

TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON NOVEMBER 29, 2016
FROM:	KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER
SUBJECT:	LAKE ERIE BI-NATIONAL PHOSPHOROUS REDUCTION TARGET AND COMMENTS ON REDUCING PHOSPHORUS TO MINIMIZE ALGAL BLOOMS IN LAKE ERIE (EBR REGISTRY NUMBER: 012-8760)

RECOMMENDATION

That, on the recommendation of the Managing Director, Environmental & Engineering Services & City Engineer, the following actions **BE TAKEN** with respect to the Lake Erie Bi-national Phosphorus Reduction Target and the Environmental Bill of Rights (EBR) posting on the subject:

- a) The following report **BE RECEIVED** for information;
- b) Comments on EBR Registry Number 012-8760 (attached as Appendix 'C') **BE ENDORSED**.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

None

2015-19 STRATEGIC PLAN

The 2015 – 2019 Strategic Plan identifies these objectives under Building a Sustainable City: 1B – Managing our infrastructure; 3E -- Strong and Healthy environment through protection of the natural environment.

BACKGROUND

Purpose

To update Council on the current status of bi-national phosphorus reduction target discussions for Lake Erie and the Thames River Watershed.

Context

Efforts to reduce algae blooms in Lake Erie that were identified as harmful in the 1960's and 1970's mainly resulted in regulated reductions in phosphorus found in cleaning products and from municipal wastewater treatment plant effluent.

While the lake has shown promising signs of recovery, occurrences of severe algae blooms returned in the 2000's. The summer of 2015 produced the largest algae bloom in Lake Erie in 100 years at 300 square miles (277 square kilometers). (ECO Watch Jun. 2016)

The reoccurrence of these blooms have resulted in impaired water quality, with impacts on ecosystem health, drinking water supplies, fisheries, recreation, tourism, and property values. To address this bi-national water quality threat the Governments of Canada and the United States are working with numerous watershed partners to further

reduce phosphorus concentrations and loadings to Lake Erie by 40% using 2008 as the baseline year.

The Canada-Ontario Action Plan (or a Domestic Action Plan, as referenced in the Canada-U.S. Great Lakes Water Quality Agreement (GLWQA)) for Lake Erie is to be developed by 2018. Action Plans are intended to identify actions that can be taken by all sectors to meet phosphorus load reduction targets, reduce algal blooms and help restore the health of Lake Erie.

There was a Provincial Environmental Bill of Rights (EBR) posting titled, *Reducing Phosphorus to Minimize Algal Blooms in Lake Erie* (EBR Registry Number: 012-8760) that described the issue and current activities to set targets to reduce phosphorus loading to Lake Erie. That EBR posting in its entirety has been included with this report as Appendix 'A'.

Certain excerpts of the EBR posting have been included in the main body of this report to frame the issue for the London –Thames River Watershed context. The excerpts are shown in *italics* in the body of this report.

Details on a complementary financial plan for implementation of Action Plans remains to be better defined. The EBR posting does mention that the Clean Water and Wastewater Fund may support these plans.

Report Summary

In order to reduce reoccurring harmful algal blooms in Lake Erie the Governments of Canada and Ontario have agreed to a bi-national phosphorus reduction target of 40% from the base year of 2008. For Canada-Ontario this means a reduction in annual phosphorus loadings to Lake Erie of 212 tonnes (6%). For the U.S. the reduction in annual phosphorus loadings equates to 3,315 tonnes (94%).

The Thames River Watershed has been identified as one of two Canadian Lake Erie tributary watersheds to meet this phosphorus reduction target. Through previous meetings between staff, the Ministry of Environment and Climate Change (MOECC) and Environment Canada and Climate Change (EC), it has been made clear that the 40% reduction targets will not be evenly distributed across all watershed sectors and that as point source contributors of dissolved reactive phosphorus, municipalities can expect to bear a larger reduction target percentage than other watershed sectors.

A Canada-Ontario Action Plan for Lake Erie is to be developed by 2018. That Action Plan (or Domestic Action Plan as referenced in the Canada–U.S. Great Lakes Water Quality Agreement) will identify actions that can be taken by all sectors to meet phosphorus load reduction targets.

For the City of London this could mean reducing phosphorus loadings from the treated sanitary effluent to the Thames River from our five WWTP's. It is estimated that capital expenditures needed to move from current phosphorus effluent loadings to a tertiary effluent quality could be in the order of \$40-\$50 million dollars. There are no details at this time on the proposed program for municipally owned WWTPs. It is hoped that more clarity will be forthcoming through the development of the Domestic Action Plan.

A high level proposal for the Action Plan was available for comment on the MOECC Environmental Bill of Rights Registry from October 6 to November 20. This report reviews the proposed program and reiterates a set of staff comments submitted to the EBR.

Possible funding from the CWWF is noted in the Action Plan proposal. The concern with use of the CWWF to meet the Domestic Action Plan is that London would be at a financial disadvantage as compared to other Canadian cities in that they are allowed to focus the Fund on their own priorities.

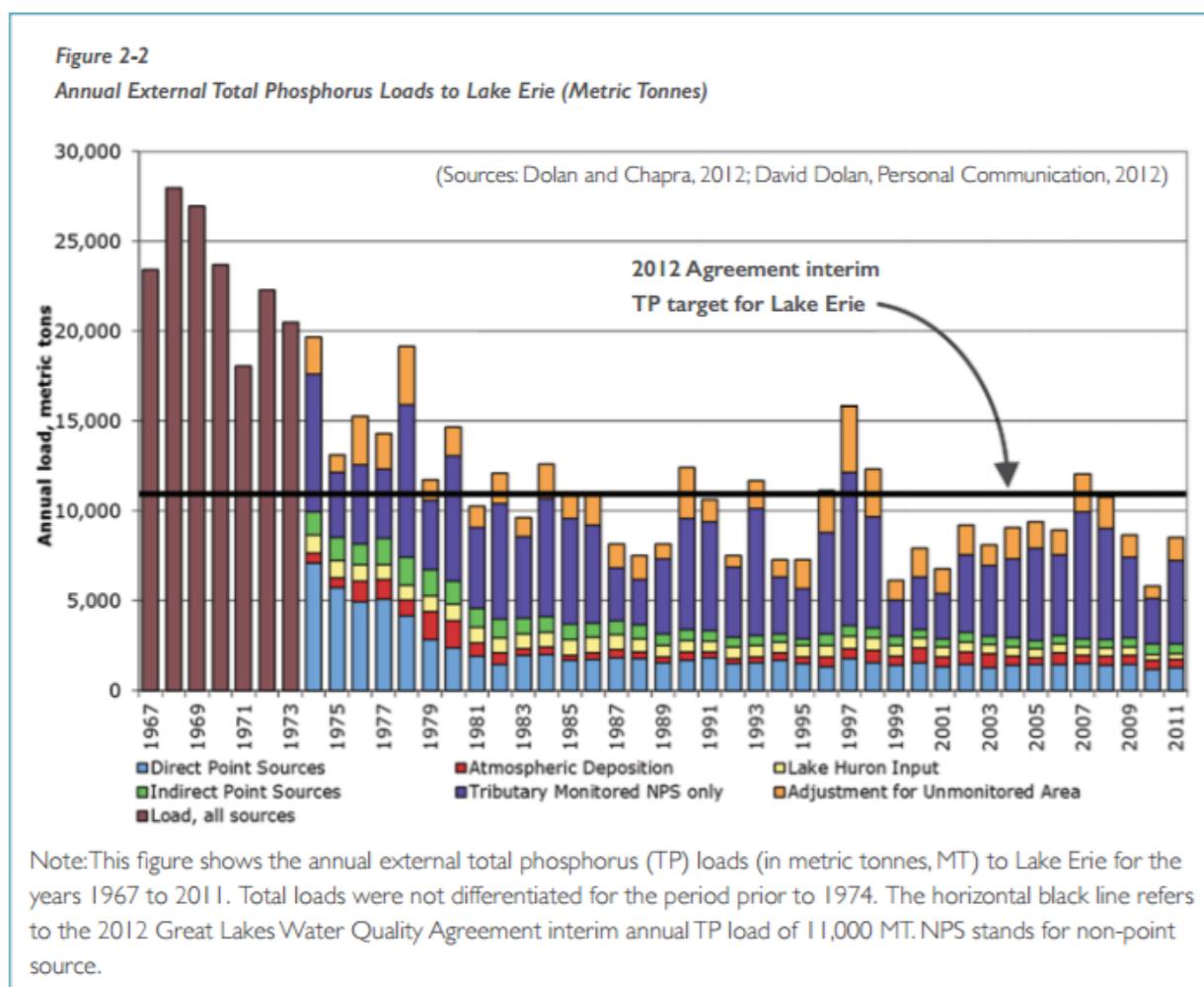
EES staff have been invited to serve on a proposed Lake Erie Nutrients Working Group.

Through his participation in this Working Group, London can continue to monitor the development of the Domestic Action Plan.

DISCUSSION

Overview

“Excessive algal blooms in the 1960s and 1970s were a major driver for the signing of the first Great Lakes Water Quality Agreement (Agreement) in 1972. In that first Agreement, the Governments of Canada and the United States agreed to reduce phosphorus loads to Lake Erie by more than 50 percent (from 29,000 to 14,600 metric tons per year). In the subsequent 1978 Agreement, the two countries agreed to a further reduction of phosphorus loads to Lake Erie to 11,000 metric tons per year. Regulation of phosphorus concentrations in detergents, investing in sewage treatment, and developing and implementing best management practices on agriculture lands successfully achieved those targets. With the achievement of phosphorus load targets, algal bloom development in Lake Erie decreased significantly throughout the 1980s. However, in the 1990s, despite ongoing efforts to limit phosphorus discharges to Lake Erie, toxic and nuisance algal blooms began increasing.” (Recommended Binational Phosphorus Targets To Combat Lake Erie Algal Blooms, Great Lakes Water Quality Agreement Nutrients Annex Subcommittee, June 2015)



(Figure above from Scavia et al. 2014. Assessing and addressing the re-eutrophication of Lake Erie: Central basin hypoxia. *Journal of Great Lakes Research* 40: 226-246.
<http://dx.doi.org/10.1016/j.jglr.2014.02.004>)

To read the above figure when reproduced in black and white, the bars from bottom to top are as follows: Direct Point Sources; Atmospheric Deposition; Lake Huron Input; Indirect Point Sources; Tributary Monitored Non Point Sources Only; Adjustment for Unmonitored Area; and for 1967 to 1973 Load, All Sources.

.....Lake Erie is the shallowest, warmest and most biologically productive of the five Great Lakes, making it highly sensitive to changes in nutrient levels and susceptible to algal blooms. Each day, the lake receives an estimated 11 billion litres of treated wastewater from Canadian municipal and industrial sources. Approximately 75 percent of the surrounding land base is dedicated to agricultural production.....



Satellite image of an algal bloom on Lake Erie, taken on September 6, 2015. Credit: NASA Worldview.

Overall Phosphorus Reduction Target

.....Following public consultation, Canada and the U.S. formally adopted a science-based binational target of 40 percent reduction in phosphorus loads for the western and central basins from 2008 levels, based on an adaptive management framework. **Canada's allocated portion of this reduction is 212 tonnes** (emphasis added), while the U.S. reduction is 3,315 tonnes. This includes reducing phosphorus loadings by 40 percent from key watersheds on both sides of the lake where localized algae is a problem, **including two watersheds in Ontario: Thames River and Leamington tributaries** (emphasis added). Ontario participated in the development of these targets and fully supports collaborative efforts at all levels to reduce excess phosphorus entering Lake Erie. At this time, a target for the eastern basin has yet to be established and requires further scientific assessment. Ontario is participating in the development of this eastern basin target.

Table 1 – Phosphorus Load Targets for Lake Erie

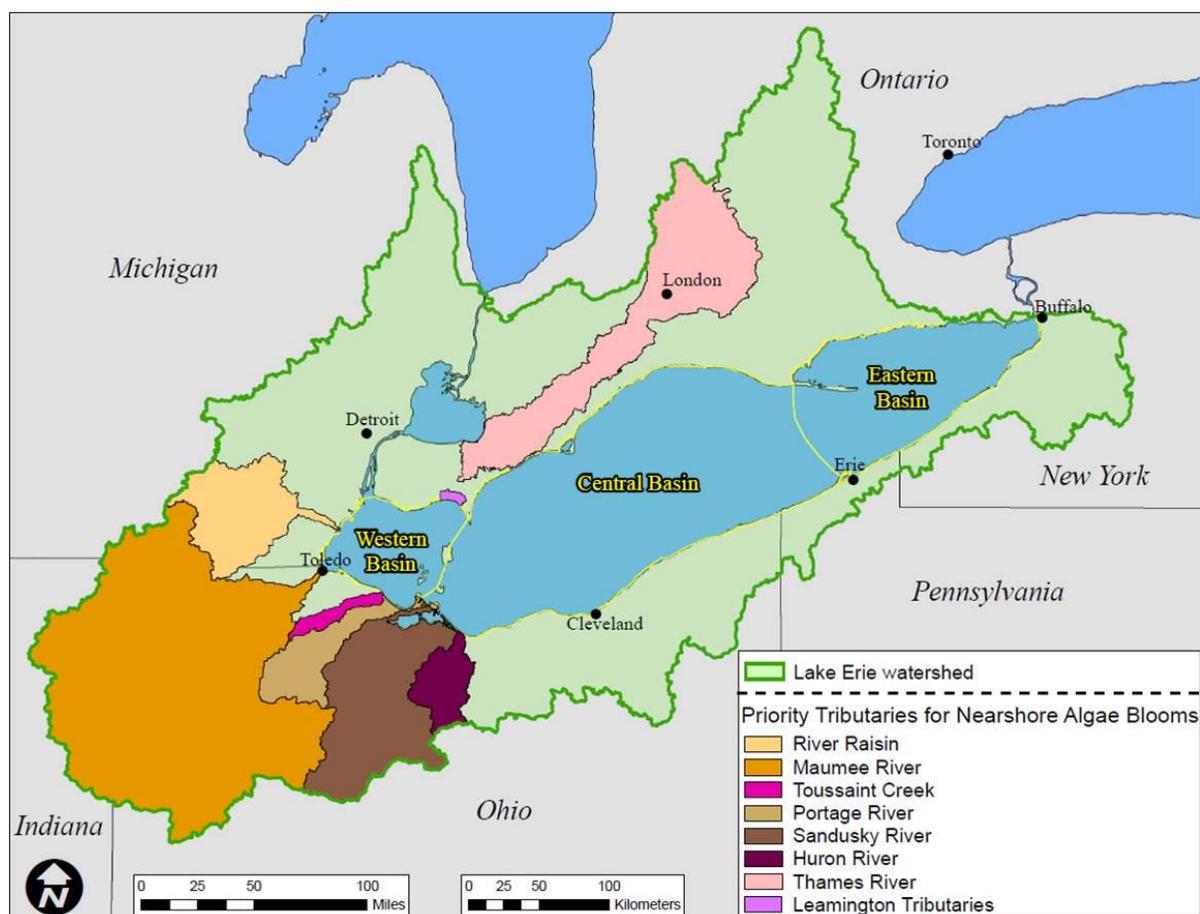
Agreement Date	Lake Erie total P Targets (tonnes)	Lake Erie West / Central Basin (tonnes)	Thames River watershed
Pre 1972	29,000		
1972	14,500		
1978	11,000		
2016	6,000 to the Central Basin	6,000 (being a reduction of 3,528 in the US and 212 in Canada)	40% reduction
2025			40% reduction (*)

(*) Sources of Phosphorus are estimated to be 15% urban and 85% rural & agricultural.

Target Areas

“To maintain algal species consistent with healthy aquatic ecosystems in the nearshore waters of the western and central basins of Lake Erie: a 40 percent reduction in spring total and soluble reactive phosphorus loads from the following watersheds where algae is a localized problem: in Canada, Thames River and Leamington tributaries; and in the United States, Maumee River, River Raisin, Portage River, Toussaint Creek, Sandusky River and Huron River (Ohio).” (Recommended Binational Phosphorus Targets To Combat Lake Erie Algal Blooms, Great Lakes Water Quality Agreement Nutrients Annex Subcommittee, June 2015)

“To maintain cyanobacteria biomass at levels that do not produce concentrations of toxins that pose a threat to human or ecosystem health in the waters of the western basin of Lake Erie: a 40 percent reduction in spring total and soluble reactive phosphorus loads from the Maumee River in the United States.” (Recommended Binational Phosphorus Targets To Combat Lake Erie Algal Blooms, Great Lakes Water Quality Agreement Nutrients Annex Subcommittee, June 2015)



(Map of Lake Erie Priority Watersheds. Created by U.S. Environmental Protection Agency)

London's Potential Action Items

The posting on the EBR provides a number of proposed actions under these topics: point source, non-point source, agricultural, natural heritage, and science, monitoring and public reporting.

See Appendix 'D' - *Phosphorus in Point Sources vs Non-point Sources* for a more detailed description on the different types of phosphorus attributed to point and non-point sources.

Below are excerpts from the EBR posting that could specifically relate to London.

Point Sources

While the relative contribution from urban point sources is estimated to be approximately 10 to 15 percent of the total load across the basin, potential gains for phosphorus reduction from this source can be made. Urban point sources also have a higher soluble reactive phosphorus content than some other sources, which is a key driver of algae growth, and provides a further rationale for continued action. Achieving reductions in point source loadings may be supported by recent funding announced by Canada and Ontario through the Clean Water and Wastewater Fund (Phase 1 of Canada's infrastructure commitments, as well as future funding under Phase 2).

Proposed Action: *Work with partners to update provincial policies for Lakes Erie and Ontario in order to establish a legal effluent discharge limit of 0.5 milligrams per litre of total phosphorus for all municipal sewage treatment plants (STPs) that have an average*

daily flow capacity of 3.78 million litres or more per day. This action will bring Ontario's policies in line with the binational recommendation under the Canada-U.S. GLWQA.

Proposed Action: Work with partners to reduce loadings where feasible, through upgrades to secondary STPs that have an average daily flow capacity of 3.78 million litres or more per day in the Lake Erie basin to a tertiary level of treatment, as well as improvements to wastewater treatment and collection infrastructure to reduce combined sewer overflows and bypasses, and stormwater management systems (including facility rehabilitation and incorporating green infrastructure).

Proposed Action: Ontario will promote and encourage optimization of sewage treatment as a way for municipalities to improve treatment plant performance (including lower phosphorus discharges) and achieve operational efficiencies. As part of this effort, Ontario will continue to support the development of area-wide optimization programs for municipal STPs to reduce phosphorus loads, and make Lake Erie the priority geography for this effort.

Non-point Sources

Urban non-point sources account for approximately 5 to 10 percent of the total load across the basin. While stormwater runoff (phosphorus loads) from municipal urbanized and rural areas are estimated to be lower than the loads from municipal sewage treatment facilities, their contribution may be significant in some watersheds.

Proposed Action: Ontario is working with developers and others to promote and support the use of green infrastructure and low impact development (LID), including clarifying and enhancing policies, and developing green standards. Ontario is in the process of drafting a LID guidance manual that will assist proponents in implementing their efforts. The draft manual is expected to be available for public comment in early 2017.

Science, Monitoring and Public Reporting

Monitoring loadings and tracking progress to achieve nutrient reductions will be essential for ensuring that actions are making a measurable difference to Lake Erie's water quality.

Proposed Action: Enhanced monitoring will be undertaken in the Thames River watershed and in Lake St. Clair to better understand the sources and types of phosphorus that are feeding algal growth.

Proposed Action: Ontario will work with its partners to provide an annual update on Lake Erie through its website, and produce a progress report every three years.....

The London Context

This part of the report summarizes what is known about the various aspects to the Action Plan as presented in the EBR posting.

Funding for Reduction Targets

At this time there has been no indication of a special Federal or Provincial funding plan, other than the recently launched Clean Water and Wastewater Fund (CWWF), related to any watershed sector in meeting these phosphorus reduction targets. The concern with use of the CWWF to meet the Domestic Action Plan is that London would be at a financial disadvantage as compared to other Canadian cities in that they are allowed to focus the Fund on their own priorities.

Point Source – Wastewater Treatment Plants

The main impact to London of these reduction targets will be at our Wastewater Treatment Plants (WWTP).

As mentioned above Canada's allocated portion of the Lake Erie 40% reduction target is 212 tonnes (6% of the total), while the US reduction target is 3,315 tonnes (94% of the total).

In 2008 (the identified base year) the Upper Thames River Watershed (being London and upstream) the total phosphorous loading was estimated at 339 tonnes/year based on measurements of the Thames as it exits London.

In 2008 London's five WWTP's contribution was 43 tonnes/year (12.7% of the total 339 tonnes/yr phosphorus load).

Since that time London's five WWTP loading averages for the period 2008 to 2015 inclusive is approximately 33 tonnes/year for total phosphorous and the loading average in the same period for the Thames River was 226 tonnes/year (WWTP 14.6% of total at Byron).

Five of our six wastewater treatment plants have rated treatment capacity larger than the identified 3.78 million litres per day. The sixth, the Southland WWTP (in Lambeth) will be soon decommissioned with the tributary flow being redirected to the Greenway WWTP. Therefore according to the above *Ontario's Proposed Actions – Point Sources* our WWTP's will be required to meet a new legal effluent limit for phosphorus of 0.5 milligrams per litre of total phosphorus and "where feasible" to a "tertiary level of treatment". Table 2 summarizes our current plant rated capacities and various phosphorus effluent limits.

Table 2 – Plant Phosphorus Performance Summary

	ADELAIDE	GREENWAY	OXFORD	POTTERSBERG	VAUXHALL
RATED CAPACITY Million L/DAY	36.4	152.2	17.2	39.1	20.9
TOTAL COMPLIANCE (LEGAL) mg/L	1.0	0.75	0.65	0.75	1.0
TOTAL OBJECTIVE (TARGET) mg/L	0.7	0.6	0.5	0.5	0.75
PROPOSED COMPLIANCE mg/L	0.5	0.5	0.5	0.5	0.5
ACTUAL * PERFORMANCE mg/L	0.45				

(* The actual performance of our WWTP's for an effluent total phosphorous "weighted average" for the period 2008 to 2015 was 0.45 mg/L or less than the proposed limit of 0.5 mg/L total phosphorous.)

While neither the "where feasible" nor "tertiary level of treatment" is defined in this EBR posting, tertiary treatment is generally meant to include some type of effluent filtration where total phosphorus concentrations could be reduced to below 0.1 milligrams per litre.

For London's WWTP's this performance level would result in a total phosphorous loading decrease from about 43 tonnes per year in 2008 to 10.3 tonnes, including the currently under construction increased treatment capacity at Greenway WWTP (170 ML/d compared to 152 ML/D in 2008). That equates to a reduction of 32.7 tonnes comprising 15.4% of Canada's 212 tonnes targeted reduction.

It also equates to a 76% phosphorus loading reduction from the 2008 base year. This is brought to the attention of the Committee since municipal WWTP's effluent phosphorus loadings, as mentioned previously, are: point sources; easy to regulate; easy to

measure; easy to document loading amounts (and therefore loading reductions); and comprised of primarily dissolved reactive phosphorus.

Previous rough estimates to install tertiary treatment at our WWTP's have been in the order of \$40-50 million dollars. This jump to tertiary has not been included in the Wastewater and Treatment Service Area's budget forecasting. However, there are many existing and developing wastewater treatment technologies available that could potentially achieve expected tertiary treatment levels of total phosphorus at less capital and operating costs.

For details of other point and non-point source reduction activities in London see Appendix 'E' *Ongoing City of London Programs*. A point form list of those programs and commentary are as follows:

Point Sources:

- Collection System Infrastructure Improvements
- Basement Flooding Reduction Efforts
- Pollution Prevention Control Plan
- Inflow and Infiltration Reduction Pilot

Non-Point Source:

- Low Impact Development
- Low Impact Strategy
- Low Impact Pilot Projects
- Subwatershed-wide Environmental Assessment

Science, Monitoring and Public Reporting.

Other.

Comments on the Environmental Bill Of Rights Registry Number 012-8760

.....Ontario is seeking early public input to help guide the content of the draft Canada-Ontario Action Plan for Lake Erie as part of a two-stage engagement process – to obtain comments now on proposed high level actions, followed by further public engagement once a draft plan is developed.....

The closing date for comments on this EBR posting was on November 20th.

EES staff compiled and submitted a number of comments regarding this EBR posting and those comments are included in Appendix 'B'.

One of the comments was to extend the comment period. This request was not granted.

Council endorsement of these comments are expected to be received and considered by MOECC, notwithstanding being submitted after the closing date.

Lake Erie Nutrients Working Group:

“The Lake Erie Nutrients Working Group is being established to help develop the draft Canada-Ontario Domestic Action Plans and serve as a platform for sharing multi-sectoral perspectives, identifying potential actions, and providing input and advice on the development of the DAP. The Working Group is not a decision-making body and will consist of technical experts and community leaders who will provide strategic advice on potential actions to reduce phosphorus loads and algal blooms.”

In December 2013, through London's leadership in founding the Thames River Clear Water Revival, staff were invited to participate in the Great Lakes Water Quality Agreement (GLWQA) Bi-national Annex 4, Municipal and Rural Programs Task Group discussions.

EES staff have continued to be an active part of the ongoing discussions on phosphorus reduction targets for Lake Erie since that time.

EES staff have been invited to serve on the Lake Erie Nutrients Working Group. The Terms of Reference for the Working Group have been attached to this report as Appendix 'C'. Through his participation in this Working Group, London can continue to advance concerns in the development of the various Domestic Action Plans and report back to the Municipal Council as the Action Plan develops.

Acknowledgements:

The following Environmental and Engineering Services Divisions contributed to this report: Wastewater Treatment Operations; Stormwater Engineering; Wastewater and Drainage Engineering; and, Environmental Programs.

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- Appendix 'A' – Environmental Bill of Rights (EBR) Registry Number: 012-8760
- Appendix 'B' – Staff comments to the EBR Registry Number: 012-8760
- Appendix 'C' – Lake Erie Nutrients Working Group – TERMS OF REFERENCE
- Appendix 'D' – Phosphorus in Point Sources vs Non-point Sources
- Appendix 'E' - Ongoing City of London Programs

Appendix 'A'

Environmental Bill of Rights (EBR) Registry Number: 012-8760

This EBR posting can be found at the following weblink:

<https://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTMwMjM2&statusId=MTk3MzY5&language=en>

Description of Policy:

Through the binational process, Canada and the U.S. adopted a 40 percent load reduction target for Lake Erie's western and central basins, based on extensive consultation on both sides of the border which included participation from the Province of Ontario. These targets were adopted by Ontario by virtue of provisions within the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2014 (COA).

Ontario is adopting a target of 40 percent phosphorus load reduction by 2025 (from 2008 levels), using an adaptive management approach, for the Ontario portion of the western and central basins of Lake Erie, as well as an aspirational interim goal of a 20 percent reduction by 2020, in order to assist in the reduction of algal blooms under Part IV subsection 9 (2) of the Great Lakes Protection Act, 2015 (GLPA).

Further, Ontario is seeking early public input on proposed actions which will support the development of a draft Canada-Ontario Action Plan for Lake Erie. These proposed actions and subsequent Action Plan will comprise the plan required under subsection 9 (5) of the GLPA.

Ontario and Canada will engage the Great Lakes community, including First Nations, Métis, and specific sectors on a draft Action Plan for Lake Erie.

Context:

The Great Lakes are integral to the health, social and cultural well-being, and economic prosperity for all those who live and work within the basin. For millennia, Indigenous peoples have lived in the Great Lakes Basin – fishing, hunting, farming and trading, while maintaining a spiritual and cultural relationship with the Great Lakes. Lake Erie is shared by the people of Ontario and four U.S. states, and it serves as a source of drinking water for over 11 million people. Lake Erie also supports a multi-billion dollar tourism and recreation industry and sustains one of the largest commercial freshwater fisheries in the world.

Lake Erie is the shallowest, warmest and most biologically productive of the five Great Lakes, making it highly sensitive to changes in nutrient levels and susceptible to algal blooms. Each day, the lake receives an estimated 11 billion litres of treated wastewater from Canadian municipal and industrial sources. Approximately 75 percent of the surrounding land base is dedicated to agricultural production. Following extensive phosphorus reduction efforts initiated in the 1970s, algal blooms that had been threatening Lake Erie were largely absent. However, harmful blue-green algae and nuisance algal blooms began to reappear in the mid-1990s.

Today, Lake Erie is once again showing symptoms of extreme ecological stress resulting in large-scale algal blooms that threaten drinking water quality, fish populations, beach quality, coastal recreation, and the overall ecological health of the lake.

There is consensus on both sides of the border that phosphorus is the primary nutrient that needs to be reduced. A number of contributing factors have been linked to algae such as increased loads of soluble reactive phosphorus (a form of phosphorus that is

easily absorbed and available to algae), invasive species such as zebra mussels, changes to agricultural systems, and changes in climate.

Excess phosphorus is causing stress within the western, central and eastern basins of Lake Erie:

- *Harmful “blue-green” algae (cyanobacteria that look like algae) bloom in the western basin and may contain toxins that can be harmful to humans and wildlife.*
- *Low oxygen (hypoxia) in the central basin is caused by the decomposition of dying algae that use up the oxygen in the lake bottom, depriving aquatic organisms (e.g., fish) of oxygen.*
- *Nuisance algae (Cladophora) in the eastern basin can clog water intakes, impede recreational uses, and degrade aquatic habitat. Algae decomposition can encourage bacterial growth and in some severe cases cause botulism resulting in bird and fish mortality.*

The amount of phosphorus going into Lake Erie is variable and is dependent in large part on runoff from the land, and therefore is heavily influenced by weather which varies from season to season and from year to year. Phosphorus loads tend to be highest in late winter and spring, and years that receive more rain will generally have higher loads of phosphorus than drier years. Sources of phosphorus entering Lake Erie are generally considered to be either point sources (e.g., municipal and industrial wastewater treatment plants) or non-point sources (e.g., agricultural and stormwater runoff). For example, high runoff from fields can cause high phosphorus loadings during wet weather, while loadings are lower in dry conditions. Given the number and types of sources, multi-jurisdictional and multi-stakeholder collaboration and partnerships are essential for reducing nutrient loads to Lake Erie.

Point sources tend to be measured on a regular basis and their variability is relatively low because treatment processes are controlled, resulting in discharges with a fairly constant quality. Non-point sources are highly variable in quality and quantity over the course of a year and loads are more difficult to measure.

In the Ontario portion of the Lake Erie basin, similar to the U.S. portion of the basin, a significant majority of the loads are from non-point sources.

Commitments to Reduce Excess Phosphorus:

Without reducing the amount of phosphorus entering the lake, we will continue to see extensive algal growth and low oxygen conditions in Lake Erie. Ambitious and aggressive actions to reduce phosphorus loads are needed to restore and protect the lake’s water quality and ecological health.

Following public consultation, Canada and the U.S. formally adopted a science-based binational target of 40 percent reduction in phosphorus loads for the western and central basins from 2008 levels, based on an adaptive management framework. Canada’s allocated portion of this reduction is 212 tonnes, while the U.S. reduction is 3,315 tonnes. This includes reducing phosphorus loadings by 40 percent from key watersheds on both sides of the lake where localized algae is a problem, including two watersheds in Ontario: Thames River and Leamington tributaries. Ontario participated in the development of these targets and fully supports collaborative efforts at all levels to reduce excess phosphorus entering Lake Erie. At this time, a target for the eastern basin has yet to be established and requires further scientific assessment. Ontario is participating in the development of this eastern basin target.

Ontario and Canada are committed to working together, through the COA, to develop a draft Action Plan for Lake Erie. The Canada-Ontario Action Plan will identify actions which are aimed at reducing nutrient loads to meet the binational targets applicable to the Ontario portion of Lake Erie, as well as those that will help to monitor and track future progress in meeting these targets.

In keeping with the need for early action, Ontario signed the Western Basin of Lake Erie Collaborative Agreement (Collaborative Agreement) with the States of Michigan and Ohio on June 13, 2015, collectively committing through an adaptive management process to a recommended 40 percent total load reduction in phosphorus entering Lake Erie's western basin by 2025, with an aspirational interim goal of a 20 percent reduction by 2020 (from a 2008 base year). Working with the bordering U.S. Lake Erie States of Ohio, Michigan, New York and Pennsylvania through the Great Lakes Commission, Ontario collaborated on the development of the Joint Action Plan which aligns with other binational and domestic nutrient efforts currently underway.

Ontario is also taking action at home to complement these efforts. Ontario's 12-Point Plan on blue-green algal blooms outlines how we are working with our many partners to prevent and respond to blooms in the Great Lakes and other lakes and rivers, and to protect drinking water supplies.

Ontario continues to work with partners on a number of other related initiatives to protect the health of Lake Erie, including COA, Lake Erie Lakewide Action and Management Plan, Lake Erie Binational Nutrient Management Strategy, and Remedial Action Plans in the Lake Erie basin. The province is also supporting various watershed plans and initiatives, which are underway with partners from all levels of government, conservation authorities, Indigenous peoples, local communities, and key sector groups.

Although Ontario's current nutrient reduction efforts are focused on Lake Erie, future efforts will be directed to Lake Ontario as the next priority Great Lake.

Canada-Ontario Action Plan for Lake Erie:

It has taken time for Lake Erie to get to its present state and because the environment of such a large lake takes time to adapt and respond to actions, it will take time to see improvements within the environment. Further, as there are many point and non-point sources of phosphorus entering Lake Erie, there is a need for immediate and collective action by all sectors and communities to achieve phosphorus load reductions.

While scientists agree that the majority of the loadings to Lake Erie are from U.S. sources, Ontarians must do their fair share of reducing phosphorus loads by 40 percent. The Canada-Ontario Action Plan for Lake Erie, to be developed by 2018, will identify actions that can be taken by all sectors to meet phosphorus load reduction targets, reduce algal blooms, and help restore Lake Erie for future generations.

Ontario (Ministries of the Environment and Climate Change, Agriculture, Food and Rural Affairs, and Natural Resources and Forestry) is working with Canada and members of the Great Lakes community to develop one plan – the Canada-Ontario Action Plan for Lake Erie (or a Domestic Action Plan, as referenced in the Canada-U.S. Great Lakes Water Quality Agreement (GLWQA)), which will meet all of Ontario's binational and domestic commitments related to various nutrient initiatives, including the COA, GLPA, Collaborative Agreement, and Joint Action Plan with U.S. states.

Ontario's Proposed Actions:

Ontario is seeking early public input to help guide the content of the draft Canada-Ontario Action Plan for Lake Erie as part of a two-stage engagement process – to obtain comments now on proposed high level actions, followed by further public engagement once a draft plan is developed. As such, the following proposed actions are not an exhaustive list, and should be viewed as preliminary.

Point Sources

While the relative contribution from urban point sources is estimated to be approximately 10 to 15 percent of the total load across the basin, potential gains for phosphorus reduction from this source can be made. Urban point sources also have a higher soluble reactive phosphorus content than some other sources, which is a key driver of algae growth, and provides a further rationale for continued action. Achieving reductions in point

source loadings may be supported by recent funding announced by Canada and Ontario through the Clean Water and Wastewater Fund (Phase 1 of Canada's infrastructure commitments, as well as future funding under Phase 2).

Proposed Action: Work with partners to update provincial policies for Lakes Erie and Ontario in order to establish a legal effluent discharge limit of 0.5 milligrams per litre of total phosphorus for all municipal sewage treatment plants (STPs) that have an average daily flow capacity of 3.78 million litres or more per day. This action will bring Ontario's policies in line with the binational recommendation under the Canada-U.S. GLWQA.

Proposed Action: Work with partners to reduce loadings where feasible, through upgrades to secondary STPs that have an average daily flow capacity of 3.78 million litres or more per day in the Lake Erie basin to a tertiary level of treatment, as well as improvements to wastewater treatment and collection infrastructure to reduce combined sewer overflows and bypasses, and stormwater management systems (including facility rehabilitation and incorporating green infrastructure).

Proposed Action: Ontario will promote and encourage optimization of sewage treatment as a way for municipalities to improve treatment plant performance (including lower phosphorus discharges) and achieve operational efficiencies. As part of this effort, Ontario will continue to support the development of area-wide optimization programs for municipal STPs to reduce phosphorus loads, and make Lake Erie the priority geography for this effort.

Proposed Action: Ontario, in collaboration with the greenhouse sector, will continue to work towards eliminating phosphorus-containing wastewater from entering Leamington area watercourses that flow into Lake Erie, through education, awareness, innovation, cost-shared investments and regulatory compliance and enforcement efforts.

Non-point Sources

Urban non-point sources account for approximately 5 to 10 percent of the total load across the basin. While stormwater runoff (phosphorus loads) from municipal urbanized and rural areas are estimated to be lower than the loads from municipal sewage treatment facilities, their contribution may be significant in some watersheds.

Proposed Action: Ontario is working with developers and others to promote and support the use of green infrastructure and low impact development (LID), including clarifying and enhancing policies, and developing green standards. Ontario is in the process of drafting a LID guidance manual that will assist proponents in implementing their efforts. The draft manual is expected to be available for public comment in early 2017.

Although septic systems are generally considered to make a minor contribution to the overall phosphorus load to Lake Erie, they can have significant local impact in nearshore areas that have a greater concentration of septic systems. The proper management and maintenance of septic tanks helps prevent phosphorus from entering waterways.

Proposed Action: In collaboration with partners, Ontario is considering enhancing and clarifying regionalized requirements for mandatory pump-out and inspections of septic systems to increase protection of ground and surface water quality.

Ontario has initiated a policy and program review for hauled sewage (e.g., septic tank pump-outs, etc.). Proper management of hauled sewage ensures protection of the environment and waterways, and leads to reduced loadings of phosphorus from rural lands in the Lake Erie basin and province-wide.

Proposed Action: As part of the hauled sewage policy and program review, Ontario will develop, and post for public comment, a draft policy framework for managing hauled sewage in the province.

Agricultural Sources

With approximately 75 percent of the Lake Erie watershed in Ontario in agricultural production, farmland is considered a substantial contributor to the total phosphorus load. Given the variability in land and agricultural systems within the basin, the best approach to reducing phosphorus loss may vary between operations.

Proposed Action: *In order to reduce phosphorus runoff during the high risk period (non-growing season), Ontario will partner with the agriculture sector to further enhance its outreach to farmers to promote the application of nutrients at the right time and is considering tighter restrictions on the application of nutrients during this period.*

Proposed Action: *Support for the implementation of an Ontario industry-led 4Rs program (right time, rate, source and placement of nutrients), based on the internationally-recognized 4R Nutrient Stewardship system which helps farmers reduce nutrient losses into the environment through efficient nutrient application.*

Proposed Action: *Ontario will continue to leverage funding for initiatives such as the Great Lakes Agricultural Stewardship Initiative that support nutrient management and soil health best practices within targeted areas in the Lake Erie basin.*

Proposed Action: *In collaboration with stakeholders, Ontario is developing an Agricultural Soil Health and Conservation Strategy to support agricultural soil management practices that provide economic, environmental and social benefits to Ontario. A document was released for public input titled “Sustaining Ontario’s Agricultural Soils: Towards a Shared Vision” proposing to build a collaborative framework for developing the strategy, which includes a draft vision, goals and objectives. The importance of long-term soil health is also featured in Ontario’s recently released Climate Change Action Plan and the government intends to provide further support for soil health initiatives.*

Proposed Action: *Ontario will continue to work with the agricultural sector to enhance and promote environmentally sustainable best practices, including the development of information and tools to increase use of cover crops during the non-growing season to reduce soil loss and field runoff.*

Proposed Action: *In an effort to support evidence based decisions to ensure healthy lands and waters, Ontario will develop a publicly available digital elevation model of the Lake Erie watershed (based on LiDAR technology) to assist all stakeholders with environmental stewardship planning.*

Natural Heritage

Actions to improve and restore natural areas provide enhanced opportunity for improving the overall health of Lake Erie. For example, wetlands can act as a natural feature for capturing phosphorus.

Proposed Action: *Through the implementation of the proposed Wetland Conservation Strategy for Ontario, we will improve wetland protection through strengthened policies to stop the net loss of wetlands and sustain essential ecosystem services, including improved water quality.*

Proposed Action: *Ontario will explore opportunities to target funds for wetland restoration/rehabilitation in priority basins.*

Proposed Action: *Continue to participate in partnerships such as the Ontario Eastern Habitat Joint Venture that work to promote and conserve Ontario’s wetlands.*

Science, Monitoring and Public Reporting

Monitoring loadings and tracking progress to achieve nutrient reductions will be essential for ensuring that actions are making a measurable difference to Lake Erie’s water quality.

Proposed Action: Enhanced monitoring will be undertaken in the Thames River watershed and in Lake St. Clair to better understand the sources and types of phosphorus that are feeding algal growth.

Proposed Action: Ontario will work with its partners to provide an annual update on Lake Erie through its website, and produce a progress report every three years.

Great Lakes Protection Act, 2015:

Ontario's Great Lakes Protection Act, 2015 provides new tools that can help address algal blooms in Lake Erie. The Act enables partners to come together to achieve shared goals in a particular watershed or geographic area in the Great Lakes-St. Lawrence River Basin. The GLPA commits the Minister of the Environment and Climate Change to set at least one target by November 2017 to assist in the reduction of algal blooms.

The Minister of the Environment and Climate Change is adopting a target of 40 percent phosphorus load reduction by 2025 (from 2008 levels), using an adaptive management approach, for the Ontario portion of the western and central basins of Lake Erie, as well as an aspirational interim goal of a 20 percent reduction by 2020, in order to assist in the reduction of algal blooms under Part IV subsection 9 (2) of the GLPA. These targets are consistent with efforts being pursued under COA for which an Action Plan for Lake Erie is currently being developed. Ontario recognizes that these targets will need continual assessment based on best available information. To that end, Ontario will work with its partners and apply an adaptive management framework so that targets and actions could be refined as needed based on monitoring, performance measures, and evolving science and information. The Province will report every three years on progress on these targets, as part of regular Great Lakes progress reports mandated under section 8 of the GLPA.

Subsection 9 (4) requires that for each target established, the area to which the target applies must also be specified, and the manner in which public bodies (such as provincial ministries, municipalities, and conservation authorities) in that area should take the target into consideration. The target of a 40 percent phosphorus load reduction will apply to the Ontario portion of the western and central basins of Lake Erie, which includes the waters from the outflow of Lake Huron through Lake St. Clair and the outflow of the Detroit River into the western basin itself. The Canada-Ontario Action Plan for Lake Erie, currently under development with all partners, will set out the manner in which public bodies with jurisdiction in that area should take the target into consideration.

Subsection 9 (5) specifies that for any target established under the GLPA, the Minister shall also prepare a plan setting out the actions that shall be taken to achieve the target. The forthcoming Canada-Ontario Action Plan for Lake Erie will serve as the Minister's plan for meeting the GLPA Lake Erie target to assist in the reduction of algal blooms.

Once a binational phosphorus reduction target is established for the Lake Erie eastern basin, MOECC will consult on that proposed GLPA target through a future Environmental Registry posting.

Purpose of Policy:

Ontario recognizes that we need to work with all partners to take action now on Lake Erie. Clear targets and a coordinated approach involving actions from all sectors and communities across the basin will help us protect Lake Erie from further deterioration.

Ontario is seeking early public input on proposed actions relating to phosphorus load reduction which will ultimately support the development of the draft Canada-Ontario Action Plan for Lake Erie. A second opportunity for public comment will be provided when a draft Lake Erie Action Plan is developed.

In addition, this notice sets out Ontario's target of a 40 percent phosphorus load reduction by 2025 (from 2008 levels), using an adaptive management approach, for the Ontario portion of the western and central basins of Lake Erie, as well as an aspirational interim

goal of a 20 percent reduction by 2020, in order to assist in the reduction of algal blooms under Part IV subsection 9 (2) of the GLPA.

Input received will help inform the development of the draft Action Plan for Lake Erie under COA, and support a number of Ontario's Lake Erie commitments under the GLPA, Collaborative Agreement, and Joint Action Plan with U.S. states.

Some questions to guide discussion and input:

1. Do you have any feedback or input on the proposed actions outlined in this notice, which will ultimately support the development of the draft Canada-Ontario Action Plan for Lake Erie?
2. Are there other actions for Lake Erie that should be pursued in specific parts of the watershed or from specific sources within the Lake Erie basin?
3. As all sectors and communities within the Lake Erie basin need to take action to reduce phosphorus loads, do you have any recommendations on how to encourage collaborative action across the basin? Are there specific actions that you or your sector or community are taking or considering?
4. Tracking progress will be essential for ensuring that actions are making a measurable difference to Lake Erie's water quality. Do you have any specific ideas for measuring progress towards achieving Lake Erie phosphorus load reduction targets?

Public Consultation:

This proposal has been posted for a 45 day public review and comment period starting October 06, 2016. If you have any questions, or would like to submit your comments, please do so by November 20, 2016 to the individual listed under "Contact". Additionally, you may submit your comments on-line.

All comments received prior to November 20, 2016 will be considered as part of the decision-making process by the Ministry if they are submitted in writing or electronically using the form provided in this notice and reference EBR Registry number 012-8760.

Please Note: All comments and submissions received will become part of the public record. Comments received as part of the public participation process for this proposal will be considered by the decision maker for this proposal.

Your personal information may be used in the decision making process on this proposal and it may be used to contact you if clarification of your comment is required. It may be shared (along with your comment) with other Ontario Ministries for use in the decision making process. Questions about this collection should be directed to the contact mentioned on the Proposal Notice page.

Other Public Consultation Opportunities:

As excess nutrients and associated algal blooms pose a threat to water quality and drinking water supplies for millions of Ontarians, it is vital that strong collaboration by all sectors be an integral part of any action plan that is developed.

Canada and Ontario will continue to engage with the Great Lakes community, including First Nations and Métis representatives and specific sectors on the development of the draft Action Plan for Lake Erie.

A Lake Erie Nutrients Working Group has been established as a platform for sharing multi-sectoral perspectives, identifying potential actions, and for providing input and advice on the development of a draft Action Plan. It includes technical experts and community leaders who are providing strategic advice on potential actions to reduce phosphorus loads and algal blooms. This Working Group includes representation from the following sectors and communities: municipal, agricultural, conservation authorities, First Nations, Métis, environmental, industrial/commercial, academic/science, tourism, cottagers, fisheries, and general public.

Further engagement opportunities will be identified as the draft Canada-Ontario Action Plan for Lake Erie is developed.

Appendix 'B'

Staff comments to the EBR Registry Number: 012-8760

November, 2016

City of London, Ontario

RE: EBR Registry Number: 012-8760

1. Extend the deadline so Municipal Councils can become involved. Alternatively, receive comment endorsements after the deadline.
2. The development of the DAP should be considered a Master Plan EA covering Phases 1 and 2. The problem has been defined (too much phosphorus), the solution agreed upon (40% reduction in phosphorus loading), and public and First Nations consultation has taken place. The requirement to complete MCEA's can add years of time and substantial costs to complete proposed DAP projects.
3. The descriptor "tertiary level of treatment" is not defined in the EBR Posting. With rapid improvements in wastewater treatment technologies significant reductions in phosphorus can be made without going to what may be considered "tertiary treatment". Without a definition of tertiary treatment included in the posting, innovation and cost control may be hampered when implementing Domestic Action Plans. Allow cost effective technical solutions to be determined that achieve the targeted outcome for point sources.
4. *"While the relative contribution from urban point sources is estimated to be approximately 10 to 15 percent of the total load across the basin, potential gains for phosphorus reduction from this source can be made."* Assuming this 10 to 15% is for the entire Lake Erie Basin, an estimate of the Urban point source load for the Thames River Watershed should be determined and broken down for each point source.
5. The Plan should address the significant knowledge gap and control opportunity that exists in the Lower Thames River watershed where extremely flat, agricultural lands are drained by an extensive pumping system that responds to changing water levels in both the Thames River and Lake St. Clair. The flat topography in this area of the watershed does not permit unassisted drainage. This point was advanced during the Source Water Protection process and watershed characterization work.
6. The points made about Science, Monitoring and Public Reporting are critical to the success to reducing phosphorus loading to the Thames River Watershed and to Lake Erie itself. Not only is there much needed work necessary to better understand and monitor phosphorus loadings in the Lower Thames River Watershed but there also needs to be an understand of how the river's flow regime takes place from Thamesville to the mouth to the Thames River. This understanding is sorely lacking and therefore it is also poorly understood how this lower watershed impacts Thames River Watershed phosphorus loadings to Lake Erie.

There also needs to be established recognized monitoring methods in order that the largest existing data sets can be fully utilized and in order to complete "apples to apples" comparisons of measured phosphorus loading and concentrations going forward. All water chemistry and benthos testing needs to be standardized provincially, federally and bi-nationally.

If meeting the bi-nationally agreed to phosphorus reduction targets are of such great importance to the health of tributary watershed and Lake Erie then there needs to be some Provincial and Federal commitments made regarding existing and new monitoring stations, sampling points and testing procedures that will not be subject to changes due to changes in provincial and federal governments.

If the Provincial and Federal Governments are unable to make such commitments then the responsibility for establishing, operating and maintaining the Science, Monitoring and Reporting Action Plan components should be removed from their jurisdiction and managed by another agencies such as the Ontario Conservation Areas.

Additionally, enhanced monitoring needs to be established now in a way to be able to undertake the next wave of nutrient monitoring / chemical monitoring / pharmaceuticals monitoring.

7. Point Source – Collection System Infrastructure: The plan should identify what can be done from a regulatory perspective to assist Municipalities regarding the private side inflow and infiltration excess flows to the sanitary sewer system that is the main cause for system overflows and bypasses.
8. Provide the 2008 starting point figures by source category, and targeted end points so London can plan its work to meet targets.
9. The posted plan references the Clean Water and Wastewater Fund (CWWF) as a source of funding to achieve the target. The CWWF is intended to address local issues (*“Ontario communities can address their specific infrastructure priorities” – Sohi*); however, meeting Federal and Provincial commitments made with another country is an added objective that should be recognized financially in addition to the CWWF. London rate payers and priorities should be supported to the same extent as any other city in Canada who are not faced with such additional requirements. The additional funding should be separate, distinct and not managed under the CWWF – this allows for it to be managed on its own schedule tied to the DAP objectives.
10. Immediately implement a mass balance study on the Thames and a comprehensive monitoring program of the watershed. The “Adaptive Management Approach” needs the results of these early in the program.
11. London has been leading the charge regarding holistic, watershed-based analysis of the Thames River since initiating the Thames River Clear Water Revival in 2008. This initiative now provides the basis for much of the knowledge pertaining to the current water quality of the entire Thames River. Enhanced funding for this initiative will complement the existing work.
12. London’s data set on river water quality spanning over 40 years is the highest quality and longest continuous record in the watershed. It was unaffected by the cost-cutting decisions of the provincial government in 1996 to shrink budgets and curtail environmental monitoring.
13. London possesses three branches of the Thames River – North, South and Main – making it a geographic location prime for monitoring progress on water quality improvements including phosphorus reductions. A proposed project design has been submitted under Phase 1 of CWWF.

14. "Heritage phosphorus" exists in the sediments of reservoirs and behind weirs and dams. Some recognition of this source and possible treatment should be explored for the flood control sites at Wildwood, Pittock and Fanshawe Dams in addition to smaller weirs and dams.
15. A better understanding of groundwater phosphorus loadings in the Thames River Upper Watershed needs researched, measured and included in the DAP.

Appendix 'C'

Lake Erie Nutrients Working Group**TERMS OF REFERENCE**

1. Background

Canada and Ontario are taking action to restore and protect the health of Lake Erie by working with all levels of government, as well as partners in the Great Lakes community, to develop actions for a Canada-Ontario Domestic Action Plan for Lake Erie (DAP) under the Canada-U.S. Great Lakes Water Quality Agreement, 2012 (GLWQA) and through the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, 2014 (COA).

The draft Canada-Ontario DAP will contain actions to reduce excessive phosphorus loads and algal blooms, and help meet the 40 percent phosphorus load reduction targets established for the western and central basins of Lake Erie, and any future target(s) established for the eastern basin.

In addition, Ontario has commitments under the Western Basin of Lake Erie Collaborative Agreement and the Great Lakes Commission's Lake Erie Nutrient Targets Working Group Joint Action Plan. Ontario's Great Lakes Protection Act, which came into effect in November 2015, commits the Minister of the Environment and Climate Change to set at least one target for algal blooms and associated action plan by November 2017. Ontario plans to meet all its commitments on Lake Erie through the development of one plan – the Canada-Ontario DAP.

2. Purpose

The Lake Erie Nutrients Working Group is being established to help develop the draft Canada-Ontario DAP and serve as a platform for sharing multi-sectoral perspectives, identifying potential actions, and providing input and advice on the development of the DAP. The Working Group is not a decision-making body and will consist of technical experts and community leaders who will provide strategic advice on potential actions to reduce phosphorus loads and algal blooms.

In addition to GLWQA and COA commitments, the Working Group may also be asked to provide input to provisions relating to target setting and associated action plan under Ontario's Great Lakes Protection Act.

Participants

Participants of the Working Group are invited based on their interest and expertise in Lake Erie nutrients issues and priorities, and will represent the views of their respective sector/community, where possible. Participants will be expected to share their expertise/perspective at meetings and to share outcomes with their respective sector/community as needed. Participation may be fluid to reflect agenda items being discussed.

Participants of the Working Group will include representatives from the following sectors/communities:

- First Nations
- Métis
- Federal Departments
- Provincial Ministries
- Municipalities
- Agricultural
- Conservation Authorities

- Environmental
- Industrial/Commercial
- Academic/Science
- Tourism
- Cottagers
- Fisheries
- General Public
- Any other experts that may be identified by the Working Group as appropriate

If a Working Group participant is unable to attend a meeting, an alternate representative from their respective sector/community can be suggested to the Co-chairs and attend the meeting on their behalf.

There will be no per diem for participants.

3. Meeting Format

Meetings of the Working Group will be set up to foster a collaborative dialogue on Lake Erie nutrient issues and priorities. Canada and Ontario will set up, communicate relevant information, and share supporting materials for each meeting. Every effort will be made to send out meeting materials at least three (3) business days in advance of meeting dates

3.1 Co-chairs

The Working Group will be co-chaired by Environment and Climate Change Canada and the Ministry of the Environment and Climate Change. The Co-chairs will organize meetings of the Working Group, at which participants are expected to attend and contribute to discussions. Agriculture and Agri-Food Canada, and the Ministries of Agriculture, Food and Rural Affairs and Natural Resources and Forestry will be active participants of the Working Group and depending on agenda items/issues being discussed may chair and/or lead discussions.

3.2 Frequency, Duration and Location

Approximately four meetings will be held over the next year and be half or full-day in length (either in person or virtual meetings, i.e., webinar, teleconference). Shorter virtual meetings may also be held (as needed).

Appendix A Participant Roles and Responsibilities

Government Agencies

- Environment and Climate Change Canada and the Ministry of the Environment and Climate Change will co-chair the meetings and provide secretariat support
- Agriculture and Agri-Food Canada and the Ministries of Agriculture, Food and Rural Affairs and Natural Resources and Forestry will support meetings as needed and depending on agenda items being discussed help chair meetings
- Agencies will foster a discussion on potential actions that could reduce phosphorus inputs to Lake Erie. Actions that come out of discussions may potentially be included in draft Canada-Ontario DAP
- Agencies will propose areas of potential collaboration, priorities for action, and potential projects to help restore and protect Lake Erie, with a focus on the Thames watershed and Leamington area tributaries

Working Group Participants

- Participants of the Working Group will be asked to provide input, advice, and support for delivering commitments related to the following:
 - Potential actions to reduce phosphorus loadings in the Lake Erie basin

- Development of draft Canada-Ontario DAP for Lake Erie
 - Nutrient efforts under COA and GLWQA Nutrient Annexes
 - Ontario's Great Lakes Protection Act, including target(s) and associated action plan
- Provide information or share findings with the Great Lakes Guardians' Council as appropriate
 - Provide input to the Co-chairs on potential agenda items and potential invitees
 - Represent their respective sector/community and communicate back on meeting outcomes as needed

Appendix 'D'

Phosphorus in Point Sources vs Non-point Sources

....There is consensus on both sides of the border that phosphorus is the primary nutrient that needs to be reduced. A number of contributing factors have been linked to algae such as increased loads of soluble reactive phosphorus (a form of phosphorus that is easily absorbed and available to algae), invasive species such as zebra mussels, changes to agricultural systems, and changes in climate....

....The amount of phosphorus going into Lake Erie is variable and is dependent in large part on runoff from the land, and therefore is heavily influenced by weather which varies from season to season and from year to year. Phosphorus loads tend to be highest in late winter and spring, and years that receive more rain will generally have higher loads of phosphorus than drier years. Sources of phosphorus entering Lake Erie are generally considered to be either point sources (e.g., municipal and industrial wastewater treatment plants) or non-point sources (e.g., agricultural and stormwater runoff). For example, high runoff from fields can cause high phosphorus loadings during wet weather, while loadings are lower in dry conditions. Given the number and types of sources, multi-jurisdictional and multi-stakeholder collaboration and partnerships are essential for reducing nutrient loads to Lake Erie.

Point sources tend to be measured on a regular basis and their variability is relatively low because treatment processes are controlled, resulting in discharges with a fairly constant quality. Non-point sources are highly variable in quality and quantity over the course of a year and loads are more difficult to measure.

In the Ontario portion of the Lake Erie basin, similar to the U.S. portion of the basin, a significant majority of the loads are from non-point sources.....

Phosphorus entering Lake Erie occurs in two basic forms, dissolved (soluble reactive) phosphorus (passes through a 0.45 micron filter) and particulate phosphorus (trapped on a 0.45 micron filter, associated primarily with inorganic sediments; lesser amounts in organic particulate matter or incorporated into living organisms, such as algae or bacteria). Together these two types of watershed borne phosphorus components comprise total phosphorus, which is directly analyzed in most phosphorus loading studies.

These two forms of phosphorus have varying degrees of bioavailability, i.e. the ability to support algal growth. Most of the dissolved phosphorus occurs as dissolved reactive phosphorus which is 100% bioavailable. While particulate phosphorus is mostly unavailable to algae, 25-50% bioavailable, the portion that is bioavailable may settle to the lake bottom before being released to support algal growth.

Phosphorus loading to Lake Erie comes from two major types of Sources. External sources (which can be directly measured) and internal sources (released from lake sediments and are relatively difficult to measure).

External phosphorus loading is comprised of four major sources:

1. Outflow from Lake Huron (a minor component for Lake Erie)
2. Atmospheric deposition (a minor component for Lake Erie)
3. Point sources (municipal and industrial wastewater treatment effluent)
4. Nonpoint sources (agricultural and stormwater runoff)

Point sources have the following characteristics:

- They are comprised primarily of dissolved reactive phosphorus and consequently are highly bioavailable.
- They are, for the most part, discharged in roughly equal daily amounts throughout the year.
- They are relatively easy to measure and therefore easy to regulate.

- Their loading can be reduced through point source controls.

Nonpoint sources of phosphorus have the following characteristics:

- They are comprised primarily of particulate phosphorus.
- The particulate phosphorus has relatively low bioavailability.
- They are delivered to the lake in pulses associated with runoff events.
- They are relatively difficult to quantify and therefore more difficult to measure and to regulate.
- Their loading is highly variable from year to year due to changing weather conditions (i.e. annual rainfall, temperature, wind).
- Load reductions are generally achieved by adoption of “best management practices” (BMPs).

Appendix 'E'

Ongoing City of London Programs**Point Source:**Collection System Infrastructure Improvements

Unlike at our WWTP's, phosphorus loadings from collection system infrastructure is estimated rather than measured. It is therefore difficult to gauge what types of reduction amounts will be made from reducing collection system overflows and bypasses. This only highlights the need for long term, watershed wide monitoring programs.

However, regarding the collection system infrastructure, London is in a good position. The service is fully funded and financially sustainable improvement programs are in place to not just replace old infrastructure (Infrastructure Replacement Program) but to also reduce overflows and bypasses both for the collection system and for the WWTP facilities.

With regards to overflows and bypasses, combined sewers are not the biggest cause of these for the City of London. The definition used for combined sewers are sanitary sewers that have catch basins directly connected to them. By the end of 2016 there will be in the sanitary collection system 19.5 km of combined sewers or 1.4% of the entire collection system network.

Based on current resource allocation plans and budget forecasts (i.e. not including CWWF projects), 80% of the combined sewers are planned to be replaced by 2029 leaving 0.3% of the total system as combined sewers by 2030.

Table 3 – Eliminating Combined Sewers in London

Year	Total Length of Combined Sewers	% of total wastewater sewer system	Combined Sewers Separated
2015	21.75 km	1.6 %	2.2 km
2016	19.5 km	1.4 %	ongoing
2017 to 2029 (projected & budgeted)	Reduced to 3.9 km	0.3%	15.6 km (or 26ubwate. 1.5 km / year)

Basement Flooding Reduction Efforts

Overflows and bypasses occur when sanitary sewers become overloaded during heavy rainfall events when too much storm water enters the sanitary system. The primary cause of this in London is not the existence of combined sewers, but the direct connection of weeping tiles (foundation drains) to the City's sanitary sewer infrastructure. Homes generally built between the 1920s and 1980s are likely to have their weeping tile connected to the sanitary sewer. Subdivisions built post 1985 have sump pits and sump pumps in the basement which collect weeping tile flow and discharge it to the ground surface outside of the home or to a private storm drain connection. It is estimated that there are approximately 50,000 homes in London with weeping tiles directly connected to a City sanitary sewer. These extraneous weeping tile flows can overwhelm sanitary sewers during significant rainfall or snowmelt events, which in turn cause not only sanitary system overflows and bypasses but can also back up into basements through floor drains and basement plumbing fixtures.

In decades past, a solution to localized basement flooding occurrences was to relieve overwhelmed sanitary sewers by cross connecting them to the storm sewer system. When the sanitary sewer becomes surcharged the excess flow travels through the overflow connection into the storm sewer system and then into the Thames River. Basement flooding problem solved; however, the City is left with these legacy cross connections that send untreated, although very diluted, wastewater to the Thames River.

The City has maintained records of all homes that have participated in the voluntary Basement Flooding Grant Program since its inception in 1985. To date, approximately 3% of the 50,000 homes that have weeping tiles connected to the sanitary sewer system PDC have participated in this voluntary disconnection program.

Pollution Prevention Control Plan

To tackle these sanitary to storm sewer cross connections the City of London is currently undertaking a Pollution Prevention and Control Plan (PPCP) to address and mitigate 149 confirmed sanitary sewer to storm sewer system cross connections.

The Pollution Prevention Control Plan is wrapping up Phase II this year and Phase III, the setting of cross connection removal priorities, will be undertaken and completed in 2017. The completion of Phase III will help to inform future budget forecasts for the sustainable removal of these system cross connections.

Inflow and Infiltration Reduction Pilot

To tackle the private side weeping tile connections a voluntary weeping tile disconnection pilot project was completed in the Sherwood Forest area on Blanchard Crescent.

Blanchard Crescent historically had basement flooding resulting from overloaded sanitary sewers during heavy rainfall/snowmelt events, due to private side weeping tile connections to the sanitary sewer system. A pilot project in 2013 tested an alternative method of source control through disconnection of weeping tile from the sanitary sewer, which involved the City undertaking remedial work on private property and within homeowner's basements. This approach was undertaken to remove excess water flows entering the sanitary sewer system at the source rather than try to accommodate excess flows by building a storage facility and/or upsizing sewer pipes, which were deemed to be more expensive and potentially less effective options.

Following the project completion, staff reported a dramatic decrease in sanitary flows due to reductions of the inflow of water during wet weather events.

This disconnection program will be offered to five other neighbourhoods in 2017.

Non-Point Source:

Low Impact Development

The Proposed Action to mitigate sources of phosphorus from stormwater urban runoff has been identified as implementing Low Impact Development (LID) measures. LIDs are stormwater management systems, also referred to as "green infrastructure," that are designed to complement "grey infrastructure" (i.e. sewer pipes and storm ponds) by capturing rainwater before it enters the stormwater system. LID systems incorporate infiltration to decrease urban runoff volume, promote groundwater recharge, improve water quality, mitigate sanitary sewer overflows, and better mimic the natural water cycle. Common examples of LID measures include bioswales (specially designed vegetated ditches), rain gardens, permeable pavers, green roofs, and perforated pipe systems.

The Ministry of Environment and Climate Change (MOECC) has concluded that by increasing infiltration through LIDs and reducing runoff volumes, phosphorus loadings will also be reduced. The MOECC is currently developing a provincial guidance manual for LIDs to be released in 2017. The City of London is participating in the stakeholder review group of the guidance manual as a representative of the Municipal Engineers Association (Ontario). Once the manual is released, it is anticipated that municipalities will be required to meet infiltration targets for stormwater runoff of new and retrofit developments.

The Stormwater Engineering Division has been preparing for the upcoming regulatory changes in several ways. In addition to participating in the MOECC stakeholder review group, an LID implementation strategy is being developed in-house, pilot projects are being designed for 2017 construction, and a subwatershed-wide Municipal Class Environmental Class Assessment (EA) has been initiated to include LID technologies.

Low Impact Strategy

The main goal of the LID strategy will be to incorporate LIDs into the City's design standards and construction for stormwater management on municipal road projects, new site plans and subdivisions, as well as retrofits. To do this, it will be necessary to review appropriate LID technologies and consider the associated risks to public safety, capital/lifecycle costs, ongoing maintenance, and encroachments with utilities.

A guiding principle of the LID strategy will be to apply the "right LID technology to the right project" and ensure a suitable level of maintenance for each site. To this end, implementation will consider sustainability for the municipality from environmental, economic, and social perspectives.

Low Impact Pilot Projects

Six pilot projects have been initiated to include LIDs within municipal infrastructure including arterial road reconstruction (Commissioners Road West Phase 2 and Sarnia Road Phase 2), the 2017 Infrastructure Renewal Program (SoHo/Waterloo Street and Oakridge) and site plans for City facilities (Southwest Community Centre and Fire Hall 11). More information regarding the City's pilot projects and the LID strategy will be presented to Civic Works Committee in January, 2017.

Subwatershed-wide Environmental Assessment

The City initiated the Dingman Creek EA in November 2015. The study area covers Dingman Creek's 17,200 hectare watershed, which is a tributary of the Thames River, and includes evaluating stormwater management strategies for lands in South London, including the limits of the Southwest Area Secondary Plan, Innovation Industrial Park, and the 401/402 corridor. The Dingman Creek EA is being prepared by Aquafor Beech, who is also the MOECC's consultant working on the provincial LID guidance manual. In this way, the stormwater management strategy for growth in South London will reflect the most up-to-date provincial stormwater management policies.

The proposed options to be considered as part of the Dingman EA process will include implementing LIDs as part of the stormwater management system as well as a strong emphasis on connecting the Natural Heritage System through developing a "complete corridor" to convey water, people, and wildlife.

The EA will establish goals, objectives, indicators and targets to improve water quality and connectivity of woodlands and wetlands. One of the main indicators of water quality will be phosphorus. The anticipated outcomes of the EA will contribute to meeting the objectives of phosphorus reduction in the Lake Erie basin through LIDs as well as wetland habitat restoration.

The measurement and monitoring of phosphorus reductions resulting from these initiatives will be a key success indicator in any long term phosphorus reduction strategy.

Science, Monitoring and Public Reporting:

These points are critical to the success of any proposed watershed action plan. Not only is there much needed work to be completed to better understand and monitor phosphorus loadings in the Lower Thames River Watershed but there is also a need to understand how the river's flow regime takes place from the downstream community of Thamesville westward to the mouth to the Thames River at Lighthouse Cove. This

practical understanding is lacking and therefore it is also poorly understood how this lower watershed impacts the Thames River phosphorus loadings into Lake Erie.

There also needs to be established recognized monitoring and testing methods in order that existing data sets can be fully utilized and in order to complete “apples to apples” comparisons of measured phosphorus loadings and concentrations. All water chemistry and benthos testing should be standardized provincially, federally and bi-nationally. London has the most comprehensive and longest (time period) river water quality data set encompassing 40 years.

If meeting the bi-nationally agreed to phosphorus reduction targets are of such great importance to the health of tributary watersheds and Lake Erie then there needs to be some Provincial and Federal sustainable commitments made regarding existing and new monitoring stations, sampling points and testing procedures that will not be subject to changes in Provincial and Federal governments.

Should the Provincial and Federal governments be unable to make such commitments then the responsibility for establishing, operating and maintaining the Science, Monitoring and Reporting Action Plan components should be established in another jurisdiction and managed by other agencies such as the Ontario Conservation Authorities. Additionally, enhanced monitoring needs to be established now in a way to be able to undertake the next wave of nutrient monitoring / chemical monitoring / pharmaceuticals monitoring.

Modeling experts from the United States and Canada used nine different computer simulation models to correlate changes in phosphorus levels with levels of algal growth. By comparing and contrasting the results of these models, the GLWQA Nutrients Annex Subcommittee was able to arrive at phosphorus load reduction targets, calculated using 2008 data.

However one must keep in mind that these are just models. It is imperative for the success of any phosphorus reduction strategy for monitoring needs to be improved and maintained in order to test, confirm and adjust these models and their outputs using real data, over a long period of time.

Other:

Reductions to phosphorus loading of the Thames River is also inherent in London lifecycle infrastructure programs that reduce pipe inflow and infiltration and growth projects that include stormwater management.

London supports research and commercialization, most notably the Western University TRESS facility that has specifically been studying algae growth in London streams, and an upcoming proposal to partner with Western again, this time on the full scale performance testing of Low Impact Development techniques at removing phosphorus from urban stormwater runoff.