” or “tar sands” oil “could not be effectively cleaned up.”²² Current methods available to the U.S. Coast Guard as first responders are inadequate to clean up a “heavy” or diluted heavy crude oil spill in the Great Lakes. In fact, a spill or release of any form of crude oil, including “tar sands” oil that has been diluted to be labeled “synthetic light” or “medium” crude oil, cannot be effectively cleaned up in winter months or windy, stormy conditions,²³ and cannot be adequately cleaned up anytime of the year, even under normal conditions.²⁴ In turn, this inadequate response would violate the standard of “reasonably prudent person” in the Enbridge Easement.

In September 2015, the State of Michigan determined and Enbridge agreed that no heavy or diluted bitumen crude oil transport through Line 5, thus relying on other alternatives in the overall pipeline system to transport “tar sands” or “heavy” crude oil to various destinations in the U.S. and Canada, or for export to other refineries from Montreal or Maine.²⁵ Given the inadequate emergency clean up response to all crude oil, especially in winter, the State of Michigan should extend this same logic and reasoning to all crude oil transported in Line 5 in the Straits.

²¹ Task Force Report, p. 45.

²² Id. See also National Academy of Science. “Spills of Diluted Bitumen from Pipelines: A Comparative Study of Environmental Fate, Effects, and Response.” December 2015, pp.45-47. <http://www.nap.edu/catalog/21834/spills-of-diluted-bitumen-from-pipelines-a-comparative-study-of> “The Great Lakes system of the U.S. and Canada has distinct characteristics that would affect the behavior and impacts of an oil spill. Transmission pipelines capable of transporting diluted bitumen products^{iv} cross the Great Lakes system at two points: the Straits of Mackinac between Lake Michigan and Lake Huron,⁷⁰ and the St. Clair River upstream of Detroit and Lake Erie. A release at either the Mackinac Straits or the St. Clair River would lead to movement of oil into the lakes. Additionally, pipelines cross many streams and rivers that flow short distances to either the southwestern shores of Lake Superior or the southern shores of Lake Michigan. Currents can be complex in the Great Lakes, with currents in the Straits of Mackinac depending on relative water levels of Lakes Michigan and Huron as well as on wind speed and direction. It could be very difficult to anticipate the movement of the spilled oil and to recover the oil, even at the surface, due to the expansive area and potential for strong wave action. Ice cover during winter could impede detection and recovery of spilled oil.” Id. at pp. 45-47 (footnotes omitted).

²³ Task Force Report, p. 45; Keith Matheny, “Oil spill, high waves: A Great Lakes disaster scenario,” USA Today/Detroit Free Press, December 6, 2015, <http://www.usatoday.com/story/experience/food-and-wine/news-festivals-events/2015/12/06/oil-spill-high-waves-great-lakes-disaster-scenario/76890650/>.

²⁴ Keith Matheny, “A readiness test: What if oil spewed into Great Lakes?” Detroit Free Press, September 25, 2015 <http://www.freep.com/story/news/local/michigan/2015/09/24/enbridge-line5-oil-pipeline-straits-mackinac-spill-great-lakes/72582654/>; Garret Ellison, “All hands on deck’ Enbridge oil spill drill planned for Mackinac straits” MLive, August 13, 2015 http://www.mlive.com/news/grand-rapids/index.ssf/2015/08/enbridge_spill_drill_mackinac.html

²⁵ Agreement, State of Michigan and Enbridge, September 3, 2015.

Executive Order No. 2015-12 and the Michigan Pipeline Safety Advisory Board

In September 2015, Governor Rick Snyder also established the Michigan Pipeline Safety Advisory Board to implement recommendations of the Task Force, including the alternative analysis, of the Task Force Report for Line 5.²⁶ Presently, the Advisory Board is reviewing and establishing a “draft scope of work” to implement the independent analysis of alternatives called for by the Task Force Report and Executive Order.

To assist the Attorney General, Department of Environmental Quality, Department of Natural Resources, Governor, and newly established Advisory Board, FLOW has prepared this report to define the proper framework, scope, and principles for the State of Michigan’s alternatives analysis called for by the Task Force Report and Executive Order 2015-12; the report also includes the accompanying technical reports from FLOW’s science and policy advisors. Part I of this report sets forth the basic framework and principles for a comprehensive and full-range alternatives analysis. Part II of this report illustrates that there is ample capacity in the evolving crude oil pipeline system into, around, through, and from the Great Lakes region for achieving a comprehensive analysis, and demonstrates, by using one of the listed alternatives in the Task Force Recommendation No.3.

PART I: A PROPER FRAMEWORK AND PRINCIPLES FOR A COMPREHENSIVE ALTERNATIVES ANALYSIS

There are two legal approaches to alternatives analyses when addressing imminent hazards, harm to the environment, and public health and safety. The first approach is based on laws and directives, such as E.O. 2015-12, that intend to prevent, eliminate or significantly reduce loss, harm or imminent risks to recognized and important values associated with public lands, waters, bottomlands, and natural resources; these protected and highly valued resources include wetlands, parklands, or wilderness areas, open space, natural areas, sand dunes, historic resources, and public trust waters and bottomlands, and their water dependent uses. The second is based on federal or state laws that require full disclosure of impacts and consideration of a full range of alternatives to avoid or minimize impacts associated with the existing or proposed conduct under review; this typically includes federal and state laws or rules that require environmental impact statements or studies or consideration of impacts and alternatives.²⁷ Both of these approaches provide useful guidance for the direction from the Task Force and Governor Snyder to conduct an independent alternatives analysis to the transport of oil in the Great Lakes, including Line 5 in the Straits of Mackinac.

The first approach is central to the alternatives analysis because the protection and prevention of unacceptable harm and unreasonable risk to the Straits and Great Lakes is well-established in the basic structure of environmental and natural resources law and policy of Michigan.²⁸ The

²⁶ Executive Order No. 2015-12, Sept. 15, 2015 (hereinafter “E.O.”).

²⁷ E.g., National Environmental Policy Act, 42 USCA 4332(C) (“NEPA”); Part 13, NREPA, MCL 324.1701 et seq.; Vanderkloot, *supra* note 3, 392 Mich at 184-186; see Part I, B, *infra*.

²⁸ E.g., Mich. Const., art. 4, Sec. 52 (the “air, water and natural resources... are of “paramount public concern” and the legislature “shall” provide by law for the “protection of air, water, and natural resources from pollution,

prohibition of conduct that would impair or destroy these important resources is consistent with this law and policy, unless it can be demonstrated that there are no alternatives. Specifically, these waters and bottomlands are protected by the public trust doctrine and Michigan law, and that legally recognized protected public trusts uses are paramount to all other uses.

A. Loss, Damage, and Unacceptable or Imminent Harm to Highly Valued Public Lands, Waters, and Natural Resources Must Be Prevented, Eliminated, or Significantly Reduced.

This first type of alternatives analysis is based on statutory, regulatory, or common law government directives that intend a clear showing that alternatives do not exist or are not suitable, feasible or prudent in order to prevent the loss or unnecessary likely loss, harm or unreasonable risks to health, safety, natural resources, lands, and the environment. This first approach is aimed at avoidance or elimination of the loss, harm or significant or unreasonable risk, where possible, to protect special water and/or lands – such as parklands,²⁹ wetlands,³⁰ or public trust waters³¹ – or unwanted hazardous risks to the environment,³² historic resources,³³ or risks to public health and safety.³⁴

impairment, and destruction;” Part 17, NREPA, MCL 324.1701 et seq. (mandates protection of “air, water, natural resources, or the public trust in those resources” from likely pollution or impairment” pursuant to art 4, sec. 52.

²⁹ *Citizens to Preserve Overton Park v Volpe*, 401 US 402, 91 S Ct. 814 (1971). Section 4(f) of the Federal DOT Act prohibits use of public parks or other special public lands unless it is shown there are no feasible and prudent alternatives to a project. 49 U.S.C. 1653(f).

³⁰ E.g., Michigan Wetlands Protection Act, Part 303, NREPA, MCL 324.30311(4)(b). “[O]ur Legislature, following the lead of the United States Congress, passed comprehensive legislation to protect Michigan’s wetlands for the benefit of its citizens. This represents a clear public policy determination and statement of the importance to the citizens of this state, including property owners, of preserving wetlands for public welfare. [M.C.L. § 324.30302](#). Moreover, the Michigan Constitution provides that “[t]he legislature shall provide for the protection of the air, water and other natural resources of this state...” *Const. 1963, art. 4, § 52*. In keeping with this mandate, the Legislature enacted the Natural Resources and Environmental Protection Act (NREPA), [M.C.L. § 324.101 et seq.](#), which contains the WPA. The Legislature vests the DEQ with the responsibility for guarding our state’s valuable natural resources on behalf of the citizens of this state. [M.C.L. § 324.501](#); *K & K Const., Inc. v. Dep’t of Env’tl. Quality*, 267 Mich. App. 523, 549, 705 N.W.2d 365, 378-79 (2005); see also *Northland Properties v DEQ*, 2010 WL 4628645 (2010). See also *Carabell v DNR*, 191 Mich App 610 (1961) (denial of wetlands permit not a takings of property where there existed feasible and prudent alternatives).

³¹ Public trust in Great Lakes is incorporated into MEPA, MCL 324.1703, and the Great Lakes Submerged Lands Act, MCL 324.32501 et seq.

³² *Schmude Oil v DEQ*, 306 Mich App 35 (2014) (Statute demanded prudent development in Pigeon River Country State Forest natural area, and lawfully prohibits drilling permits where there is no showing of or there exist feasible and prudent alternatives).

³³ *Grosse Pte. Park v Detroit Historic Comm’n*, 2012 WL 1367533 (Mich App No. 298802, 2012) (protection of historical buildings where no showing that there was no feasible use or development alternatives).

³⁴ *Industrial Union AFL-CIO v Hodgson*, 449 F.2d 467, 477-478 (1974) (Secretary of Labor finds significant material risk to health, Secretary can establish new “most protective” standard to avoid the risk, where feasible, and increased costs or lower profits, in light of the protective intent, is not sufficient to reject an alternative); See also, *Airport and Airway Improvement Act (“AAIA”)*, 49 USC 47106(c)(1)(B). The Secretary of Transportation, after assessing environmental and safety risks can approve a project “only after finding that no possible and prudent alternative to the project exists.” *Id.* Like Sec. 4(f) in the DOT Act, addressed in *Overton Park*, supra note 29, the AAIA provision seeks to avoid the use of publicly owned lands, such as parks, recreation areas, wildlife refuges, or historic sites.

This first approach is uniquely suited for the independent alternatives analysis directed by the Task Force and E.O. 2015-12. The Great Lakes and public trust are highly valued waters, resources, and public trust and riparian uses that all agree should be protected from unacceptable harm and risks such as a catastrophic oil spill.

For example, the Michigan Environmental Protection Act (“MEPA”) applies to all state and local government agencies, boards, or other government bodies in Michigan.³⁵ There is an affirmative duty to prevent, or, if determined to be not feasible or prudent, then minimize likely degradation of the environment or public trust.³⁶ Where there is a demonstrated “likely”³⁷ pollution or impairment of air, water, natural resources, or the public trust in those resources, the conduct must be prohibited or modified to eliminate the harm or serious endangerment of pollution or impairment, where it is shown that there are no feasible and prudent alternatives.³⁸ In Michigan, under the MEPA, the burden of proof rests with the person engaging in the conduct to demonstrate there are truly unusual factors of an extraordinary magnitude to show an alternative does not exist or cannot be implemented. Inconvenience and increased costs, as a rule, are not sufficient reasons to reject an alternative.³⁹

³⁵ Part 17, NREPA, MCL 324.1701 et seq.; Vanderkloot, *supra* note 3; MCL 324.1703, *Nemeth v Abonmarche Development Co*, 457 Mich 16; 576 NW2d 641 (1998); *Wayne County Health Dept v Olsonite*, 79 Mich App 668 (1977) (defendant required to implement feasible and prudent paint-spray technology to eliminate or reduce likely pollution and health risks, particularly where studies of alternatives were inadequate).

³⁶ See FLOW September 2015 Expert Report, pp.7, 25-26. *Ray v Mason Co Drain Comm’r*, 393 Mich 294; 224 NW2d 883 (1975). The Court recognized that “likely” is a function of probability and magnitude of harm or impairment. If the magnitude of harm is high, then the threshold for “likely” pollution or impairment is correspondingly lower. See *Env. Action Council v Natural Resources Comm’n*, 405 Mich 741 (1979) (despite unknown extent or probability, the Court found a prima facie “likely” impairment because oil and gas development based on evidence could alter the return of a rare, unique elk herd population in the Pigeon River Country Forest).

³⁷ The term “likely” is a function of magnitude of harm and probability that determine risk. A release of crude oil, as recognized by Task Force Report, is an unreasonably high risk that should be prevented or avoided. Such a high or unreasonable risk is tantamount to “likely.” *Ray*, *supra* note 36, 393 Mich at 308.

³⁸ *Wayne County Health Dept.*, *supra* note 35, 79 Mich App at 703-707. This case and others provide a clear substantive set of standards and principles regarding the nature, approach, scope, and substantive standards for an alternative analysis. See also *Nemeth*, *supra* note 35; *Ray*, *supra* note 36.

³⁹ *Id.*, 79 Mich App at 704-705. The court noted: “This interpretation of ‘prudent alternative’ is bolstered by recognition that the Legislature rejected an amendment which would have inserted the phrase, ‘considering all relevant surrounding circumstances and factors’ before the ‘feasible and prudent’ language of s 3(1). See, *[at] 706 Note, Michigan’s Environmental Protection Act: Political Background, 4 U.Mich.J.L.Ref. 358, 363 (1970), and Thibodeau, Michigan’s Environmental Protection Act of 1970: Panacea or Pandora’s Box, 48 Journal of Urban Law 579, 586 (1971). [co anchor F191978145567_1](#) Applying the cited cases to the facts at hand, we conclude that the defendant has failed to show the technical, economic infeasibility and the imprudence of alternatives to defendant’s conduct. Although the adoption of additional pollution controls may financially burden Olsonite and adversely affect its profit margin, Hodgson, *supra*, we believe, in light of the revenue data noted, *supra*, that the company is fully able to finance the added cost of restraining odorous emissions. The costs involved do not approach ‘extraordinary magnitude’ or ‘truly unusual factors’, *Overton Park*, *supra*, refute the demonstrated prudence of alternative systems. We believe that a reasonable, cost-effective solution to Olsonite’s odor problem can be achieved if an earnest examination of other abatement methods is made. Defendant’s conduct, then, will no longer be inconsistent with the promotion of public health, safety and welfare in light of Michigan’s paramount concern for the natural resources of the state.” See also *STOP H-3 Ass’n v Dole*, 740 F3d 1442 (9th Cir. 1984).

Parklands are protected against highway routes and development where there exist feasible and prudent alternatives.⁴⁰ Risks, impacts, harms and loss of natural public lands or property are protected where there are alternatives for the location of airport facilities.⁴¹ Similarly, given the common law and statutory recognition of the importance of public trust in the Great Lakes, the Straits of Mackinac are legally protected from likely harm or endangerment, where feasible and prudent alternatives exist.

Accordingly, the state's independent alternatives analysis of the crude oil pipeline system in the Great Lakes region, including the Line 5 segment in the Straits of Mackinac, should follow the legal framework for the study of alternatives that protect the public trust, water, and natural resources in the Straits and Great Lakes and avoid alternatives like oil transport in the Straits – especially where the analysis reveals that the greater pipeline system can address or adjust through other suitable pipeline options and alternatives.

B. Environmental Impact and Alternatives Statements and Assessments “Rigorously” Evaluate Potential Impacts and a Comprehensive and “Full Range” of Potential Alternatives That Would Avoid or Minimize Such Impacts.

This second type of alternatives analysis is found in government actions that require consideration of possible impacts and alternatives, so called environmental impact statements (“EIS”) or reports, including evaluation of alternatives.⁴² The EIS or National Environmental Protection Act (“NEPA”) assessment of impacts is considered a procedural *disclosure requirement*, and not a *substantive* standard to approve or reject a project or operation, such as those described in Part I, A. above.⁴³ Typically, the EIS or assessment must evaluate a full range of reasonably possible alternatives to accomplish the basic purpose of the project under review⁴⁴ – that is, a detailed disclosure of alternative ways or methods that would avoid or reduce impact and accomplish the goal or purpose.⁴⁵ However, in doing so, the government body must conduct a thorough evaluation and provide detailed reasons for its conclusions.⁴⁶

This second approach provides a useful guideline for government bodies in determining the scope of the substantive framework and principles that underlie the nature of the substantive

⁴⁰ Overton Park, *supra* note 29.

⁴¹ See *supra* note 34 on the Airport and Airways Improvement Act, 42 USC 47106(c)(1)(B), which has an alternative analysis based on avoiding or reducing risks to public safety, nuisance, and noise.

⁴² E.g. Section 4332(C), National Environmental Policy Act, 42 USCA 4332(C) (hereafter “NEPA” and its “EIS” requirement); Calvert Cliffs Coordinating Committee v Atomic Energy Comm’n, 449 F 2d 1109 (D.C. Cir. 1971); Michigan Environmental Protection Act, Part 17, NREPA, 324.1705(2) (“MEPA” – government must consider and determine likely effects and existence of alternatives that would avoid those effects); Vanderkloot, *supra* note 3, (duty consider likely effects and alternatives).

⁴³ E.g., Village of Palatine v US Postal Service, 742 F Supp 1377 (N. D. Ill 1990); Sierra Club v Coleman 421 F Supp 63 (D.C. Dist. 1976).

⁴⁴ E.g., Council of Environmental Quality rules on NEPA impact and alternative studies and statements. 40 CFR 1500.

⁴⁵ *Id.* NEPA EIS, Alternatives requirement, 42 USCA 4332(C)(3). “The purpose of an EIS is a “full and fair discussion [to] inform decision makers of environmental impacts... and reasonable alternatives which would avoid or minimize adverse impacts.” 40 CFR 1502.1; Stewart Park & Reserve Coal Inc. v Slater, 352 F 3d 545, 557 (2d Cir. 2003).

⁴⁶ Sierra Club v Coleman, *supra* note 43.

analysis required under the first type of approach described in Part I, A above. The Task Force Report concludes there must be a “comprehensive” analysis of a “full range” of alternatives. E.O. 2015-12 charges the Pipeline Safety Advisory Board with implementing this Task Force recommendation. Likewise, EIS and NEPA guidelines encourage thorough analysis and demand a full and detailed study of alternatives and impacts where reasonably possible. For example, the requirements for a federal NEPA-type EIS analysis of alternatives must be based on a full evaluation and disclosure of all possible approaches or paths that would avoid or lessen impacts to the environment.⁴⁷ NEPA’s principles include “rigorous” detailed study of effects and alternatives.⁴⁸ A wide range of possible paths of reasonable alternatives must be considered to eliminate or minimize possible impacts. A “hard look” detailed evaluation of alternatives is required.⁴⁹ Moreover, the approach to the alternative requirement cannot be drawn too narrowly where it would result in the impacts or significant risks that are to be disclosed or avoided.⁵⁰ In sum, an agency is forbidden to limit the range of reasonably possible alternatives.

The common law of environmental quality that has evolved under MEPA, Part 17, Natural Resources and Environmental Protection, also requires a consideration of the likely impacts of a project or on-going operation and full range of alternatives, before a government body approves or allows a project to operate.⁵¹

In *Ray*, the Michigan Supreme Court imposed a substantive duty on both public and private entities alike “to prevent and minimize” likely impairment, pollution, or degradation of the environment.”⁵² In other words, there is an enforceable duty that those engaged in conduct or review such conduct must seek to prevent, if possible, threatened or likely environmental degradation.

⁴⁷ Calvert Cliffs Coordinating Comm., supra note 42.

⁴⁸ 40 C.F.R. 1506(a)(2).

⁴⁹ E.g., *State of California v Bergland*, 483 F Supp. 465 (1980); *Citizens for Env. Quality v U.S.*, 731 F Supp 970 (1989).

⁵⁰ 40 CFR 1502.14. “[A]gencies shall: (a) Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated. (b) Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits. (c) Include reasonable alternatives not within the jurisdiction of the lead agency.” This is similar to Michigan wetlands law, which discourages alternative analysis that draws the purpose or conduct in question so narrowly as to preclude consideration of alternatives that would eliminate or significantly reduce the loss of wetlands or natural resources that are threatened. MCL 303011(b)(4); R281. DEQ WPA rules prohibit “unduly narrowing” the basic project purpose to avoid considering alternatives, as did the respondent in this case. Applicant cannot narrow the purpose and must prove it has considered and established least damaging or wetland loss alternatives are not feasible and prudent. R281.922a(4), .922a(8); .922(A)(6).

⁵¹ *Id.*, Vanderkloot, supra note 3, 392 Mich at 185-186. While [MEPA] creates a procedural cause of action, [MEPA] also establishes substantive standards imposed upon those engaging in, or likely to engage in, pollution, impairment, or destruction of the air, water or other natural resources or the public trust therein. “In relevant part [MEPA] proscribes such pollution, impairment, or destruction unless it is demonstrated that “...There is no feasible and prudent alternative to (the polluting, impairing, or destroying entity’s) conduct and that such conduct is consistent with the promotion of the public health, safety, and welfare in light of the state’s paramount concern for the protection of its natural resources from pollution, impairment or destruction”

⁵² 393 Mich at 308 (“such a showing is not restricted to actual environmental degradation... Obviously the evidence necessary to constitute a Prima facie showing will vary with the nature of the alleged environmental degradation involved.”)

In *Vanderkloot*, the Michigan Supreme Court ruled that the MEPA established two fundamental and enforceable duties on the part of government bodies. One, the government body must consider the possible impacts and full range of alternatives that would avoid or minimize the possibility or likelihood of impacts. Two, where there are likely effects that would pollute or impair the air, water, natural resources, or public trust, the conduct is not to be allowed if there exist feasible and prudent alternatives, as described in Part I, A, above.⁵³ The Court invalidated the decision on a highway route and development because the department had failed to comprehensively consider alternatives.⁵⁴ In addressing the scope of alternative analyses the Court stated,⁵⁵ the MEPA is designed to accomplish two distinct results:

- (a) to provide a Procedural cause of action for protection of Michigan’s natural resources; and
- (b) to prescribe the Substantive environmental rights, duties and functions of subject entities.

‘3. Evaluation of alternatives... “[S]hould include a *full* explanation of the reasons why the agency decided to pursue the action in its contemplated form rather than an alternative course of action”

Indeed, the Court in *Vanderkloot* advised government bodies to look to the NEPA EIS requirements under federal law when considering the effects of a project and conducting a “full” alternatives analysis under the MEPA.⁵⁶

In summary, the Task Force Report calls for a “full range” and “comprehensive” alternatives analysis of crude oil transport in the Straits segment of Line 5. As shown in Section A and B above, the law and court principles support this recommendation. The following framework, nature, scope, and principles should be applied to assure that a legally proper independent alternatives analysis is followed for the transport of crude oil through Line 5 in the Straits of Mackinac.

⁵³ MCL 324.1705(2). For principles and standards on the meaning of “feasible” and “prudent,” see Wayne County Health Dept, *supra*, note 35 at 704-707.

⁵⁴ *Vanderkloot* has been affirmed by subsequent appellate cases. *Genesco v MDEQ*, 250 Mich App 45 (2002); *Buggs v Michigan Public Service Comm’n*, 2015 WL 159795 (Mich App Nos. 315058, 315064, Jan. 13, 2015). It is most important to note that EPA does not, as both parties imply, merely provide a separate Procedural route for protection of environmental quality, it also is a source of supplementary substantive environmental law. See Sax and Conner, ‘Michigan’s Environmental Protection Act of 1970: A Progress Report,’ 70 Mich. L.R. 1004, 1054—1064 (1972).

⁵⁵ 392 Mich at 187-188.

⁵⁶ *Id.* The Court noted that although NEPA did not apply, it was useful guidance to a government body in fulfilling its duty to consider impacts and a range of alternatives when reviewing a project: “While Executive Directive 1971—10 quoted by the Commission (Commission’s Brief pp. 37—38) was not issued until September 30, 1971 and was not in effect when the Statement of Necessity in this case was filed May 12, 1971, it usefully illustrates; and the Commission indicates adoption as, a proper executive interpretation of [Const.1963, art. 4, s 52](#) and, more particularly, the ‘no feasible and prudent alternative’ provision of [M]EPA.” *Id.*, at p. 188.

1. The nature and purpose of the independent alternatives analysis of the transport of crude oil through Line 5 in the Straits is to prevent or eliminate the risk of a crude oil leak, spill, or release in the Great Lakes and Straits of Mackinac.
2. To prevent or avoid a leak, spill or release from Line 5, the transport of crude oil in the Straits segment should be eliminated or prohibited unless it is demonstrated there are or is no feasible and prudent alternative to this conduct.
3. The approach and scope should be comprehensive and evaluate the “full range” or reasonable alternatives to the transport of crude oil in the Straits through the location, capacity, adaptability, and reasonable potential to achieve the overall dynamic purposes served by the crude oil pipeline system through and around the Great Lakes.
4. The overall purposes of the crude oil pipeline network in and around the Great Lakes must not be drawn or evaluated too narrowly; in other words, segments of the whole system should not be isolated from the evaluation of the system as a whole.
5. The standards for evaluating an alternative location, route, and capacity exists or can be put into place in the future are whether the alternative or alternatives in combination are “feasible,” “prudent,” or “suitable.” Mere inconvenience or additional or increased costs are not proper reasons for finding an alternative does not exist. Other factors, such as social, public health, safety, relative costs and benefits, risk to tourism, loss of public uses, harm to public and private property maybe considered, but the balancing of these factors cannot be used as a substitute to the feasible, prudent, or suitable standards.
6. The burden of information to establish alternatives do not exist generally on the entity, like Enbridge, whose conduct has been determined to require a full alternatives analysis.

PART II DYNAMIC AND EVOLVING CRUDE OIL PIPELINE SYSTEM IN, THROUGH, OUT OF GREAT LAKES REGION AND THE DEMONSTRATION OF ADEQUATE CAPACITY AND ALTERNATIVES TO TRANSPORT CRUDE OIL WITHOUT USING LINE 5 IN STRAITS OF MACKINAC

FLOW’s scientific and technical advisors have prepared three separate reports (attached as Appendices), based on publicly available information, to:

- (1) describe the current dynamic and evolving crude oil pipeline system into, through, around, and out of the Great Lakes Basin;
- (2) evaluate the capacity and reasonable adjustments and alternatives that can accommodate the purposes and objectives of the pipeline system, and

(3) demonstrate by example the evaluation of an alternative that, if applied, would eliminate the transport of crude oil in Line 5 in the Straits.

A. The Dynamic Nature of the Evolving Crude Oil Pipeline System in the Great Lakes Region

This section summarizes the key findings and conclusions of Rick Kane's Report, *"The Context: Understanding the Evolving North American Oil Pipeline System in Preparation for Considering Alternatives to Enbridge's 'Line 5' in the Mackinac Straits,"* which is attached in Appendix A.

The proper context for considering and conducting the State of Michigan's forthcoming assessment of alternatives to the Enbridge Line 5 oil pipelines is a "systems" view and understanding, rather than a segmented approach.

The search for alternatives to the "Line 5" oil pipelines must be understood in a larger "systems" context rather than an isolated debate about the importance of the pipeline's continued operation, pipeline reliability versus other transportation modes, and emergency response capability. Enbridge's 645-mile Line 5 pipeline is just one segment of a vast pipeline system involving complex strategies among producers, pipeline operators and other transporters, refineries, and end users. A pipeline "systems view" and understanding of company strategies is an essential step in protecting the public trust waters and bottomlands of the Great Lakes and their protected uses, including for navigation, swimming, fishing, and community drinking waters supplies, and in protecting the water-based economy and ensuring energy supply security.

The hazardous liquids (oil and natural gas liquids) transport sector operates as a complex, dynamic, and evolving system that has a significant impact of public safety, the environment, citizen rights, the economy, and national energy security. For example, the North American crude oil and natural gas liquids ("NGLs") supply-chain system has witnessed a rapid evolution driven largely by the development of NGL and crude oil shale reserves in North Dakota and tar-sands crude oil reserves in Alberta, Canada and more recently the Marcellus and Utica shale reserves in Pennsylvania, West Virginia and Ohio. As a result, crude oil and NGLs that once flowed from the Gulf of Mexico north to Great Lakes refineries, are being reversed so that the Gulf and the East Coast are the final destinations or raw and refined crude from the north.

Surprisingly, however, a comprehensive systems view about the sector's evolving nature is not available to government agencies and the public at large, which hampers their ability to make fully informed decisions about public trust resources like the Great Lakes and other impacts of pipeline and related projects and existing operations at the local, state, and federal levels. Without a comprehensive pipeline systems view, state and federal decision-makers are unable to identify and evaluate better alternatives, and, in turn, are unable to eliminate high-level risks and unacceptable harm, as in the case with the location of Enbridge's Line 5 twin pipelines in the Straits of Mackinac.

Key systems drivers and assumptions in the oil and gas, chemical, and energy sectors include, among others, (a) the development of new crude oil and NGLs reserves, (b) global events altering supply, demand, and pricing of these global commodities, and (c) pipelines

preferred over other transportation modes where large, long-term reserves are being exploited.

Key system drivers and assumptions are critical to understanding a systems approach. As noted above, the development of the Bakken crude shale and Alberta tar sands has transformed North American energy, shifted the direction of the flow of petroleum products, and even created excess for export. Refinery operators and petrochemical and energy producers accordingly have evolved, invested in, and modified their assets⁵⁷ based on forecasted availability and pricing for the different feedstock. Similarly, pipeline companies and rail carriers have adapted and expanded their networks to meet the needs of the producers or feedstock shippers. As between the different modes of transportation (particularly in light of major rail accidents), pipelines are the preferred and safest option for transporting crude oil and NGLs.⁵⁸

Segment-by-segment pipeline expansion of the Enbridge network results in understated impacts, harm, and risk, and conceals existing capacity within, and other alternatives to, the overall pipeline system.

In the past decade, North American pipeline system owners are expanding and modifying their networks to transport Bakken crude oil and Alberta tar-sands crude oil to the coasts. While public attention has focused on the now-rejected Keystone XL pipeline, Enbridge has quietly and strategically expanded capacity in a segment-by-segment fashion, resulting in a system-wide redirection of Bakken crude oil and Alberta tar sands to the East Coast (Montreal and Portland, Maine), the Gulf Coast, and the Canadian West Coast.⁵⁹

In Michigan, for example, the Public Service Commission (“MPSC”) missed an important opportunity to examine Enbridge’s Lakehead pipeline system and alternatives to Line 5 in the Straits of Mackinac, when Enbridge requested the Line 6B pipeline replacement, following its unprecedented, nearly million-gallon heavy tar sands oil spill in 2010 into the Kalamazoo River and its watershed. Had the MPSC conducted a proper systems alternatives analysis, the agency would have considered the high-level risk and imminent harm associated with Line 5 in the Straits and concluded whether this pipeline pathway is an acceptable and necessary alternative.

Instead, the MPSC’s review was too narrowly construed, enabling Enbridge to capitalize on this opportunity to double the capacity of its Line 6B from its original, pre-spill⁶⁰ volume of 400,000 barrels per day (bpd) to 800,000 bpd. This Michigan example illustrates why decision-makers

⁵⁷ For example, some Great Lakes refineries like Marathon have been retrofitted to process tar sands.

⁵⁸ Parfomak, Paul W. (2015). *DOT's Federal Pipeline Safety Program: Background and Key Issues for Congress*. (CRS Report No. R44201). p. 2 n 5, Retrieved from Congressional Research Service, <https://www.fas.org/sgp/crs/misc/R44201.pdf>.

⁵⁹ Song, Lisa, “Map: Another Major Tar Sands Pipeline Seeking U.S. Permit. Canadian energy giant Enbridge is quietly building a 5,000- mile network of new and expanded pipelines that would achieve the same goal as the Keystone,” Inside Climate News, Jun 3, 2013, <http://insideclimatenews.org/news/20130603/map-another-major-tar-sands-pipeline-seeking-us-permit>.

⁶⁰ Line 6B was restricted to 240,000 bpd from 400,000 bpd after the Kalamazoo River spill, and before replacement. See Matheny, Keith, “Enbridge’s expanded oil pipeline draws ire of homeowners in its path,” Detroit Free Press, June 24, 2013, and Hasemyer, David, Michigan Pipeline to Restart, Now New and Double the Capacity, InsideClimate News, April 10, 2014.

must properly scope this alternatives analysis to examine the pipeline system rather than focusing merely on Line 5 as a debate between alternative transportation modes.

Understanding Enbridge’s current North American and Great Lakes pipeline network strategies are critical to evaluating the role of Line 5 in Michigan.

Enbridge is the largest crude oil transporter in North America, and thus, it is critical to understand both their overall and their Great Lakes pipeline network strategies. Based on publicly available information, Enbridge’s apparent strategy⁶¹ is to expand its pipeline network capacity across the northern tier to their Superior, Wisconsin, terminal, down to and south of the Chicago area, across southern Michigan to Sarnia, Ontario, on to Montreal, and through partnerships, eventually to Portland, Maine. This multi-billion collection of projects completed and underway will enable transporters to move Bakken and Alberta crude oil in large quantities to refineries along the way and for export or maritime shipment from Montreal and eventually Portland.

Line 5 Light Crude Oil: As for Enbridge’s Line 5, this pipeline carries approximately 80 percent light crude oil products (including synthetic or partially processed tar sands) and 20 percent NGLs. The overwhelming majority of Line 5’s Canadian light crude product returns to Canada in Sarnia, via the crossing at Marysville, Michigan. Relatively small batches of oil from Michigan fields⁶² are transported in Line 5 below the Straits of Mackinac crossing in Lewiston, Michigan. Thus, Enbridge’s 2013 Line 5 capacity expansion of 10 percent to 540,000 bpd optimizes its light crude and NGLs shipments so that it can concentrate heavy crude oil shipments in larger quantities through existing pipelines in Wisconsin and southern Michigan to the east and southbound to the U.S. Gulf Coast.

Line 5 NGLs: Line 5 services NGLs to Northern Wisconsin, Michigan’s Upper Peninsula residents via a depropanizer in Rapid River near Escanaba (before reaching the Mackinac Straits), and petrochemical producers in Sarnia, Ontario. The study of alternatives to Line 5 in the Mackinac Straits also must consider supply system alternatives involving pipeline and trucks for delivering propane that would allow Line 5 to be shut down at the Straits of Mackinac. Alternative NGLs supply routes to Sarnia also are under development, including Kinder Morgan’s project from the Marcellus shale play, the Sunoco Mariner Pipeline, and Gulf Coast projects.

B. The Crude Oil Pipeline System in Michigan and the Great Lakes Region Provide Sufficient Capacity and Opportunities to Serve Users In and Out of the Region without Transport of Oil In the Straits.

⁶¹ It should be noted that Enbridge’s pipeline strategy for its numerous projects is not publicly available.

⁶² See *Appendix B: Street, Gary L., M.S., P.E., “Current and Possible Alternative Supply Systems for Transporting Oil and Natural Gas Liquids to Refineries in Detroit, MI; Toledo, OH; Warren, PA; and Sarnia, ON, and Propane for the Upper Peninsula of Michigan,”* Prepared for and in partnership with FLOW, December 14, 2015. Roughly 10,000 bpd of light crude are routinely added to Line 5 from sources in Northern Lower Michigan, reducing the need for medium crude for Marathon refinery from outside of Michigan to 20,000 bpd.

This section summarizes the key findings and conclusions of Gary Street’s Report, “*Current and Possible Alternative Supply Systems for Transporting Oil and Natural Gas Liquids to Refineries in Detroit, MI; Toledo, OH; Warren, PA; and Sarnia, ON, and Propane for the Upper Peninsula of Michigan,*” which is attached in Appendix B.

Enbridge “Line 5” in the Mackinac Straits is not vital energy infrastructure to Michigan's economy nor energy security, with other pipelines owned by Enbridge and competitors in place serving the same refineries in Detroit, Toledo, and Sarnia, Ontario, and having the available capacity to replace Line 5’s crude oil supply. As for propane, based on an analysis of alternatives, there appears to be no valid reason for a disruption of propane in the Upper Peninsula or Northern Wisconsin if Line 5 is shut down at the Straits of Mackinac.

This report considers current and possible replacement sources of crude oil to refineries in Detroit, Toledo, and Sarnia, Ontario, and propane to customers in Northern Michigan and Michigan’s Upper Peninsula that are currently served by Enbridge’s Line 5.

Crude oil coming from the following sources:

- Bakken crude from North Dakota (Light, sweet crude)
- Alberta Tar Sands (Heavy crude)
- U.S. Gulf Coast – Louisiana and Texas (Light, sweet crude)
- Northern Lower Peninsula of Michigan (Light, sweet crude)

Refineries in Detroit and Toledo served by Enbridge, and others:

1. Marathon – Detroit; Crude capacity = 130,000 barrels per day (bpd)⁶³
2. BP-Husky – Toledo; Crude capacity = 160,000 bpd⁶⁴
3. PBF⁶⁵ – Toledo; Crude capacity = 170,000 bpd⁶⁶
4. United Refining (Warren, PA) = 70,000 bpd⁶⁷

Refineries in Sarnia⁶⁸ served by Enbridge:

1. Imperial – Sarnia, Crude capacity = 121,000 bpd⁶⁹
2. Shell – Sarnia, Crude capacity = 75,000 bpd⁷⁰
3. Suncor – Sarnia, Crude capacity = 85,000 bpd⁷¹

⁶³ Source: Marathon Detroit Refinery, March 2015.

⁶⁴ Source: BP-Husky, “What do we do?,” 2015. http://www.bp.com/en_us/bp-us/what-we-do/refining/toledo.html

⁶⁵ In December 2010, Sunoco sold its refinery in [Toledo, Ohio](http://www.sunoco.com/locations/toledo), to [PBF Energy](http://www.pbfenergy.com) for US \$400 million.

⁶⁶ Source: PBF Energy, 2015.

⁶⁷ https://en.wikipedia.org/wiki/United_Refining_Company

⁶⁸ A recent step by Enbridge has exacerbated the issue of supply to Sarnia by eliminating a previous source of crude oil to Sarnia. In March, 2014, the National Energy Board of Canada approved a request by Enbridge to reverse the flow of Line 9. Instead of crude coming from Montreal to Sarnia, it now flows from Sarnia to Montreal, for export outside of Canada. This development has removed an important source of crude oil for the Sarnia refineries.

⁶⁹ http://www.imperialoil.ca/Canada-English/operations_refineries_sarnia.aspx

⁷⁰ <http://www.shell.ca/en/aboutshell/our-business-tpkg/downstream/oil-products/sarnia.html>

(Map 2 in full report)

Detroit/Toledo Crude Oil Supply Pipelines



(Original map by Marathon has been revised)

While Enbridge Line 5 carries light crude, the Marathon refinery in Detroit uses primarily heavy crude from the Alberta Tar Sands via the recently expanded Enbridge Line 6B, which can also meet Marathon's light crude needs from the Bakken formation in North Dakota.

- After its Line 6B burst in 2010 spilling nearly a million gallons of heavy crude into the Kalamazoo River watershed, Enbridge installed a new Line 6B from Griffith, IN, to Marysville, MI.⁷² In doing so, Enbridge increased its capacity to ship heavy crude to Sarnia via this route by 200 percent, and boosted the crude capacity of the segment between Griffith, Indiana, and Stockbridge, Michigan, by over 300 percent. The old Line 6B has been shut down, but not removed.
- Marathon consumes 130,000 barrels per day (bpd) of crude. Of this amount, they can utilize 100,000 bpd of heavy crude, which arrives by Line 6B. This leaves a need for 30,000 bpd of light or medium crude. Since Line 5 transports 23,000,000 gallons per day or 540,000 bpd, the maximum demand by Marathon on Line 5 is $30,000/540,000 = 5.6$ percent.

⁷¹ <http://www.suncor.com/en/about/232.aspx>

⁷² Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012, PDF, pg. 11.

- Light crude can also be transported from the southern United States via the Mid-Valley and Capline pipelines to Marathon and the two Toledo refineries. Light crude is also available via Line 6B from the Bakken formation in North Dakota. Further, roughly 10,000 bpd of light crude are routinely added to Line 5 from sources in Northern Lower Michigan, reducing the need for medium crude for Marathon from outside of Michigan to 20,000 bpd.
- Based on the above, it is reasonable to conclude that only a small portion of the capacity of Line 5 is used by Marathon.⁷³ And even this can be supplied by other pipelines.

The BP-Husky refinery in Toledo also receives heavy crude from Line 6B, as well as light crude from as many as three pipelines (possibly including Line 5), and plans to convert to processing only heavy crude within a few years.

- BP-Husky (Toledo) consumes 160,000 bpd of crude oil. They are able to receive 60,000 bpd of heavy crude from Enbridge Line 6B, in conjunction with Line 17. In the near future they will also receive heavy crude via a new line, Enbridge Line 79 (See Map).
- While it is possible that BP-Husky is currently receiving some of the remaining 100,000 bpd via Line 5, it is also possible they receive it now, or could receive it in the future, via the Mid-Valley and Capline pipelines, which bring light and medium crude up from the southern United States (See Map).
- Several references⁷⁴ to BP-Husky converting entirely to heavy crude feedstock were discovered. The schedule for the conversion is varied, but even the most cautious estimate is that it will be complete by 2020. Assuming this happens, when the conversion is complete, BP-Husky in Toledo will be totally independent of a light crude supply, such as that from Line 5, Bakken, or Mid-Valley.

The PBF Energy refinery in Toledo has the capacity to process light, medium, and heavy crude, and receives light and medium crude via the Mid-Valley and Capline pipelines and likely *not* from Line 5.

- Nothing was found to suggest that PBF Energy (Toledo) has the capacity to process heavy crude. They are receiving light and medium crude via the Mid-Valley and Capline pipelines. While it may be possible for PBF Energy to receive crude via Line 5, and a Sunoco line running from Marysville to Toledo, it is unlikely they use this source.

⁷³ As mentioned above, the percent of crude in Line 5 that goes to Marathon is approximately 5.6%. However, the percent of crude in the feed stock that Marathon **consumes**, which comes from Line 5 is $30,000/130,000 = 23\%$. But this number does not take into account 14,000 bpd that come from Northern Lower Michigan. When that is factored in, the percent of light crude, originating in Canada and supplied by Line 5 to Marathon, is $16,000/130,000 = 12.3\%$ of what Marathon consumes daily. Since the crude coming from Northern Lower Michigan does not cross the Straits, it would not be affected by shutting down Line 5 at the Straits.

⁷⁴ Pre-Filed Direct Testimony of Mark Sitek before the State of Michigan Public Service Commission, April 16, 2012, U-16937, pdf pp. 16, 21, 44, 69.

Conclusions regarding the Refineries in Detroit and Toledo:

- Based on the information available, we conclude that no more than 5-10 percent of the crude oil in Line 5 is going to the Detroit and Toledo refineries. In reality, it is most likely closer to 5 percent than 10 percent.
- If Line 5 is shutdown, this amount of light and medium crude could be supplied from the Capline and Mid-Valley pipelines, along with crude from Northern Michigan. These sources are currently transporting crude to the area, and could most likely make up the relatively small amount that may be coming to the U.S. from Line 5. In addition, Bakken light crude could also be transported to the area via Line 6B.
- As another alternative, if Line 5 is shut down at the Mackinac Straits, but the remainder of it is kept operational from Lewiston, Michigan, southward, Michigan crude can continue to be transported to refineries in Detroit and Toledo.

Refineries in Sarnia, Ontario, receive the great majority of Line 5's light crude, using the Mackinac Straits as a high-risk shortcut for moving Canadian light crude to Canadian markets further to the east.

- The overwhelming majority of Line 5 crude goes back into Canada via the crossing at Marysville, MI, to Sarnia, ON, and then on to Canadian markets.

Regarding propane, Line 5's flow is from Wisconsin to Michigan or west to east, so the Mackinac Straits segment of Line 5 is not needed to deliver propane to residents in Northern Wisconsin, the Upper Peninsula, or in the northern Lower Peninsula. Propane via Line 5 is separated and offloaded at a terminal and processing center at Rapid River, MI, near Escanaba, in the Upper Peninsula, stored, loaded into large trucks that haul it to localized distribution centers (or directly to large end-customers), then loaded into smaller trucks for local delivery to residences.

- Regarding propane, preliminary engineering alternatives have been developed during this investigation that show that the transport of crude oil in Line 5 at the Straits of Mackinac can be shut down, but still provide customers in the Upper Peninsula and Northern Wisconsin with propane, by Enbridge, or by some other supplier, should Enbridge chose not to continue to do so.
- Based on analysis of alternatives, there appears to be no valid reason for a disruption of propane in the Upper Peninsula or Northern Wisconsin if Line 5 is shut down at the Straits of Mackinac.

C. Evaluating the “Decommission Line 5 in the Straits” Alternative to Demonstrate that Existing Pipeline Infrastructure Alternatives Can Meet the Purposes and Objectives of Regional Refineries, Suppliers, and End Users and Simultaneously Eliminate the Unacceptable Risk to the Great Lakes.

This section summarizes the key findings and conclusions of Rick Kane’s Report, “*Evaluating Alternatives: A Model for Evaluating Alternatives to Enbridge’s “Line 5” Pipelines in the Mackinac Straits and Eliminating Unacceptable Risk to the Great Lakes,*” which is attached in Appendix C.

An alternatives analysis identifies objectives for the system, and then evaluates and develops options for risk elimination and reduction.

This alternatives analysis approach identifies objectives and assumptions and then evaluates the alternative by identifying and analyzing a well-defined *system*. The primary system objectives for the Line 5 pipeline analysis include:

1. Supply propane to Michigan Upper Peninsula customers;
2. Support crude oil shipments from Michigan’s Lower Peninsula oil fields;
3. Supply Marathon Detroit, Toledo, Ohio, and eastern Canada refineries;
4. Supply natural gas liquids (“NGLs”) to Sarnia, Ontario, petrochemical producers; and
5. Enable crude oil exports via Montreal, eventually Portland, ME (lowest priority).

The advantage of developing an alternatives analysis is to move beyond the justification of a single alternative (as in the case of the existing Line 5 Straits Pipelines with its high-level of risk) towards multiple options and a best possible option that considers all stakeholder requirements for risk, uncertainty, and citizen, environmental, public safety, and public and private property protections.

A comprehensive analysis should be launched immediately on this alternative – *decommission Line 5* – because the current debates have focused *only* on Line 5 (i.e., the consequences and likelihood of a failure, company pipeline operations and integrity management programs) and have *not* explored the feasibility of operating without this pipeline.

The current public discourse around Line 5 is narrowly drawn and primarily centers on alternative modes of transportation as between pipeline, rail, ship/barge, and truck. Notably missing from the Task Force Report’s Recommendation Three alternative list, for example, is an alternative analysis of the existing pipeline system network to transport Line 5’s crude oil supply. This is a critical issue because by framing the alternative analysis between alternative modes of transportation, pipelines are considered the safest and will necessarily trump the other transportation alternatives. In other words, a true alternative analysis must evaluate the overall system, such that Enbridge’s 645-mile Line 5 pipeline is understood as just one segment of a vast pipeline system involving complex strategies among shippers, pipeline operators, refineries, and end users.

The Advisory Board should ensure that the comprehensive alternatives analysis requires information on business and operating strategies, supply and demand forecasts, engineering design, pipeline integrity, and end-of-life predictions. A system like this that includes supply-chain operators, customers, government agencies, and citizens is inherently complex yet dynamic and flexible in nature. For example, systems face new inputs and new constraints, and necessarily must evolve and adapt to support new supply sources, changes in materials being shipped, desired final destinations, and regulatory requirements.

The alternative “Decommissioning Line 5 in the Straits” is a strong possible best-case option.

While recognizing that a review of other options needs to be done in parallel, the State of Michigan should make a pre-determination that the “decommission Line 5 in the Straits” alternative is a strong possible best-case option. The rationale for exploring a model alternatives assessment for the shutdown of Line 5 is that it provides a credible option to protect the Great Lakes, drinking water supplies, local communities, navigation, public and private riparian land, fishing, habitat and ecosystem, while also safeguarding the state’s tourist-driven economy and securing Michigan’s energy needs.

This model demonstrates that Line 5 can be decommissioned without a negative strategic impact on key stakeholders. Pipeline system goals can be met without Line 5 because other existing pipelines exist around the Great Lakes to accommodate additional capacity and this alternative eliminates the current and unacceptable risk to the Straits of Mackinac and the Great Lakes. A comprehensive assessment must not be delayed while studying other options that, by definition, do not fully meet the upfront stated objective to eliminate the risk and to protect Michigan’s greatest natural resource – the Great Lakes.

A model “Decommissioning Line 5 in the Straits” alternative demonstrates that this pipeline is not vital to Michigan’s energy infrastructure, that the system has considerable flexibility, and that this option will eliminate the high-level risk of imminent harm demanded by the Easement’s Reasonably Prudent Person and Public Trust Standards.

The key model alternative conclusions include the following:

1. Line 5 is not vital to supply propane to U.P. customers, and other suppliers also serve the area using bulk tank truck shipments. Supply to U.P. customers would not be affected at all if crude oil is not shipped in the Straits segment of Line 5.
2. If Line 5 is decommissioned at the Mackinac Straits, with modification, the existing line below Lewiston could be used or a new pipeline installed along the corridor for the smaller quantity of material being shipped.
3. The original Line 6B that failed in 2010 has been replaced and the capacity expanded by approximately 200 percent over the pre-disaster capacity limit. Line 6B is a multi-

purpose pipeline and can transport NGLs, light condensate, and intermediate and heavy crude oil, including dilbit.

4. Marathon and the Ohio refineries also can receive crude oil from the southern United States via Marathon- and Sunoco-operated pipelines in Indiana and Ohio.^{75, 76} Rail shipments can provide emergency backup in the event of any operating problems in the network.
5. Based on available information, a material balance indicates that with Line 5 decommissioned, there is an adequate supply of feedstock via Line 6B and pipelines from the south into the Great Lakes – St. Lawrence Basin to support refineries.
6. The most likely net impact would be lower quantities of heavy tar-sands crude that could be shipped to export customers via eastern Canada and Portland. However, shippers still have the alternative option to export light, medium, and heavy crude oil from the U.S. Gulf Coast and Canadian West Coast.
7. Defining the scope for the system as the Great Lakes – St. Lawrence Basin, and not a specific company’s assets, adds the Kinder Morgan and Sunoco pipeline networks into the system, as well as possible better costs for the customers.
8. Under the terms of the 1953 Easement, Enbridge must act as a “reasonably prudent person;” however, this model highlights that Enbridge’s apparent strategy for using Line 5 is risking a Great Lakes incident for an incremental export opportunity to the East Coast.

Interim measures should be imposed immediately on Line 5 in the Straits of Mackinac.

While the Michigan Pipeline Safety Advisory Board completes comprehensive risk and alternatives analyses in 2016, the State of Michigan simultaneously should impose interim measures to halt the transport of oil in Line 5 in the Straits of Mackinac given the high-level risk, imminent hazard, and high magnitude of harm posed by a potential oil spill or release.

According to the U.S. Coast Guard, a spill or release of any form of crude oil, (heavy or light), cannot be effectively cleaned up in winter months,⁷⁷ and cannot be adequately cleaned up anytime of the year, even under ideal conditions.⁷⁸ Given this dire situation, all forms of crude oil should be removed from transport through Line 5 in the Straits. And yet the State of Michigan in its Task Force Report chose not to apply the same logic and reasoning to all forms of crude oil and not to impose any interim measures, leaving the Great Lakes at great risk to a catastrophic spill.

⁷⁵ See Appendix B.

⁷⁶ See Appendix A.

⁷⁷ See supra note 24.

⁷⁸ See supra note 23.

IV. CONCLUSION AND SUMMARY

Governor Executive Order 1015-12 created and directed the Michigan Pipeline Safety Advisory Board to implement the recommendations of the Michigan Petroleum Pipeline Task Force Report on the future of oil transport through Line 5 in the Straits of Mackinac and pipelines throughout the state. The July 2015 Task Force Report concludes that Line 5 in the Straits presented the most acute threat given the potential for a catastrophic spill in the heart of the Great Lakes. The Task Force Report accordingly calls for an independent alternatives analysis, including the decommissioning of Line 5 in the Straits for oil transport. Other reports, including FLOW's (For Love of Water) September 2015 Expert Report, have substantiated that the transport of oil through Line 5 in the Straits constitutes an unacceptable high-level risk and imminent harm to our waters for drinking, recreation, commerce, navigation, tourism, and our *Pure Michigan* way of life. Immediate action therefore is necessary, including the orderly completion of the alternatives and risk analyses and interim actions to eliminate imminent harm.

FLOW now submits this report titled, *Eliminating Line 5 Oil Pipeline's Unacceptable Risk to the Great Lakes through a Comprehensive Alternatives Analysis and Systems Approach*, to the Advisory Board to assist in implementing a comprehensive alternatives analysis to Line 5 in the Straits per the recommendations of the Task Force Report.

Part I of the foregoing Report lays out the background, framework, scope, and standards for the alternatives analysis directed by the Advisory Board and the Executive Order. Part II provides a factual analysis of the crude oil pipeline system in the Great Lakes, including Line 5, identifies the capacity of this system, and demonstrates the adaptability of this system to accommodate and meet the needs related to the transport of crude oil into, around, through and out of the Great lakes region and, at the same time, eliminate the transport of crude oil in the Straits of Mackinac.

This report makes the following conclusions:

1. The approach to an alternatives analysis must account for the legally recognized highly valued public trust waters, bottomlands, and protected public uses and duties under the public trust doctrine in the Great Lakes and Michigan law, such as the Michigan Environmental Protection Act ("MEPA"), Part 17, NREPA. Part 17 expressly incorporates the protection of the public trust in water and related natural resources, and it imposes a duty on governmental bodies to prevent imminent harm or likely degradation or impairment of the waters and public trust of the Straits of Mackinac. The nature of analysis under Part 17 also recognizes – as is the case with Line 5 – that the threshold of harm or impairment is met where the magnitude of harm and risk is high or unacceptable or imminent. Consistent with the Task Force Report and Executive Order, the law requires a "comprehensive" analysis of a "full" range of alternatives. Therefore, the alternatives analysis should review the transport of crude oil in the context of the purposes and objectives of the overall system of oil pipelines, routes, capacity, and adaptability into, though, around, and out of Michigan and the Great Lakes region; this is because alternatives analysis principles forbid or discourage a limited or unduly narrow

review of alternatives that would preclude other potentially viable and reasonable alternatives. Moreover, evaluating an alternative, it should not be rejected if it is “feasible” and “prudent” and otherwise suitable as those terms have been interpreted in law; in other words, it cannot be rejected unless there are truly unusual factors, such as an extraordinarily high magnitude of obstacles or cost-prohibitive circumstances. Mere inconvenience, new adjustments or actions, lower profits or increased costs in themselves are not a proper basis for rejecting an alternative.

2. As determined by FLOW’s scientific and policy advisors’ reports, the proper context for a “full” and “comprehensive” alternatives analysis requires an understanding of the crude oil transport system in the Great Lakes region. If the alternatives analysis is limited to simply Line 5, it prevents review of potentially better, viable and feasible or prudent alternatives for transport of crude oil to meet the needs and purposes of the overall system, as well as Enbridge, the operator of Line 5. In short, viewing only Line 5 would segment the analysis, and could prevent consideration of alternatives that would eliminate Line 5 in the Straits and still meet the overall needs and objectives of the pipeline system in Michigan, the Great Lakes region and beyond. The very nature of crude oil pipelines is dynamic and evolving, based on changing factors or “drivers” that occur in the present and overtime. Key system “drivers” include capacity and flow volumes, changing user needs, new crude oil and NGL reserves, changing domestic and global markets, supplies and demands, changing legal barriers for imports and exports, shifted directions of flows to meet demands and needs elsewhere, changes in feedstock sources and prices, and changes to meet long-term, long-range pipeline forecasts and needs.
3. The segment-by-segment approach by Enbridge in the State of Michigan, including Line 5 and Line 6B around Chicago, through Indiana, and across southern Michigan to Sarnia, with spurs to Detroit and Toledo, over the last several years has precluded this state from reasonably considering the full range of viable alternatives, including Line 5 in the Straits. For example, on its own accord, Enbridge added pump stations and anti-friction injection systems to increase flows in Line 5 from 300,000 barrels per day (bpd) to 540,000 bpd in 2013. In addition, after the 2010 Kalamazoo oil spill disaster, Enbridge applied for “maintenance and integrity” measures for Line 6B before the Michigan Public Service Commission, when in fact, it built a brand new Line 6B that more than doubled its capacity to as much as 800,000 bpd. Segment-by-segment, Enbridge has effectively built its own version of the now rejected “Keystone XL Pipeline” through the center of the Great Lakes and across Michigan without public, state, and federal consideration and evaluation of the full range of existing alternatives. Had Enbridge disclosed its larger project intentions, a more properly scoped alternative analysis would have evaluated Line 5, Line 6B, other pipelines, needs of users, and the pipeline system as a whole, and the imminent and unacceptable harm to the Straits could and would have been addressed. If implemented and completed properly, the alternative analysis can help correct this legal deficiency.
4. Applying a comprehensive and full evaluation of the entire basic pipeline system reveals feasible, prudent, and suitable alternatives to Line 5 in the Straits. The primary transport of crude oil to Canada or the three refineries in the Detroit-Toledo area could still be met,

and natural gas liquids, including propane distribution to Michigan's Upper Peninsula would not be affected. Indeed, such alternatives offer the advantage of eliminating the unacceptable harm to the Great Lakes and Straits, high and imminent risks to communities, and public and private property in the Straits.

5. The crude oil pipeline transport system in Michigan and the Great Lakes region provides sufficient capacity and opportunities to meet demand without putting the Great Lakes in peril. Line 5 is not a vital infrastructure to Michigan's economy, poses substantial security and environmentally unacceptable risks, and propane service to customers in the Upper Peninsula will continue.
6. The Task Force Report identified some of the alternatives that can be evaluated. One of those was decommissioning Line 5 in the Straits. FLOW's technical advisor analyzed this alternative as an example or "model" of a properly conducted alternative analysis based on the basic crude oil pipeline system of the Great Lakes region. Proper alternatives analysis should identify, evaluate, and develop options for risk elimination and reduction. It would require information on business and operating strategies (such as back-up pipeline routing or plan, current and future plans), supply and demand forecasts, engineering designs and options, pipeline integrity, and end-of-life predictions.⁷⁹
7. Based on such a comprehensive alternatives analysis, the model to decommission Line 5 in the Straits (by implication this would necessarily include the alternative of no crude oil in the Straits) concluded that (a) it would eliminate or avoid the unacceptable and imminent harm and high risk to the Straits and Great Lakes, (b) that the dynamic pipeline system serving Michigan, the Great Lakes region, and elsewhere has the capacity and would adjust to meet the purposes of the system, and (c) Enbridge could continue to transport substantial volumes of crude oil. The decommissioning of Line 5 in the Straits is a strong best-case option or alternative.
8. Because of the imminent harm and high risk from the transport of crude oil in the Straits, a full and comprehensive alternative analysis and assessment must be completely immediately to eliminate a potential catastrophic oil spill in the Great Lakes.
9. As previously concluded in FLOW's September 2015 Expert Report, and further highlighted by more recent investigations concerning the inability to respond adequately

⁷⁹ It should be recognized that as in any alternatives analysis, a reasonable time should be factored for the system to adjust, except in the case where high-level risk must be eliminated. As noted in Part of the legal analysis, an alternative is still feasible and prudent even though it does not include an identical route, pipeline, or volume of flow, or other inconvenience or increased costs. Part I, supra, pp. 7-13. Thus, while the no oil alternative is feasible, prudent, and reasonable, especially given the importance of eliminating the high and unacceptable risk of a release in the Straits, there would be a natural and temporary adjustment period in the pipeline system that serves Michigan and the Great Lakes region. Moreover, as described above, Enbridge has strategically constructed major new pipelines and capacity in Line 6B and Line 5 and avoided a comprehensive alternatives analysis and review required by law. In doing so, Enbridge is responsible for its decisions, and is equitably estopped from claiming imprudence or infeasibility with respect to the alternative that eliminates the high risk and harm to the Straits, when it could have avoided by full disclosure of the objectives of its massive increase in capacity into, through and out of the Great Lakes. It is not up to the state to bail out a pipeline carrier who undertakes a project at its own risk.

to a release of crude oil in the Straits, immediate interim measures should be imposed on Enbridge, including the temporary shutoff of oil, in winter or other times when responses to a release are recognized as inadequate, and stepped-up monitoring, disclosure of products being transported, and in-place capacity and equipment.

APPENDICES

FLOW's scientific advisors prepared the following technical reports:

Appendix A: Kane, Rick. QEP, CHMM, CPP. *"The Context: Understanding the Evolving North American Oil Pipeline System in Preparation for Considering Alternatives to Enbridge's 'Line 5' in the Mackinac Straits,"* Prepared for and in partnership with FLOW, December 14, 2015.

Appendix B: Street, Gary L., M.S., P.E., *"Current and Possible Alternative Supply Systems for Transporting Oil and Natural Gas Liquids to Refineries in Detroit, MI; Toledo, OH; Warren, PA; and Sarnia, ON, and Propane for the Upper Peninsula of Michigan,"* Prepared for and in partnership with FLOW, December 14, 2015.

Appendix C: Kane, Rick. QEP, CHMM, CPP. *"Evaluating Alternatives: A Model for Evaluating Alternatives to Enbridge's 'Line 5' Pipelines in the Mackinac Straits and Eliminating Unacceptable Risk to the Great Lakes,"* Prepared for and in partnership with FLOW, December 14, 2015.

APPENDIX A: THE CONTEXT: UNDERSTANDING THE EVOLVING NORTH AMERICAN OIL PIPELINE SYSTEM IN PREPARATION FOR CONSIDERING ALTERNATIVES TO ENBRIDGE’S “LINE 5” IN THE MACKINAC STRAITS

By Rick Kane, QEP, CHMM, CPP

December 14, 2015

Prepared for and in partnership with FLOW (For Love of Water)

I. PURPOSE

The purpose of this report is to describe the evolution and current state of the North American oil pipeline system in order to evaluate the State of Michigan’s forthcoming assessment of alternatives to the Enbridge “Line 5” oil pipelines running through the Great Lakes at the Mackinac Straits, where Lake Michigan and Lake Huron converge.

To that end, this report presents an introduction and guidance about the apparent strategies of crude oil and natural gas liquids (NGLs) shippers, pipeline operators, and end users that impact the system of which the Enbridge Line 5 pipeline is a component. A “systems view” and understanding of company strategies is an essential, if not mandatory, step for energy security and for protection of the public trust waters, fishing, drinking water, communities, and the environment. Without a systems approach, the state and its Michigan Pipeline Safety Advisory Board simply cannot conduct a proper alternatives assessment of Line 5.

Line 5 transports light and synthetic crude oil and natural gas liquids (including propane) from Enbridge’s terminal in Superior, Wisconsin, across Michigan’s Upper Peninsula, through the Straits of Mackinac, across the Lower Peninsula and finally beneath the St. Clair River to Sarnia, Ontario. Under a recent agreement with the State of Michigan, Line 5 does not carry heavy crude oil or diluted tar sands crude oil (diluted bitumen) known as dilbit.¹

This report was prepared for and in partnership with FLOW (For Love of Water), a Great Lakes water law, science, and policy center located in Traverse City, Michigan, to provide information in support of FLOW’s companion report that presents an alternatives analysis model and credible option for the shutdown of Line 5 in order to protect the Great Lakes, drinking water supplies, local communities, navigation, public and private

¹ Michigan Petroleum Pipeline Task Force, *Agreement Between The State Of Michigan And Enbridge Energy, Limited Partnership Regarding The Transportation Of Heavy Crude Oil Through The Straits Of Mackinac Pipelines*, September 3, 2015, www.michigan.gov/pipelinetaskforce.

riparian land, fishing, habitat and ecosystem, and the state's tourist-driven economy while continuing to meet energy needs.

FLOW's team of legal and scientific experts previously documented and concluded that the transport of oil through Line 5 poses high consequence environmental risk and imminent harm to the Great Lakes and should be halted while the state seeks an alternative.^{2,3,4}

II. INTRODUCTION

The North American (NA) crude oil and NGLs supply-chain system is undergoing a rapid evolution driven largely by the development of natural gas and crude oil shale reserves in North Dakota and tar sands crude oil reserves in Alberta, Canada. Pipeline networks are a key component of the supply-chain system, as well as railroad, truck, and maritime modes of transportation. For the pipeline network, there are numerous new installations, expansions and modifications, such as reversing the direction of flow in existing pipelines.

Publicly available information on pipelines covers specific projects and their justification but typically not the alternative options. A consolidated or "systems view" is not available that shows how individual pipeline projects unite to form the supply-chain strategy. Effective planning and regulatory management by federal, state, and local governments requires an understanding of the evolution and future direction of the pipeline system to ensure the protection of citizens, the environment, and the energy supply. As noted at the outset, without a systems view, alternatives cannot be properly evaluated. For the most part, the private sector and company goals and objectives drive the evolution of the system, which remains dynamic because of a number of factors, including supply, demand, regulations, and public policy.

² Olson, James, J.D., LL.M., and Kirkwood, Liz, J.D. *A Composite Summary of Expert Comment, Findings, and Opinions on Enbridge's Line 5 Oil Pipeline in The Straits of Mackinac in Lake Michigan*, compiled by on behalf of FLOW's (For Love of Water) Great Lakes Water Policy Project for submission to the Michigan Petroleum Pipeline Task Force, April 30, 2015, www.michigan.gov/pipelinetaskforce (Hereinafter *FLOW April 2015 Expert Report*).

³ Schuette, Bill, Attorney General, and Wyant, Dan, DEQ Director, *Michigan Petroleum Pipeline Task Force Report*, July 2015, www.michigan.gov/pipelinetaskforce.

⁴ Olson, James, J.D., LL.M. and Kirkwood, Liz, J.D., *A Scientific and Legal Policy Report on the Transport of Oil in the Great Lakes, (1) Recommended Immediate Actions on the Transport of Oil Through the Line 5 Under the Straits of Mackinac; and (2) Supplemental Comments on the Michigan Petroleum Pipeline Task Force Report*, September 21, 2015 FLOW (For Love of Water), www.flowforwater.org (hereinafter "FLOW September 2015 Expert Report").

III. BACKGROUND

Pipelines, rail tank cars, tank trucks, barges, and ships are transportation modes used for crude oil and NGLs. Pipelines are viewed as the safest mode.⁵ Natural gas is normally shipped by pipeline unless imported or exported where it is shipped from main ports in liquefied form (LNG). Historically, refineries and petrochemical producers in the Chicago and Michigan areas and eastern Canada received feedstock from the U.S. Gulf Coast, Southwest, and northwest United States, as well as from Alberta, Canada, and via import (See Figure 1).

Refinery operators and petrochemical and energy producers invest in and modify their assets based on forecasted availability and pricing for the different feedstock, such as natural gas versus crude oil or refined products. They also invest to have feedstock flexibility and multiple supply options, giving them a competitive advantage. Pipeline companies and rail carriers build their networks to meet the needs of the producers or feedstock shippers.

With the development of new or improved technologies, such as high-volume liquid or other fracking techniques to extract oil from shale and the recovery of heavy oil, shale oil, and tar sands oil, new reserves are being opened up and the pipeline system is constantly evolving (See Figures 1 and 2). This collection of industries and companies comprises U.S. and Canadian critical infrastructure and is referred to by the governments as the oil and gas, chemical, and energy sectors. These sectors are connected by supply-chains and the whole interacts as a dynamic *system* that evolves to meet the objectives of system drivers such as:

- **Sector players** – oil and gas producers, pipeline operators, refiners, chemical producers, etc.
- **External stakeholders** – government agencies, communities, other businesses, nonprofit organizations, citizens, etc.
- **External factors** – supply disruptions, natural disasters, law and policy requirements and changes, etc.

⁵ Parfomak, Paul W. (2015). *DOT's Federal pipeline safety program: Background and key issues for Congress*. (CRS Report No. R44201). p. 2 fn 5, Retrieved from Congressional Research Service, <https://www.fas.org/sgp/crs/misc/R44201.pdf>

Key crude oil pipeline *system* drivers and assumptions used in this report include:

- Crude oil and NGLs are global commodities, but there can be local/regional cost differentials caused by availability, processing capability of users, and supply-chain cost. For example, some refineries cannot use tar sands crude oil, and some refineries that *can* are located closer to the source fed by a pipeline and will have a lower feedstock cost.
- Events in other regions of the world can affect supply, demand, and pricing.
- Pipeline shipments are preferred due to safety and lower cost compared to rail and truck shipments. However, the investment cost for new pipelines is high with lengthy regulatory approval times. Moreover, pipelines also carry high safety risks or risks of high consequences or harm.
- Crude oil rail shipments have increased dramatically and rail transportation is more flexible and faster than pipeline shipments. However, major rail accidents have occurred, resulting in new regulatory requirements for rail tank cars which are in short supply, and new train control regulations that slow or restrict shipments.
- Crude oil transportation by ship/barge in the Great Lakes is not addressed in this report. The risk of a spill and resultant major environmental damage is so high that this shipment mode has not been allowed because of the substantial imminent harm and endangerment of freshwater and aquatic resources.
- Tank trucks were not considered in this report as they are effectively only an option for short distances or for limited time periods such as during emergencies, since large numbers of vehicles would be required to replace rail tank cars or pipelines.

IV. THE SYSTEM AND EVOLUTION

The oil and gas sector operates as a complex, dynamic, and evolving system, as do many other industry sectors. However, the oil and gas sector supply-chain system is unique because of the huge impact that operations have on public safety, the environment, national energy security, citizen rights, and other economics. Unfortunately, a comprehensive view of the system and how it is evolving is not available to government agencies that would enable them to make fully informed decisions and for citizens and other interests to understand the impact of projects and operations on their communities.

This lack of a comprehensive pipeline system view also inhibits the identification and analysis of better alternatives. The lack of a systems view or starting point unduly

narrows the range of purposes or overall goals, thereby restricting the range of alternatives considered. At a minimum, a systems view and understanding of the evolution are needed for government agencies to set limits and boundaries, eliminate unacceptable harms or high level risks, and protect people's rights. See Box A for an example.

BOX A

Line 5 Crossing the Straits of Mackinac A time to implement a better alternative - today

The Enbridge Line 5, crude oil/NGL pipeline was installed in 1953 across the Michigan Upper Peninsula, the Straits of Mackinac and Lower Peninsula, the shortest, most expedient route from Superior Wisconsin to Sarnia Ontario. New pipelines installed 15 to 20 years later were routed west of Lake Michigan and around Chicago, and across southern Michigan, a longer route but avoiding highly sensitive environmental areas or areas of high level risks and unacceptable harm, such as the Great Lakes crossing at the Straits.

As a result of numerous pipeline failures in North America, including Enbridge's 2010 Line 6B pipeline disaster causing the largest inland oil spill in U.S. history along the Kalamazoo River, and the risk of Line 5 in the Straits and other pipelines in Michigan, Governor Snyder created the Michigan Petroleum Pipeline Task Force in 2014. The final report issued by the Task Force in July 2015 included a recommendation for an *alternatives analysis study*.

Companies routinely conduct alternatives analyses following identified risk management issues or major incidents or near misses, as well as for investment projects. Board of Directors, shareholders, and insurers demand such assessments as part of normal practice. Similarly, government regulators demand proper alternative analyses in situations where there are public trust concerns, operational reliability/safety questions, major environmental risks and when permit requests or renewals are submitted. To date, company, government, and public focus has been on Line 5, and not on other better possible or feasible and prudent alternatives.

Unfortunately, there is no clear, consolidated supply-chain strategy for pipelines in the Great Lakes – St. Lawrence Basin. However, this report highlights the apparent strategy and evolution of the system based on publicly available information. This report provides the basis for an alternatives analysis model showing how system goals can be met without Line 5.⁶

⁶ Kane, Richard J. QEP, CHMM, CPP, *A Model for Evaluating Alternatives to Line 5 Pipeline and Eliminating Unacceptable Risk to the Great Lakes*, December 11, 2015. FLOW (For Love of Water) www.flowforwater.org (Hereinafter *Appendix C Report*).

Historically, as previously mentioned, crude oil and NGLs flowed to the Great Lakes – St. Lawrence Basin from the Gulf Coast and the Southwest United States, as well as Alberta, Canada, and the East Coast (See Figure 3). Today, the crude oil and NGL sources and destinations have changed and the pipeline system is evolving to support shipments. Enbridge, Kinder Morgan, and PanCanada are expanding and modifying their networks to transport Bakken crude oil and Alberta tar sands crude oil to the coasts. The PanCanada Keystone XL pipeline project down through the central United States is well known, and the Obama Administration recently rejected the project. Meanwhile, their competitor, Enbridge, is working on multiple projects to expand capacity and redirect flows to transport Bakken crude oil and tar sands crude oil to the East Coast (Montreal and Portland, Maine), the U.S. Gulf Coast, and the Canadian west coast. The Enbridge strategy will provide feedstock to refineries in these regions and to main ports for export (See Figure 4).

Nationally, the Keystone XL project is highly visible and the strategy is transparent. Enbridge's pipeline network strategy is less obvious, especially to government regulators and the general public, as it is being implemented segment-by-segment and involves several partners. Segment-by-segment implementation is a typical company engineering and investment approach, and a few state and local regulators might review the individual segments for piece-meal permitting, but state officials and the public often do not know about these incremental changes because there is no review of the overall project or purpose. The Michigan Public Service Commission (MPSC) reviewed single pump stations and new or old line replacements of Line 6B, but not the overall system and purpose; this resulted in a lack of adequate study of alternatives in light of the overall project purpose. However, a segmented approach without the availability of a comprehensive and consolidated systems view hinders stakeholders from understanding the impact and identifying better alternatives. It also results in a lack of establishment of constraints on a project.

Segment-by-segment implementation can be a classic *divide and conquer* strategy for obtaining approvals. The system then evolves without an appropriate consideration of better options for citizen safety and environmental protection. The segment-by-segment understates harms and risks, and fails to properly assess alternative pipelines, systems, and capacities.

The current Enbridge Line 5 controversy is an example of a segmented strategic approach by the company to maintain the status quo. The debate is primarily centered on Line 5; the company defends the importance for continued operation, pipeline reliability, and emergency response capability, while citizen groups focus on the imminent hazard and catastrophic consequences of a major release. The State of Michigan now recognizes that

an alternatives analysis is needed. Priority action is needed. As the debate continues, the system continues to evolve, potentially missing opportunities for a better solution or possibly leading to an actual oil spill.

It also should be noted that during the past several years as Enbridge has incrementally expanded its capacity and replaced Line 6B across southern Michigan to Sarnia, with *spur* pipelines to Toledo and Detroit, the MPSC could have, but did not, adopt a systems view and consider alternative options for Enbridge and crude oil pipeline transport in Michigan. For example, a proper alternative analysis or study by the MPSC for the doubling of the capacity or flow volume of Line 6B would have considered high level risk and imminent harm associated with Line 5 under the Straits, or considered whether crude oil transport and the risk of such an unacceptable harm is necessary or an acceptable alternative. Fortunately, given the expansion and enlargement of Line 6B and the recommendation of the Pipeline Task Force, the state's alternative analysis is underway (See FLOW's companion Alternatives Analysis Report).⁷

V. THE PIPELINE NETWORK IN THE GREAT LAKES REGION AND SYSTEM EVOLUTION

Prior to the Enbridge Line 6B Kalamazoo River crude oil spill in 2010, pipeline system strategic goals were different but beginning to change rapidly. Crude oil and NGLs feedstock to the Great Lakes – St. Lawrence Basin was primarily inbound from western Canada, U.S. Gulf Coast, southwest U.S. and imports or maritime shipments via the East Coast and Montreal. Figure 5 shows the main refineries in the Great Lakes and St. Lawrence Basin. However, the new goals of the oil and gas sector as well as the U.S. and Canadian governments are to capture the benefits of the Bakken, Alberta, shale and tar sands reserves and the Utica and Marcellus shale reserves in Pennsylvania, Ohio, and West Virginia; to reduce energy dependence on imports; increase employment; and use the lower-cost feedstock to expand economic growth and promote crude oil exports. These goals are driving major changes in the crude oil and NGLs supply-chain system, especially the pipeline network.

⁷ Id.

Based on publicly available information, the oil and gas sector strategy as affecting the Great Lakes – St. Lawrence Basin region includes the following:

- Exploit domestic U.S. and Canadian crude oil, tar sands, and natural gas reserves in the Bakken, Utica, and Marcellus shale and Alberta tar sands regions as lower cost sources, for less dependence on imports, increased economic development including jobs, and stronger energy security. Thus, use oil and gas resources within North America but also take advantage of export opportunities.
- For North America, maximizing pipeline network utilization aids in reducing railroad transportation, which has a higher safety risk. However, railroad transportation will remain as a key mode and government regulators are moving to reduce risk through new regulations on tank car specifications and positive train control.
- For Enbridge specifically, the apparent strategy is to expand their pipeline network capacity across the northern tier to their Superior, Wisconsin terminal, down to and south of the Chicago area, across Michigan to Sarnia, Ontario, on to Montreal, and through partnerships, eventually to Portland, Maine. This collection of projects completed and underway will enable shippers to move Bakken and Alberta crude oil in large quantities to refineries along the way and for export or maritime shipment from Montreal and eventually Portland (See Figure 6).
- The Enbridge and partner pipeline projects also will enable connections to southbound pipelines to refineries and export ports in the Gulf Coast region. Existing pipelines from the Gulf Coast to the north now are underutilized. Projects are underway that will reverse the flow to carry crude oil southbound. Smaller south-to-north pipelines may be installed and the larger existing lines used for shipments south (See Figure 7).

The projects under development or completed to implement the above Supply-Chain System Strategies include (See Figure 8):

1. **The Alberta Clipper and Southbound Wisconsin Pipeline Network** – The Alberta Clipper or Enbridge Line 67 runs from Hardisty, Alberta, to Superior, Wisconsin. Line 67 was put in service in 2010 with a capacity of 450,000 barrels per day (bpd). A Phase 1 expansion increased it to 570,000 bpd in 2014. A Phase 2 expansion is in the permitting / approval process and will take the capacity to 880,000 bpd.

2. **Line 5, Michigan U.P., Straits, L.P.** – Early in the evolution to ship heavy and tar sands crude oil eastward, Line 5 and the installation of a new parallel line were considered. This plan was dropped and the existing Line 5 was expanded through the addition of new pumping and friction reducing agent injection stations over a number of years. In September 2015, an agreement to prevent shipment of heavy crude oil in Line 5 was reached with the State of Michigan, but this is not a permanent ban. Enbridge’s operations optimize the use of Line 5 for shipment of light crude and NGLs enabling heavy and tar sands crude oil to be shipped in larger quantities through Wisconsin and southern Michigan to the East and southbound to the U.S. Gulf Coast. The overwhelming majority of Line 5 crude oil goes back into Canada via the crossing at Marysville, Michigan, to Sarnia, Ontario.⁸
3. **Line 6B, southern Michigan** – Enbridge replaced the old Line 6B that failed in 2010. The new parallel line was completed in 2014 and expands capacity from the restricted flow on the original 6B of 240,000 bpd to 800,000 bpd.
4. **Flanagan South Pipeline Project** – Enbridge completed pipeline construction in 2014 to ship heavy crude oil from collection terminals in Pontiac, Illinois, to a Cushing, Oklahoma, storage hub. It is carrying 585,000 bpd with an ultimate capacity of 880,000 bpd to support refineries on the U.S. Gulf Coast and export opportunities.
5. **Line 9 Flow Reversal⁹** – Enbridge pipeline from Sarnia, Ontario, to Montreal, Quebec. Line 9 originally supplied crude oil from the west to eastern Canadian refineries. It was reversed in 1998, flowing east to west, to supply cheaper imported crude oil to eastern Canada refineries. The flow is being returned west to east to enable refineries to access Bakken and tar sands crude oil and enable maritime shipments and exports from Montreal. Line 9 has a current capacity of 240,000 bpd.
6. **Portland – Montreal Pipeline** – This is an old pipeline network to ship crude oil imported through Portland, Maine, to Montreal. The business has dropped dramatically as the imported oil is not cost competitive in the current market. Enbridge is working with their partners to develop a project to reverse the flow,

⁸ Street, Gary L., M.S., P.E., *Current and Possible Alternative Supply Systems for Refineries in Detroit, MI and Toledo, OH, and Propane Supply for the Upper Peninsula*, December 14, 2015.). www.flowforwater.org. (Hereinafter *Appendix B Report*).

⁹ Tobben, Sheela and Murtaugh, Dan., *Enbridge Line 9B Said to Deliver Crude Oil to Eastern Canada* December 2, 2015, <http://www.bloomberg.com/news/articles/2015-12-02/enbridge-line-9b-said-to-deliver-crude-oil-to-eastern-canada>

enabling heavy and tar sands crude oil maritime shipments from Portland. This project is being strongly resisted by the Portland community.

7. **Enbridge Trunkline Project** – Enbridge will convert an existing natural gas pipeline to crude oil service and reverse the flow to ship crude oil from Patoka, IL, to St. James, LA. Capacity would be increased from 420,000 bpd to 660,000 bpd and transport U.S. and Canadian Bakken crude oil to support Gulf Coast refineries (See Figure 8).
8. **Capline Pipeline** – Marathon operates this pipeline, the largest crude oil pipeline in the United States, with a capacity of 1,200,000 bpd. It currently ships from St. James, Louisiana, to Patoka, Illinois. A project is under study that will reverse the flow because utilization has dropped in recent years with crude oil from the Gulf Coast region being displaced by crude oil from the Bakken/Alberta regions in northern refineries. Plans to reverse the flow may include the installation of a smaller south-to-north pipeline to maintain smaller volume shipments along the historical route. This would connect these crude oil sources through Enbridge pipelines both south and east. In effect, along with the incremental expansion and doubling of Line 6B, it appears that Enbridge has been building, piece-by-piece, its own version of the Keystone XL Pipeline recently rejected by U.S. President Obama (See Figure 7).
9. **MPLX Patoka, IL, to Lima, OH, Pipeline** – Marathon operates this pipeline with a 249,000 bpd capacity. A study is underway incrementally expanding the pipeline. This line feeds the network to Toledo, Ohio, and Detroit, Michigan (See Figure 9).
10. **Detroit Marathon Refinery** – This refinery is continuing to expand capabilities to consume tar sands crude oil that has a lower cost. The refinery currently receives crude oil from Enbridge Line 6B via Enbridge Line 17 and Line 79 from Stockbridge, Michigan, to Freedom Junction and then on through the leased Wolverine Pipeline to the refinery. The refinery also receives light crude oil from Line 5 via the Sunoco Pipeline and crude oil from the Mid-Valley and Capline pipelines (See Figure 10). The following information is summarized from an analysis conducted by G. Street,¹⁰ which provides a detailed material balance or quantitative analysis of system capabilities.

Marathon currently consumes 130,000 barrels per day of crude at capacity. They likely use 100,000 bpd of heavy crude and dilbit via Line 6B as noted above,

¹⁰ Id. *Appendix B Report*.

leaving 30,000 bpd demand for light crude. This small volume, now supplied by Line 5, could alternatively be supplied by the Mid-Valley, MPLX, and Capline pipeline network, which is partly owned by Marathon.

11. **Toledo Area Refineries** – BP-Husky (Toledo) consumes 160,000 bpd of crude oil at capacity with 100,000 bpd of heavy crude from Enbridge Line 6B via Line 17 and a new line, Enbridge Line 79 (See Figure 10). While BP-Husky may receive part of the remaining 60,000 bpd of light crude oil via Line 5, it is more likely received via the Mid-Valley and Capline pipelines from the southern United States.

PBF Energy (Toledo) does not appear to be processing heavy crude oil or dilbit and are most likely receiving light and medium crude oil via the Mid-Valley and Capline pipelines.¹¹

VI. NATURAL GAS LIQUIDS IN THE GREAT LAKES – ST. LAWRENCE BASIN

Natural gas liquids (NGLs) contain lighter hydrocarbon materials (ethane, propane, butane) and can be liquefied and shipped in the same pipelines as crude oil. NGLs are “coproduced” during natural gas and crude oil production. NGLs consist of ethane, used in petrochemical production; propane, used for heating and chemical production; and butane, used in gasoline blending and chemical production. “Light condensates” have the same components as NGLs but higher amounts of butane, pentane, and hexane. Light condensates are also known as “natural gasoline.”

Tar sands crude oil at the point-of-origin is highly viscous and cannot be directly pumped through pipelines. By diluting tar sands crude with NGLs and/or light condensates, the physical properties of the resulting blend, called dilbit, are then similar to heavy crude oil enabling pipeline shipment. NGLs and light condensates are sent to the tar sands regions in large quantities for blending into dilbit.

NGLs are shipped from the Northwest in Line 5 to petrochemical producers in Sarnia Canada (See Figure 11). At Rapid River, Michigan, some of the NGLs are diverted through a de-propanizer unit to extract propane and the remainder of the stream (ethane, butane) is then re-injected into Line 5 for shipment to Sarnia. The extracted propane is used for home and commercial heating in the Michigan Upper Peninsula. Other suppliers using tank trucks also supply propane to the Upper Peninsula.

Alternative supply routes for NGLs to Sarnia are under development:

¹¹ Id. *Appendix B Report*.

- Kinder Morgan has a project to ship NGLs and light condensate from the Marcellus Pennsylvania shale oil and gas fields via the Cochin Pipeline to Riga, Michigan, then to Windsor, Ontario and from there through a Canadian line to chemical manufacturers in Sarnia. This routing is in competition to Enbridge Line 5. The Cochin Pipeline will also transport NGLs and light condensates west and north to be used as diluent for the Alberta tar sands crude oil (See Figures 12 and 13).
- The Sunoco Mariner Pipeline will transport NGLs and light condensate from the Marcellus and Utica shale gas fields to the Toledo, Ohio, area where it can then move north to Sarnia (See Figure 13).
- New projects are also being implemented to ship light condensate from the Gulf Coast Region to Alberta for blending into dilbit.

VII. THE CURRENT PIPELINE SYSTEM EVOLUTION AND THE ROLE OF LINE 5

Crude oil and NGL sources are changing and driving pipeline company strategies. Enbridge and PanCanada are expanding and modifying their networks to transport Bakken and Alberta tar sands crude oil to North American refineries and export ports on the East, West, and Gulf Coasts.

The recently rejected PanCanada Keystone XL pipeline project through the central United States is well known and the strategy is visible to government agencies and the public. Enbridge, their competitor, is working on multiple projects to expand capacity and redirect flows to transport Bakken crude oil and tar sands crude oil to the East Coast (Montreal, Maine), U.S. Gulf Coast, and the Canadian west coast and to refineries along the routes or at the destinations.

Enbridge's pipeline strategy has not been so visible or obvious, as a consolidated view of their numerous projects is not readily available. The Enbridge pipeline network is being expanded and modified segment-by-segment and integrated with pipeline partners. Segment-by-segment implementation is a typical company engineering and investment approach; however, without disclosure or a transparent overall view, this avoids and hinders government agencies and citizen stakeholders from understanding the impact and considering, identifying, and requiring better alternatives with the elimination of potential for unacceptable or high level risks of catastrophic harm such as that posed by Line 5 under the Straits. Segment-by-segment review and development result in an overall

higher level of risk and potential catastrophic harm, like a spill of crude oil in the Great Lakes at the Straits, than would the overall project or risk and alternatives analysis.

The end result is that government regulators and the general public cannot launch effective alternative analyses that may result in better solutions or, at a minimum, ensure that government agencies set adequate regulatory constraints. Without transparency and alternative analyses on the appropriate parts of the overall *system*, the pipeline network evolves in an optimum direction for the oil and gas sector and the evolution may not adequately address citizen safety and environmental protection.

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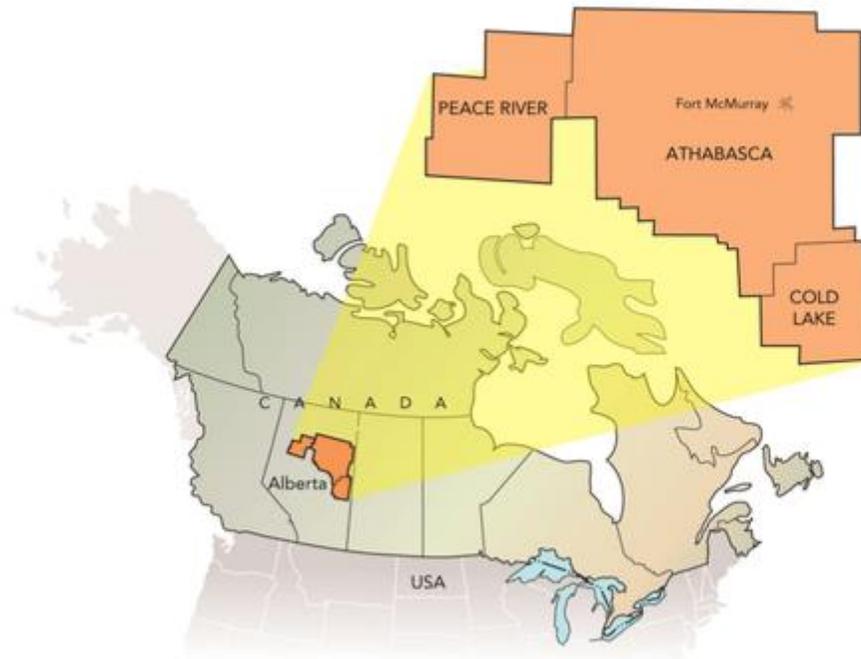
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**Figure 1. Shale Plays Driving Pipeline System Evolution
In Great Lakes – St Lawrence Basin**



★ The primary shale areas (“plays”) that are driving changes in the pipeline network in the Great Lakes – St. Lawrence Basin for crude oil, NGL’s, light condensates and natural gas are the BAKKEN UTICA and MARCELLUS plays

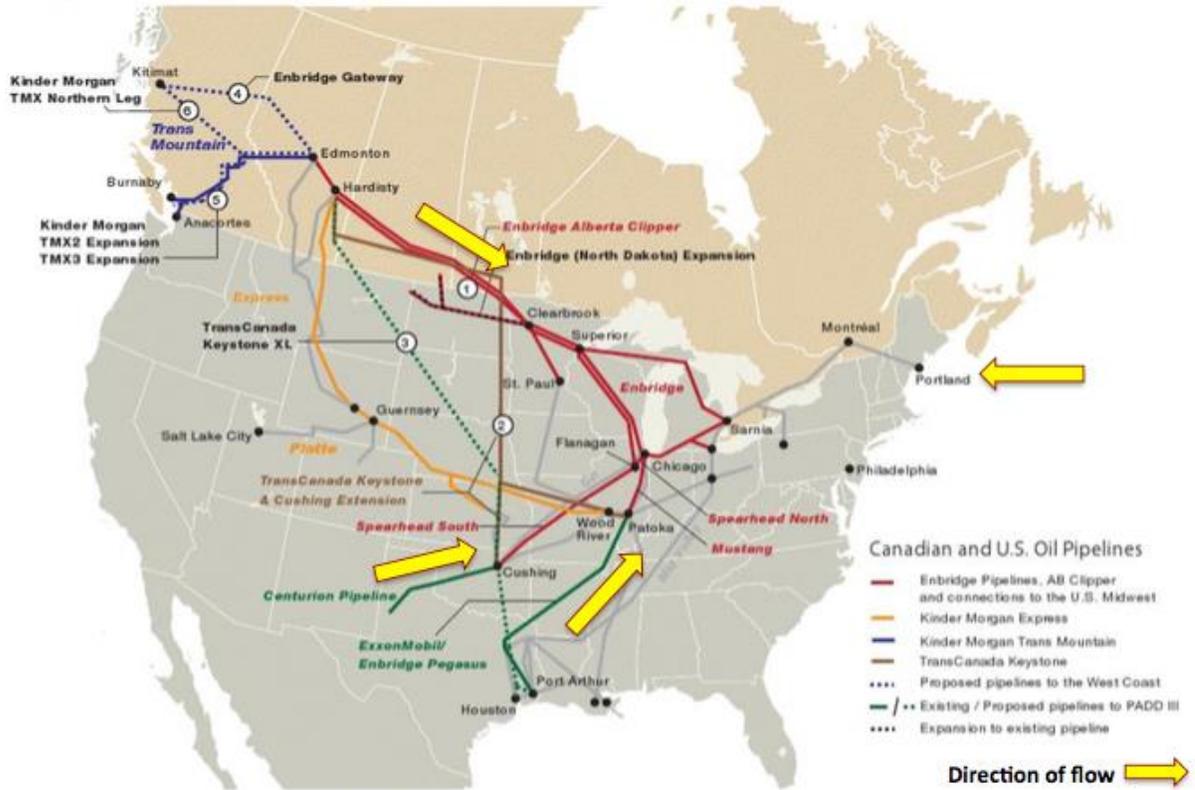
Figure 2. Canada Oil Sands Areas Driving Pipeline System Evolution in



Source: Government of Alberta Energy

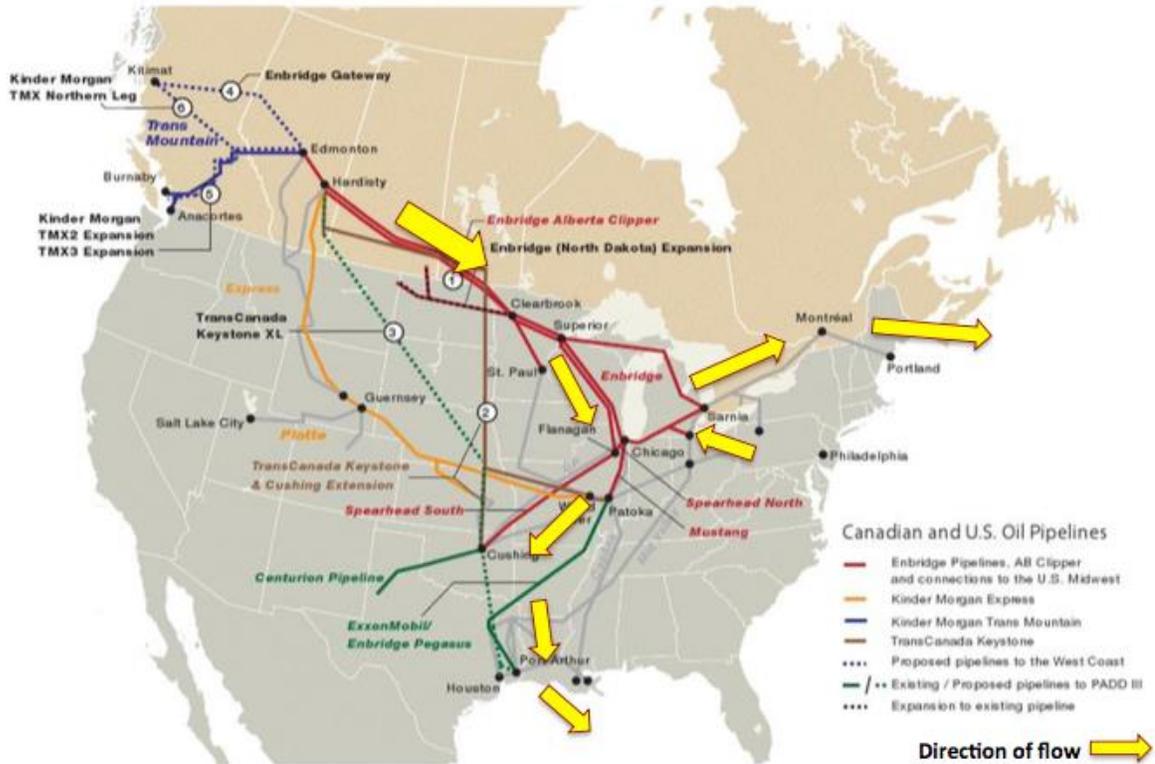
Tar-sands areas that are driving changes in the pipeline network in the Great Lakes – St. Lawrence Basin. Tar-sands crude oil is extracted and either partially processed to “synthetic crude oil” or diluted to create “Dilbit”, which has a lower viscosity and can be shipped by pipeline

Figure 3. Historic Crude Oil, NGL Flows to the Great Lakes – St Lawrence Basin



Historic, crude oil and NGL flows - Alberta, the U.S. Southwest and Gulf Coast, imports from the east.

Figure 4. Evolving Crude Oil, NGL, Light Condensate Flows to the Great Lakes – St Lawrence Basin



The pipeline system is evolving and directions changing. Projects are being implemented to move crude oil from North Dakota/Alberta to the Chicago area and on to the east and south to serve refineries enable maritime shipments and exports from the East Coast and Gulf Coast. Light condensate and NGL's pipeline projects will enable shipments from Pennsylvania, Ohio and West Virginia to the Detroit, Windsor and Sarnia areas.

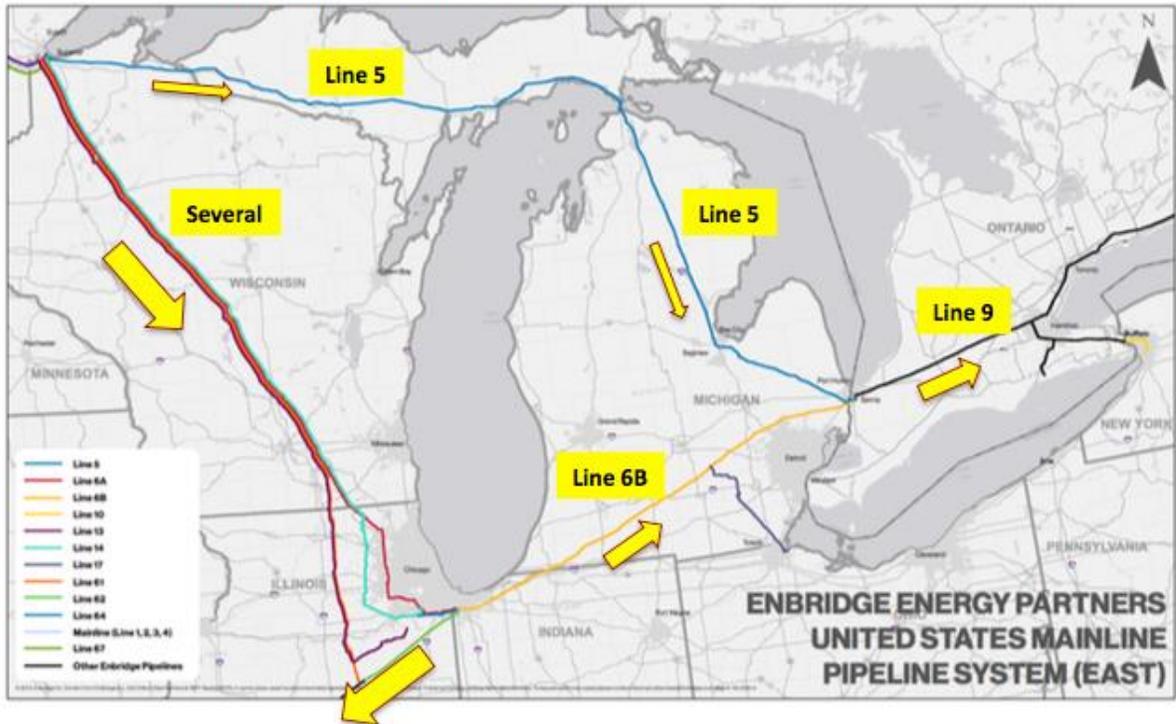
Figure 5. Refineries in the Great Lakes - St. Lawrence Basin



State/Province	City	Company	Refining capacity (bpd)
Indiana	Whiting	BP	400,000
Michigan	Detroit	Marathon	123,000
Ohio	Lima	Husky Energy	165,000
	Oregon	BP/Husky Oil	155,000
	Oregon	PBF	540,000
Wisconsin	Superior	Calumet	45,000
Quebec	Montreal	Suncor Energy	137,000
Ontario	Nanticoke	Imperial Oil	112,000
	Sarnia	Imperial Oil	121,000
	Sarnia	Suncor Energy	85,000
	Corunna	Shell Canada	72,000

Reference 5. Great Lakes Commission report on crude oil shipments in the Great Lakes – St Lawrence Basin

Figure 6. Enbridge Strategy – Expand to Ship Bakken and Tar Sands Crude Oil to the Midwest and East Coast



Enbridge is expanding its network to maximize Bakken and tar-sands crude oil shipment capability into the Great Lakes region and then on to East and Gulf Coasts refineries and ports for export.

Figure 7.

Pipeline Projects to Transport Crude Oil South Bound



1 – Line 67, Alberta Clipper and others

2 - Flanagan South Pipeline

3 – Capline Flow Reversal

Figure 8. Pipeline Projects to Transport Crude Oil South and East Bound



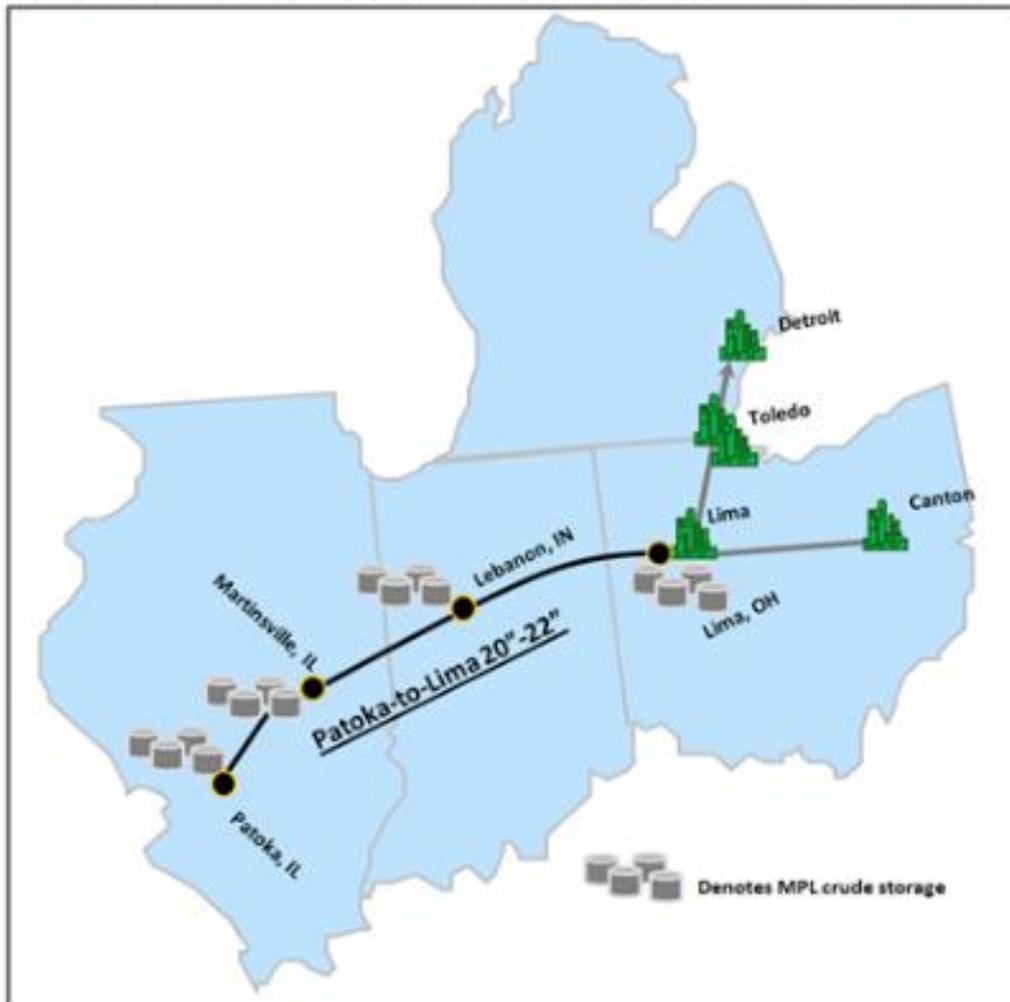
- 1 – Line 67, Alberta Clipper and others
- 2 – Line 5
- 3 – Line 6B
- 4 – Flanagan South
- 5 – Line 9 Reversal
- 6 – Portland Montreal Reversal
- 7 – Enbridge Trunkline Project

6
Montreal → Portland

7
St. James, LA ← Patoka, IL

Figure 9.

MPLX (Marathon) Pipeline Project From Patoka, IL to Lima, OH



An expansion that will increase crude oil shipment capacity to Toledo Refineries and the Detroit Marathon Refinery

Figure 10 Detroit/Toledo Crude Oil Supply Pipelines

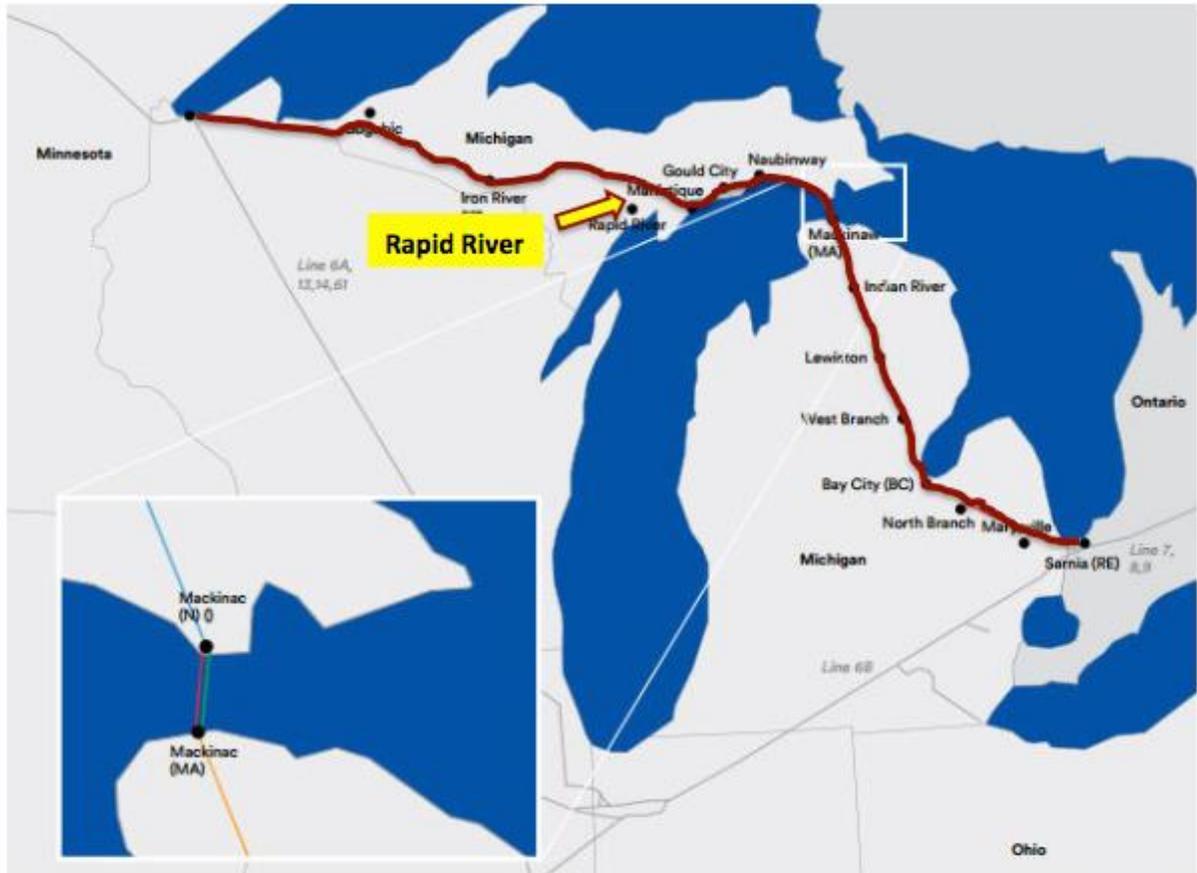


Source: Enbridge, MPC



Reference 7. (Original map by Marathon has been revised by FLOW)

Figure 11. Enbridge Line 5 Transports NGL's and Crude Oil



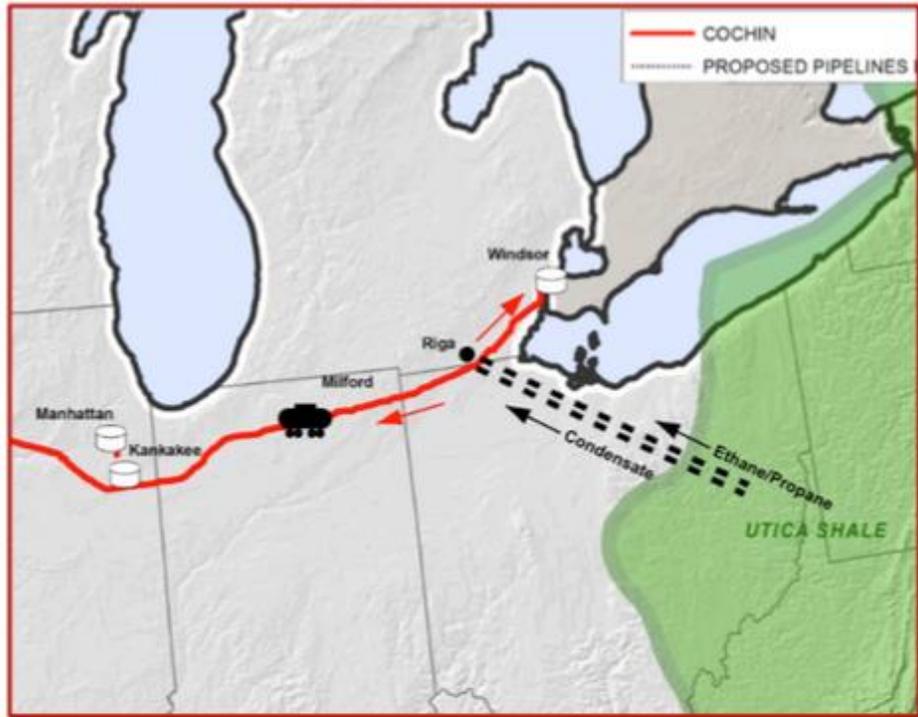
Propane is extracted at Rapid River and for commercial and home heating in the Upper Peninsula

Figure 12.

NGL's and Light Condensate Shipments from Ohio and Pennsylvania

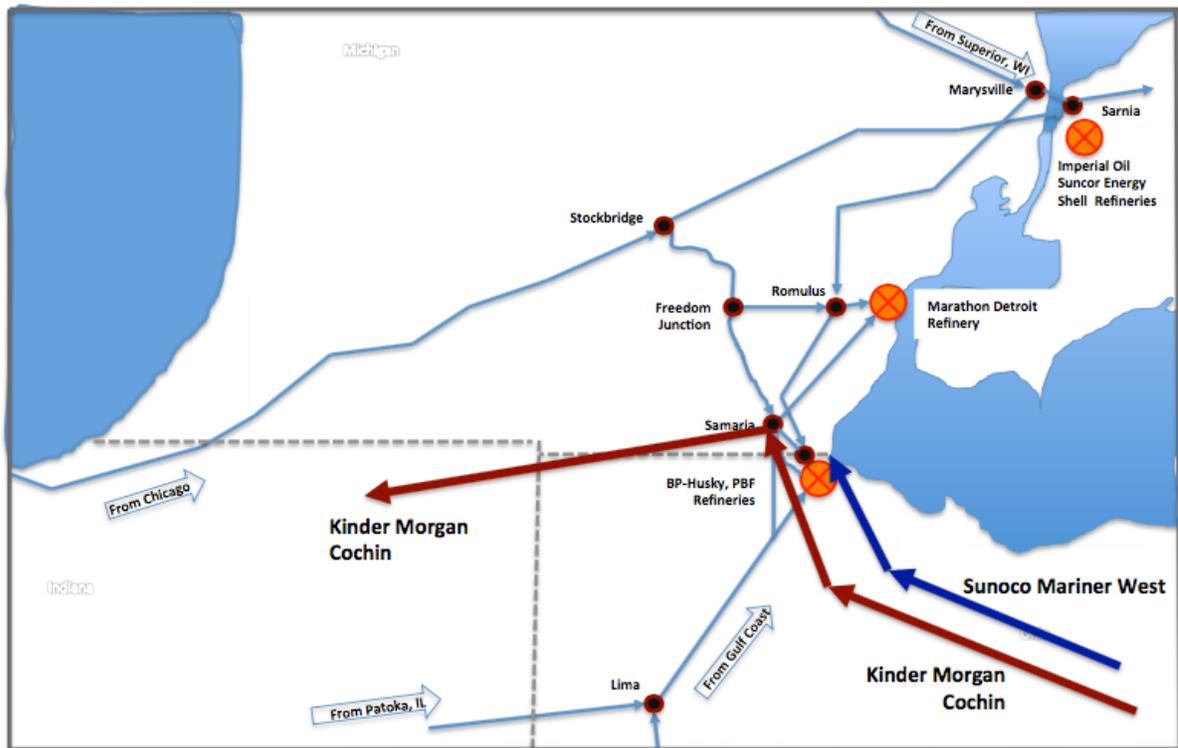


Cochin East Leg Opportunities



NGL's and light condensate feedstock will move from the Utica and Marcellus Shale Plays into the Windsor-Sarnia area to provide low cost feedstock to petrochemical producers in Canada

Figure 13. Kinder Morgan Cochin and Sunoco Mariner West Pipelines



These pipelines transport light condensate and NGLs' from the Utica and Marcellus Shale Plays

APPENDIX B: CURRENT AND POSSIBLE ALTERNATIVE SUPPLY SYSTEMS FOR TRANSPORTING OIL AND NATURAL GAS LIQUIDS TO REFINERIES IN DETROIT, MI; TOLEDO, OH; WARREN, PA; AND SARNIA, ON, AND PROPANE FOR THE UPPER PENINSULA OF MICHIGAN

By: Gary L. Street, M.S., P.E.

December 14, 2015

Prepared for and in partnership with FLOW (For Love of Water)

REPORT STATUS: The report that follows is based on an initial and ongoing investigation. New information is frequently uncovered. As new information is found and verified, it will be added to the report, as a revision or supplement.

PURPOSE

1. To identify the sources and amounts of crude oil that can be transported by pipeline to the Detroit refinery and two Toledo refineries, plus a refinery in Warren, PA.
2. Review the crude oil source for refineries in Sarnia, ON.
3. Consider supply system alternatives for delivering crude oil to the refineries – via pipeline – that would allow Line 5 to be shut down at the Straits of Mackinac.
4. Consider supply system alternatives involving pipeline and trucks for delivering propane to the Upper Peninsula and Northern Wisconsin that would allow Line 5 to be shut down at the Straits of Mackinac.

SUMMARY

- **Refineries in Detroit and Toledo served by Enbridge, and others:**
 1. Marathon – Detroit; Crude capacity = 130,000 barrels per day (bpd)¹
 2. BP-Husky – Toledo; Crude capacity = 160,000 bpd²
 3. PBF³ – Toledo; Crude capacity = 170,000 bpd⁴
- **Refineries in Sarnia served by Enbridge:**
 1. Imperial – Sarnia, Crude capacity = 121,000 bpd⁵
 2. Shell – Sarnia, Crude capacity = 75,000 bpd⁶
 3. Suncor – Sarnia, Crude capacity = 85,000 bpd⁷

¹ Source: Marathon Detroit Refinery, March 2015.

² “What do we do?” BP Husky. http://www.bp.com/en_us/bp-us/what-we-do/refining/toledo.html

³ In December 2010, Sunoco sold its refinery in Toledo, Ohio, to PBF Energy for US \$400 million.

⁴ Source: PBF Energy, 2015.

⁵ “Operations: Sarnia manufacturing site,” http://www.imperialoil.ca/Canada-English/operations_refineries_sarnia.aspx.

⁶ “Sarnia Manufacturing Centre Profile,” <http://www.shell.ca/en/aboutshell/our-business-tpkg/downstream/oil-products/sarnia.html>.

⁷ “Refining,” Suncor, <http://www.suncor.com/en/about/232.aspx>.

- A recent step by Enbridge has exacerbated the issue of supply to Sarnia by eliminating a previous source of crude oil to Sarnia. In March, 2014, the National Energy Board of Canada approved a request by Enbridge to reverse the flow of Line 9. Instead of crude coming from Montreal to Sarnia, it now flows from Sarnia to Montreal, for export outside of Canada. This development has removed an important source of crude oil for the Sarnia refineries.
- It is not the responsibility of the citizens of Michigan, nor other Great Lakes states and provinces, to risk an environmental disaster, simply to meet the demands of Canadian refineries, or a Canadian pipeline company, which serve a multi-national market, far beyond the needs of the Great Lakes region.
- After its Line 6B burst in 2010 spilling one million gallons of heavy crude into the Kalamazoo River watershed, Enbridge installed a new Line 6B from Griffith, IN, to Marysville, MI.⁸ In doing so, Enbridge increased its capacity to ship heavy crude to Sarnia via this route by 200 percent, and boosted the ultimate crude capacity of the segment between Griffith, Indiana, and Stockbridge, Michigan, by over 300 percent. The old Line 6B has been shut down, but not removed.
- Marathon consumes 130,000 barrels per day (bpd) of crude. Of this amount, they utilize 100,000 bpd of heavy crude, which arrives by Line 6B. This leaves a need for 30,000 bpd of light or medium crude. Since Line 5 transports 22,680,000 gallons per day or 540,000 bpd, the maximum demand by Marathon on Line 5 is 30,000/540,000 = 5.6%.
- Roughly 14,000 bpd⁹ of light crude are routinely added to Line 5 from oil wells in the **Northern Lower Peninsula of Michigan**, reducing the need for medium crude for Marathon - from outside of Michigan - to 16,000 bpd, or 12% of Marathon's daily crude demand. Since the Michigan crude is extracted south of the Straits, it can continue flowing to Marathon, via Line 5, even if Line 5 at the Straits is shutdown.
- Light crude can also be transported from the southern United States via the Mid-Valley and Capline pipelines to Marathon and the two Toledo refineries. In addition, light crude is also available via Line 6B from the Bakken formation in North Dakota.
- Based on the above, it is reasonable to conclude that only a small portion of the capacity of Line 5 is needed by Marathon and can be supplied by other existing pipelines.

⁸ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012, PDF, pg. 11.

⁹“How does Michigan benefit? Line 5 keeps the wheels turning in Michigan,” <http://www.enbridge.com/Line-5/Benefits.aspx> .

- BP-Husky (Toledo) consumes 160,000 bpd of crude. They are able to receive 60,000 bpd of heavy crude from Enbridge Line 6B, in conjunction with Line 17. In the near future they will also receive heavy crude via a new line, Enbridge Line 79 (See Map 2).
- While it is possible that BP-Husky is currently receiving some of the remaining 100,000 bpd via Line 5, it is also possible they receive it now, or could receive it in the future, via the Mid-Valley and Capline pipelines, which transport light and medium crude from the southern United States (See Map 2).
- Several references¹⁰ to BP-Husky converting entirely to heavy crude feed stock were discovered. The schedule for the conversion is varied, but even the most cautious estimate is that it will be complete by 2020. Assuming this happens, when the conversion is complete, BP-Husky in Toledo will be totally independent of a light crude supply, such as that from Line 5, Bakken, or Mid-Valley.
- Nothing was found to suggest that PBF Energy (Toledo) has the capacity to process heavy crude. They are receiving light and medium crude via the Mid-Valley and Capline pipelines. While it may be possible for PBF Energy to receive crude via Line 5, and a Sunoco line running from Marysville to Toledo, it is unlikely they use this source.
- Regarding propane, preliminary engineering alternatives have been developed during this investigation that show that Line 5 at the Straits of Mackinac can be shut down, but still provide customers in the Upper Peninsula and Northern Wisconsin with propane, by Enbridge, or by some other supplier, should Enbridge chose not to continue to do so.

CONCLUSION

- Based on the information available, we conclude that no more than five to tenpercent of the crude oil in Line 5 is going to the Detroit and Toledo refineries. In reality, it is most likely closer to five percent than ten percent.
- If Line 5 were shutdown, this amount of light and medium crude could be supplied from the Capline and Mid-Valley pipelines, along with crude from northern Michigan. These sources are currently transporting crude to the area, and could most likely make up the relatively small amount that may be coming to the U.S. from Line 5. In addition, Bakken light crude could also be transported to the area via Line 6B.

¹⁰ Pre-Filed Direct Testimony of Mark Sitek before the State of Michigan Public Service Commission, April 16, 2012, U-16937, pdf pgs. 16, 21, 44, 69.

- The overwhelming majority of Line 5 crude goes back into Canada via the crossing at Marysville, MI, to Sarnia, ON.
- Based on analysis of alternatives, there appears to be no valid reason for a disruption of propane in the Upper Peninsula or Northern Wisconsin if Line 5 is shut down at the Straits of Mackinac.
- If Line 5 is shut down at the Mackinac Straits, but the remainder of it is kept operational from Lewiston, MI, southward, Michigan crude can continue to be transported to refineries in Detroit and Toledo.

SCOPE

This report considers crude oil coming from the following sources:

- Bakken crude from North Dakota (Light, sweet crude)
- Alberta Tar Sands (Heavy crude)
- U.S. Gulf Coast – Louisiana and Texas (Light, sweet crude)
- Northern Lower Peninsula of Michigan (Light, sweet crude)

I. Bakken Crude from North Dakota (Light, sweet crude)

Bakken crude is further described by the North Dakota Petroleum Council.¹¹ There are numerous references in testimony to the Michigan Public Service Commission (MPSC) that Bakken crude is readily available to Marathon and BP-Husky at this time,¹² particularly via Line 6B.

II. Alberta Tar Sands (Heavy crude) and the Possibility of Crossing the Straits

In 2012, Enbridge considered an expansion of Line 5 rather than replacing Line 6B.¹³ Since Line 6B is primarily a line for heavy crude, the new Line 5, as considered by Enbridge, would also have carried heavy crude. This did not happen, and with the agreement to ban heavy oil in Line 5 recently reached between the State of Michigan and Enbridge, it may not happen.

“Enbridge evaluated expansion of its Line 5 pipeline, which would require the construction of a second, 645-mile parallel pipeline from Superior to Sarnia. This approach would not provide the incremental pipeline capacity in the timeframe needed. Additionally, it would be more intrusive to landowners, local communities and the environment, and would not provide the immediate capacity requirements of shippers on Line 6B. Therefore, Enbridge dismissed this alternative and no further studies were conducted.”

III. Upgrade of Line 6B

(From testimony by Thomas Hodge of Enbridge before the Michigan Public Service Commission,¹⁴ (“MPSC”))

MPSC: *“Will this project increase the operating pressure of Line 6b?”*

Hodge: *“Yes.”*

MPSC: *“Please explain.”*

Hodge: *“Replacement of these remaining segments will restore the original ultimate pipeline capacity of Line 6B.¹⁵ As Line 6B is expected to continue to operate at pressures below the*

¹¹ “Bakken Crude Properties,” North Dakota Petroleum Council, <http://www.ndoil.org/resources/bkn/>.

¹² Testimony by Michael Ashton before the Michigan Public Services Commission, Case # U16937, May 24, 2012.

¹³ Enbridge, Line 6B Phase 2 Replacement Project, June 15, 2012, p. 14.

¹⁴ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012.

previous maximum operating pressure, the available pipeline capacity on Line 6B is reduced as a direct result. By replacing the remaining segments of Line 6B with new pipeline, Enbridge will be able to achieve its original ultimate capacity and also provide the pipeline capacity necessary to meet its shippers' current transportation requirements.

Shippers are also forecasting a need for additional capacity above current demands. Since Line 6B has experienced periodic apportionment based on monthly shipper demand, Enbridge anticipates that the frequency of apportionment will only increase, especially as demand for additional pipeline capacity rises to meet the feedstock requirements of the refineries directly and indirectly served from Line 6B.

Enbridge plans to replace certain segments of Line 6B with a 36-inch diameter pipe and to install new facilities at certain existing station locations in order to meet its shipper's future transportation requirements."

A. Impact of Reduced Flow in Line 6B and Subsequent Total Replacement

Enbridge repeatedly has stressed that it replaced the entire length of Line 6B, from Griffith, IN, to Maryville, MI, due to "Integrity and Maintenance" considerations. While these factors may have contributed to the decision, the evidence clearly shows the over-riding consideration to be economic.

After the spill at Marshall on July 25, 2010, Enbridge was ordered by the Pipeline and Hazardous Materials Safety Administration (PHMSA) to reduce the operating pressure of Line 6B to 80 percent of its pre-spill amount.¹⁶ This meant the operating pressure could not exceed 340 psig (prior to the rupture, the line was operated at 425 psig). The reduced operating pressure in turn reduced the flow in the line from roughly 400,000 bpd^{17,18} to a maximum of 240,000 bpd.^{19,20} Such a capacity reduction represented a loss of revenue for Enbridge, and may have created supply problems for Marathon. In addition, Mr. Warner²¹ of the Michigan Public Service

¹⁵ In reality, the project does more than "restore the original capacity," it increases the capacity of Line 6B substantially.

¹⁶ Travis Warner, a Public Utilities Engineer in the Gas Operations Section of the Commission's Operations and Wholesale Markets Division, before the Michigan Public Service Commission, History of Proceedings, Case # U-17020, January 31, 2013, pg. 13.

¹⁷ Matheny, Keith, "Enbridge's expanded oil pipeline draws ire of homeowners in its path," *Detroit Free Press*, June 24, 2013.

¹⁸ Hasemyer, David, "Michigan Pipeline to Restart, Now New and Double the Capacity," *Inside Climate News*, April 10, 2014.

¹⁹ Matheny, Keith, "Enbridge's expanded oil pipeline draws ire of homeowners in its path," *Detroit Free Press*, June 24, 2013.

²⁰ See *supra* note 18.

²¹ Testimony by Travis Warner, a Public Utilities Engineer in the Gas Operations Section of the Commission's Operations and Wholesale Markets Division, before the Michigan Public Service Commission, Case # U-17020, January 31, 2013, pg. 13.

Commission staff stated, “[T]here is no guarantee that PHMSA will ever allow Enbridge [to] operate Line 6B at its original design pressure and the subsequent capacity.”

To counter this, Enbridge installed an entire new line from Griffith, IN, to Marysville, MI²². The cost, as reported by Enbridge,²³ was \$2.8 billion. However the new line is 36 inches in diameter from Griffith, Indiana, to Stockbridge, Michigan, then 30 inches in diameter from Stockbridge to Marysville, Michigan. It is important to note that the old Line 6B was 30 inches in diameter for its entire path, not 36 inches from Griffith to Stockbridge.

Taking into account the larger diameter, and the removal of federal restrictions on operating pressure due to the installation of a new pipeline, Enbridge now has an Ultimate Annual Capacity in the 36-inch diameter portion (Griffith to Stockbridge) of 800,000 bpd, and an Ultimate Annual Capacity in the 30-inch diameter section (Stockbridge to Marysville) of 525,000 bpd. When this is compared to the 240,000 bpd that Enbridge was restricted to with the “old” Line 6B, it is obvious why they sought to replace the entire Line 6B, even at the cost of \$2.8 billion (See Table 1).

It appears that the total replacement of Line 6B from Stockbridge to Marysville was primarily motivated by economic considerations – the ability to operate at even higher flow rates in the future. Other considerations, such as safety, environmental, and disruption of landowners, while valid, were secondary.

This conclusion is borne out by testimony before the MPSC by Mr. Thomas Hodge of Enbridge.²⁴ In April, 2012, he stated, “*This will enable Enbridge to restore Line 6B to its original ultimate pipeline capacity and along with certain facility installations at existing station sites, to provide the pipeline capacity necessary to meet its shippers’ current and future transportation requirements.*” For the definition of “capacity” terms as used by Enbridge, see Addendum 1.

In January 2013, in testimony before the MPSC, Mr. Hodge A once again was quoted regarding an increase in capacity if Line 6B were completely replaced.²⁵

²² Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012, pg. 12.

²³ Neiles, Byron, “Enbridge Major Projects,” Enbridge Day 2014, http://www.enbridge.com/~media/www/Site%20Documents/Investor%20Relations/2014/ENBDays/3_Major_Projects.pdf.

²⁴ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012, Exhibit A-2, pg. 5

²⁵ Michigan Public Service Commission, Order Approving Application, U-17020, January 31, 2013, pg. 9.

“Mr. Hodge also explained that the improvements to Line 6B will allow for operation of the pipeline at an increased operating pressure, which will increase its capacity. The details of the pre- and post-construction operating specifications appear on Table No. 3 at 6 Tr 364.”

From Enbridge on April 2, 2014

From the various statements by Enbridge, cited above, it is obvious that replacement of Line 6B not only satisfied regulatory conc: *“Then after the completion of the full replacement of 6B, there will be work involving pump upgrades and terminal work as well as the construction of five additional tanks at Stockbridge all of this for 2016.”*²⁶

The pump upgrades and additional storage tanks are all part of increasing the flow in Line 6B to the Ultimate Annual Capacity, as defined by Enbridge. The footnotes in Table 1 further confirm this conclusion.

erns, but it also provided the opportunity to significantly increase the flow of heavy crude to Michigan, Ohio, Ontario, and Pennsylvania.

Specifics of the Line 6B Phase 2 Replacement Project.²⁷ Enbridge Energy Partners, L.P., has replaced approximately 210 miles of existing 30-inch diameter Line 6B pipeline in Indiana and Michigan by installing new pipe.²⁸ Per Enbridge, *“The Line 6B Phase 2 Replacement Project responds to growing demand for pipeline transportation capacity while also reducing the frequency of future integrity inspections and individual repairs in the replacement segments. This is a combination capacity/integrity-driven project and is distinct from the integrity-driven Line 6B 2012 Maintenance and Rehabilitation Program...”*

B. Justification for the Increased Capacity in the New Line 6B:

The History of Proceedings for Order of Approval²⁹ issued by the MPSC, mentions, in several places, the justification used by Enbridge and the State to increase the capacity of Line 6B.

A typical statement from the MPSC.³⁰ *“The Staff agrees that it would be in the public interest to replace the existing Line 6B with the new project, which would address the integrity issue, reduce future maintenance digs, and increase capacity to serve the present and future needs of shippers and local refineries. Indeed, Staff witness Warner testified that he had recently confirmed the need for additional pipeline capacity at the site of Marathon’s Detroit refinery.”*

²⁶ Thomson Reuters Street Events, Edited Transcript, EEP and MEP Investor Day, April 2, 2014, pg. 15.

²⁷ “Pipeline Safety Trust: About Pipelines, Enbridge Expansion backgrounder,” <http://pstrust.org/about-pipelines/enbridge-expansion-backgrounder/>.

²⁸ Hasemyer, David, “Michigan Pipeline to Restart, Now New and Double the Capacity,” *Inside Climate News*, April 10, 2014.

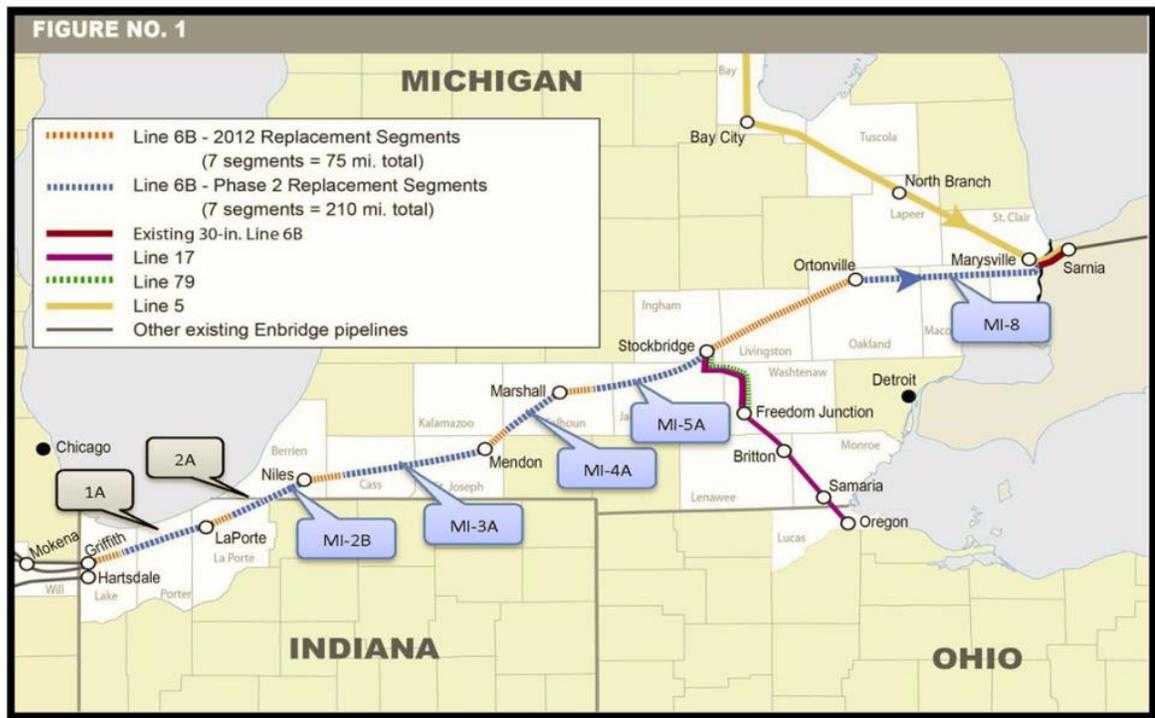
²⁹ Michigan Public Service Commission, Order Approving Application, U-17020, January 31, 2013, pgs. 9, 14, & 18.

³⁰ *Id.*

Table 1, and the other sources cited above, Enbridge used the opportunity to not only replace Line 6B, which very likely had additional “integrity” issues, but also increased their Initial Annual Capacity to send heavy crude between Griffith and Stockbridge by 208 percent (500,000 bpd/240,000 bpd = 208 percent).

Lastly, should Enbridge install additional pumps and other hardware, taking Line 6B to its Ultimate Annual Capacity, this same segment could see an increase of 333 percent (800,000 bpd/240,000 bpd = 333 percent).

Map 1 – Upgraded Enbridge Line 6B³¹



³¹ Pre-Filed Direct Testimony of Mark Sitek before the State of Michigan Public Service Commission, April 16, 2012.

Table 1 – Existing Line 6B Capacity and Increased Line 6B Capacity³²

Pipeline Capacity	Existing Line 6B 30-Inch (BPD)*	Post- Construction 36-Inch (BPD) **	Post- Construction 30-Inch (BPD) **
Ultimate Design Capacity	450,000*	889,000	583,333
Ultimate Annual Capacity	Ranged from 400,000 (bpd) to 410,000 (bpd)*	800,000	525,000
Initial Design Capacity		550,000	550,000
Initial Annual Capacity		500,000	500,000
Maximum Operating Pressure (72% of maximum yield strength)	624 psi*	1400 psi	1260 psi
The above Table No. 3 is from Exhibit A-2 of the Application			
* Prior to Sept. 2010			
** Stated capacity includes station upgrades indicated in Section 6 of Exhibit A-2 of this Application			

IV. Enbridge Lines 17 and 79

Line 17 is 16 inches in diameter and runs from Stockbridge, MI, to Toledo, OH. It is mainly used to deliver crude to BP-Husky in Toledo³³ (See Map 2.)

Enbridge Line 79 is used to transport western Canadian heavy crude.³⁴ It is 20 inches in diameter.³⁵ Line 79 was installed adjacent to Line 17 and was scheduled to start up in 2013.³⁶ The capacity of Line 79 is 80,000 bpd.³⁷

In testimony before the Michigan Public Service Commission,^{38,39} Mr. Neil Earnest, a Vice President and Director of Muse, Stancil & Co. of Addison, TX, stated, “*With only one refinery in North Dakota, much of the state’s crude oil production is delivered throughout the Midwest via the Enbridge Mainline System. The Marathon Detroit Refinery currently can receive Bakken production via Enbridge’s Line 5, a pipeline segment devoted to light and medium crude oil types (Bakken crude oil is light). The BP-Husky Toledo Refinery currently does not have direct*

³² Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012.

³³ Testimony before the Michigan Public Service Commission, January 12, 2012, p. 6.

³⁴ Testimony before the Michigan Public Service Commission, January 12, 2012, p. 7.

³⁵ Testimony before the Michigan Public Service Commission, January 12, 2012, p. 13.

³⁶ Kasler, Dale. “Federal energy agency supports California in dispute with JPMorgan Chase,” The Terra News. June 6, 2013. <http://www.theterranews.com/content/?m=20130606>.

³⁷ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, May 3, 2012, pdf pg. 63.

³⁸ Pre-Filed Testimony of Neil Earnest before the State of Michigan Public Service Commission, May 3, 2012, pdf pg. 44, U-16937.

³⁹ Id, pdf pg. 45.

pipeline access to Bakken supplies; however, with the additional capacity available for this refinery on Line 17 with the completion of this Project, Enbridge will be able to periodically batch supplies of Bakken crude to BP-Husky via Line 17.”

There is no mention in any of the testimony that the PBF refinery in Toledo will be served by either Line 17 or Line 79.

Conclusion: Lines 17 and 79 can supply either heavy crude or light crude to Marathon and BP-Husky, but do not supply any crude to PBF.

V. Enbridge “Project 24”: Recent and Planned Expansion of the Capacity of the Lakehead System⁴⁰

Enbridge has requested approval from the Federal Energy Commission (FERC) to increase the capacity of portions of its Lakehead System. The other pipelines involved are Line 61, Line 67, Line 62, and Line 6B.

Table 2: Summary of Capacity Increases – Project 24

Line Number	Description	Timing
61	Increase capacity to 1,200,000 bpd	3 Q 2015
67	Increase capacity to 800,000 bpd	mid - 2015
62	New “twin” line. Initial capacity to be 570,000 bpd	3 Q 2015
6B	Increase current annual capacity from 500,000 bpd to 570,000 bpd. See Table 1.	1 Q 2016

Quoting FERC,⁴¹ “According to Enbridge Energy, the Line 6B Expansion will enhance the Line 6B facilities between Griffith, Indiana, and Stockbridge, Michigan. Enbridge Energy points out that this segment of Line 6B was replaced recently, and the replacement pipe will not be expanded further. Instead, continues Enbridge Energy, the expansion will include pump station modifications and new tankage at the Hartsdale and Stockbridge terminals, which will increase the total capacity of Line 6B from 500,000 bpd⁴² to approximately 570,000 bpd. Enbridge

⁴⁰ FERC, Federal Energy Regulatory Commission, 150 FERC 61,069, February 2, 2015.

⁴¹ Id., pg. 4.

⁴² See

Table 1 and addendum 1 for definition and use of “Capacity.”

Energy expects the Line 6B expansion to commence service during the first quarter of 2016 or earlier, at a cost of \$365 million.”

VI. Marathon Refinery in Detroit

Marathon – Detroit; Crude Capacity = 130,000 bpd⁴³.

Crude oil demand at Marathon’s Detroit, Michigan, refinery is supplied exclusively by pipeline⁴⁴.

The capacity for processing heavy crude at Marathon in Detroit was reported to be 100,000 bpd in 2015⁴⁵. Citing Marathon’s web site - *Upon completion of the DHOUP (Detroit Heavy Oil Upgrade Project) in 2012,*⁴⁶ *the refinery became able to process 100,000 bpd of heavy Canadian crude.*

The capacity to process heavy crude at Marathon was further confirmed by the testimony of Clifford Cook⁴⁷ (Marathon, Senior Vice President). Mr. Cook stated that at the time of his testimony, Marathon could process 25,000 bpd of heavy crude from Canada. He then referred the need for a new pipeline between Samaria, MI, and Detroit so the volume of heavy crude processed could be increased by 75,000 bpd. The DHOUP Project, referred to above, and now operational, increased the capacity to 100,000 bpd.

In addition to crude received from Alberta, Marathon receives 14,000 bpd of crude from the northern Lower Peninsula of Michigan⁴⁸ via Line 5. Taking this into account, their total need of 130,000 bpd, along with the 100,000 bpd they receive by Line 6B, says they only need 16,000 bpd from some other pipeline source – equal to about 12% of their daily demand. (130,000 – 14,000 = 16,000. 16,000/130,000 = 12.3%)

Conclusion: The section of Line 5, in the Lower Peninsula, between Lewiston and Marysville, could remain in operation if Line 5 were shut down at the Straits, and continue to supply 16,000 bpd of crude to Marathon.

⁴³ Marathon Petroleum Company, Marathon Detroit Refinery, March 2015, www.marathonpetroleum.com.

⁴⁴ Pre-Filed Direct Testimony of Clifford C. Cook before the State of Michigan Public Service Commission, March 23, 2007 (Cook, at the time of the testimony, was Senior Vice President for Supply and Distribution, Marathon Petroleum Company).

⁴⁵ Lefebvre, Ben. “Marathon Petroleum restarts Detroit refinery after major expansion project,” Hydrocarbon Processing. November 6, 2012. <http://www.hydrocarbonprocessing.com/Article/3113909/Marathon-Petroleum-restarts-Detroit-refinery-after-major-expansion-project.html>.

⁴⁶ Id.

⁴⁷ Testimony of Clifford Cook, Marathon, before the Michigan Public Service Commission, May 3, 2007, Case # U-15251, 225540.doc2, p. 8., <https://efile.mpsc.state.mi.us/efile/docs/15251/0002.pdf>

⁴⁸ “How does Michigan benefit? Line 5 keeps the wheels turning in Michigan,” <http://www.enbridge.com/Line-5/Benefits.aspx>.

Marathon has a pipeline from Samaria to Detroit.⁴⁹ This line is 16 inches in diameter.

Enbridge, Wolverine, and Marathon, have a sequential pipeline system from Line 6B to Freedom Township, then to Romulus, MI, and finally to the Marathon refinery (See Map 2).

VII. The MPLX Crude Oil Pipeline System⁵⁰

(MPLX was spun off from Marathon about 2 years ago. MPLX LP is a master limited partnership formed by Marathon Petroleum Corporation (MPC).

Table 3

Crude Oil Pipelines System : Overview

Crude Oil Pipeline System	Diameter (Inches)	Length (miles)	Capacity (MBPD) ¹	Initial Term (Years)	MPC Min. Commitment (MBPD) ¹
Patoka to Lima	20" / 22"	302	249	10	40
Catlettsburg and Robinson	20" / 24" / 20"	484	495	10	380
Detroit	16" / 16"	61	320	10	155
Wood River to Patoka	22" / 12"	115	314	5	130
Wood River Barge Dock	--	--	84	5	40
Total	--	962	1,462	--	745

Market Realist

Source : MPLX LP

Patoka to Lima Crude Pipeline System

From Table 3 the Pakota to Lima crude pipeline system is made up of approximately 302 miles. (MPC = Marathon Petroleum Corporation)

Crude is delivered to MPC's tank farm in Lima, from where it is shipped to MPC's Canton, Ohio, refinery, or to other third-party refineries in Lima and Toledo, Ohio. Crude is also shipped to MPC's Detroit refinery through the Samaria to Detroit pipeline.

VIII. PBF Energy and the PBF Refinery in Toledo

PBF – Toledo: Crude Capacity = 170,000 barrels/day⁵¹

⁴⁹ Banz, Keisha. "The MPLX crude oil pipeline system," December 16, 2014. <http://finance.yahoo.com/news/mplx-crude-oil-pipeline-system-183449008.html>, and Marathon Pipeline LLC Operated Pipeline Systems, May, 2015.

⁵⁰ Banz, Keisha. "The MPLX crude oil pipeline system," December 16, 2014. <http://finance.yahoo.com/news/mplx-crude-oil-pipeline-system-183449008.html>.

⁵¹ PBF Energy, 2015

PBF is a petroleum refiner and supplier of unbranded transportation fuels, heating oils, lubricants, petrochemical feedstocks, and other petroleum products, founded in 2008 with headquarters in Parsippany, New Jersey. The company's three refineries include one in Toledo, Ohio, one at the Port of Paulsboro in Gibbstown, New Jersey, and the Delaware City Refinery in Delaware City.

Sources of Crude

From the 2014 PBF Energy Annual Report.⁵²

“Toledo has a throughput capacity of approximately 170,000 bpd and a Nelson Complexity Index of 9.2. Toledo primarily processes a slate of light, sweet crudes from Canada, the Mid-Continent, the Bakken region and the U.S. Gulf Coast.

Crude is delivered to the Toledo refinery through three primary pipelines: (1) Enbridge from the north, (2) Capline from the south and (3) Mid-Valley from the south. Crude is also delivered to a nearby terminal by rail and from local sources by truck to a truck unloading facility within the refinery.”

While PBF states that it gets light crude via “Enbridge from the north,” it does not mean it must come by way of Line 5. It could also come by way of Line 6B.

There is no mention of heavy crude or dilbit.

Conclusion: There is no evidence that the PBF refinery in Toledo has the capability to process heavy crude, nor plans to do so in the near future.

IX. Capline Pipeline: The Capline crude pipeline⁵³ is the biggest pipeline in the mainland United States. It is 40 inches in diameter, and runs 632 miles. It can handle 1.2 million bpd. It is co-owned by Marathon, Plains All-American, and BP. It transports crude northward from the **Gulf Coast**, originates in St. James, LA, and terminates at Patoka, IL (See Map 2).

X. Mid -Valley Pipeline: The Mid-Valley Pipeline Company owns a pipeline, which originates in Longview, TX, and terminates in Samaria, MI.^{54,55} It transports crude oil to refineries primarily in the Midwest United States. The pipeline is 20 inches in diameter in some sections, and elsewhere, 22 inches in diameter.⁵⁶ It is 1,100 miles long.⁵⁷ The crude oil that is transported

⁵² PBF Energy Inc. 2014 Annual Report, p. 19.

⁵³ Resnick-Ault, Jessica, “UPDATE 2-Capline, biggest U.S. crude conduit, to study future options,” Reuters, Oct. 30, 2014, <http://www.reuters.com/article/2014/10/30/marathonpetroleum-capline-idUSL1N0SP18220141030>.

⁵⁴ “Sunoco Logistics Asset Map,” <http://www.sunocologistics.com/Customers/Business-Lines/Asset-Map/241/>.

⁵⁵ “Sunoco Logistics Asset Map,” <http://www.sunocologistics.com/Customers/Business-Lines/Crude-Oil-Pipeline-System/55/>.

⁵⁶ Sunoco Pipeline L.P./Inland Corporation/Mid-Valley Pipeline Company, 2015.

⁵⁷ Sunoco Pipeline L.P./Inland Corporation/Mid-Valley Pipeline Company, 2015.

in the Mid-Valley pipeline is Light Texas Crude. The pipeline has a reported capacity of 238,000 bpd⁵⁸ to 280,000 bpd⁵⁹ of Light Texas Crude (LTC).

On November 5, 2015, Reuters reported⁶⁰ that, “Sunoco Logistics expects to return its 280,000 barrels per day Mid-Valley pipeline to full capacity early next year once it completes hydro-testing on the system.”

Note: This pipeline is NOT transporting heavy crude. The pipeline system in the Toledo area for this line becomes somewhat complex.⁶¹

XI. BP-Husky Refinery in Toledo

BP-Husky – Toledo; Crude Capacity = 160,000 bpd⁶²

Sources of Crude:

1. Toledo Oil Pipeline⁶³ (aka Enbridge Line 17). From Stockbridge, MI, to the refinery. See **Map 2**. Design Capacity of Line 17^{64,65} is 100,000 bpd. Annual Capacity of Line 17: 90,000 bpd. Since this line is a spur of Line 6B, it most likely is supplying heavy crude to the refinery. However it could also be used to supply light crude.
2. The Mid-Valley pipeline is owned by Sunoco.⁶⁶ Mid-Valley Pipeline includes 20-inch and 22-inch diameter sections. It has a nominal capacity of 280,000 bpd⁶⁷. The pipeline, “...originates in Longview, Texas and passes through Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, and Ohio, and terminates in Samaria, Michigan.”⁶⁸

Considering the source of the Mid-Valley pipeline, it is not supplying BP-Husky with heavy crude. Rather it is a source of lighter crude, similar to that currently in Line 5.

⁵⁸ Zacks Equity Research. “Sunoco Logistics; Mid-Valley Pipeline Spills,” *Zacks*. March 20, 2014.

<http://www.zacks.com/stock/news/127113/sunoco-logistics-midvalley-pipeline-spills>.

⁵⁹ Hampton, Liz. “Sunoco Logistics Mid-Valley pipeline to return to full capacity early next year,” *Market News*. December 10, 2015. http://www.ubs.wallst.com/ubs/mkt_story.asp?docKey=1329-L1N1301QL-1&first=0.

⁶⁰ Ibid.

⁶¹ Doherty, Kevin E. “Sunoco Logistics,”

http://sitemanager.pdigm.com/user/file/Ohio/Sunoco_Pipeline_LP_Inland_Corporation_Mid_Valley_Pipeline_Company.pdf.

⁶² “What do we do?” BP Husky. http://www.bp.com/en_us/bp-us/what-we-do/refining/toledo.html

⁶³ “Toledo Oil Pipeline,” <http://abarrelfull.wikidot.com/toledo-oil-pipeline>.

⁶⁴ “Toledo Oil Pipeline,” <http://abarrelfull.wikidot.com/toledo-oil-pipeline>.

⁶⁵ Testimony before the Michigan Public Service Commission, Sitek, et. al., May 3, 2012, U-16937, pdf pg. 6.

⁶⁶ “Toledo Oil Pipeline,” <http://abarrelfull.wikidot.com/mid-valley-crude-oil-pipeline>.

⁶⁷ Williams, Nia. “Husky says Mid-Valley pipeline curtailment into Lima refinery may last into 2015,” *Reuters*. October 23, 2014. <http://www.reuters.com/article/2014/10/23/husky-energy-pipeline-lima-idUSL2N0SI1TP20141023#YLKzOwfe1WR9HPYd.97>.

⁶⁸ Ibid.

3. The BP-Husky Refinery near Toledo is being converted to process ONLY heavy crude.^{69,70} The conversion is expected to be complete sometime between 2016 and 2020.

⁷¹ *“The partners plan to invest \$2.5bn in the refinery by 2015 to increase processing capacity and enable it to process crude oil produced at the Sunrise field. Located in the Canadian oil sands, the Sunrise field produces bitumen which is heavy, black and viscous in nature. The investment will increase the capacity of the refinery to 170,000 bpd of heavy oil and bitumen.”*

4. Based on our investigation to date, the heavy crude that BP Husky is using is coming – and will come in the future - from Line 6B.

XII. United Refinery in Warren PA Supply of Crude Oil⁷²

Substantially all of our crude supply is sourced from Canada and the Northern Plains states through the Enbridge pipeline. We are however, not dependent on this source alone. While not utilized during the closure of the Enbridge 6B pipeline because of the anticipated length of the disruption, we could within 90 days shift up to 70% of our crude oil requirements to some combination of domestic and offshore crude. With additional time, 100% of our crude requirements could be obtained from non-Canadian sources.

We access crude through the Kiantone Pipeline, which connects with the Enbridge pipeline system in West Seneca, New York, which is near Buffalo. The Enbridge pipeline system provides access to most North American and foreign crude oils through three primary routes:

(i) Canadian crude oils are transported eastward from Alberta and other points in Canada, (ii) foreign crude oils unloaded at the Louisiana Offshore Oil Port are transported north via the Capline and Chicap pipelines which connect to the Enbridge pipeline system at Mokena, Illinois, and (iii) foreign crude unloaded at Portland, Maine shipped to Montreal then shipped on Enbridge’s line 9 to Sarnia, Ontario. Enbridge has announced the Phase I (partial) reversal of Line 9. This reversal includes the segment from Westover to Sarnia. It does not interfere with crude deliveries from Montreal to Westover and deliveries into West Seneca.

The Kiantone Pipeline, a 78-mile Company-owned and operated pipeline, connects our West Seneca, New York terminal at the pipeline’s northern terminus to the refinery’s tank farm at its southern terminus. We completed construction of the Kiantone Pipeline in 1971 and have operated it continuously since then. We are the sole shipper on the Kiantone Pipeline, and can

⁶⁹ “BP-Husky Toledo Refinery, United States of America,” <http://www.hydrocarbons-technology.com/projects/bp-husky/>.

⁷⁰ McLendon, Kelly. “Oil sands project called critical for local refinery,” *Toledo Blade*. June 6, 2013. <http://www.toledoblade.com/Energy/2013/06/06/Oil-sands-project-called-critical-for-local-refinery.html>.

⁷¹ “BP-Husky Toledo Refinery, United States of America,” <http://www.hydrocarbons-technology.com/projects/bp-husky/>.

⁷² “United States Securities and Exchange Commission, Form 10-K” August 31, 2011. <http://www.sec.gov/Archives/edgar/data/101462/000119312511324609/d257760d10k.htm>

currently transport up to 70,000 bpd along the pipeline. Our right to maintain the pipeline is derived from approximately 265 separate easements, right-of-way agreements, licenses, permits, leases and similar agreements.

The pipeline operation is monitored by operators using a recently upgraded SCADA system at the refinery. Shipments of crude arriving at the West Seneca terminal are separated and stored in one of the terminal's three storage tanks, which have an aggregate storage capacity of 485,000 barrels. The refinery tank farm has two additional crude storage tanks with a total capacity of 200,000 barrels. An additional 35,000 barrels of crude can be stored at the refinery.

XIII. Propane Supply to the Upper Peninsula If Line 5 is Shut Down at the Straits of Mackinac

Concern has been expressed that if Line 5 at the Straits were “shut down,” it would prevent delivery of propane to the Upper Peninsula.

Periodically, Enbridge uses Line 5 to transport natural gas liquids (NGLs) to various locations, including a terminal and processing center at Rapid River, MI. The compounds making up NGLs are shown in Table 4.

At Rapid River, Enbridge operates a “depropanizer” to separate and purify the propane from the other compounds that are present. After separation, the liquefied propane is stored under pressure in large steel cylinders. Propane is then loaded into large trucks that haul it to localized distribution centers, or in some cases, directly to the end-customer. If not taken directly from Rapid River to an end-customer, but instead taken to a localized distribution center, the propane is loaded into smaller trucks, for local delivery to residences, small businesses, offices, etc.

Rapid River is centrally located on the southern edge of Michigan's Upper Peninsula, about half way between Ontonagon and St. Ignace. It is ideally located to provide propane to most of the Upper Peninsula, as well as Northern Wisconsin.

From a logistics and engineering viewpoint, there is no basis for concern. Rapid River is 130 miles west of where Line 5 crosses the Straits, very much “upstream” of the Mackinac Straits. If Line 5 were shut down at the Straits, the Rapid River facility could continue to receive NGLs, and process them to remove and purify the propane. Given the geography of the Rapid River location, receiving propane via Line 5 would not be impacted. The Superior to Rapid River segment of Line 5 could remain in operation.

Attached are preliminary Process Flow Diagrams that show (1) the existing propane purification tower (depropanizer) and propane storage tanks at Rapid River; and (2) two workable and

straightforward alternatives. There are likely additional options. Enbridge engineers, if not constrained by the status quo, could likely come up with these same alternatives – and more.

The first drawing (Figure 1) shows the depropanizer at Rapid River as it likely exists today. Figure 2 assumes the depropanizer remains at Rapid River, MI, but continues to produce propane for the local area. It uses the hardware that is currently in place to produce the propane. All of the propane is then stored in tanks for distribution to the Upper Peninsula and Northern Wisconsin. None is sent to the Lower Peninsula. Figure 3 assumes the depropanizer is moved to Superior, WI, where it could produce propane for the Upper Peninsula and Northern Wisconsin. As with Figure 2, this option will continue to supply propane to the areas mentioned, even if Line 5 at the Straits is shutdown.

Any of the alternatives shown would allow Line 5 to be shut down at the Straits, without interfering with distribution of propane in the Upper Peninsula or Northern Wisconsin. From an engineering viewpoint, the alternatives are straightforward, and are very doable.

There would be a relatively small capital expenditure associated with either of the two alternatives, as shown in Figure 2 and Figure 3. However, considering the cost to Enbridge of a spill at the Straits, it would be nearly trivial.

The alternative presented in Figure 3 is slightly more complicated, and likely a little more costly. However, it provides for the greatest flexibility in the future, and therefore may be preferred by Enbridge. Regardless, either of the alternatives shown (Figure 2 or Figure 3) would be acceptable.

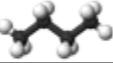
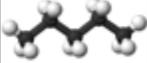
The alternatives presented are conceptual. While several details would need to be addressed, there are none, in our opinion, that would prevent implementation.

Finally, we have looked at the propane supply alternatives ONLY from an Enbridge view point. It is nearly certain that if Enbridge ceased to supply propane to the Upper Peninsula and/or Northern Wisconsin, some other company would be eager to pick up this business.

Conclusion: Alternatives have been identified that allow Line 5 at the Straits to be shut down but permit Enbridge – or other Companies – to supply propane to the Upper Peninsula and Northern Wisconsin.

Table 4

What are natural gas liquids and how are they used?⁷³

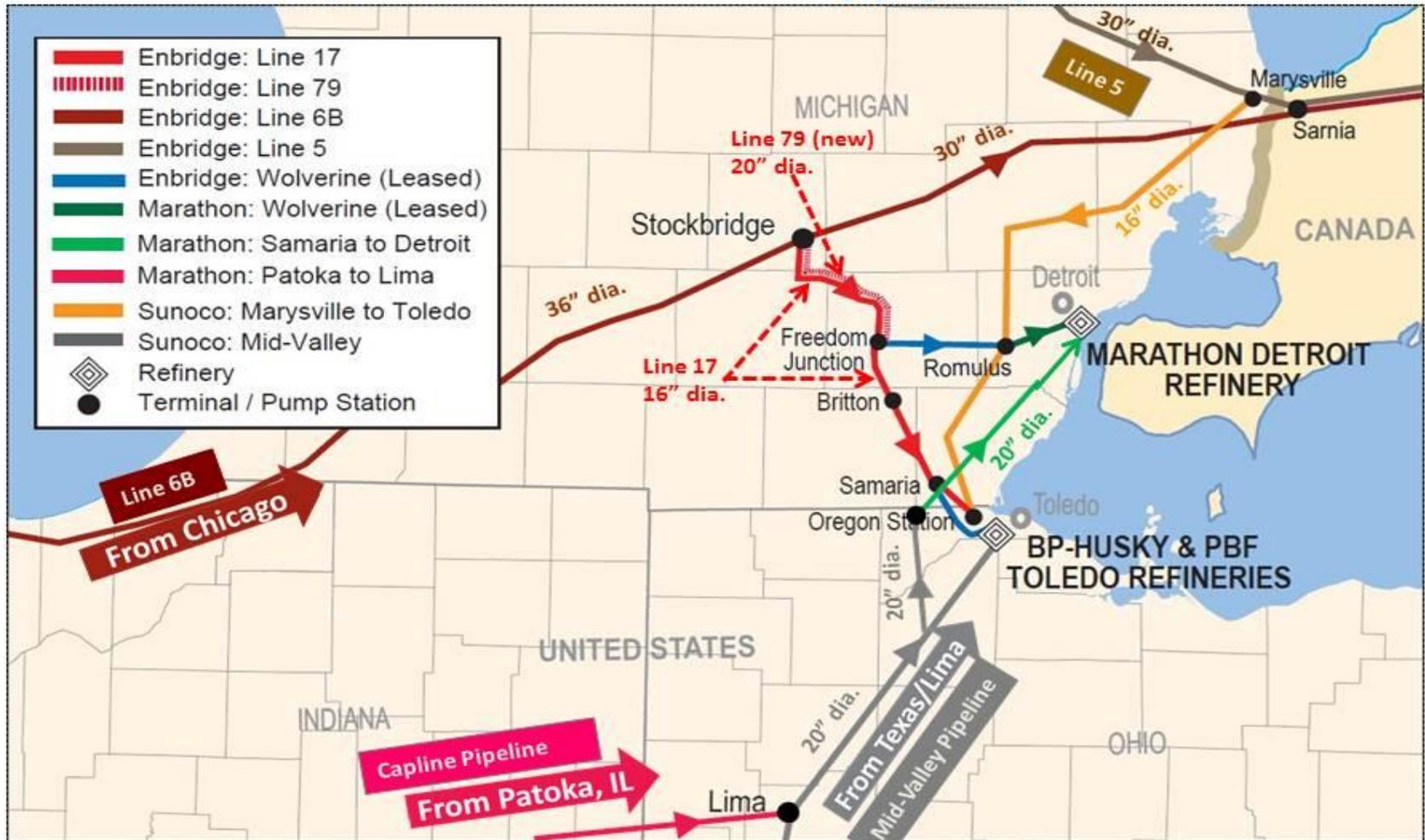
NGL Attribute Summary				
Natural Gas Liquid	Chemical Formula	Applications	End Use Products	Primary Sectors
Ethane	C_2H_6 	Ethylene for plastics production; petrochemical feedstock	Plastic bags; plastics; anti-freeze; detergent	Industrial
Propane	C_3H_8 	Residential and commercial heating; cooking fuel; petrochemical feedstock	Home heating; small stoves and barbeques; LPG	Industrial, Residential, Commercial
Butane	C_4H_{10} 	Petrochemical feedstock; blending with propane or gasoline	Synthetic rubber for tires; LPG; lighter fuel	Industrial, Transportation
Isobutane	C_4H_{10} 	Refinery feedstock; petrochemical feedstock	Alkylate for gasoline; aerosols; refrigerant	Industrial
Pentane	C_5H_{12} 	Natural gasoline; blowing agent for polystyrene foam	Gasoline; polystyrene; solvent	Transportation
Pentanes Plus*	Mix of C_5H_{12} and heavier	Blending with vehicle fuel; exported for bitumen production in oil sands	Gasoline; ethanol blends; oil sands production	Transportation

C indicates carbon, H indicates hydrogen; Ethane contains two carbon atoms and six hydrogen atoms
 *Pentanes plus is also known as "natural gasoline." Contains pentane and heavier hydrocarbons.

Natural gas liquids (NGLs) are hydrocarbons, in the same family of molecules as natural gas and crude oil, composed exclusively of carbon and hydrogen. Ethane, propane, butane, isobutane, and pentane are all NGLs (see table above).

⁷³ "What are natural gas liquids and how are they used?" U.S. Energy Information Administration, Bentek Energy LLC, April 20, 2012. <http://www.eia.gov/todayinenergy/detail.cfm?id=5930>.

Detroit/Toledo Crude Oil Supply Pipelines



Source: Enbridge, MPC



(Note: Original map by Marathon has been revised)

Map 3

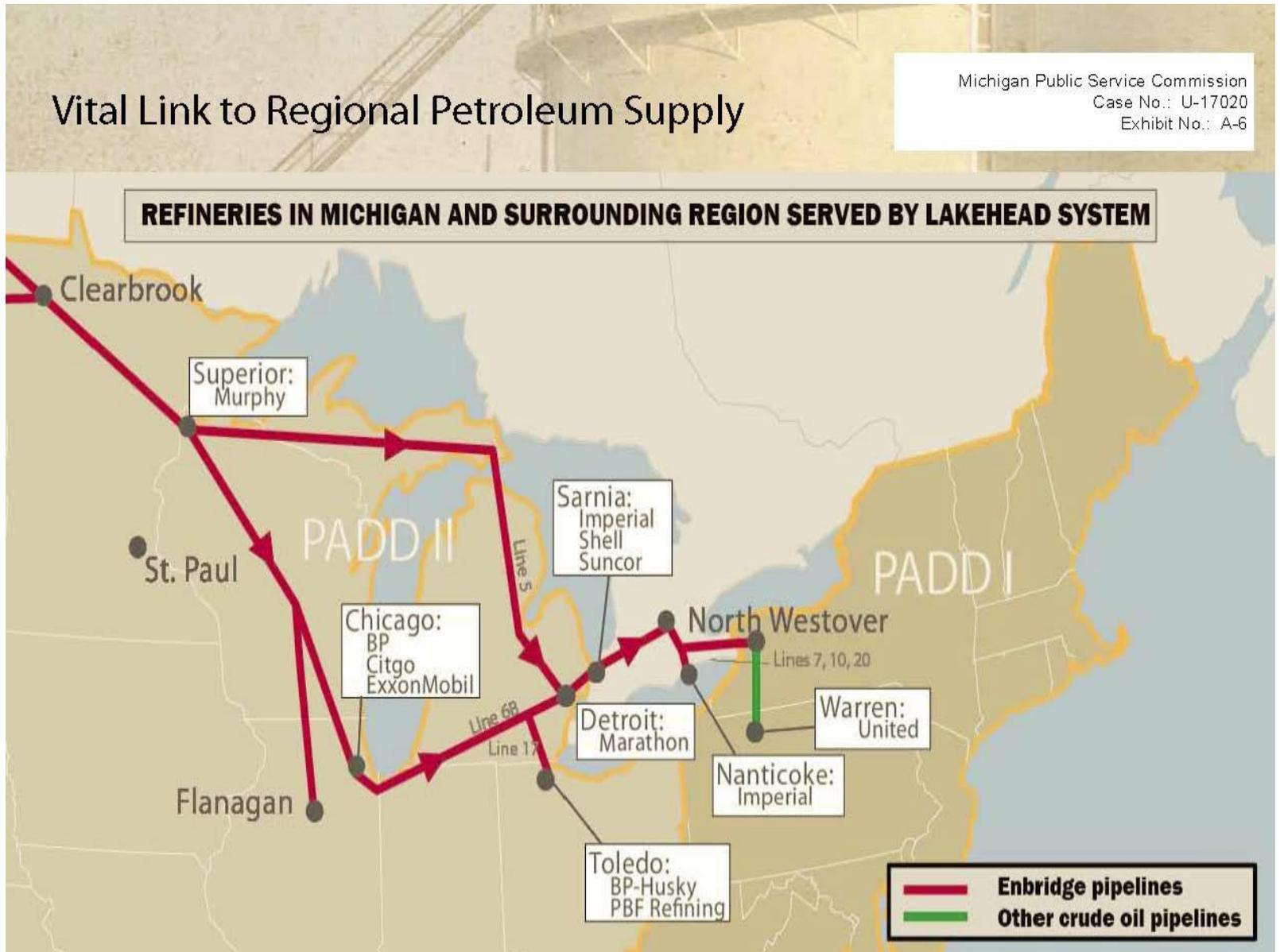


Figure 1

Probable Existing Enbridge Facility for Propane Purification and Distribution in the MI U.P. & Northern WI

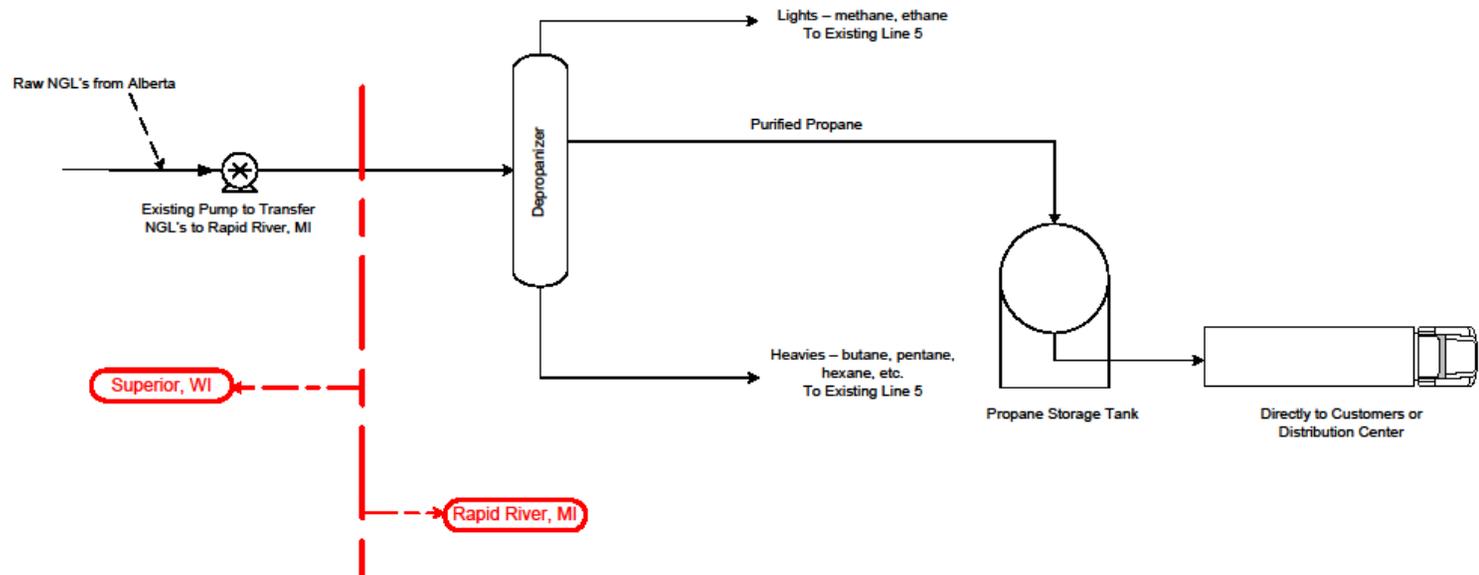


Figure 2

Facility for Propane Purification and Distribution in MI U.P. &
Northern WI w/ Line 5 Shut Down at the Straits --
Continue Depropanizer and Distributon from Rapid River

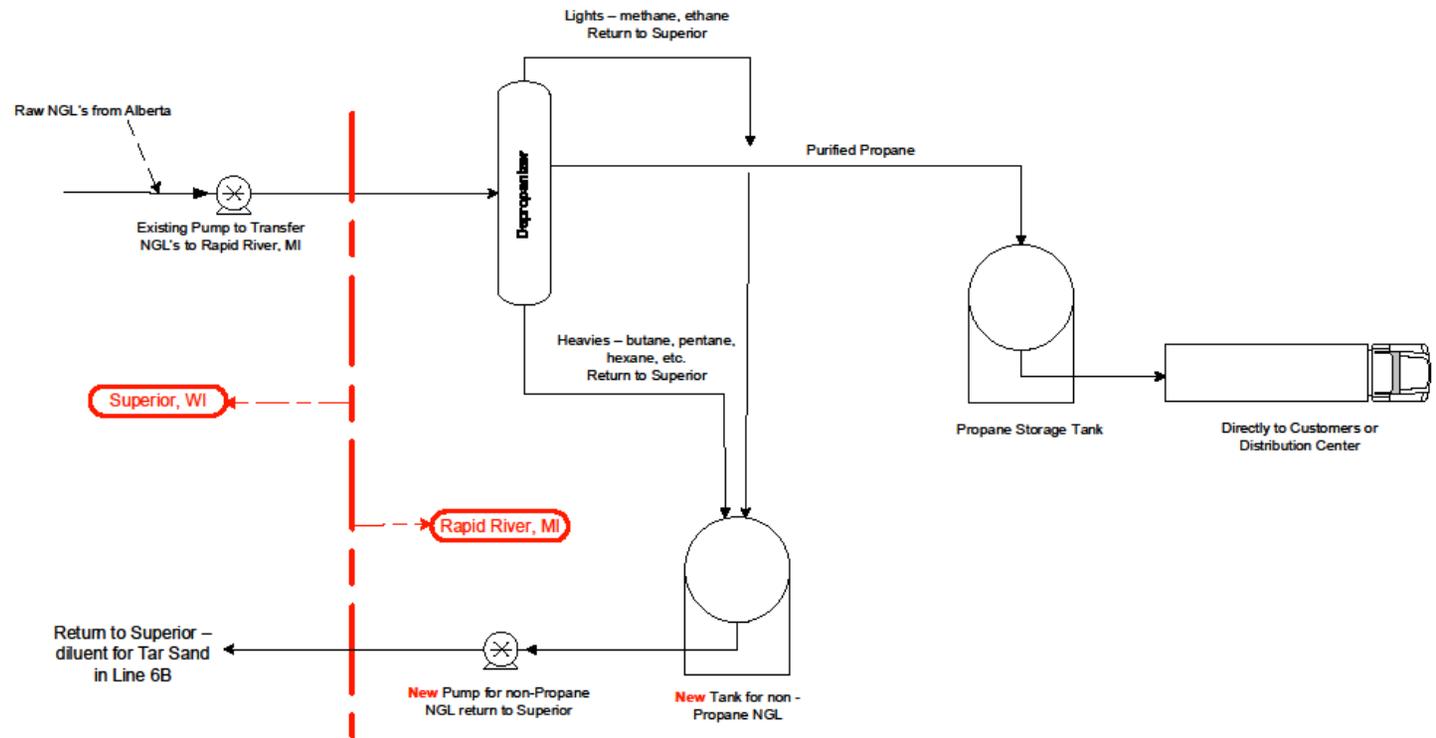
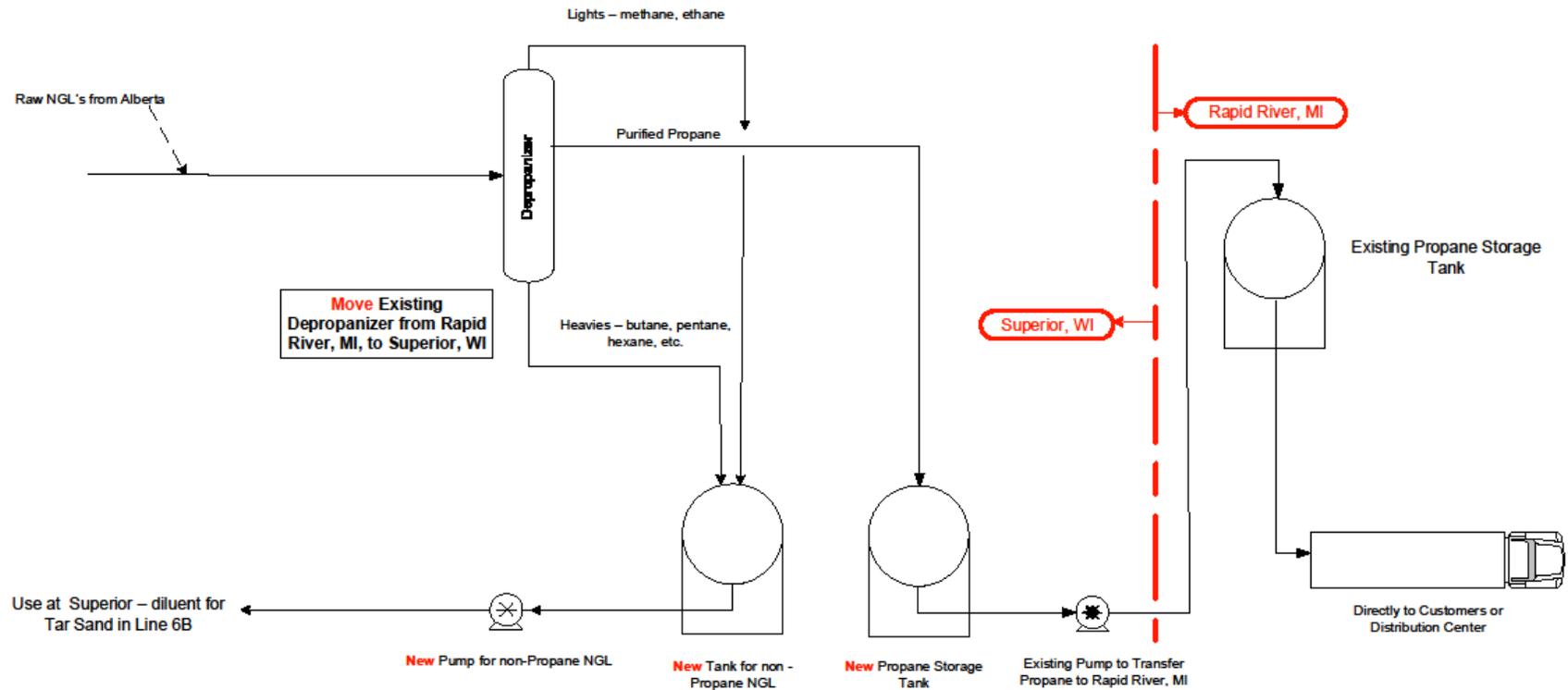


Figure 3

Facility for Propane Purification and Distribution in MI U.P.
& Northern WI w/ Line 5 Shut Down at the Straits
Depropanizer Moved to Superior, WI



ADDENDUM 1: ENBRIDGE DEFINITION OF VARIOUS “CAPACITY” TERMS⁷⁴

Michigan Public Service Commission (MPSC) to Enbridge: DEFINE THE MEANING OF THE TERMS: “ULTIMATE CAPACITY,” “DESIGN CAPACITY,” AND “ANNUAL CAPACITY” OF A CRUDE OIL AND PETROLEUM PIPELINE.

Hodge (Enbridge)⁷⁵: Typically, there are three definitions used to describe pipeline capacity for a crude oil and petroleum pipeline. They are “Ultimate Capacity,” “Design Capacity,” and “Annual Capacity.”

- **“Ultimate Capacity”** is the maximum capacity of an individual line. **In order to achieve the ultimate capacity, the pipeline requires maximum horsepower over its current design.**
- **“Design Capacity”** is the theoretical capacity of the pipeline for given types of liquids and their batch sequence. Design Capacity is calculated assuming theoretically ideal operating conditions with a given amount of horsepower available. Design Capacity in liquid petroleum pipelines context describes the maximum instantaneous throughput that a particular pipeline is capable of achieving under design conditions for a particular suite of commodities. With replacement and station installations, the Initial Design Capacity of Line 6B post-construction is 550,000 barrels per day (bpd).⁷⁶
- **“Annual Capacity”** is the average sustainable throughput over a year. Annual Capacity is calculated assuming historic average annual and operating conditions. These operating conditions include scheduled and unscheduled maintenance activities, normal operating variables and crude supply availability. Annual Capacity of a pipeline is typically 90 percent of Design Capacity.
- Table 1 provides design data pertinent to the proposed new 36-inch or 30-inch pipeline segments.

⁷⁴ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, U-17020, April 16, 2012, pg. 13.

⁷⁵ Ibid

⁷⁶ This is only for the 30-inch diameter segment, between Stockbridge and Marysville.

ADDENDUM 2: UNDERSTANDING CAPACITY DEFINITIONS AS USED BY ENBRIDGE

Design Capacity could be achieved only if the facility (in this case, a pipeline) runs 100 percent of the **allotted hours per year, at full operating rate, and as noted above, with the installed hardware**. Even here the numbers may mean different things to different people. For example, the allotted hours might mean 24 hr/day, 5 days per week, 52 weeks per year. Or they might mean 24 hr/day, 365 days/year, or perhaps some other definition. Obviously this definition – or “basis” – can have a big impact on the Annual Capacity number. It must be clearly stated for each process.

Another issue is “Operating Factor”. No facility can operate 100 percent of the time, and at full capacity. For example, routine maintenance must be done; allowance must be made for unscheduled maintenance; unforeseen interruptions may occur.

Enbridge uses 90 percent as the Operating Factor, which is perhaps a little on the low side, considering that pipeline technology is well established, but still reasonable.

Finally, Enbridge uses the term “Ultimate Capacity.” This refers to what the facility is capable of **if all the hardware is eventually installed and made operational**.

How Does This Relate to Enbridge and Table 1?

Quoting Thomas Hodge of Enbridge:⁷⁷ *“Enbridge plans to replace the remaining pipeline segments of its Line 6B in the Griffith to Stockbridge section with new 36-inch diameter pipe and the pipeline segment east of Ortonville to the St. Clair River near Marysville with new 30-inch diameter pipe.”*

Based on Enbridge documentation (See **Table 1– Existing Line 6B Capacity and Increased Line 6B Capacity**), the Griffith to Stockbridge pipeline was sized for future potential needs. The additional hardware, such as more pumping stations, and/or larger pumps, was NOT installed when Line 6B was recently completely replaced. Ultimate Capacity, as Enbridge defines it, is the potential capacity in the future when all of the hardware is installed and is fully operational.

Why wouldn't Enbridge install all the hardware on day 1? There are at least three reasons:

1. The additional capacity may never be needed due to unforeseen circumstances. If so, excess capital has been invested, with no return.

⁷⁷ Pre-Filed Testimony of Thomas Hodge before the State of Michigan Public Service Commission, April 16, 2012, Exhibit A-2, pg. 3.

2. Even if it is a 100 percent certainty that, in the future, the hardware will be needed, it is better, based on the concept of “Time Value of Money,” to postpone the expenditure until that time.
3. Lastly, technology may change. In the future, an improved version of the hardware may become available. If you commit too soon, you may not be able to take advantage of future developments.

In addition, pumping stations can be upgraded. New pumping stations can be constructed. Larger pumps can be installed. But once the pipe is in the ground, it is very difficult, and expensive, to replace it with a larger-diameter pipe.

In Table 1, Enbridge alludes to “future improvements,” as well as the capacity reduction mandated by PHMSA in July 2010, following the rupture at Marshall, MI, of Line 6B.

RECOMMENDATIONS

Since Enbridge plans to modify the hardware associated with Line 6B as needed to continue meeting the demands of the refineries, it is reasonable to base our evaluation on the Ultimate Capacity. Based on the above discussion and the data provided by Enbridge to the Michigan Public Service Commission, the following Ultimate Capacity values are recommended:

Line 6B Segment	Diameter, new Line 6B, inches	Ultimate Capacity, bpd
Stockbridge Griffith -	36	800,000
Stockbridge - Marysville	30	525,000
Marysville - Sarnia	30	525,000

Even then, Design Capacity could be achieved only if the facility ran 100 percent of the ***allotted hours per year, at full operating rate, and as noted above, with the installed hardware.***

The numbers may mean different things to different people. For example, the allotted hours might mean 24 hr/day, 5 days per week, 52 weeks per year. Or they may mean 24 hr/day, 365 days/year, or perhaps some other definition. Obviously this definition or “basis” can have a significant impact on the Annual Capacity number. It must be clearly stated for each process.

Another issue is “Operating Factor”. No facility can operate 100 percent of the time, and at full capacity. For example, routine maintenance must be done; allowance must be made for unscheduled maintenance; unforeseen interruptions may occur.

The “Operating Factor,” particularly for a completely new process, is somewhat subjective. Since the process is new, there is no actual experience to base it on. Given the technology of

pipeline systems is well established, it would seem an Operating Factor of 95% might be achievable.

Enbridge uses 90% as the Operating Factor. Perhaps a little on the low side, considering that the technology is well established, but still reasonable.

**APPENDIX C: EVALUATING ALTERNATIVES: A MODEL FOR EVALUATING
ALTERNATIVES TO ENBRIDGE’S “LINE 5” PIPELINES IN THE MACKINAC STRAITS AND
ELIMINATING UNACCEPTABLE RISK TO THE GREAT LAKES**

By Rick Kane, QEP, CHMM, CPP
December 14, 2015

Prepared for and in partnership with FLOW (For Love of Water)

I. PURPOSE

The purpose of this report is to provide an illustrative example or model for conducting an alternatives analysis for the benefit of the State of Michigan in its forthcoming assessment of alternatives to the Enbridge “Line 5” oil pipelines running through the Great Lakes at the Straits of Mackinac, where Lake Michigan and Lake Huron converge.

To that end, this report presents a credible option for the shutdown of Line 5 in order to protect the Great Lakes, drinking water supplies, local communities, and the state’s tourist-driven economy while continuing to meet energy needs. This report builds upon and elaborates on *Report – The Context: Understanding the Evolving North American Oil Pipeline System in Preparation for Considering Alternatives to Enbridge’s “Line 5” in the Mackinac Straits*.

Line 5 transports light and synthetic crude oil and natural gas liquids (including propane) from Enbridge’s terminal in Superior, Wisconsin, across Michigan’s Upper Peninsula, through the Straits of Mackinac, across the Lower Peninsula and finally beneath the St. Clair River to Sarnia, Ontario. Under a recent agreement with the State of Michigan, Line 5 does not carry heavy crude oil or diluted tar sands crude oil (diluted bitumen) known as dilbit.¹

This report was prepared for and in partnership with FLOW (For Love of Water), a Great Lakes water law, science, and policy center located in Traverse City, Michigan. FLOW’s team of legal and scientific experts previously documented and concluded that the transport of oil through Line 5 poses high consequence environmental risk and imminent harm to the Great Lakes and should be halted while the state seeks an alternative.^{2,3,4}

¹ Michigan Petroleum Pipeline Task Force, *Agreement Between The State Of Michigan And Enbridge Energy, Limited Partnership Regarding The Transportation Of Heavy Crude Oil Through The Straits Of Mackinac Pipelines*, September 3, 2015, www.michigan.gov/pipelinetaskforce.

² Olson, James, J.D., LL.M., and Kirkwood, Liz, J.D. *A Composite Summary of Expert Comment, Findings, and Opinions on Enbridge’s Line 5 Oil Pipeline in The Straits of Mackinac in Lake Michigan*, compiled by on behalf of FLOW’s (For Love of Water) Great Lakes Water Policy Project for submission to the Michigan Petroleum Pipeline Task Force, April 30, 2015, www.michigan.gov/pipelinetaskforce

II. INTRODUCTION

After nearly a year's study, the Michigan Petroleum Pipeline Task Force in July 2015 issued its final report and concluded that a release of oil from Line 5 in the Straits of Mackinac would cause "devastating ecological and economic damage."⁵ It outlined four recommendations specific to Line 5 in the Straits:

- (1) Prevent the transportation of heavy crude oil through the Straits Pipelines;
- (2) Require an independent risk analysis and adequate financial assurance for the Straits Pipelines;
- (3) Require an independent analysis of alternatives to the existing Straits Pipelines; and
- (4) Obtain additional information from Enbridge relating to the Straits Pipelines.⁶

Notably, Recommendation Three's independent alternatives analysis included exploring several options, including among others: "Constructing alternative pipelines that do not cross the open waters of the Great Lakes and then decommissioning the existing pipelines."⁷

(hereinafter "FLOW April 2015 Expert Report").

³ Schuette, Bill, Attorney General, and Wyant, Dan, DEQ Director, *Michigan Petroleum Pipeline Task Force Report*, July 2015, https://www.michigan.gov/documents/deq/M_Petroleum_Pipeline_Report_2015-10_reducedsize_494297_7.pdf (hereinafter "Task Force Report").

⁴ Olson, James, J.D., LL.M. and Kirkwood, Liz, J.D., *A Scientific and Legal Policy Report on the Transport of Oil in the Great Lakes, (1) Recommended Immediate Actions on the Transport of Oil Through the Line 5 Under the Straits of Mackinac; and (2) Supplemental Comments on the Michigan Petroleum Pipeline Task Force Report*, September 21, 2015 FLOW (For Love of Water), www.flowforwater.org (hereinafter "FLOW September 2015 Expert Report").

⁵ Task Force Report, *supra* note 3, Executive Summary.

⁶ *Id.* at 49-50. Recommendation Three included four alternatives outlined below along with a clear rationale: "3. Require an Independent Analysis of Alternatives to the Existing Straits Pipelines. These alternatives should include: a. Constructing alternative pipelines that do not cross the open waters of the Great Lakes and then decommissioning the existing pipelines; b. Utilizing alternative transportation methods and decommissioning the existing pipelines; c. Replacing the existing pipelines using the best available design and technology; d. Maintaining the status quo, including an analysis of the effective life of the existing pipelines. Rationale: The 1953 Easement requires Enbridge to "exercise the due care of a reasonably prudent person for the safety and welfare of all persons and of all public and public and private property." What a reasonably prudent person would do depends on the circumstances involved, including the alternatives available and the associated risks and benefits. Decisions about the future of the Straits Pipelines must be informed by an independent, comprehensive analysis of the alternatives. The State should require Enbridge to pay for (but not control) a study by relevant experts of the feasibility, costs, including the specific costs to Michigan, and public risks and benefits of alternatives to the existing Straits pipelines."

⁷ *Id.*

On September 3, 2015, Governor Snyder created the State of Michigan’s Pipeline Safety Advisory Board by Executive Order to review and make recommendations for statutory, regulatory, and contractual implementation of the Task Force Report. Chaired by Executive Director of the Michigan Agency for Energy, Valerie Brader, and Department of Environmental Quality Director Dan Wyant, this Advisory Board is currently finalizing scoping documents for conducting both a risk analysis and an independent alternatives analysis.

This report accordingly presents an alternatives analysis model to evaluate Line 5 as part of a proper “systems view” or framework (See Appendix A for a full discussion) thereby eliminating unacceptable risk to the Great Lakes. In addition, this report specifically evaluates one of the Task Force report’s alternatives (decommissioning Line 5⁸) to demonstrate a systems approach that necessarily evolves to support supply sources, demands, business strategies, changes in shipped products, and public safety and environmental regulatory requirements. The rationale for selecting this alternative was the Task Force Report’s, FLOW reports, and other studies that demonstrate that a release from Line in the Straits is unacceptable and should be prevented if there are other viable options or alternatives within and/or through suitable changes within the pipeline system infrastructure that serves Michigan and other users.

This alternatives analysis approach identifies objectives and assumptions and then evaluates the alternative by identifying and analyzing a well-defined *system*. If the appropriate system is not well-defined, erroneous or suboptimum solutions will be obtained. In analyzing the system, it is also important to understand its dynamics, as it will evolve due to actions by stakeholders to capture opportunities and respond to constraints placed on it.^{9,10} The primary system objectives for this analysis include:

- Supply propane to Michigan’s Upper Peninsula customers;
- Support crude oil shipments from Michigan’s Lower Peninsula oil fields;
- Supply Marathon Detroit, Toledo, Ohio, and eastern Canada refineries;
- Supply natural gas liquids (NGLs) to Sarnia, Ontario, petrochemical producers; and
- Enable crude oil exports via Montreal, eventually Portland, ME (lowest priority).

⁸ “Decommissioning Line 5” as used in this report includes (a) retiring use of the Line 5 in the Straits segment, or others if deemed proper as part of the overall analysis, and/or (b) prohibiting the use of Line 5 in the Straits segment for the transport of crude oil. It follows that if option (a) is viable because of overall system and infrastructure capacity, options, adjustments or changes, then (b) is viable.

⁹ O’Brien, Mary, *Making Better Environmental Decisions, An Alternative to Risk Assessment*, The MIT Press, 2000.

¹⁰ Meadows, D. H., *Thinking in Systems*, Chelsea Green Publishing, Sustainability Institute, 2008.

An additional goal of this report is to move the debate *beyond* the narrow focus on the continued use of Line 5 as the best and only option. This report illustrates that the current high risk to the Straits of Mackinac and Great Lakes from the transport of crude oil in Line 5 in the Straits can be eliminated entirely within the existing and/or modest adjustments or modifications to the overall pipeline system and infrastructure. It should be readily apparent from the Task Force Report and others that there is an urgent need to expand the overall analysis of options and alternatives that would accommodate or provide for the transport of oil through other pipelines or system options – to protect the unacceptable Straits of Mackinac, drinking water supplies, water resources and uses, public safety, and the water-dependent economy.

III. BACKGROUND

Since Enbridge’s 2010 Kalamazoo Line 6B pipeline disaster (causing the largest inland oil spill in U.S. history), the State of Michigan and the public have tuned into pipeline issues throughout the Great Lakes State. The pipeline that has captured the most attention is Enbridge’s Line 5 petroleum pipeline, which is located in public waters and bottomlands of the Great Lakes and transports nearly 23 million gallons of oil every day under the Straits of Mackinac where Lakes Michigan and Huron converge. Crossing 34 major waterway tributaries, as well as the Straits of Mackinac, this 62-year-old pipeline poses a high level of risk and unacceptable harm to the Great Lakes and substantial endangerment to public safety and environmentally sensitive areas along its route across Michigan.

In response to government and citizen concerns about Enbridge’s lack of compliance with the 1953 Easement with the State of Michigan, Governor Snyder created in mid-2014 the Michigan Petroleum Pipeline Task Force (“Task Force”) to evaluate and recommend actions. Chaired by Attorney General Bill Schuette, and Michigan Department of Environmental Quality (DEQ) Director Dan Wyant, the Task Force heard from different stakeholders and published a formal report with recommendations nearly a year later in July 2015.¹¹

FLOW (For Love of Water) – a Great Lakes water law and policy center based in Traverse City – authored two significant expert reports to help inform and shape the recommendations of the State’s Task Force.^{12, 13}

Key FLOW issues and recommendations presented in these previous submissions included:

¹¹ Task Force Report *supra* note 3, p. 49-50.

¹² FLOW April 2015 Expert Report, *supra* note 2.

¹³ FLOW September 2015 Expert Report, *supra* note 4.

- The Straits are covered by the 1953 Easement from the State to Enbridge that contains a “reasonably prudent person” standard, and the public trust interest and responsibility in the Great Lakes and navigable waters, both of which require public officials and Enbridge to investigate and eliminate the imminent or high risk or hazard.
- The Straits pipelines are an imminent hazard and substantial endangerment, given the potential consequences and magnitude of harm. An “imminent hazard” or “substantial endangerment” of high magnitude of harm for transporting hazardous materials, like crude oil, is defined by statute, and action must be taken because of the potential consequences. Based on imminent harm and substantial endangerment from hazardous materials principles, the degree of probability, high or low, is *not* a factor to be considered. The risk must be eliminated or substantially reduced to prevent the risk of high magnitude of harm.¹⁴
- Extraordinary monitoring and emergency response resources must immediately be put in place locally beyond those currently available, including prohibiting oil transport until a permanent risk-elimination alternative has been implemented. The importance of these two factors is well known as being vital in early detection and prevention or mitigation of damage from a pipeline failure.

In addition, FLOW recommended that the State of Michigan conduct a comprehensive alternatives assessment with the objective of identifying and implementing a permanent solution that eliminates the risk of a spill in the Mackinac Straits and ideally reduces public safety and environmental risk along the environmentally sensitive route through Michigan’s Upper and Lower Peninsulas. The Task Force incorporated this recommendation in its final report as a key methodology for evaluating risk, harm, and a permanent solution.¹⁵

IV. UNDERSTANDING AN ALTERNATIVES ANALYSIS FOR A PIPELINE SYSTEM

Risk assessments in the oil and gas, chemical, and transportation sectors are routinely conducted for a number of reasons, including:

- Company business continuity and risk management planning for the protection of stakeholders, such as employees, shareholders, customers, and communities;
- After accidents, incidents, and near-miss events;
- Regulatory and insurance requirements, audits, and investigations;

¹⁴ See e.g. *Ethyl Corp v. EPA*, 541 F2d 1, 18-20 (D.C. Cir. 1976); FLOW September 2015 Expert Report, *supra* note 4, p. 14-15.

¹⁵ Task Force Report, *supra* note 3, p. 26.

- Company policy for high risk operations, investment project approval, significant changes in suppliers, customers and supply-chains; and
- A standard industry best-management practice.

Several of the reasons above justify a comprehensive risk review of Line 5, especially as detailed in the previously referenced Task Force and FLOW reports. An alternatives analysis is an important and normal part of a comprehensive review. A definition of an alternatives analysis is a helpful starting point:

An Alternatives Analysis is used to identify, analyze and develop options for risk elimination or reduction. The approach is used to address a wide range of issues including private and government sector infrastructure, facilities, environmental protection, protection of public health, safety, property and communities, and establishment of sustainability projects. The purpose of an Alternatives Analysis is to move beyond the justification of a single alternative, in this case the existing Line 5 Straits Crossing, which continues the underlying conditions and circumstances that result in a high risk category, to an exploration of multiple options to establish the best possible option in a rational defensible manner, which considers all stakeholder requirements for risk, uncertainty, and citizen, environmental, public safety, and public and private property protections.¹⁶

An alternatives analysis is conducted by starting with a high-level view. For complex, interrelated issues, understanding the system is vital. An alternatives analysis avoids a narrow focus on an issue, examining in-place assets or being bounded by limited stakeholder objectives. In the case with pipelines, for example, an alternatives analysis would not be merely limited to an evaluation of different modes of transport, meaning pipeline versus railroad, trucks, or barge. Rather, an alternatives analysis identifies the *system* and has the goal to eliminate risks through new and better solutions.

The basic steps for an alternatives analysis are presented below:

- (1) Assemble a team of multi-functional experts;
- (2) Define the mission and scope of the analysis;
- (3) Define high-level objectives and desired outcomes;
- (4) Identify the appropriate *system* and boundaries;
- (5) Identify all options, screen and develop a short list;
- (6) Identify facts, assumptions, bases and relevant sub-systems;

¹⁶ See FLOW April 2015 Expert Report, *supra* note 2.

- (7) Conduct an analysis on the short list; and
- (8) Issue recommendations and an action plan.

Examples of possible alternatives are presented in Addendum A.

V. EXAMINING ONE ALTERNATIVE TO LINE 5

This report provides a qualitative example, with objectives, to demonstrate the process and advance the pursuit of better solutions from a proper purposes-and-systems framework. The alternative analyzed is:

“Decommission Line 5”¹⁷

The partial use of assets on either side of the Mackinac Straits is allowed, but not a Mackinac Straits crossing.

Decommissioning Line 5 was selected for analysis to explore the other end of the range of options, as current debates have largely focused only on Line 5 – the consequences and likelihood of a failure, company pipeline operations, mechanical integrity programs, emergency management – and *not the feasibility of operating without Line 5*. Defining and understanding the supply-chain system and its potential evolution are very important in developing the best solution. The model-example will demonstrate better solutions through proper crude oil pipeline system and infrastructure definition and understanding.

A. The Existing System and Infrastructure, Projected Evolution and Role of Line 5

The historical pipeline network and the evolution of the system and related infrastructure are addressed in the Appendix A Report filed simultaneously with this report on alternatives analysis.¹⁸ This document should be reviewed to obtain an understanding of the relevant system and evolution. The key findings are summarized as follows.

The oil and gas sector as affecting the Great Lakes – St Lawrence Basin has and continues to undergo a major evolution with the development of Bakken, Utica, and Marcellus shale crude oil and gas reserves and Alberta tar sands crude oil reserves. As these reserves are not located in traditional production areas, the supply-chains (pipelines, rail and ships/barges) also are evolving to support shippers moving the materials to

¹⁷ As noted earlier, “Decommissioning Line 5” also includes decommissioning the Straits segment, or prohibiting the transport of crude oil through Line 5 in the Straits segment.

¹⁸ Kane, Richard J. QEP, CHMM, CPP, *Report – The Context: Understanding the Evolving North American Oil Pipeline System in Preparation for Considering Alternatives to Enbridge’s “Line 5” in the Mackinac Straits*, December 14, 2015. FLOW (For Love of Water) www.flowforwater.org

refineries, chemical producers, fuel consumers, and export markets. Figures 1 and 2 show the historic and evolving supply-chain system.

The most visible project is the PanCanada Keystone XL Pipeline Project, but moving in competition are several Enbridge / partner projects; building a network to the East, West, and Gulf Coasts. This network is being implemented segment-by-segment. Using a segmented approach is practical for engineering and investment and simplifies local and state regulatory permitting. The segment-by-segment approach results in their overall strategy being less transparent to government agencies and citizen groups and makes the identification and implementation of better alternatives extremely difficult and systemically flawed.¹⁹

Line 5 is part of Enbridge's strategy to maintain the leading position in supplying Bakken and tar sands crude oil refineries on the network and to the coasts for export. Heavy crude and tar sands crude oil (diluted bitumen, known as "dilbit") shipments were once planned for Line 5; but are now not allowed by agreement with the State of Michigan. Line 5 is now used to ship light and synthetic crude oil (derived from "tar sands" heavy oil) and NGLs, enabling near dedicated shipment of heavy crude oil through the greatly expanded pipeline network in Wisconsin, to Illinois, Indiana, and then across southern Michigan – the expanded Line 6B in 2012 that recently replaced the 6B, out of service after the Kalamazoo river release disaster in 2010. Line 5 provides a measure of cost efficiency, and also enables maximum shipment of heavy crude oil east by Enbridge via other pipelines, including the doubled-capacity (400,000 to 800,000 bpd) that exists in the new Line 6B.²⁰

B. Objectives for This Model Analysis

The NGLs and crude oil supply chain overall, and pipeline network in particular, must be viewed as a system that is evolving to support new supply sources, changes in materials being shipped, desired final destinations, and regulatory requirements. The primary drivers for system evolution are the business strategies of the producers/shippers, pipeline operators and end-users (refineries and exporters). Public safety and environmental protection are constraints that are placed on the system, but unfortunately a consolidated strategy providing a transparent view of the system, evolution, and risks is normally not available to government agencies and citizens; that is, those setting the constraints.

As the pipeline system is evolving, can objectives and constraints be set to drive the evolution to a better alternative scenario, eliminating the need for Line 5? The analysis

¹⁹ Id. pp. 3-5, 9.

²⁰ See Appendix A, R. Kane. After the Kalamazoo spill, former Line 6B was reduced to 240,000 bpd, so at time of replacement in 2012 with the new 36-inch line, Enbridge's infrastructure capacity to transport crude oil in Michigan was increased by 560,000 bpd, more than the capacity of Line 5, which was increased to 540,000 bpd from the original 300,000 bpd during and after approval and construction of the new Line 6B.

of one alternative, “Decommission Line 5” has the following objectives:

- Decommission Line 5 under the Straits of Mackinac at a minimum, entirely if possible;
- Ensure that the Upper Peninsula propane heating supply is adequate and reliable;
- Provide transportation for crude oil produced in the northern Lower Peninsula to refineries; further south;
- Prioritize regional refineries and chemical producers over export markets; and
- Retain attractive business supply-chain system for operators.

C. Assumptions

This is a qualitative analysis and does not presume to provide an optimum solution for the objectives. Detailed engineering, safety, environmental, risk, and economic analyses are required using information from a range of stakeholders to fully assess the scenarios. The assumptions listed below are presented so they can be challenged and modified to improve the analysis:

1. Drivers affecting the North American supply-chain and pipeline system evolution in the Great Lakes – St Lawrence Basin

- Markets for Bakken and Alberta tar-sands crude oil are refineries in the Midwest, East, West, and Gulf Coasts, and export customers accessed by maritime ports in these regions.
- U.S. law currently does not allow crude oil exports except in some cases to Canada. Canada *does* allow exports, and in anticipation of the U.S law changing, pipeline companies are racing to expand and modify their networks to U.S. and Canadian maritime ports.
- The Obama Administration has rejected the TransCanada Keystone XL pipeline project. In reports to the shareholders, Enbridge stated that their North American pipeline investment plan is profitable with Keystone XL in place. Enbridge’s profitability is better with Keystone’s delay cancellation, as their network, integrated with other pipeline company partners, will serve the East, West, and Gulf Coasts.
- Over-water crude oil shipments (ships and barges) were not addressed in this assessment, but should be evaluated for “completeness” of the alternatives assessment process. This alternative poses a high risk to the Great Lakes and approval is highly unlikely.
- Rail tank car shipments are an acceptable crude oil transportation mode and should also be analyzed. Pipeline shipment is recognized as a safer mode and

does not create many of the problems posed by the large number of rail tank cars required to replace a pipeline. However, a network that includes linked pipeline and rail shipments (multi-mode) may provide acceptable risk, flexible shipment scheduling, and back-up supply options for some regions.

- Existing pipelines from the Gulf Coast to Midwest are being studied for flow reversal to enable shipment of Bakken and Alberta tar-sands crude oil to the south and east.
- Not all refineries in the Midwest and eastern Canada can use heavy crude oil. Those that can or are expanding or modifying operations to capture a feedstock cost advantage.
- Moving heavy crude through the region and on to main ports in the East and Gulf Coasts is a primary driver in the evolution of the pipeline network.
- One element of the “Enbridge US Mainline System East” and “Enbridge Canadian Mainline System East” strategy, of which Line 5 is a part, is to implement projects to move crude oil east to Montreal for export and eventually to Portland, Maine, for maritime shipments and export.
- Agreements currently restrict Line 5 from transporting heavy and tar-sands crude oil; only light crude oil and NGLs are shipped. Line 6B is then dedicated as much as possible to maximize transportation of heavy crude oil.
- Western Ontario petrochemical producers are historic customers for Line 5 NGLs and light condensates. They are new customers for these materials from the Utica and Marcellus plays (Pennsylvania, Ohio, and West Virginia).

2. Assumptions to analyze Line 5 pipeline, specifically:

- Options are analyzed from the perspective of a “reasonably prudent person,” with goals to eliminate or reduce major safety and environmental risks.
- The analysis is based on publicly available information.
- The boundaries of the systems analysis include existing assets and new projects under study. The system is not restricted to assets of a specific company or geography of a state or country.
- Eliminating crude oil pipeline shipments through the Straits of Mackinac or elsewhere on the Great Lakes eliminates the primary risk of environmental disaster.
- The highest business priority for the supply-chain is to support U.S. and Canadian markets. Supplying Bakken and Alberta tar-sands crude oil to the export market is a subordinate priority to the shutdown of Line 5.
- The Marathon refinery in Detroit is increasing the capability to use heavy crude oil feedstock to capture the cost advantage. Other refineries along the

route consume little or do not have a strategy to use heavy crude.

- Other priorities in the region include propane supply to heating fuel customers in Michigan’s Upper Peninsula, crude oil transportation for producers in the northern area of Michigan’s Lower Peninsula, and NGL and light condensate feedstock for petrochemical producers in western Ontario.

D. Alternatives Analysis

Presented below is a simplified approach for analyzing alternatives for Line 5; it is a qualitative approach or “pre-screen” that would indicate if a comprehensive analysis would be warranted. For a comprehensive assessment, the multi-disciplinary team would have responsibility for defining the system, objectives, and alternative options, and conducting the analysis. Definition of the system is vital or the best solution may be missed.

For this model analysis:

- The objectives (or fundamental purposes) were defined above.
- The system is fundamentally pipelines surrounding the Great Lakes – St Lawrence Basin and adjacent states. All transportation modes would be considered, but in this case only the pipeline network was reviewed. Addendum A has a partial listing of other options as well ones identified by the Michigan Pipeline Safety Advisory Board.^{21,22}
- The analysis is not constrained by self-limiting company or state or national boundaries.
- The alternative scenario is “Decommission Enbridge Line 5.”²³

E. Decommission Enbridge Line 5

As noted above, this analysis is based on publicly available information. A comprehensive assessment would require information on business and operating strategies, supply and demand forecasts, engineering design, pipeline integrity, and end-of-life predictions. System modifications may be required as well as regulatory approvals for alternatives.²⁴ By contrast, however, it appears Enbridge, through its internal business decisions, has successfully avoided a comprehensive review of its

²¹ Michigan Pipeline Safety Advisory Board, *Independent Analysis of Alternatives to the Existing Straits Pipelines*, October 28, 2015 http://michigan.gov/som/0,4669,7-192-45414_45416-368183--,00.html.

²² Michigan Pipeline Safety Advisory Board, *Draft Scope of Work Independent Risk Analysis for the Straits Pipelines*, October 28, 2015 http://michigan.gov/som/0,4669,7-192-45414_45416-368183--,00.html.

²³ This includes decommissioning Line 5 in the Straits segment, or prohibiting crude oil in the Straits segment.

²⁴ R. Kane, *supra* note 16, p. 3-4.

pipeline system and instead instituted strategic changes segment-by-segment, with little disclosure of its basic objective to greatly expand its overall system and infrastructure during State of Michigan review, and no comprehensive alternative assessment.²⁵

As the system includes suppliers, supply-chain operators, customers, government agencies, and citizens, it is complex and dynamic and inputs and constraints placed on it will change its dynamics and evolution. For this alternative, the primary constraint is “a notice that action will be taken resulting in Line 5 not being available after a limited adjustment period.” The key question is then: “Can the system meet and/or evolve to meet the objectives of key players and the goals of a reasonable, prudent person?”

Line 5 has the current customers or shippers requiring support if Line 5 is decommissioned:

1. Michigan Upper Peninsula propane heating customers;
2. Michigan Lower Peninsula oil field shipments, southbound;
3. Marathon Detroit, Toledo, Ohio, and eastern Canada refineries;
4. Sarnia NGL petrochemical customers; and
5. Crude oil exports via Montreal, and eventually Portland, ME (lower priority).

1. Michigan Upper Peninsula Propane Heating Customers

Line 5 is currently important to propane heating customers in the Upper Peninsula. Propane is extracted from NGLs using a depropanizer at Rapid River, Michigan, where NGLs are shipped through the line. The remaining portion of the NGL stream (ethane, butane, etc.) is re-injected for shipment east and southbound (See Figure 3). An analysis of options was conducted by G. Street on behalf of FLOW.²⁶ Options included partial use of Line 5 and the Rapid River facility, or relocation of the depropanizer to Superior, Wisconsin, and using Rapid River as a distribution facility. The primary conclusion is that Line 5 is not vital to supply propane to U.P. customers, and other suppliers also serve the area using bulk tank truck shipments. Supply to U.P. customers would not be affected at all if crude oil is not shipped under the Straits segment of Line 5.

2. Michigan Lower Peninsula Crude Oil Shipments, Southbound

Crude oil from oil fields in Michigan’s northern Lower Peninsula is gathered by the MarkWest Michigan Pipeline Company and injected into Line 5 at Lewiston, Michigan,

²⁵ Id.

²⁶ Street, Gary L., M.S., P.E., *Current and Possible Alternative Supply Systems for Refineries in Detroit, MI and Toledo, OH, and Propane Supply for the Upper Peninsula*, December 14, 2015. www.flowforwater.org (hereinafter [Appendix Report B](#)).

for shipment southbound (See Figure 4). If Line 5 is decommissioned at the Mackinac Straits, with modification, the existing line below Lewiston could be used or a new pipeline installed along the corridor for the smaller quantity of material being shipped.

3. Marathon Detroit, Toledo, Ohio, Sarnia and Eastern Canada Refineries

Figures 5 and 6 show refineries and the pipeline network in southern Michigan and Ohio. Line 5 currently supplies an estimated 5 percent to 20 percent of Marathon’s light crude oil needs. Heavy and tar-sands based crude oil grades are supplied by Line 6B from south of Chicago through connecting Enbridge Lines 17 and 79 to Marathon and Ohio refineries capable of using it. The original Line 6B that failed in 2010 has been replaced and the capacity expanded by approximately 200 percent over the pre-disaster capacity limit. Line 6B is a multi-purpose pipeline and can transport NGLs, light condensate, and intermediate and heavy crude oil, including dilbit.

Marathon and the Ohio refineries also can receive crude oil from the southern United States via Marathon- and Sunoco-operated pipelines in Indiana and Ohio.^{27, 28} Rail shipments can provide emergency backup in the event of any operating problems in the network.

The Capline, Trunkline, and MPLX pipelines transport oil from the Gulf Coast, West Texas, Oklahoma, and Louisiana to the Chicago and Toledo areas. Flow reversal projects are being studied to carry Bakken and Alberta tar-sands oil southbound to Gulf Coast refineries and maritime ports using one or more of these pipelines. Major expansions of the Enbridge network between North Dakota/Alberta (Alberta Clipper Project) to the south Chicago area have created the capability to transport large quantities of crude oil to the Midwest and then southbound.

Introducing a constraint into the system, “decommission Line 5” would drive changes in strategy for Line 6B and networks in southeast Michigan and northern Ohio. The key players in this area most likely already have business continuity plans in place to adjust operations accounting for a Line 5 shutdown. Preliminary material balances indicate that the network can absorb the impact of a shutdown; maritime shipments and exports may be lower from the East Coast; however, the system will adjust to move the flow southbound from the Chicago area to the Gulf Coast.

Figure 5 shows the refineries in the Great Lakes – St Lawrence Basin. Refineries in Ontario receive crude oil by Line 9. In the beginning, the Line 9 flowed from west to east and later changed to flow from east to west to carry imported crude oil from ports in Montreal and Portland, Maine. Line 9 flow is being reversed again to enable Canadian

²⁷ Appendix Report B, *supra* note 22.

²⁸ R. Kane, *supra* note 15.

refineries to consume domestic feedstock from the west and supply the export markets from Montreal and potentially Portland.

In summary, based on available information, a material balance indicates that with Line 5 decommissioned, there is an adequate supply of feedstock via Line 6B and pipelines from the south into the Great Lakes – St. Lawrence Basin to support refineries. Line 6B's operation may be less efficient without Line 5 as there may be more frequent changes in the material mix shipped. Pipeline operators like to ship fewer products, as scheduling and control of product separation is easier. The most likely net impact would be lower quantities of heavy tar-sands crude that could be shipped to export customers via eastern Canada and Portland. However, shippers still have the alternative option to export light, medium, and heavy crude oil from the U.S. Gulf Coast and Canadian West Coast.

4. Sarnia NGL Petrochemical Customers

Petrochemical producers in Sarnia, Ontario, are the primary customers for NGLs shipped in Line 5. There are alternative options to Line 5. Enbridge can ship NGLs in Line 6B and make appropriate connections in the system near Sarnia to get the NGLs to the customers. This action will impact the efficiency of Line 6B's operation, but shipping different materials and optimizing scheduling is a fundamental pipeline operator business practice. Again, the net impact may be a reduction in heavy crude oil export capability from Montreal and the East Coast.

Defining the scope for the system as the Great Lakes – St. Lawrence Basin, and not a specific company's assets, adds the Kinder Morgan and Sunoco pipeline networks into the system, as well as possible better costs for the customers. The Kinder Morgan is studying a project to use their Cochin pipeline to move NGLs and light condensates from the Utica and Marcellus plays in Pennsylvania, Ohio, and West Virginia, and to the Detroit area, Windsor, and on to Sarnia. This network provides an alternative option to Line 6B and supports the Line 5 decommissioning. Sunoco is also considering a similar project with their Sunoco Mariner West Pipeline. The attractiveness of the competing projects actually improves with Line 5 out of the network (See Figure 7).

5. Export Markets from Eastern Canada / United States

Elements of this strategy were previously covered; summarizing, Enbridge and their partners are establishing the leading pipeline network to support shippers of Bakken, Alberta, and tar-sands crude oil to markets in the Midwest, East, West, and Gulf Coasts for maritime shipments and exports. Current agreements with the State of Michigan do not allow the shipment of heavy crude oil through Line 5 but using it for NGLs and light crude oil reduces the number of materials shipped through Enbridge's Line 6B (increases logistics efficiency) and enables larger quantities of heavy crude oil to be shipped

eastward for export. **Thus, a “reasonably prudent person” is risking a Great Lakes incident with Line 5 for an incremental export opportunity.** Exports could alternatively be done from the West and Gulf Coasts (See Figure 8).

VI. CONCLUSION

This model provides an approach to conducting a qualitative alternatives assessment. A comprehensive alternative analysis of the system and infrastructure would identify all possible alternatives to the current “status quo option,” screen for feasibility, and then conduct an in-depth analysis of alternatives on the “short-list.” For this model one alternative was selected, “Decommission Line 5,” to demonstrate the approach, and move the “Line 5 debate” beyond Line 5 to a consideration of an alternative based on a proper definition of the system.

This model defines objectives, selects a feasible alternative, lists the assumptions and bases for an analysis, defines the system and addresses the objectives. If the appropriate system is not defined, a viable, best solution might be missed. In addition, the dynamics and evolution of the system must be analyzed. The technologies, reserves, and economics of crude oil supplies are changing; the demands and constraints on the supply chain and business strategies for refiners and exporters also are changing, creating a dynamic system. While setting one constraint, for example “decommission Line 5,” may change the system equation, the system is designed to evolve to meet new objectives. All key stakeholders must participate as needed to forecast the evolution.

This model does not claim to represent necessarily the best or only solution, but it does show that “decommissioning Line 5” is a viable alternative, especially when the system and dynamics are properly defined. In this case, the system boundaries are defined by the network, use, and possible modifications, and not limited to a specific company’s assets or state or country boundary. The model shows that the system has considerable flexibility and with limited scope projects and operating changes, Line 5 can be shut down, and the model represents an option or alternative that eliminates the high-level risk of imminent hazard and harm that would meet the “reasonably prudent person” requirement in the Enbridge 1953 Easement or other law as recommended by the Task Force Report.

The strategic needs of refineries, chemical producers, and propane heating customers would not be affected, as the system can adjust to meet their needs and continue to evolve to meet new unforeseen conditions. Maintaining an imminent environmental hazard at the Straits of Mackinac, Line 5, to supply East Coast export markets is not a strategic need as determined by a “reasonably prudent person.”

In analyzing the system, “Decommissioning Line 5” was also found to reduce public safety risk from an aging line traversing populated areas, and also to reduce environmental risk to nationally recognized and extremely sensitive watersheds, streams, and rivers which feed the Great Lakes.

VII. RECOMMENDATIONS

This simple process and example demonstrates that Line 5 can be decommissioned without a negative strategic impact on key stakeholders. Due to the imminent hazard Line 5 presents to the Great Lakes and public safety risk along its route:

- The comprehensive alternatives analyses and assessment should embrace the overall pipeline system and infrastructure, including capacity, options, modifications, such as the recently expanded new Line 6B, and be undertaken and completed as expeditiously as possible.
- While recognizing that a review of other options needs to be done in parallel, the state should make a pre-determination that the “decommission Line 5” (as defined in this report) alternative is a strong possible best-case option. The comprehensive assessment must not be delayed while studying other options that, by definition, do not fully meet the upfront stated objective to eliminate the risk.
- Interim measures, such as those recommended in FLOW’s September 2015 Expert Report (See www.FLOWforWater.org), should be imposed immediately on Line 5 under the Mackinac Straits because of the high-level risk, imminent hazard, and high magnitude of harm in the event of an oil spill or release during the completion of the comprehensive assessment.

ADDENDUM A – EXAMPLES OF POSSIBLE ALTERNATIVES

The following is list of possible alternatives provided as examples. The list is not comprehensive. When conducting the alternatives assessment, the list would be developed by the assessment team, condensed to a feasible short-list, and then the remaining options analyzed in detail against the objectives.

- Maintain status quo of current activities.
- Upgrade Line 5 monitoring, integrity management, and emergency response capability.
- Restrict Line 5 operating criteria and capacity to less severe conditions.
- Decommission Line 5.
- Replace Line 5 with rail and/or truck shipments, as needed, to supplement other pipelines, not necessarily in total for Line 5 capacity.
- Use a portion of Line 5 or the right-of-way to support the propane market in the Upper Peninsula. Line 5 downstream and across the Straits would be decommissioned.
- Use a portion of Line 5 or the right-of-way to support crude oil shipments from the Lower Peninsula southbound. Line 5 upstream and across the Straits would be decommissioned.
- Replace Line 5 with a new best-in-class pipeline.

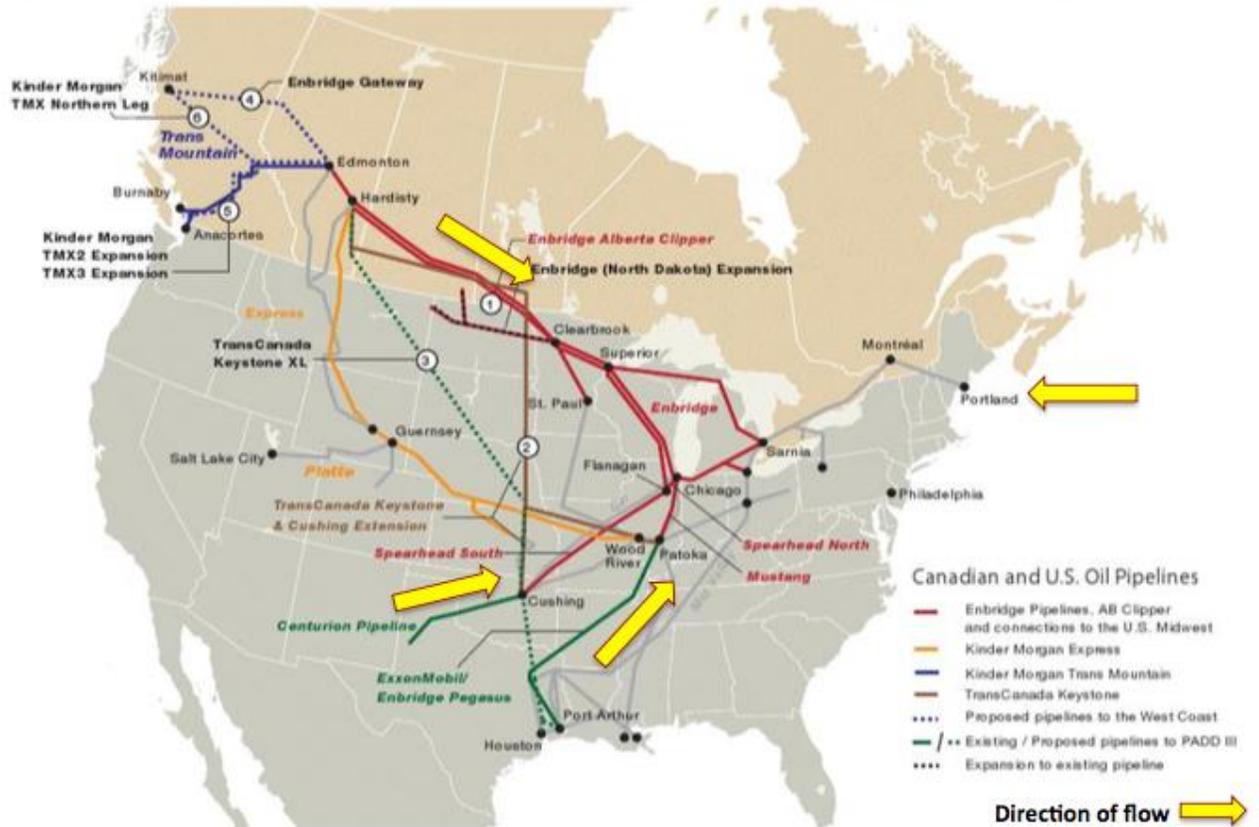
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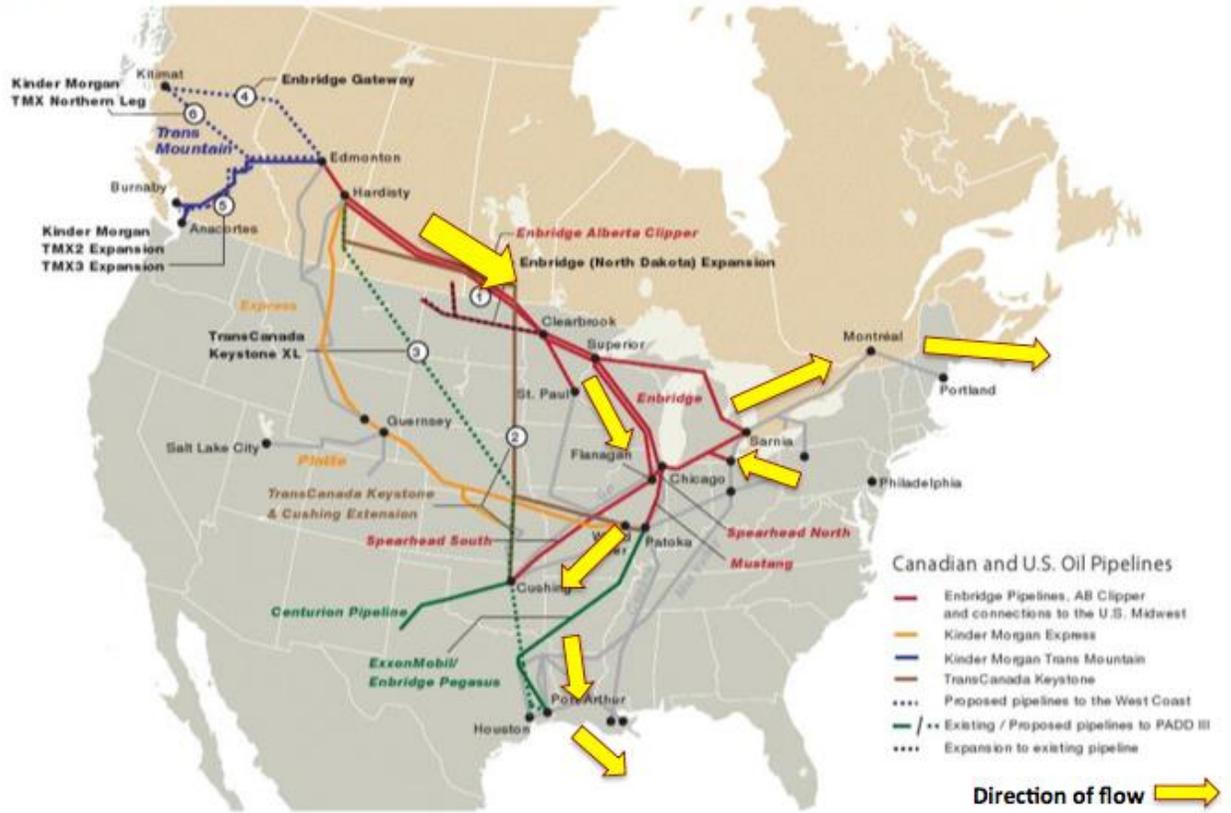
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Figure 1. Historic Crude Oil, NGL Flows to the Great Lakes – St Lawrence Basin



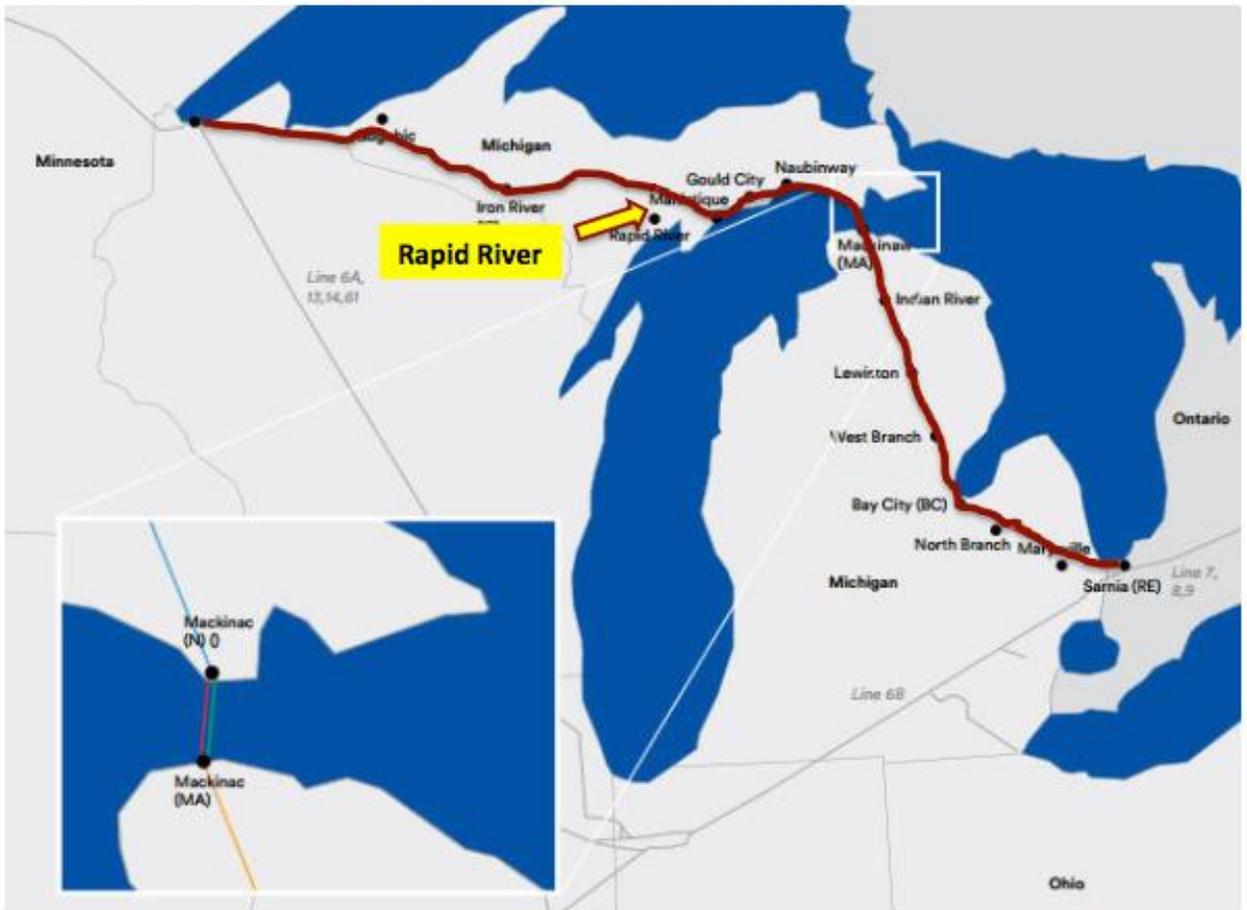
Historic, primary NGL and crude oil flows were from Alberta, the U.S. Southwest and Gulf Coast to the Midwest and imports from the east into Canada.

Figure 2. Evolving Crude Oil, NGL, Light Condensate Flows to the Great Lakes – St Lawrence Basin



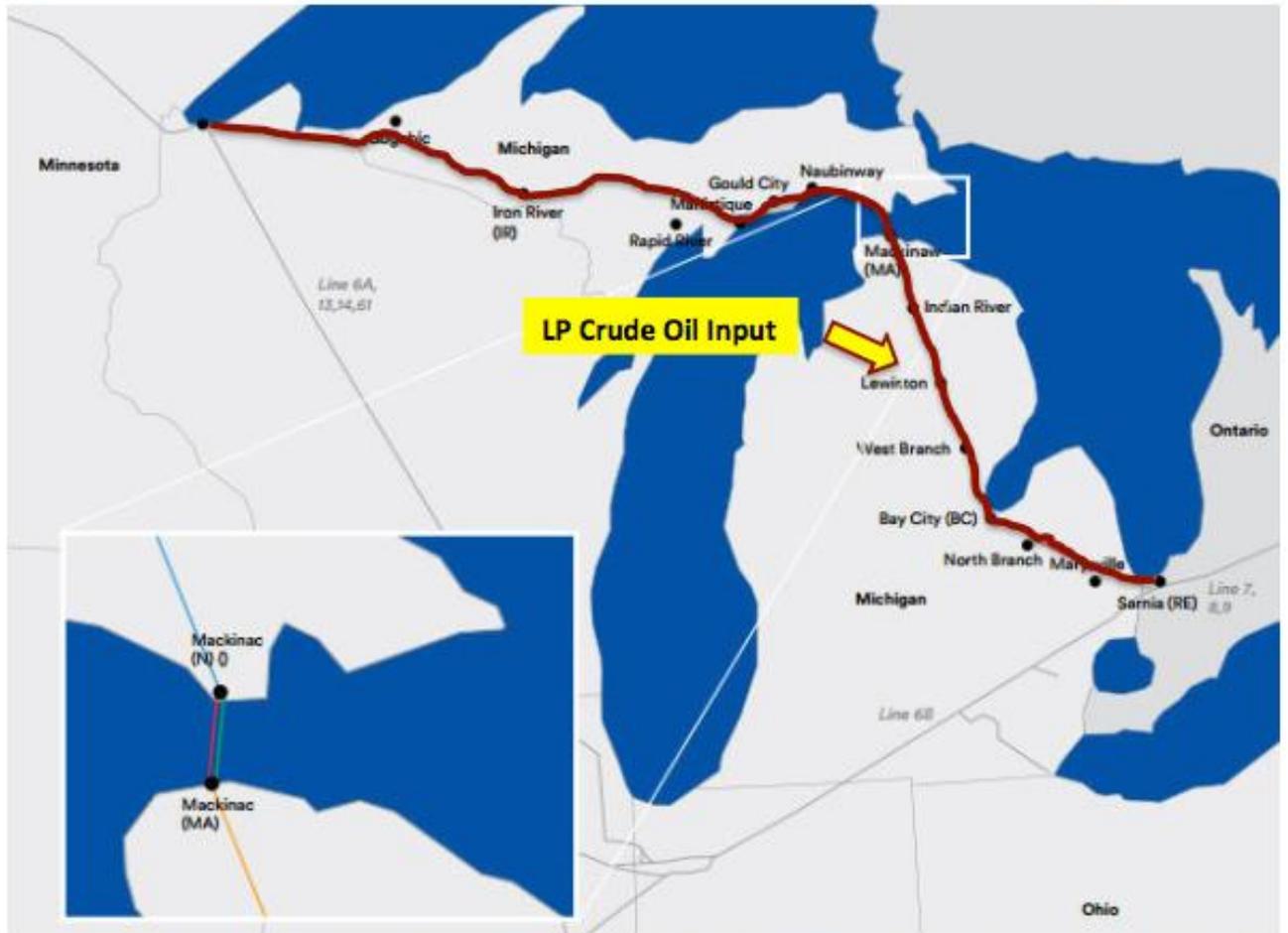
The pipeline system is evolving and directional flows are changing. Projects are being implemented to move crude oil from North Dakota/Alberta to the Chicago area and on to the east and south to serve refineries enable maritime shipments and exports from the East Coast and Gulf Coast. Light condensate and NGL's pipeline projects will enable shipments from Pennsylvania, Ohio and West Virginia to the Detroit, Windsor and Sarnia areas.

Figure 3. Enbridge Line 5 Transports NGL's and Crude Oil



Propane is extracted at Rapid River and used for commercial and home heating in the Michigan Upper Peninsula. With Line 5 shutdown at the Straits, the upstream segment ahead of Rapid River could be used to operate the depropanizer, or ship propane or use the right-of-way or move the operation to Superior Wisconsin.

Figure 4. Lower Peninsula Crude Oil Production Feed Point to Enbridge Line 5



Options: use the existing line and batch ship crude oil, modify Line 5 for lower throughput, use the right-of-way with a smaller line, decommission and use an alternative shipment mode.

Figure 5. Refineries in the Great Lakes - St. Lawrence Basin



State/Province	City	Company	Refining capacity (bpd)
Indiana	Whiting	BP	400,000
Michigan	Detroit	Marathon	123,000
Ohio	Lima	Husky Energy	165,000
	Oregon	BP/Husky Oil	155,000
	Oregon	PBF	540,000
Wisconsin	Superior	Calumet	45,000
Quebec	Montreal	Suncor Energy	137,000
Ontario	Nanticoke	Imperial Oil	112,000
	Sarnia	Imperial Oil	121,000
	Sarnia	Suncor Energy	85,000
	Corunna	Shell Canada	72,000

Reference 5. Great Lakes Commission report on crude oil shipments in the Great Lakes – St Lawrence Basin

Figure 6 Detroit/Toledo Crude Oil Supply Pipelines



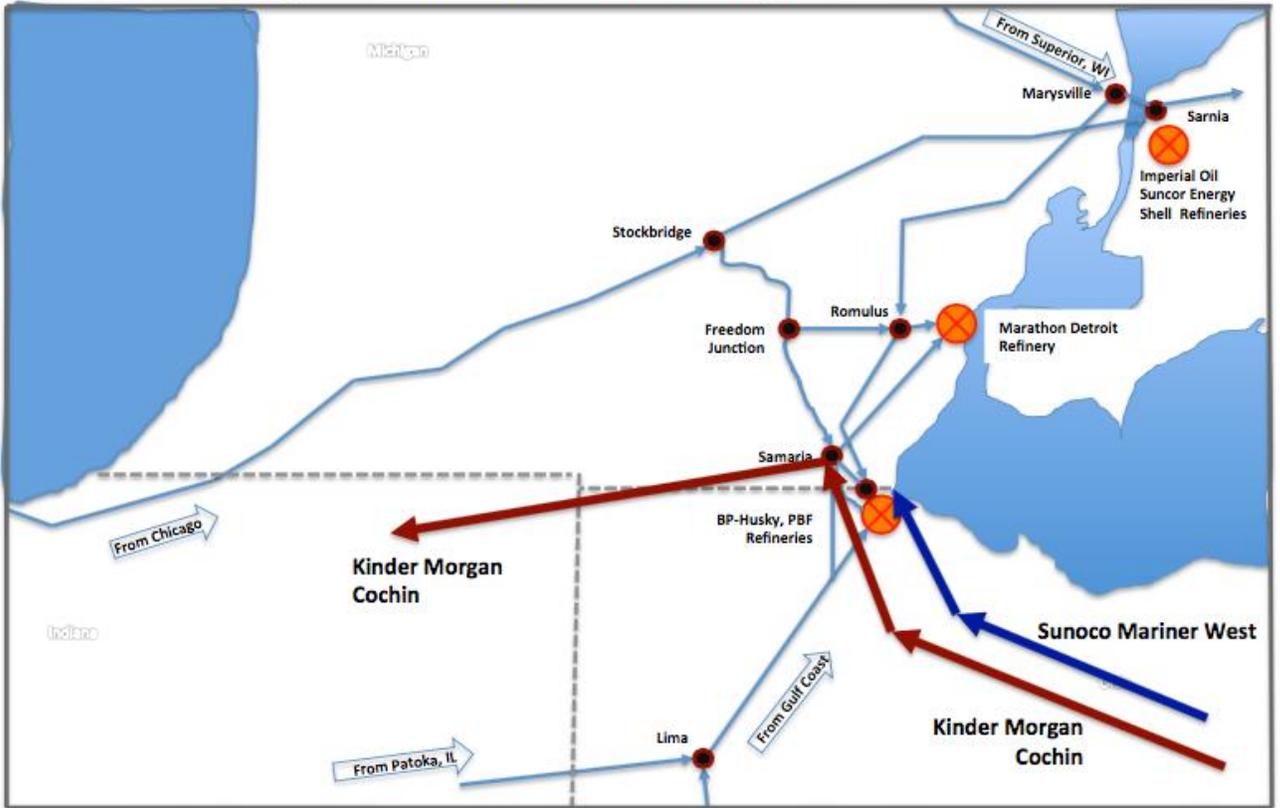
Source: Enbridge, MPC



(Original map by Marathon has been revised by FLOW)

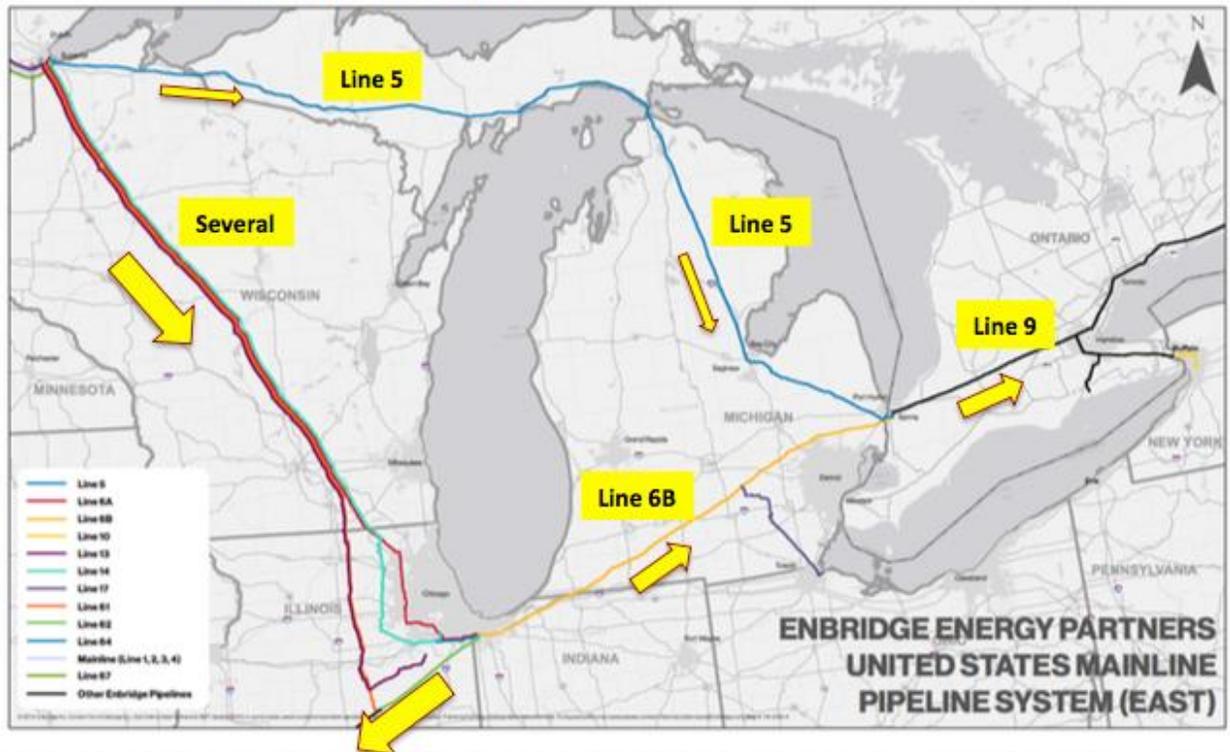
Reference 7. G. Street

Figure 7. Kinder Morgan Cochin and Sunoco Mariner West Pipelines



These pipelines transport light condensate and NGLs from the Utica and Marcellus Shale Plays

Figure 8. Enbridge Strategy – Expand to Ship Bakken and Tar Sands Crude Oil to the Midwest and East Coast



Enbridge is continuing to expand its network to maximize Bakken and tar-sands shipment capability into the Great Lakes region for refineries and transshipment to the East and Gulf Coasts to refineries and ports for export.