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TO:	**CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON APRIL 24, 2017**
FROM:	**KELLY SCHERR, P.ENG., MBA, FEC MANAGING DIRECTOR, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER**
SUBJECT:	**PARTNERING IN PHOSPHORUS CONTROL: ACHIEVING PHOSPHORUS REDUCTIONS IN LAKE ERIE FROM CANADIAN SOURCES (EBR Registry Number: 012-9971)**

RECOMMENDATION

That, on the recommendation of the Managing Director Environmental and Engineering Services and City Engineer, the following actions **BE TAKEN** with respect to the Environmental Bill of Rights (EBR) posting regarding phosphorus reduction in Lake Erie from Canadian sources:

a) The following report **BE RECEIVED** for information; and

b) Comments on EBR Registry Number 012-9971 (attached as Appendix 'B') **BE ENDORSED**.

PREVIOUS REPORTS PERTINENT TO THIS MATTER

"Lake Erie Bi-National Phosphorus Reduction Target and Comments on Reducing Phosphorus to Minimize Algal Blooms in Lake Erie – EBR Registry Number: 012-8760", Civic Works Committee, November 29, 2016.

2015-2019 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 the Municipal Council on the proposed actions of the Canada-Ontario Draft Action Plan in achieving phosphorus reductions in Lake Erie from Canadian sources, and the effects of these actions on the Thames River watershed.

CONTEXT:
Elevated nutrient levels in the Great Lakes can significantly degrade overall water quality and cause undesirable outcomes such as low oxygen zones and excessive plant growth, and ultimately, trigger harmful and nuisance algal blooms in the lake. These algal blooms impact our ecosystems, fish populations, drinking water quality, degrade

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our beaches and pose a risk to human health by exposure to bio-toxins, as produced by cyanobacteria.

Phosphorus typically limits primary production in freshwater ecosystems and is therefore the main contributing factor to eutrophication (excessive nutrients and oxygen depletion in the water body) and excessive algae growth. To address the issues in the Great Lakes, Canadian and US Governments are working together to reduce phosphorus by 40% from its 2008 levels by 2025 in order to better control nutrient concentrations. The Provincial Environmental Bill of Rights (EBR) posting titled, *Partnering in Phosphorus Control: Achieving Phosphorus Reductions in Lake Erie from Canadian Sources* (EBR Registry Number: 012-9971), which highlights strategies for achieving phosphorus reduction on the Canadian side of Lake Erie, seeks public comments and ideas on the proposed actions to take forward to the final Action Plan. This Action Plan is set to be finalized by 2018 and will identify specific actions for each sector to achieve in order to meet the phosphorus reduction target.

The proposed strategies outlined in the Draft Action Plan are designed to meet commitments under the Canada-US Great Lakes Water Quality Agreement (2012) and the Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (2014). Sections of the EBR posting are included with this report as Appendix 'A'.

Excerpts from the EBR posting included in the main body of this report will be shown in *italics*.

EXECUTIVE SUMMARY

A draft Action Plan (Domestic Action Plan, as referenced in the Canada-US Great Lakes Water Quality Agreement), was released on March 10th, 2017 and is seeking input regarding the proposed actions for reducing phosphorus to the Lake Erie Basin. Excessive phosphorus loading into Lake Erie can significantly degrade overall water quality and cause undesirable outcomes such as low oxygen zones and excessive plant growth, and ultimately, trigger harmful and nuisance algal blooms in the lake. To overcome these negative outcomes, and improve the health of not only the Lake Erie basin, but also the Thames River watershed, targets, including a 40% reduction in spring loads of total phosphorus and soluble reactive phosphorus for priority tributaries were set. The EBR posting highlights proposed actions to be taken to achieve these targets. Comments regarding this draft Action Plan are being accepted until May 9th, 2017. A final Action Plan is set to be released by 2018.

As highlighted in the proposal for this Action Plan, the Governments of Canada and Ontario have agreed to achieve a bi-national phosphorus reduction target of 40% from the base year of 2008 by 2025. For Canada-Ontario this means a reduction in annual phosphorus loadings to Lake Erie of 212 tonnes (6%). For the US, the reduction in annual phosphorus loadings equates to 3,315 tonnes (94%). In Canada, one of the most significant contributors to the phosphorus loading to Lake Erie is the Thames River, which flows into Lake St. Clair. Along this major tributary, approximately 15% of the phosphorus loads are thought to originate from urban sources, whereas 85% of the total loads are from agricultural and rural sectors (non-point sources).

One of the proposed actions involves establishing a legal effluent discharge limit of 0.5 mg/L total phosphorus for all municipal wastewater treatment plants exceeding an average annual flow capacity of 3.78 MLD. Initially, implementing tertiary level

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treatment was highlighted as a potential strategy to achieve reduction targets. The draft Action Plan has clarified that achieving reduction levels similar to a tertiary level of treatment will be sufficient, meaning upgrades to secondary level treatment will be acceptable.

There still remains the opportunity to hold other sectors (i.e., agricultural and rural sectors) to the same standard as municipalities. The fertilizer industry has developed, along with other government agencies, a nutrient stewardship program which encourages the optimization of fertilizer use to minimize residuals while maximizing soil conditions and growth. This is a voluntary stewardship program. Acknowledgment has been made in the draft Action Plan to the difficulties in measuring and quantifying phosphorus loading from these non-point sources, however, this should speak to the importance of developing a robust monitoring and sampling program. Supporting the implementation of such a program is necessary to track the success or failure of reduction strategies. It will also allow for more detail on phosphorus loading within the watershed.

The Canada-Ontario Draft Action Plan also speaks to the importance of developing a watershed plan. Currently, an update to the 1975 Water Management Study – Thames River Basin is underway. Representatives from all levels of government, the City of London, Upper Thames River Conservation Authority and First Nations are collaborating through the Thames River Clear Water Revival to create a unified document about the quality and quantity of our shared waters within the watershed. The new river plan will support achieving the Action Plan targets.

Funding for the development of monitoring programs, implementation of urban Best Management Practices (BMPs) and/or municipal upgrades remains vague in the latest Action Plan proposal. The Plan only states that upgrades or investments to wastewater treatment may be applicable under infrastructure or other funding programs. There was no mention of funding for possible stormwater BMPs (i.e., LIDs). Furthermore, support of the development of a possible credit/trading program for phosphorus reduction was mentioned, but lacked any information on details.

DISCUSSION

Reduction Target Overview:

Specific phosphorus reduction targets were adopted in February, 2016 for Lake Erie's western and central basin. A target for the Lake's eastern basin is under consideration, pending further research and monitoring. Specifically, the targets include:

1. *A 40% reduction in spring loads of total phosphorus and soluble reactive phosphorus for the Maumee River to minimize harmful algal blooms in the western basin;*
2. *A 40% reduction from 2008 loadings to the central basin, with a target total binational loading for 6,000 tonnes per year of total phosphorus; and*
3. *A 40% reduction in spring loads of total phosphorus and soluble reactive phosphorus for priority tributaries to minimize harmful algal blooms in the nearshore areas.*

Actions being undertaken by our partners such as agricultural organizations, municipalities, conservations authorities, and First Nations and Metis communities will

be integral to the reduction of phosphorus in Lake Erie basin. Such actions are not yet included in this draft Plan. The intention of the first draft is to therefore invite others to contribute their actions and ideas on how to reduce phosphorus loads from Canadian sources.

- The actions taken by municipalities have yet to be considered in this draft. Comments by 'others' are encouraged. This posting, based on the text above, appears to be directed to solicit comments from the general public rather than sector technical experts. It is expected that more in depth discussions will take place over the course of 2017 on the development of Domestic Action Plans.

Legacy Phosphorus:
Actions to reduce phosphorus over time will help in reducing the amount of legacy phosphorus available to the Lake Erie ecosystem.

Phosphorus can exist in a particulate or dissolved (soluble) form. The combination of these two forms is referred to as total phosphorus. The dissolved form is highly bioavailable and readily taken up by plants, however, it can also lead to eutrophication. Particulate phosphorus is bound to soil particles and is much less bioavailable. Transport of this occurs via water and wind erosion. As mentioned in the November 29, 2016 staff report the term 'heritage' or 'legacy' phosphorus refers to the buildup of soil phosphorus that exceeds crop requirements. Legacy phosphorus can be problematic in the sense that it is characterized by intermediate storage and remobilization along flow paths, such as the Thames River, that are slow and winding between the source and outlet. When reduction measures are implemented, high amounts of legacy phosphorus may mask the benefits of reduction strategies making it difficult to distinguish the reduction efforts from the phosphorus loadings that exist in riverine sediments. Depending on the amount of legacy phosphorus that has accumulated in the soil and riverine sediments, a visible decline in phosphorus loadings from implementation of reduction strategies may take time to become apparent.

Fertilizer use has also changed over the years. While the agricultural sector now uses significantly less fertilizer per unit of crop compared to the 1970-80s, historical applications of nutrients are responsible for accumulation of soil phosphorus in some parts of the basin. These legacy sources of phosphorus have the potential for ongoing contributions to phosphorus loadings.

The 4R Nutrient Stewardship program (Fertilizer Canada, OMAFRA & Ontario Agri-Business Association) aims to help meet provincial objectives to improve water quality to the Great Lakes by inviting farmers to partake in this nutrient planning and management method. The 4R method encourages using the Right Source, Right Rate, Right Time and Right Place to minimize adverse effects of poor fertilizer use. Approximately 67% of farms across Ontario have implemented aspects of this program to their fertilizer application practices to reduce nutrient runoff.

- Encouraging Stewardship within the agriculture communities will be important for the success of the Action Plan. As of 2015, rural and agricultural sectors were responsible for approximately 85% of the phosphorus loading in the Thames River. Holding this sector accountable and encouraging participation in nutrient management programs, such as the 4R Nutrient Stewardship, will aid in achieving the reduction targets.
- Monitoring methods to identify background levels of legacy phosphorus would provide detail on the efficiency of implemented phosphorus reduction strategies.

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- Phosphorus reduction action plans for the agriculture sector continue to be voluntary in nature, while municipal wastewater treatment plants will be regulated with more strict effluent compliance limits on phosphorus concentrations. All watershed sectors should be treated in the same manner.

Land Use and Phosphorus Sources:
With point sources well controlled, most of the phosphorus entering the lake now comes from non-point sources such as agriculture, rural and urban stormwater runoff. Controlling these sources can be challenging because solutions require thousands of individual sites instead of a small number of known point sources, and must be tailored to particular land management and biophysical site characteristics.

Most of the growth is expected to occur around urban centers over the next 25 years. Due to this growth, some agricultural land will be lost and this new development will cause an increase in impervious land. This will result in slightly higher stormwater runoff volumes and peak flow rates. London is the largest urban center in the watershed. It is logical to recognize that with increased growth that wastewater flows will also be increased to our treatment plants. Meeting even more stringent phosphorus effluent concentrations in the future will need to be accounted for in future financial planning for the Wastewater and Treatment Service Area, not just for the estimation of capital works but also for operating costs and the setting of future rates.

Climate Change:
Extreme weather events are now more frequent, and have the potential to increase runoff volume and associated phosphorus. Current climate change model projections suggest that over the next 25 years, Lake Erie will experience slightly greater precipitation during the winter, spring and fall. A warming climate is also expected to decrease snowfall events and increase rainfall events, which will increase runoff and stream flow in the winter. The summers will likely be drier with more frequent extreme storm events leading to flash floods. Increased rainfall and flooding could also lead to more combined sewer overflow or bypass events.

Bare, saturated soils are more susceptible to runoff and erosion, which could result in a greater amount of phosphorus being carried off the land. This can be intensified during storm events and snow melt conditions. For the urban sector, this could result in higher stormwater runoff and increase the instances of overflows and bypass events.

For the agricultural sector, the concern is runoff that occurs in the spring when fertilizer or manure has been applied to bare lands. To limit the amount of phosphorus runoff that could occur in these conditions, some US state jurisdictions (i.e., Ohio) have state regulations that require mandatory training, certification of landowners on fertilizer application, and requirements for several Best Management Practices (BMPs). Offenders are subject to a $10,000 fine if fertilizer is spread during the following three land conditions: on frozen or snow covered lands; when the top two inches of soil are saturated; and when local weather forecasts predict a greater than 50% chance of precipitation exceeding one inch in a 12-hour period of fertilizer application and one-half inch in a 24 hour period for manure application.

- Consideration should be made to control the amount of fertilizer applied to residential lawns and/or to remove phosphorus from lawn fertilizer.

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<u>Phosphorus Loading from Canadian Tributaries</u>:
Most Ontario tributaries in the Lake Erie basin would benefit from reductions in phosphorus, as most of the monitored streams in the Lake Erie basin exceed the Provincial Water Quality Objective for phosphorus concentrations. Loadings to each of Lake Erie's basins are dominated by tributary loadings, which are highly variable from year to year as a result of hydrological and other factors. By contrast, point sources are relatively consistent from year to year.

Most of the current total phosphorus loading to Lake Erie is however the result of inputs from a few major tributaries, the locations of which are illustrated in Figure 1. ***In Canada, the most significant contributors are the Thames River, which flows into Lake St. Clair*** (emphasis added)*, and the Grand River, which flows into the eastern basin. The Sydenham River, which discharges to Lake St. Clair, and Kettle and Big Otter Creeks, which discharge to the central basin, are also significant sources. These larger rivers contain a mix of non-point source pollution, including rural and urban runoff, and point source pollution, including treated municipal sewage. Reducing the phosphorus load from the Thames River is a priority because it contributes to nearshore cyanobacteria blooms in Lake St. Clair and central basin hypoxia. The phosphorus load from the Grand River is potentially a factor in nuisance Cladophora blooms in the nearshore zone of the eastern basin.*

For nearshore areas of Lake Erie, including river mouths and embayments where excess algae occurs as the result of localized discharge from the up-stream watershed, a 40 percent reduction in ***spring total*** *and soluble reactive phosphorus loads (from 2008 levels) from the following watershed is recommended: in Canada, the Thames River and Leamington tributaries (emphasis added); and in the U.S., the Maumee River, River Raisin, Toussaint Creek, Sandusky River and the Huron River.*

- There has been no discussion to date on how the 40% phosphorus target reduction in spring loading is to be met.
- It is unlikely that there will be seasonal phosphorus effluent criteria for municipal wastewater treatment plants.

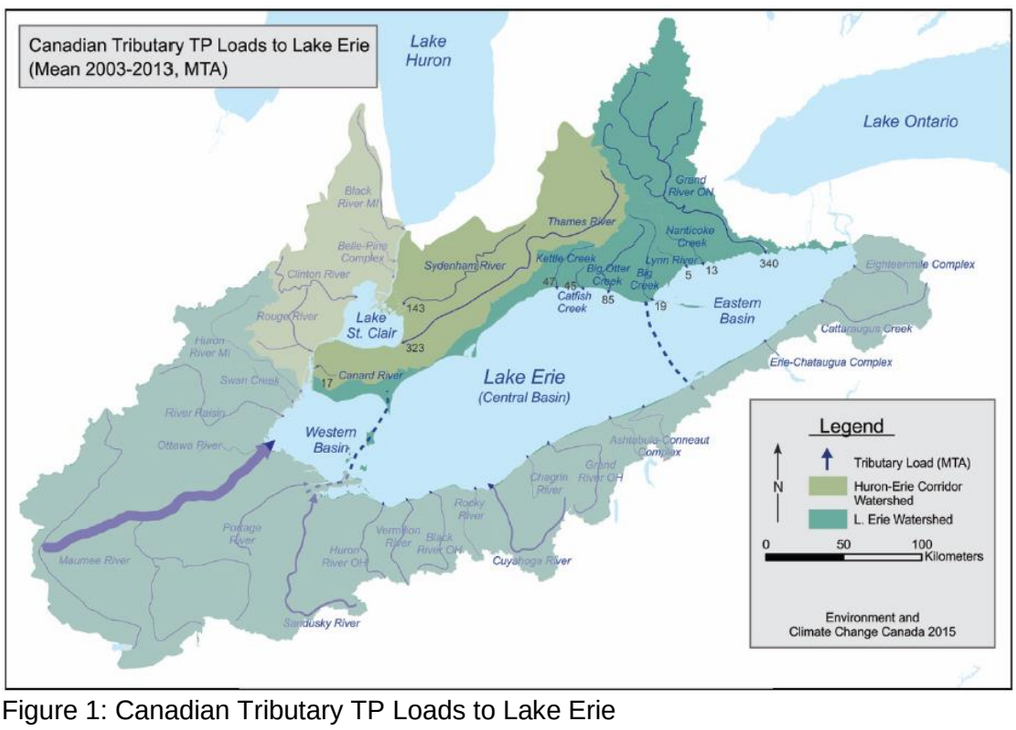

Figure 1: Canadian Tributary TP Loads to Lake Erie

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The Importance of Natural Heritage Features:
Natural heritage features are the "green infrastructure" of the natural environment. They include: structures such as natural channel form, wetlands, and the riparian zone – the area of land adjacent to tributaries and the lake, where vegetation may be influences by flooding or elevated water tables.

The reference to the natural heritage system as "Green Infrastructure" being natural channel form, wetlands and riparian zone is not consistent with previous uses of the term Green Infrastructure (GI). GI is most often associated with Low Impact Development (LID) measures, which are engineered systems meant to mimic nature but are not naturally occurring.

Monitoring of Phosphorus Loads:
While more research and monitoring of these systems are necessary, especially to determine the status and trend of soluble reactive phosphorus, it is clear that some watersheds require focused action to reduce phosphorus loads.

Under Section 3.1 of the draft Action Plan, the importance of monitoring phosphorus loading for the purpose of developing realistic targets and achievable management strategies was highlighted. It mentions that programs are being developed by various government agencies to improve the information on point and non-point loading of phosphorus. More research and monitoring is required, however, to determine the status and trend of soluble reactive phosphorus. Preliminary numbers regarding the total phosphorus loads from the Lake Erie tributaries suggest that some subwatersheds require a more focused action with regards to monitoring.

- Actions suggest that "Canada" will be undertaking all Items, with the exception of Item 4 which will be conducted by "Ontario". From a municipal perspective it should be hoped that the Province and Federal Governments will take leadership on this front. The concern is that this important work will be downloaded to municipalities or Conservation Authorities with no corresponding funding support.

Point and Non-point Sources of Phosphorus:
With point sources well controlled, most of the phosphorus entering the lake now comes from non-point sources such as agriculture, rural and urban stormwater runoff…

There is acknowledgement that modification to municipal systems will not have an adequate impact to meet the required 40% reduction targets, even with regulated and enforced phosphorus limits proposed to control effluent concentrations for municipalities. Other sector participation remains voluntary.

Furthermore, Section 3.3.1 (Estimated Current Phosphorus Loading from Ontario non-point Sources) identifies non-point sources to contribute 71% of total phosphorus loading. Stormwater runoff is lumped in with agriculture runoff.

- A breakdown of non-point source contribution is requested. Literature suggests that urban stormwater runoff represents only a small portion of overall runoff when compared to the amount contributed by agricultural sources.

Actions for Proposed Plan:
The proposed actions of the Plan are highlighted in the Table below. Details for each proposed action can be found in the attached Appendix A.

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Table 1: Summary of the Canada-Ontario Action Plan for Lake Erie

Goal: Reduce Canadian Phosphorus Loadings by 40 Percent				
Category of Action				
Reduce Phosphorus Loadings	**Ensure Effective Policies, Programs and Legislation**	**Improve the Knowledge Base**	**Educate and Build Awareness**	**Strengthen Leadership and Coordination**
Strategic Actions				
A1 Support watershed and nearshore-based strategies and community-based planning for reducing phosphorus loadings	B1 Support and strengthen policies, programs and legislation	C1 Conduct monitoring and modelling	D1 Enhance communication and outreach to build awareness, improve understanding and influence change	E1 Improve communication and coordination
A2 Reduce phosphorus loadings from urban areas[5]	B2 Strengthen decision-making tools	C2 Conduct research to better understand nutrient dynamics in the Lake Erie basin	D2 Share data and information	E2 Establish an adaptive management framework
A3 Reduce phosphorus loadings from agricultural and rural areas[6]		C3 Conduct research to better understand and predict the impact of climate change on the Lake Erie ecosystem		
		C4 Conduct research to improve existing practices and develop new innovative practices and technologies for phosphorus loss reduction		

Proposed actions that are relevant to the City of London are highlighted below. These actions recognize where the City has already completed work towards reduction efforts or where the City may need to make improvements.

A1. Support Watershed and nearshore-based strategies and community-based planning for reducing phosphorus loadings. Several watershed plans, such as the Grand and Thames River, already exist for the tributaries throughout the Lake Erie basin. Supporting the development of additional plans and linking them to nearshore-based strategies and other phosphorus reduction actions at a community level, avoids duplication of effort and ensure that resources are efficiently used.

In 1975, a report titled “Thames River Basin Water Management Study” was prepared by two Ontario ministries (Environments and Natural Resources) which provided broad watershed recommendations. The plan was based on an assessment of the surface and groundwater, land uses, and existing and potential water resource problems at that time. Some of the recommendations in the report included the construction of more dams to control and augment river flows. Currently, an update to the Water Management Plan is underway to include the improved knowledge of the watershed and its systems, evolved BMPs and new water quality and quantity guidelines and standards. The development of the updated plan is being undertaken by the Thames River Clear Water Revival initiative and involves representatives from many levels of government, the City of London, Upper Thames River Conservation Authority and First Nations. The first stage of this multi-year, multi-partnership collaboration will replace and update the 1975 study.

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- The Domestic Action Plan will benefit from the discussions as this plan will provide more detailed information on phosphorus loading.
- Increased and consistent funding from the Province is needed for the Thames River Clear Water Revival initiative in order for it to meet its objectives.

A2. Reduce phosphorus loadings from urban areas

Municipal point sources are now well controlled, with all wastewater treatment plants in the Ontario portion of the basin having at least secondary treatment. However, there are still opportunities to optimize the performance of treatment plants, and to reduce volume and frequency of bypasses and overflows and to reduce loads of urban stormwater…

1. Ontario will work with municipal partners in establishing a legal effluent discharge limit of 0.5 mg/L TP for all municipal sewage treatment plants in the Lake Erie basin that have an average daily flow capacity of 3.78 MLD.

Ontario and its municipal partners will work towards reducing loadings, where feasible, through: (1) upgrades and other modifications to secondary STPs that have an average daily flow capacity of 3.78 million litres or more per day in the Lake Erie basin, with an objective of approaching the phosphorus effluent concentrations achievable through a ***tertiary level of treatment*** (emphasis added)*; (2) improvements to wastewater treatment and collection infrastructure to reduce combined sewer overflows and bypasses, and (3) improvements to stormwater management systems (including facility rehabilitation and incorporation of green infrastructure)…*

3. … Canada and Ontario will promote eligible investments for the reduction of excess phosphorus from point sources such as municipal wastewater treatment systems or municipal stormwater effluent under applicable infrastructure and other funding programs.

4. Ontario will work with developers, municipalities, conservation authorities, and others to promote and support the use of green infrastructure and low impact development for stormwater management… Ontario's draft stormwater LID guidance manual is aimed at assisting proponents in implementing LID and green infrastructure, and will be available for public comment in early 2017.

As previously highlighted, five of the six WWTPs in London have a rated treatment capacity greater than the identified 3.78 MLD. In 2008, the five WWTPs contribution to total phosphorus load was 43 tonnes per year (12.7%) of the total 339 tonnes per year. As of 2015, the loading averages were approximately 33 tonnes per year of total phosphorus. The weighted average of actual performance for total phosphorus effluent from these plants was 0.45 mg/L or less. This is lower than the proposed 0.5 mg/L total phosphorus discharge limit now being suggested.

The binational phosphorus reduction target is 3,527 tonnes per year. The US is to reduce by 3,315 tonnes per year (94%) and Canada by 212 tonnes per year (6%). The total capacity for the five WWTPs in London is approximately 266 million litres per day. If reduction of total phosphorus through tertiary level of treatment is required, then City of London would have to achieve an annual average discharge of 10.3 tonnes, meaning a 32.7 tonnes per year reduction. This breakdown is shown in Figure 2.

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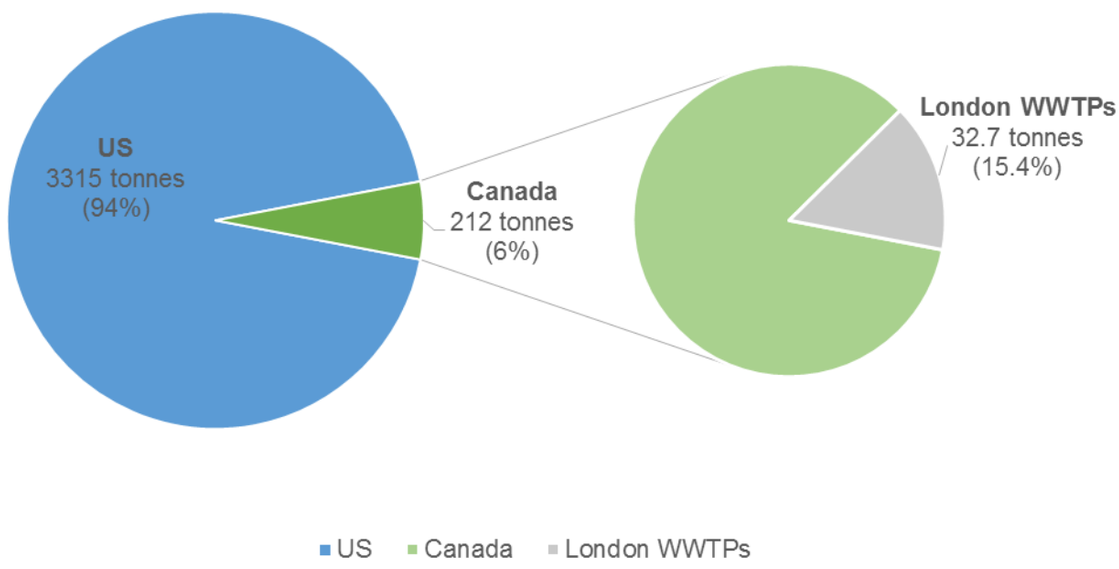

Figure 2: Breakdown of Phosphorus Reductions for US, Canada and London's WWTPs

The LID manual posting has been deferred several times. Draft versions of the document suggest significant additional investments from municipalities to retrofit storm water management controls (quality/quantity) in existing areas. This should be considered in the cost-impact analysis during policy creation and appropriate funding should be considered to support municipalities including, but not limited to, considering a Provincial Sales Tax (as in Minnesota) or other funding program.

- Clarification on "tertiary level of treatment" has been made in the latest plan proposal to indicate that it may not be required if upgrades to secondary level treatments are able to meet such requirements.
- The City of London is currently undergoing optimization of its WWTPs. This optimization will lead to reduced levels of phosphorus discharged from its effluent flow.
- The Plan supports optimization of wastewater plants but does not acknowledge funding for such. Funding sources for upgrades required to meet reduction levels still remain vague.
- Consideration of the cost of implementing stormwater retrofits should be considered when developing policies. Funding sources should be highlighted to support municipalities for these retrofits.

A3. Reduce phosphorus loadings from agricultural and rural areas
… Currently, through the Great Lakes Agricultural Stewardship Initiative (GLASI) and the Growing Forward 2 Funding Assistance Program for Producers, Canada and Ontario are providing cost-share funding to support on-farm improvements that enhance soil health and water quality.

- Potential funding sources have been highlighted for agricultural and rural areas.

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- No specific reduction limits have been set for these sectors. Participation in BMPs remains voluntary, whereas stringent limits on phosphorus effluent discharge are proposed for enforcement for municipalities.

B1: Support and strengthen policies, programs, legislation

2. Ontario will consider further restrictions on the application of nutrients during the non-growing season.

13. Ontario will streamline processes for environmental assessments and approvals related to Lake Erie municipal wastewater projects, where feasible.

- More stringent regulations than "further restrictions" seems necessary. A possible ban on the sale and distribution of pesticides and fertilizers outside of the growing season may be required.
- With regards to Item #13, municipal stormwater projects (i.e., LIDs, GIs, EAs, etc.) should be included in this list.

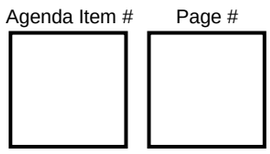
C. Improve the Knowledge Base

Long term monitoring programs have provided essential data to track spatial and temporal changes in the nearshore waters of Lake Erie and in Lake Erie watershed. These monitoring programs can be enhanced to gather information from specific sources or activities and new or enhanced monitoring tools can facilitate data collection. As part of adaptive management, available information and research questions continually evolve resulting in a need to coordinate research activities and share the information generated across government agencies, stakeholder groups, and other partners.

Section C (Improving the Knowledge Base) of the proposed actions outlines the monitoring, modelling and research opportunities that will be supported and encouraged in order to reduce phosphorus levels. For example, research to understand the source and types of phosphorus contributing to algae growth in Lake St. Clair/Lower Thames, research and monitoring of invasive mussels and their influence on phosphorus cycling, etc. Each of these specific Actions are included in Appendix 'A'. More detail regarding the execution of the monitoring is required. Standardized monitoring should be established and required parameters identified (i.e., water quality parameters, sampling methodology, benthic monitoring, etc.). Furthermore, there is no mention of the source of funding for such research.

The City of London has been a leader in watershed-based monitoring and analysis of the Thames River including efforts such as initiating the Thames River Clear Water Revival in 2008. This initiative has provided much of the information and knowledge pertaining to the water quality and health of the entire Thames River. Continued support of these initiatives will be important for proving the reduction levels highlighted in the Domestic Action Plan. London continues to be a leader in river quality information, with relevant, continuous data spanning over 40 years. Thamesville has been an important monitoring site for the City of London and the Thames River. Continued support and monitoring at this location will be important for determining reduction efforts and phosphorus loads contributions from upstream of the site, which would include the City of London.

Developing representative models to forecast phosphorus loading is extremely complex and is dependent on a variety of factors, including, but not limited to soil type, soil composition, quantity of legacy phosphorus within soil, saturation levels, etc. These factors are site specific and vary from season to season.



Development of a model to predict phosphorus loading and travel from one site may not be applicable to other sites within a watershed. A stronger focus on monitoring to calibrate and inform model simulations is recommended.

- More detail regarding the execution of monitoring is required. Standardized monitoring should be established and required parameters identified (i.e., water quality parameters, sampling methodology, benthic monitoring, etc.).
- Maintaining the Thamesville monitoring site is important for the continued determination of phosphorus loading from the Thames River, which includes the City of London.
- A focus on monitoring would be more effective than modelling.
- There is reference to the need for Soil and Water Assessment Tools for the Thames River to allow for BMP scenario testing, which is encouraging and beneficial. (Category C1. Item #7)
- There is reference to the need for monitoring and research to understand the source and types of phosphorus in the Lower Thames River. (Category C2. Item #4)
- The mention of exploring phosphorus trading as a potential future tool is encouraging as an alternative reduction strategy. (Category C4. Item#10)

D2. Share data and information

1. Canada and Ontario will make relevant long-term data and information on Lake Erie public as it becomes available.

Having long-term data available will be beneficial for displaying trends and reduction performance. However, there is concern about the lack of standardization of monitoring across the watershed and between watersheds. Development of standardized monitoring and sampling methods will ensure that data between the varying sectors (i.e., municipalities, agricultural and rural communities, etc.) can be compiled and compared. This will be especially important for soluble reactive phosphorus and total phosphorus loading data, which in the past did not meet requirements for developing basin-wide trends.

Implementation:

In order to achieve our targets, widespread on-the-ground action is needed urgently, but progress will not be apparent overnight. It will take time to implement actions to the extent that significant phosphorus load reductions are achieved, and it will take time for the aquatic environment to respond.

Implementing a monitoring program is essential in order to track the success or failure of phosphorus reduction strategies. Without monitoring, localized reduction strategies cannot be properly evaluated for levels of removal. This is necessary to quantify the reduction taking place.

Adaptive Management:

An adaptive management plan, supported by a strong monitoring, research, and modeling effort for Lake Erie, will provide a framework for ongoing measurement of compliance with established target loads and adjustment of management strategies over time… Implicit in this must be the recognition that the ***legacy effects of past activities in urban and rural settings may delay the observable effects of implementation of new phosphorus mitigation activities*** (emphasis added).

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1. Annual routine monitoring of loads, total phosphorus and soluble reactive phosphorus concentration in key Canadian tributaries leading into Lake Erie, and in-lake nutrient-eutrophication response indicators.

There is an acknowledgement that legacy phosphorus may delay the observable effects of the implementation of BMPs for phosphorus reduction. Annual monitoring will be done, however, with the proposed actions in C3 (Impacts of Climate Change). Monitoring more frequently will give a better understanding of the seasonal effects and how they impact phosphorus cycling. Quarterly monitoring in these tributaries may be more beneficial.

- Quarterly monitoring in key tributaries may be more beneficial than annual monitoring. This will allow for trends and seasonal changes to be identified.

CONCLUSIONS

The following are major points that should be addressed in the next future drafting of Domestic Action Plans:

1. **Hold all sectors to the same accountability:** Stringent regulations are being enforced for municipalities, however, BMPs suggested for rural and agricultural sectors are voluntary.
2. **Break down removal expectations for the different sectors:** Showing the 2008 starting point figures and the percent reduction requirements for each sector would allow for planning and design of necessary reduction strategies.
3. **Provide more detail on monitoring programs:** A standardized monitoring program should be developed and presented in the next draft Domestic Action Plan which addresses the following details; what, how, how frequently, where, etc. More specifically, what parameters will be monitored, where will monitoring happen and how often, what instruments/ methodology will be acceptable, etc. Without addressing these details, localized reduction strategies cannot be properly evaluated for levels of removal and the sharing of data will not be efficient.
4. **Identify funding opportunities:** Funding for municipalities remains to be addressed. Generalized statements, "*under applicable infrastructure and other funding programs"* do not address this concern. Specific funding sources have been highlighted for agricultural and rural improvements. Securing funding sources to aid in meeting reduction targets will be important for the success of the strategy, whether the funding be for municipal upgrades, implementation of stormwater BMPs or for the development of phosphorus trading credit programs.

EES staff has compiled a number of comments regarding this EBR posting. These comments are included in Appendix 'B'. The readers of the posting were asked to consider seven questions while reading the posting. These seven questions are highlighted in Appendix 'B' as well the staff comments organized under each of the relevant questions.

Council endorsement of these comments is recommended prior to submission. The closing date for submitting comments regarding this EBR posting is May 9th, 2017.

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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: 012-9971
Appendix ‘B’ – Staff Comments to the EBR Registry Number: 012-9971

APPENDIX 'A'

Environmental Bill of Rights (EBR) Registry Number: 012-9971

Do to the length of the original document, this Appendix includes only a portion of the EBR posting highlighting three relevant sections of the report: Actions to Achieve Phosphorus Reduction Targets, Implementation and Moving Forward. The full EBR posting can be found at the following weblink:

http://www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTMxOTM3&statusId=MjAwMjQ2&language=en

4 ACTIONS TO ACHIEVE PHOSPHORUS REDUCTION TARGETS

Once finalized, this draft Action Plan will reflect commitments by Canada and Ontario under COA, as well as past and proposed actions by many other stakeholders, including municipalities, First Nations and Métis communities, sector and commodity organizations, farmers and the broader agri-food industry, conservation authorities, non-government organizations, academic researchers, and others. A lot of good work has already been completed.

Category A: Reduce Phosphorus Loadings

This draft Action Plan identifies a range of on-the-ground actions to reduce phosphorus loadings from urban, agricultural and rural lands, and to encourage good stewardship. These actions need to be coordinated and linked to current federal, provincial, municipal, conservation authority, sectoral and other initiatives.

A1: Support watershed and nearshore-based strategies and community-based planning for reducing phosphorus loadings

The nearshore zone is the area where shoreline discharges and tributary flows have the greatest impact. Along the Ontario shoreline, these impacts include algal blooms which produce cyanotoxins, including the toxin microcystin, which can have significant human health consequences if ingested or through skin exposure, and may also be toxic to other organisms. In addition, Cladophora blooms can clog water intake pipes and be a nuisance for commercial and recreational anglers. The physical, chemical, and biological dynamics of the nearshore zone in the lake are complex and require greater understanding.

Several watershed plans, such as the Grand and Thames Rivers, already exist for the tributaries throughout the Lake Erie basin. Supporting the development of additional plans, and linking them to nearshore-based strategies and other phosphorus reduction actions at a community level, avoids duplication of effort and ensures that resources are efficiently used.

1. Canada and Ontario will collaborate with landowners,municipalitiesconservation authorities, First Nations and Métis communities and others on a coordinated approach to watershed planning for reducing phosphorus loadings.

2. Canada and Ontario will work with partners to implement existing watershed plans focussed on reducing on reducing phosphorus loadings in the Lake Erie basin, and develop new ones where required.

3. Canada and Ontario will explore the development of a multi-agency program(s) that supports the implementation of local actions within high risk areas for phosphorus loadings in the western and central Lake Erie basins.

4. Canada will lead with Ontario's support the implementation of the binational nearshore assessment and management framework for Lake Erie.

5. Canada and Ontario will continue to participate in partnerships such as the Ontario Eastern Habitat Joint Venture to promote and conserve Ontario's wetlands.

A2: Reduce phosphorus loadings from urban areas

Municipal point sources are now well controlled, with all wastewater treatment plants in the Ontario portion of the basin having at least secondary treatment. However, there are still opportunities to optimize the performance of treatment plants, and to reduce the volume and frequency of bypasses and overflows and to reduce loads from urban stormwater. Since 2008, the baseline year upon which phosphorus reduction targets have been established, treated effluent quality has improved through a combination of treatment upgrades and operational improvements at many municipal sewage treatment plants.

Some of the actions below are intended to achieve further reductions from municipal sewage treatment plants; it is recognized that there may be new technology retrofits and/or and process modifications which can be made to existing secondary sewage treatment plants that can approach or match the effluent phosphorus concentrations attainable through conventional tertiary treatment (i.e., chemically-assisted filtration), but at a lower cost.

With regard to stormwater, action to promote green infrastructure and low impact development, as well as actions to reduce phosphorus at the source (e.g., elimination of phosphorus from most residential lawn fertilizers by the fertilizer industry) are expected to achieve phosphorus load reductions from urban landscapes. Stormwater green infrastructure and low impact development (LID) technologies and systems reduce phosphorus loads to lakes and streams by managing rain where it falls so that less phosphorus is washed off surfaces (e.g., from properties, streets) and transported into waterbodies. Overall, stormwater green infrastructure and LIDs help to maintain and restore the natural water cycle.

1. Ontario will work with municipal partners in establishing a legal effluent discharge limit of 0.5 milligrams per litre of total phosphorus for all municipal sewage treatment plants (STPs) in the Lake Erie basin that have an average daily flow capacity of 3.78 million litres or more per day (See Section B1).

Ontario and its municipal partners will work towards reducing loadings, where feasible, through: (1) upgrades and other modifications to secondary STPs that have an average daily flow capacity of 3.78 million litres or more per day in the Lake Erie basin, with an objective of approaching the phosphorus effluent concentrations achievable through a tertiary level of treatment; (2) improvements to wastewater treatment and collection infrastructure to reduce combined sewer overflows and bypasses, and (3) improvements to stormwater management systems (including facility rehabilitation and incorporation of green infrastructure).

2. Ontario will collaborate with municipal partners to 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. Ontario will also continue supporting area-wide optimization programs for municipal STPs to reduce phosphorus loads, and make Lake Erie the priority geography for this effort.

3. Canada and Ontario will promote eligible investments for the reduction of excess phosphorus from point sources such as municipal wastewater treatments systems or municipal stormwater effluent under applicable infrastructure and other funding programs.

4. Ontario will work with developers, municipalities, conservation authorities, and others to promote and support the use of green infrastructure and low impact development (LID) for stormwater management, including clarifying and enhancing policies, and developing green standards. Ontario's draft stormwater LID guidance manual is aimed at assisting proponents in implementing LID and green infrastructure, and will be available for public comment in early 2017.

A3: Reduce phosphorus loadings from agricultural and rural areas

There are many tools available to the agriculture and rural communities to support environmental sustainability including education and awareness, stewardship, cost-shared investments, and regulation. It is important to build on these and focus efforts for phosphorus reduction in the Lake Erie basin. Widespread action to adopt a multi-barrier approach (more than one BMP used in combination to reduce the risk of phosphorus loss at the farm scale), customizable to individual properties and agriculture operations, are critical to achieving targets.

A significant amount of work has been done over the past several decades to develop and implement BMPs that enhance nutrient, soil and water stewardship on privately owned agricultural and public lands. In Ontario, Environmental Farm Plans have been used voluntarily by farmers since

the 1990s to help them identify and plan areas for improvement and various cost-share funding programs have assisted with the costs of implementing on-farm projects. Currently, through the Great Lakes Agricultural Stewardship Initiative (GLASI) and the Growing Forward 2 Funding Assistance Program for Producers, Canada and Ontario are providing cost-share funding to support on-farm improvements that enhance soil health and water quality.

A greenhouse environmental compliance plan was initiated to support the sector's efforts to reduce phosphorus discharges and drive water quality improvements. The plan includes support for education and awareness, investigating new technologies, annual water monitoring activities and inspections, which have encouraged progress towards environmental improvement. Where significant impacts were found, the Ministry of the Environment and Climate Change (MOECC) required operators to take action.

Ontario actively engaged the greenhouse sector when it developed a new Greenhouse Nutrient Feedwater regulation that came into effect in 2015 to provide a land application alternative requested by the greenhouse sector. By April 1, 2017, the MOECC will require greenhouses to submit applications for wastewater and stormwater discharge approvals to drive water quality improvements. After this date, the MOECC will continue addressing non-compliance using a risk-based approach.

The majority of the municipalities on the Canadian side of Lake Erie are rural. They are concerned about the impacts excess phosphorus is having on Lake Erie and their communities, and are taking action. Rural municipalities have partnered with the Province of Ontario in encouraging and implementing progressive design and construction of drainage systems that will help reduce the transport of phosphorus to the Great Lakes.

Through the Great Lakes and St. Lawrence Cities Initiative, municipalities have also partnered with the Ontario Federation of Agriculture on a collaborative strategy to reduce phosphorus loss from farmland by improving water management on private land and in the municipal drainage system.

1. There is also a need to prevent and control invasive species, because of their potential to alter riparian and wetland habitat and reduce its effectiveness in trapping and storing sediment and phosphorus. Canada and Ontario will continue to leverage existing funding initiatives to 2018 (e.g., Growing Forward 2, Great Lakes Agricultural Stewardship Initiative, and the Species at Risk Farm Incentive Program) to support implementation of agricultural BMPs and environmental investments in targeted regions of the Lake Erie basin.

2. Canada and Ontario will pursue, under the next agriculture policy framework, programming that supports a multi-BMP whole farm approach to achieve phosphorus runoff reduction from farmland in the western and central basin of Lake Erie.

3. Ontario will continue to support the development and implementation of an Ontario industry-led 4R program (right source of nutrients at the right rate, time, and placement) based on the internationally-recognized 4R Nutrient Stewardship system which helps farmers reduce nutrient losses into the environment through efficient nutrient application.

4. Ontario in collaboration with the greenhouse sector will continue working with greenhouse growers to encourage nutrient recycling and reduce phosphorus levels in discharges to watercourses that flow into Lake Erie with a priority on the Leamington area and Thames River. Actions include education, awareness, innovation, monitoring, cost-shared investments and regulatory compliance and enforcement. Ontario with Canada's support will work with the agriculture sector to harmonize and streamline planning tools (e.g., Environmental Farm Plan (EFP), Farmland Health Checkup, nutrient management planning) to support an integrated, whole-farm approach to environmental sustainability.

5. Ontario will work with the Lake Erie community to implement restoration of native habitats including wetlands, and riparian habitat; focusing efforts in priority watersheds where phosphorus loadings are high and natural cover is low.

6. Ontario will encourage stewardship activities on private lands that support phosphorus reduction in Lake Erie by providing incentives for landowners through programs such as the Conservation Land Tax Incentive Program (CLTIP) and the 50 Million Tree program.

7. Canada and Ontario will ensure public land is managed to minimize phosphorus losses.

8. Canada and Ontario will encourage dam owners to explore managing dams to reduce phosphorus outputs (without compromising aquatic invasive species management or hydroelectric power generation).

Category B: Ensure Effective Policies, Programs and Legislation

Policies and legislation are two effective tools for reducing phosphorus inputs to the environment. Over the years the federal and provincial governments have imposed requirements and developed various policies that reduce phosphorus loadings to Lake Erie. Examples include federal regulation of the phosphorus content of detergents under the Canadian Environmental Protection Act; municipal wastewater discharge quality requirements under the Ontario Environmental Protection Act, and the Ontario Water Resources Act, and nutrient management controls under the Ontario Nutrient Management Act (NMA). Work will continue to enhance and strengthen these tools to manage excess phosphorus inputs to aquatic ecosystems.

B1: Support and strengthen policies, programs and legislation

A first step in ensuring effective policies and legislation is to understand what currently exists and ensure that it is working to its full potential. There are also opportunities to identify gaps and explore innovative policy approaches for reducing phosphorus loadings.

1. Canada and Ontario will, in cooperation with the U.S. counterparts, develop phosphorus load reduction targets to reduce nuisance algae in the eastern basin of Lake Erie.

2. Ontario will consider further restrictions on the application of nutrients during the non-growing season.

3. Ontario will continue to phase in farms under the Nutrient Management Act through building permit approvals.

4. Ontario will finalize and implement a new Agricultural Soil Health and Conservation Strategy developed in collaboration with stakeholders, to support agricultural soil management practices that provide economic, environmental and social benefits to Ontario and maximize long-term carbon storage in soils while protecting their long-term productivity.

5. Ontario will, in 2018, begin a review of the province's approach to rural stormwater and agricultural drainage management using an integrated watershed approach. This will include an examination of the interactions between runoff from rural lands and roads, outlet drainage from agricultural lands, and municipal drains with the objective of identifying opportunities to improve the sustainable management of water.

6. Ontario will provide updated guidance related to stormwater management and municipal planning to support the implementation of policies in the Provincial Policy Statement (2014).

7. Ontario will, in collaboration with partners, consider enhancing and clarifying regionalized requirements for mandatory pump-out and inspections of septic systems to increase protection of ground and surface water quality.

8. Ontario will, as part of the hauled sewage policy and program review, develop, and post in 2017 for public comment, a draft policy framework for managing hauled sewage in the province.

9. Canada will continue to work on revisions to the Feeds Regulations that would remove minimum nutrient levels for livestock feeds (including phosphorus). This is anticipated to be enacted in 2018 and will enable the industry to be more flexible and decrease levels of phosphorus in feeds, where it makes sense to do so. This is anticipated to result in a corresponding reduction in phosphorus content of manure.

10. Ontario will, through the implementation of the proposed Wetland Conservation Strategy for Ontario, improve wetland protection through strengthened policies to stop the net loss of wetlands and sustain ecosystem services, including improved water quality.

11. Ontario will work with partners to update provincial policies for Lake Erie, in order to provide the basis for establishing a legal effluent discharge limit of 0.5 milligrams per litre of total phosphorus for all municipal sewage treatment plants (STPs) in the Lake Erie basin that have an average daily flow capacity of 3.78 million litres or more per day.

12. Ontario will update existing wastewater policies (F-series Guidelines and Procedures), and develop stormwater management policies and supporting guidance (e.g., low impact development and green infrastructure) to enhance environmental protection, including reduction of nutrient loadings.

13. Ontario will streamline processes for environmental assessment and approvals related to Lake Erie municipal wastewater projects, where feasible.

B2: Strengthen decision-making tools

Continuous improvement of decision-support tools will strengthen capacity for science-based decision-making. Examples include development or enhancement of economic analysis tools, computer simulation (modelling) tools, and graphical and communication tools.

1. Ontario with Canada's support will, in 2018 make publicly available a digital elevation model of the Lake Erie watershed (based on LiDAR technology) to assist all members of the Lake Erie community in making evidence-based decisions (e.g., flood mapping, areas of soil erosion risk identification, precision agriculture) to ensure healthy lands and waters.

2. Ontario will work with municipalities to encourage the development of decision-making tools that help manage phosphorus in urban stormwater at the source.

Category C: Improve the Knowledge Base

A strong science and monitoring foundation underlies this draft Action Plan and will continue to inform its implementation. For example, Ontario has undertaken several monitoring and research studies as part of its Great Lakes Nearshore Monitoring Program. These studies include tracking the influence of the Grand River in the nearshore of Lake Erie's eastern basin (2010), investigating the impacts and causes of the 2012 fish kill along the north shore of the central basin, and monitoring the extent and causes of harmful algal blooms along the shoreline of the western and central basins (2013). Long term monitoring programs have provided essential data to track spatial and temporal changes in the nearshore waters of Lake Erie and in Lake Erie watersheds. These monitoring programs can be enhanced to gather information specific to particular sources or activities and new or enhanced monitoring tools can facilitate data collection. As part of adaptive management, available information and research questions continually evolve resulting in a need to coordinate research activities and share the information generated across government agencies, stakeholder groups, and other partners.

In addition, Canada through its Great Lakes Nutrient Initiative has made significant investments in monitoring to improve our understanding of phosphorus loadings from Canadian tributaries, and the health of biota and water quality conditions in the nearshore of Lake Erie. Models have been developed to assist in the development of phosphorus load reduction targets and to improve our understanding of the linkages between land types, use and management and phosphorus loadings to tributaries and ultimately Lake Erie. Numerous research studies have also been conducted to improve our understanding of the factors, including phosphorus, that contribute to the development of harmful algal blooms and toxin production, Cladophora growth and hypoxia.

C1: Conduct monitoring and modelling

Long-term monitoring is the cornerstone of an adaptive management approach. Programs in the Lake Erie watershed are continually being assessed to ensure priority locations and high-risk phosphorus loading conditions, such as large storm events, are being monitored. In some cases, emerging technology is being incorporated to enhance existing monitoring efforts.

1. Canada will measure phosphorus loads to Lake Erie from selected Canadian tributaries.

2. Canada will continue to monitor and assess biota and water quality conditions in Lake Erie through the Great Lakes Surveillance Program.

3. Canada will continue to collect and coordinate hydraulic and hydrologic data, including maintaining Canada's role on the Canada U.S. Coordinating Committee on Great Lakes Basin

Hydraulic and Hydrologic Data to ensure accurate flow information is available to calculate seasonal and annual phosphorus loads.

4. Ontario will continue long-term monitoring programs including the Provincial Water Quality Monitoring Network, Provincial Groundwater Monitoring Network, Great Lakes Intake Monitoring Program, and Great Lakes Nearshore Monitoring Program.

5. Canada and Ontario will continue to deploy real-time monitoring systems in Lake Erie to monitor temperature, dissolved oxygen and algal pigments which allows tracking of hypoxia and lake stratification.

6. Canada will continue to produce an annual national field-scale crop inventory map using remotely-sensed imagery.

7. Canada will continue to develop Soil and Water Assessment Tool models for the Thames River which will allow for BMP scenario testing.

8. Canada will continue to improve models and tools at two scales for risk of phosphorus loss: soil-landscape scale (Indicator of Risk of Water Contamination by Phosphorus, IROWC-P) and the field scale (P-Index).

C2: Conduct research to better understand nutrient dynamics in the Lake Erie basin

There is a long history of research on nutrient dynamics and associated ecosystem changes in Lake Erie. A variety of research initiatives are currently underway, both in Canada and the United States, by government agencies, academic institutions, and non-government organizations. It is important to incorporate available knowledge and work with research partners to develop and refine research questions over time.

1. Ontario will continue a multi-watershed nutrient study, to assess the interaction between agricultural land use and nutrient loadings in streams in the Great Lakes basin.

2. Ontario will support and conduct research on the use of sensor-based technology for monitoring phosphorus and associated parameters.

3. Canada and Ontario will continue research to improve understanding of factors contributing to toxic and nuisance algae growth and their impacts on water quality and ecosystem health.

4. Ontario will lead, with Canada's support, the undertaking of a monitoring and research project in Lake St. Clair/Lower Thames to better understand the source and types of phosphorus that are contributing to algal growth.

5. Canada will lead, with Ontario's support, research and monitoring to improve understanding of invasive mussels and their influence on phosphorus dynamics and Cladophora growth in the eastern basin of Lake Erie.

6. Ontario will work with the Lake Erie community to conserve and manage aquatic habitat and the fish community to maintain fish population health and resiliency.

7. Ontario will lead research on the bioaccumulation of the algal toxin microcystin in fish tissue to better understand its impact on human health.

C3: Conduct research to better understand and predict the impact of climate change on the Lake Erie ecosystem

As the climate changes, earlier winter thaws, increased spring stream flows, and more intense rainfall events can result in more nutrients being washed into the lake. These, combined with longer warm water periods, have the potential for increased algal blooms. Climate change is a cross-cutting issue that needs to be integrated into research activities conducted in the Lake Erie Basin. In 2016, Ontario released the Climate Change Action Plan, a five-year plan that will help Ontario fight climate change over the long term. The plan outlines the actions to help Ontario households and businesses reduce harmful greenhouse gas pollution.

Also in 2016, the federal government worked with the provincial and territorial governments to develop the Pan-Canadian Framework on Clean Growth and Climate Change, which is the Government of Canada's commitment and plan to reduce greenhouse gas emissions and build resilience to adapt to a changing climate. The Framework builds on the actions taken individually and collectively by provinces and territories, and works to ensure that Canadians are engaged to strengthen and deepen action on clean growth and climate change. The plan includes a pan-Canadian approach to carbon pricing, measures to reduce greenhouse gas emissions in all sectors, adaptation to climate impacts, and increased technology development and adoption to help Canada move toward a low-carbon economy.

The synergies and co-benefits of actions under both Climate Change Action Plans and the Canada-Ontario Action Plan for Lake Erie will be coordinated and maximized where possible. (e.g., stormwater green infrastructure planning under the Provincial Policy Statement and municipal Official Plans; Agriculture Soil Health and Conservation Strategy, science to understand the impacts of climate change on phosphorus loadings to Lake Erie)

1. Canada will run existing watershed simulation models under different climate change scenarios.

2. Ontario will consider climate change in all of its research and monitoring efforts relating to Lake Erie.

C4: Conduct research to improve existing practices and develop new innovative practices and technologies to reduce phosphorus loadings

Ongoing research to improve and develop new practices and technologies to reduce, recycle and recover phosphorus from point and non-point sources will be important for achieving the targets.

Canada and Ontario continue to invest in research and demonstration initiatives to improve knowledge and understanding of the effectiveness of best management practices on reducing nutrient loss and improving nutrient and water use efficiency in agriculture production.

Ontario and Canada provided funding to demonstrate greenhouse nutrient feedwater recycling. This has led to the adoption of new technologies and reduction of phosphorus loadings to the environment.

One of the most promising research areas relates to the development of innovative practices to capture, store, and in some cases recover phosphorus from point and non-point sources. In support of this, Ontario has partnered on an innovative technology competition (George Barley Water Prize) to reduce and recover phosphorus from water bodies and will host the pilot stage in Ontario to demonstrate cold climate application. In another example, Ontario is taking action to maintain its regulation-making authority, under the Ontario Water Resources Act, that could enable the use of water quality trading as a potential tool for managing phosphorus in the future. The proposed actions will build on a strong foundation of past and ongoing research supported through partner research projects.

1. Ontario will continue to leverage government research programs and initiatives (e.g., New Directions, OMAFRA - University of Guelph Partnership) to fund needed research and new technologies to test and improve agricultural BMPs for phosphorus reduction.

2. Canada and Ontario will continue to research the effectiveness of BMPs in reducing phosphorus losses from agricultural land during typical and extreme weather events.

3. Canada will continue to identify the capacity and progress of different agricultural production systems in implementing activities that reduce the risk of nutrient loss.

4. Canada will continue to develop and assess methods for evaluating sustainable phosphorus levels in soils.

5. Canada and Ontario will conduct research to improve modeling capability to quantify phosphorus reductions from BMPs at a landscape scale.

6. Canada and Ontario will investigate current (baseline) and future adoption of BMPs within the Lake Erie basin and within selected sub-watersheds to inform monitoring efforts and progress towards targets.

7. Ontario will investigate social, economic and environmental determinants impacting BMP adoption.

8. Ontario will support studies that improve understanding of the correlation between phosphorus load reduction and high uptake of low impact development/green infrastructure.

9. Canada and Ontario will work with partners to measure effectiveness of wetlands and other natural heritage features in reducing phosphorus through overland flow into watercourses.

10. Canada and Ontario will evaluate the feasibility of using economic instruments to achieve phosphorus reductions.

Category D: Educate and Build Awareness

All levels of government, conservation authorities, non-government organizations, and other stakeholder groups, and the public have worked hard to communicate the importance of reducing phosphorus loadings to Lake Erie. As audience needs and communication technologies evolve, there is a need to review and adjust communication strategies for maximum impact to ensure the message is reaching the intended audience.

D1: Enhance communication and outreach to build awareness, improve understanding and influence change

Through initiatives including the Farmland Health Check-up and the Environmental Farm Plan (EFP), Canada and Ontario have supported agri-environmental education and awareness initiatives to educate farmers about beneficial management practices and regulatory requirements to reduce their on-farm environmental risks. Over 70 percent of Ontario farmers have participated in the EFP program.

These actions focus on developing and advancing awareness of and knowledge about phosphorus sources and impacts as well as what can be done by the Lake Erie community to contribute to reducing phosphorus loadings.

1. Canada and Ontario will develop a digital marketing campaign to build awareness of the need for actions to reduce phosphorus in the Lake Erie basin.

2. Canada and Ontario will, in collaboration with the Lake Erie community, enhance the awareness of the impacts of phosphorus on aquatic ecosystems.

3. Ontario will work with the agriculture sector to communicate practices for responsible nutrient management, including soil testing to determine appropriate phosphorus requirements.

4. Ontario will, in partnership with the agriculture sector, continue to develop and deliver information and tools to increase cover crop use in the non-growing season to reduce soil loss and field runoff and to promote the application of nutrients at the right time through the “Timing Matters” initiative.

5. Ontario will deliver by 2018 enhanced drainage and erosion control education and training to increase awareness of causes of nutrient loading in runoff and how to manage drainage to reduce phosphorus loads.

6. Ontario will by 2018 develop a provincial award to recognize excellence, innovation and leadership in demonstrating environmental action at the farm level in the Lake Erie basin.

7. Ontario will facilitate an event, by March 2018, showcasing the adoption of leading municipal approaches to integrated stormwater management.

D2: Share data and information

Canada and Ontario are committed to making their data available to the public in an accessible form. As part of this commitment, Canada and Ontario intend to periodically report on progress in achieving the goals of the Action Plan.

1. Canada and Ontario will make relevant long-term data and information on Lake Erie public as it becomes available.

2. Ontario will work with its partners to provide an annual update on Lake Erie through its website, and report on Lake Erie as part of the progress report required every three years under Ontario's Great Lakes Protection Act, 2015.

Category E: Strengthen Leadership and Coordination

Effective leadership and coordination are essential for successful reduction of phosphorus loadings to Lake Erie. This coordination is already apparent in a variety of collaborative working arrangements, research partnerships, and similar initiatives. The strategic actions listed below are intended to enhance the current level of coordination by clarifying roles and responsibilities and strengthening the effectiveness of existing committees and other governance structure.

E1: Improve communication and coordination

Implementation of this Action Plan requires the engagement of a number of sectors and communities in the reduction of phosphorus from various sources. Therefore, it will be essential that there are mechanisms in place for the coordination of these efforts, and that opportunities exist to communicate on the progress that is being made.

1. Canada and Ontario will engage First Nations and Métis communities to facilitate their participation and input in the development and implementation of the Action Plan. This will include consideration of Traditional Ecological Knowledge from First Nations and Métis if offered.

2. Canada and Ontario will build on existing governance structures to implement the Action Plan.

3. Canada and Ontario will update the Great Lakes community on progress in implementing the Action Plan through opportunities such as webinars, forums and meetings.

4. Canada and Ontario will coordinate research, monitoring and modelling activities to improve scientific efforts towards phosphorus reduction on an annual basis.

E2: Establish an adaptive management framework

Adaptive management is a guiding principle of this draft Action Plan. It is a systematic, iterative process through which management objectives and approaches and policies can be adjusted and improved over time, providing a mechanism for continuous improvement. In an adaptive management system, the implementation and results of management actions are monitored and evaluated by regulatory agencies and partners, and used to inform the next cycle of monitoring and management, including the research agenda.

1. Canada and Ontario will assess and report on progress towards achieving phosphorus reduction actions and targets in 2023 and every five years thereafter.

2. Canada and Ontario will use the binational metrics developed to establish the phosphorus loading targets, as a foundation for establishing a suite of performance measures, and will adjust as necessary to ensure existing metrics are feasible and sustainable.

3. Canada and Ontario will develop land based performance measures to track changes to land use and management over time.

4. Canada and Ontario will work with the U.S. federal and state agencies and other partners to develop a binational information platform to track progress towards meeting the phosphorus reduction targets to reduce cyanobacteria in the western basin (e.g., through GLWQA Nutrients Annex and the Great Lakes Commission's ErieStat project).

5 IMPLEMENTATION

This draft Action Plan sets out strategic actions and tactics to meet Canada's phosphorus reduction commitments under the GLWQA. It is clear that phosphorus reduction targets will only be achievable with significant change across the basin and with the adoption of a multi-barrier approach across all phosphorus sources.

In order to achieve our targets, widespread on-the-ground action is needed urgently, but progress will not be apparent overnight. It will take time to implement actions to the extent that significant phosphorus load reductions are achieved, and it will take time for the aquatic environment to respond. Implementing the Action Plan therefore requires adaptive management, strong governance, effective engagement of accountable partners.

5.1 Adaptive Management

Natural systems are inherently variable, and the impacts of management actions are difficult to predict accurately across Lake Erie's diverse landscape. Uncertainty is even greater with a changing climate and changes in the ecosystems from invasive species. For these reasons, it will be important to implement the Action Plan with an adaptive management approach. This Action Plan focuses on phosphorus reduction. Other factors will be addressed through the development of the Lake Erie Lakewide Action and Management Plan in 2018.

An adaptive management plan, supported by a strong monitoring, research, and modelling effort for Lake Erie, will provide a framework for ongoing measurement of compliance with established target loads and adjustment of management strategies over time; see Figure 11. Implicit in this must be recognition that the legacy effects of past activities in urban and rural settings may delay the observable effects of implementation of new phosphorus mitigation activities. The proposed adaptive management strategy incorporates the following elements:

1. Annual routine monitoring of loads, total phosphorus and soluble reactive phosphorus concentrations in key Canadian tributaries leading into Lake Erie, and in-lake nutrient-eutrophication response indicators.

2. An intensive monitoring, research, and modeling program which will allow the plan partners to review progress every five years. This will include evaluation of whether phosphorus mitigation activities have been immediately effective in meeting targets, effective but with a delay in meeting targets due to legacy effects, or ineffective at current adoption levels.

3. Report every 5 years based on a series of performance measures. The intended outcomes are reduced extent and frequency of harmful algal blooms; reduced hypoxia in the Central Basin; and reduced nuisance algal blooms in nearshore zone of the Eastern Basin.

4. A five-year review cycle; see Figure 10.

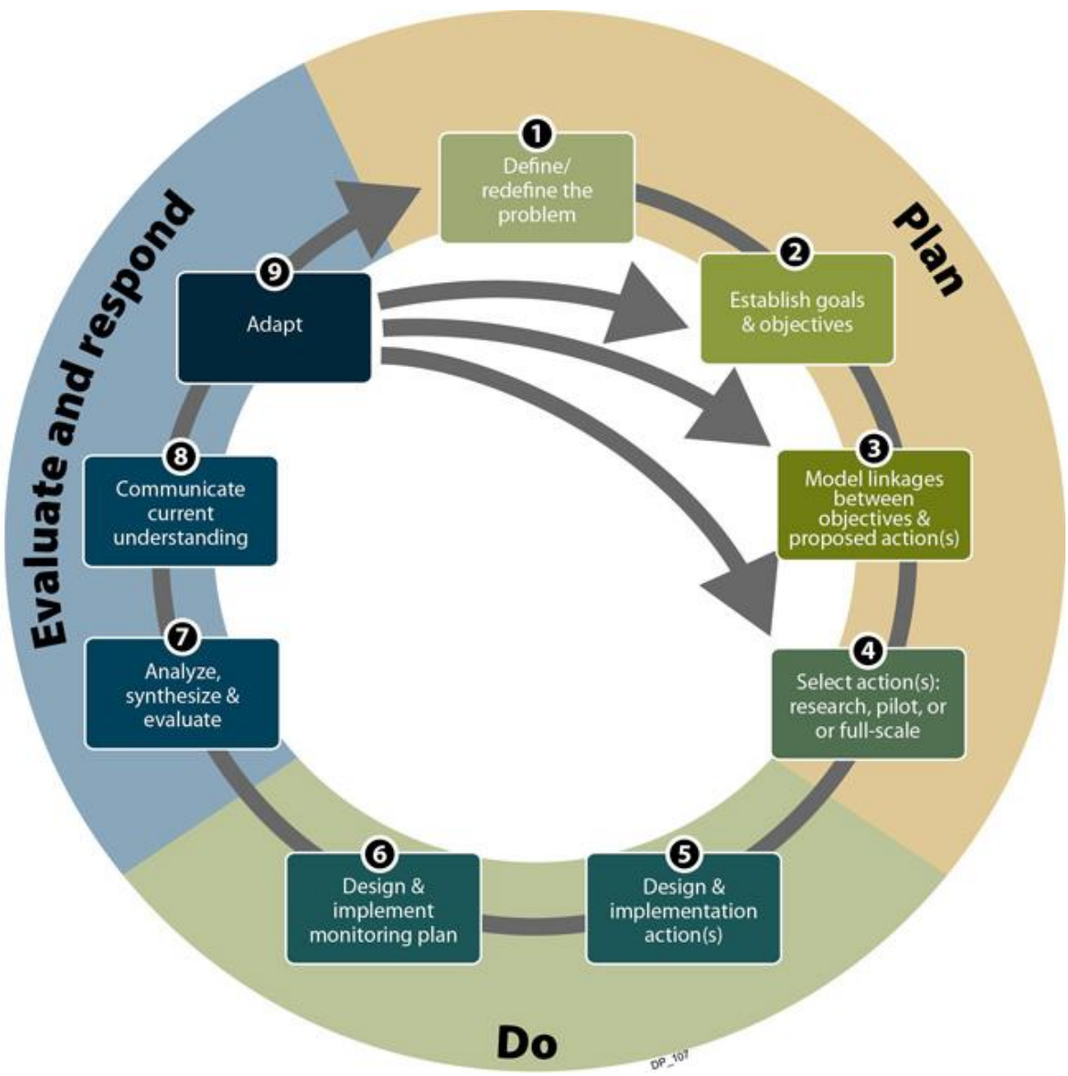

Figure 10: The adaptive management cycle.

5.2 Governance

Management of phosphorus loads to Lake Erie is a complex and challenging task that bridges many levels of government and multiple agencies as well as private sector organizations. A broad network of partners and stakeholders will be essential for successful implementation of the Action Plan. These include federal, provincial, and municipal governments and agencies; First Nations and Métis communities; conservation authorities; industries, agriculture and other businesses; the academic community; nongovernment organizations; property owners; and the general public. Roles and responsibilities must be clear. Canada and Ontario are exploring options to manage this complex problem with the objective of improving coordination between and enhancing existing mechanisms to the extent possible.

5.3 Stakeholder and Partner Engagement

Excess nutrients and associated algal blooms pose a threat to water quality and drinking water supplies for hundreds of thousands of Ontarians in the Lake Erie basin, so it is vital that effective engagement of stakeholders, partners, and the general public be an integral part of Action Plan development and implementation. To that end, 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 this draft Action Plan[7]. Membership of the Working Group includes representation from First Nations and Métis communities, municipalities, agriculture, conservation authorities, environmental non-government organizations, industry and commerce, academia, the tourism industry, cottage associations, commercial and recreational fisheries interests, and the general public. Canada and Ontario are committed to continued engagement with this working group, and the broader Great Lakes community in the development and implementation of the Action Plan. This may include additional engagement with First Nations and Métis based on their interest.

5.4 Reporting and Accountability

The Action Plan will be reviewed and revised in 2023 and every five years thereafter to align with COA reporting. It will be supported by and linked to other key documents, including LAMP reports, CSMI reports, but also related work such as the water quality and natural heritage components of conservation authority watershed plans and municipal natural heritage strategies; municipal and provincial reporting of wastewater treatment plant upgrades and optimization; and documentation of agricultural BMP adoption.

Each agency has its own system for data management and reporting, and each is committed to making data available to a broader audience through COA. Canada and Ontario will explore the potential of central web-accessible portals to support sharing of information across different platforms. Reporting will be coordinated by Canada and Ontario through the COA Nutrients Annex Committee and made available to partners, stakeholders, and the public through the common portal. Information to be shared in this way could include scientific data, metadata (location, timing, contact information and so on associated with science data), and reports.

6 MOVING FORWARD

Reducing phosphorus loadings to Lake Erie is a challenging task, and one that will require collective action by many partners throughout the basin. Factors such as climate change, legacy sources of phosphorus, and the changing human activities on the landscape make it difficult to predict the rate at which we could see significant changes in the lake.

While we continue to improve our knowledge of phosphorus and its impacts, it is critical that we take action now to improve the health of Lake Erie. We must undertake actions in recognition of that time lag, monitoring key performance measures to track progress toward loading reduction targets. As our knowledge of the lake ecosystem improves, adaptive management will encourage regular plan review and will guide adjustment of management strategies to increase their effectiveness and ensure continued progress.

The intention of this initial draft Action Plan is to generate ideas on how to reduce phosphorus loadings to Lake Erie from Canadian sources. Please consider the discussion questions that appear on page ii and provide your feedback and suggestions to letstalklakeerie.ca or Land.Water@ontario.ca**(External link)**. The information gathered through this process will form part of the dialogue as the Canada-Ontario Action Plan continues to be developed.
Thank you for taking the time to get engaged.

APPENDIX 'B'

Staff Comments to the EBR Registry Number: 012-9971

*Readers were encouraged to consider the following questions (**bolded and italicized**) while reviewing the draft Action Plan and provide feedback and suggestions for each category*. Staff comments have been organized under each the relevant question, with specific Category/Item Numbers highlighted when necessary.

1. Do you have any feedback or input on the proposed actions outlined in this document?

General Comments:

1. Clarification on "tertiary level of treatment" has been made to indicate that tertiary level treatment may not be required if upgrades to secondary level treatments are able to meet proposed phosphorus effluent concentration limits. (Category A2)

2. More stringent regulations than "*further restrictions on the application of nutrients during the non-growing season*" is necessary. For urban sectors a possible ban on the sale and distribution phosphorus containing fertilizers outside of the growing season may be required. (Category B1. Item #2)

3. Municipal stormwater projects (i.e., LIDs, GIs, EAs, etc.) should be included in this list for screening processes for environmental assessments and approvals related to Lake Erie municipal wastewater projects. (Category B1. Item #13)

Science, Monitoring, Modelling and Reporting:

4. Actions suggest that "Canada" will be undertaking all Items, with the exception of Item 4 which will be conducted by "Ontario". From a municipal perspective we hope that the Province and Federal Governments will take and show leadership on this front. The concern is that this important work will be downloaded to municipalities or Conservation Authorities with no corresponding funding support. (Category C1. Items #1-8)

5. More detail regarding the execution of monitoring is required. Standardized monitoring should be established and required parameters identified (i.e., water quality parameters, sampling methodology, benthic monitoring, etc.). What, how, how frequently, where, and funding opportunities are not mentioned. Implementing a monitoring program is essential in order to track the success or failure of phosphorus reduction strategies. Without monitoring, localized reduction strategies cannot be properly evaluated for levels of removal. This is necessary to quantify the reduction taking place.

6. Maintaining the Thamesville monitoring site is important for the continued determination of phosphorus loading from the Thames River, which includes the City of London.

7. Focus on monitoring would be more effective than modelling. Developing representative models to forecast phosphorus loading is extremely complex and is dependent on a variety of factors, including, but not limited to soil type, soil composition, quantity of legacy phosphorus within soil, saturation levels, etc. These factors are site specific and vary season to season.

Development of a model to predict phosphorus loading and travel from one site may not be applicable to other sites within a watershed.

8. There is reference to the need for Soil and Water Assessment Tools for the Thames River to allow for BMP scenario testing, which is encouraging and beneficial. (Category C1. Item #7)

9. There is reference to the need for monitoring and research to understand the source and types of phosphorus in the Lower Thames River. (Category C2. Item #4)

10. The mention of exploring phosphorus trading as a potential future tool is encouraging as an alternative reduction strategy. (Category C4. Item#10)

2. Many agencies, stakeholders, and other partners have a role in reducing phosphorus loadings to Lake Erie. What actions does your organization/ community plan to undertake as part of the Action Plan?

11. The Domestic Action Plan will benefit from the Water Management Plan currently being developed for the Thames River watershed. It is co-Chaired by the City of London. This plan will provide more detailed information on phosphorus loading from this watershed.

12. The City of London is currently preparing optimization plans for its wastewater treatment plants. This optimization will lead to reduced levels of phosphorus discharged from its effluent flow.

13. London is hosting Western University riverine phosphorus research, “Thames River Experimental Stream Sciences Centre (TRESS Centre)”, at the Adelaide Wastewater Treatment Plant.

14. London is undertaking a redevelopment plan EA for the significant Dingman Creak Subwatershed, including urban growth, naturalization and a piloting a subwatershed-wide Environmental Compliance Approval.

15. London has an annual capital program to maintain its SWM facilities.

3. How do you see regional or local planning initiatives linking with or fitting into the implementation of this plan?

16. p. 31 – Thames River Clear Water Revival is currently undertaking a Water Management Plan. Continued support and coordination with the Thames River Clear Water Revival is recommended.

4. What do you see as the most significant barriers to reducing phosphorus loadings to Lake Erie? Do you have any suggestions for overcoming these barriers?

17. Encouraging Stewardship within the agriculture communities will be important for the success of the Action Plan. As of 2015, rural and agricultural sectors were responsible for approximately 85% of the phosphorus loading in the Thames River.

Holding this sector accountable and encouraging participation in nutrient management programs, such as the 4R Nutrient Stewardship, will aid in achieving the reduction targets.

5. 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?

18. A breakdown of non-point source contributions is requested. Literature suggests that urban stormwater runoff represents only a small portion of overall runoff when compared to the amount contributed by agricultural sources.

19. Consideration should be made to control the amount of fertilizer applied to urban lands or to remove phosphorus from lawn fertilizer.

20. No specific reduction limits have been set for rural and agricultural sectors. Participation in BMPs remains voluntary, whereas stringent limits on phosphorus effluent discharge are being enforced for municipalities.

21. Having a breakdown of removal expectations for the different sectors and direct actions for each of these would be beneficial in the next draft.

6. Tracking progress and adaptive management will be essential for ensuring that actions are making a difference to the health of the Lake Erie basin. Do you have any specific ideas for measuring progress towards achieving Lake Erie phosphorus load reduction targets?

22. Monitoring methods to identify background levels of legacy phosphorus would provide detail on the efficiency of implemented phosphorus reduction strategies.

23. Adaptive Management highlights annual monitoring in key tributaries. With the proposed actions in C3 (Impacts of Climate Change), monitoring more frequently will give a better understanding of the seasonal effects and how that impacts phosphorus cycling. Quarterly monitoring in these tributaries may be more beneficial.

24. p.10 – SWEEP programs from 1980's and 90's include a pilot project in south London referred to as the North Kettle Creek watershed project. Although originally located outside the City in 1990, the site was absorbed into the city in 1993. This site provides a 20 year comparison of information available on agricultural BMP's to reduce agricultural non-point source pollution. Unfortunately, phosphorus is not one of the parameters originally monitored; however, indirect inferences could be made to assist with future BMP's. This site should be considered for future research work.

7. Do you have any other suggestions for reducing, managing or treating phosphorus run-off and discharges, including innovative approaches or technologies for phosphorus removal or recovery?

25. Reference to "Green Infrastructure" in Section 2.8 should be reviewed. This term is most often associated with LID measures, which are engineered systems and not a part of our natural environment.

OTHER STAFF COMMENTS:
Funding Comments:

26. Funding remains to be addressed. Generalized statements "*under applicable infrastructure and other funding programs"* have been mentioned with regards to funding for municipal upgrades. Specific funding sources have been highlighted for agricultural and rural improvements. Securing funding sources to aid in meeting reduction targets will be important for the success of the strategy, whether the funding be for municipal upgrades, implementation of stormwater BMPs or for the development of phosphorus trading credit programs.

27. Supporting funding needs with regards to the development of the upgraded Thames River Watershed Management Plan will complement the efforts of the Domestic Action Plan by ensuring relevant and up-to-date data is available about the Thames River watershed.

28. The Plan supports optimization of wastewater plants but does not acknowledge funding for such. Funding sources for upgrades required to meet reduction levels still remain vague.

29. Consideration of the cost of implementing stormwater retrofits should be considered when developing policies. Funding sources should be highlighted to support municipalities for these retrofits.

Outstanding Comments from that Previously Approved by the Municipal Council:

1. Provide the 2008 starting point figures by source category and targeted end points so London can plan its work to meet targets.

2. Provincial and federal governments should make a commitment to keep existing and add new monitoring stations and sampling points on the Thames River and that testing procedures will not be subject to change.

3. The Province must make public its assessment of needed monitoring in the Thames River basin and its plans to complete the necessary network of monitoring stations and sampling points in the Thames River basin. The Province, in collaboration with the federal government, municipalities and conservation authorities, also need to implement a mass balance study on the Thames River.

4. The Province needs to make the Thames River monitoring information publicly available on a continuous basis, rather than simply providing an annual update and a progress report every three years.

5. Conduct a cost-benefit analysis of investments in the agricultural sector vs. municipal treatment plant upgrades. Complete this analysis before a decision is made about provincial action on phosphorus.

6. Specific actions are needed in the proposal that address phosphorus transportation off land into the waterways during intense storm and snow melts.