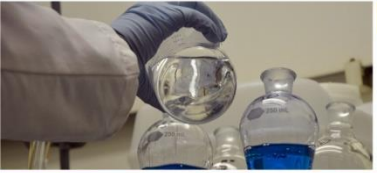

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Pennsylvania Lake Erie Phosphorus Reduction Domestic Action Plan (DAP)

June 15, 2017

Dial-in number for Audio: 1-650-479-3208
Access code: 644 430 066
WebEx Technical Support: 1-866-229-3239

Tom Wolf, Governor

Secretary Patrick McDonnell

Agenda

- Overview of DEP's Office of the Great Lakes
- Pennsylvania's role in the Great Lakes Water Quality Agreement (GLWQA)
- Draft Pennsylvania Lake Erie Phosphorus Reduction Domestic Action Plan

Presenter: Tim Bruno, Chief of the Great Lakes

Pennsylvania Department of Environmental Protection
Office of the Great Lakes
Tom Ridge Environmental Center
301 Peninsula Drive, Suite 4
Erie PA 16505
814.835.1477

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DEP Office of the Great Lakes

- Located at the Tom Ridge Environmental Center at Presque Isle State Park.
- Multi-disciplinary staff covering wide array of environmental technical and policy areas.
- A focus on Great Lakes water quality and quantity and linking the community with the resource.
- Forming community partnerships to encourage municipal and county cooperation and protect the environment.

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Great Lakes Water Quality Agreement

- ***First GLWQA signed between US and Canada in 1972***
  - Focused on reducing algae through a coordinated approach to reducing phosphorus inputs.
  - Established basin-wide water quality goals and formed the Great Lakes Water Quality Board and Research Advisory Board.
- ***GLWQA of 1978:***
  - Reaffirmed and replaced the 1972 Agreement.
  - Focused on an "ecosystem approach" with an end goal of restoring and maintaining chemical, physical, and biological integrity of the Great Lakes.
  - Included additional emphasis on toxic substances.

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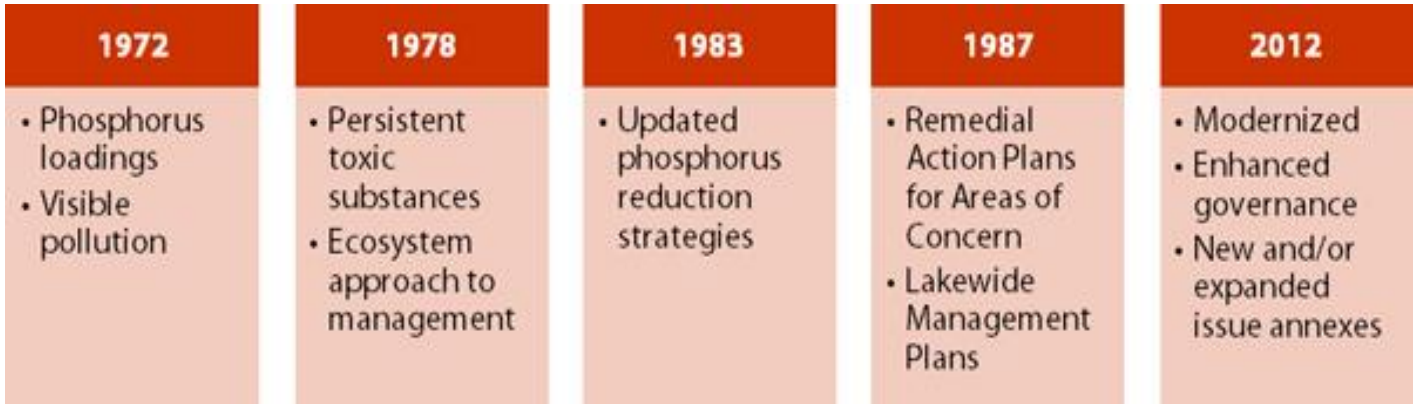
Great Lakes Water Quality Agreement

- ***1987 Amendments***
  - ➢ Included Areas of Concern and commitments to restore.
- ***2012 Amendments:***
  - ➢ Emphasized General and Lake Ecosystem Objectives.
  - ➢ While US and Canada are responsible for final decision-making, the 2012 Amendments created the Great Lakes Executive Committee to oversee progress on water quality protection and restoration efforts.



Great Lakes Water Quality Agreement

Annex 4 requires:

- Management of phosphorus concentrations and loadings.
- Establishment of Lake Ecosystem Objectives.
- Establishment of Substance Objectives for total phosphorus concentrations and loadings
- Program evaluation and enhancement.

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Great Lakes Water Quality Agreement

Lake Ecosystem Objectives

- Minimize hypoxic zones.
- Maintain algae below nuisance.
- Maintain healthy algae species.
- Maintain cyanobacteria at levels below which are a threat to humans or ecosystem.
- Maintain mesotrophic conditions in West/Central Erie and oligotrophic conditions in East Erie.

Picture: Courtesy of NASA Earth Observatory

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Great Lakes Water Quality Agreement

Picture Courtesy of www.binational.net

Annex 4 requires:

- Within 3 years for Lake Erie: 2016
  - Review interim objectives and loading targets.
  - Determine loading allocations by country.
  - Develop concentrations for nearshore waters.
  - Establish load reduction targets for priority tributary watersheds.
  - ***COMPLETED***
- Within 5 years: 2018
  - U.S. and Canada must develop Binational Strategy and Domestic Action Plans

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Draft Pennsylvania Lake Erie DAP

Applicable Lake Erie Phosphorus Target:

To minimize the extent of hypoxic zones in the waters of the central basin of Lake Erie: 40 percent reduction in total phosphorus entering the western and central basins of Lake Erie—from the United States and from Canada—to achieve an annual load of 6,000 metric tons to the central basin.

Picture: Courtesy of NASA Earth Observatory

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Draft PA Lake Erie DAP

Regional Objectives:

- Regional reduction objectives established through load modeling conducted by Maccoux, et al.
- Maccoux estimates better for larger sources (tributaries and point sources) that had more data available.
- Valuable for determining and assigning significant reductions that need to occur on the lake-wide scale.

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- Difficulties in using Maccoux data.
- Lack of high-frequency data in PA.
- Maccoux mixed watersheds from different basins.
- Questions on extent of Central Basin.
- Use of reference and surrogate watersheds for loading estimations.

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Total and soluble reactive phosphorus loadings to Lake Erie
A detailed accounting by year, basin, country, and tributary

Matthew J. Maccoux [a,*], Alice Dove [b], Sean M. Backus [b], David M. Dolan [c,1]

[a] Milwaukee, WI 53222, USA
[b] Water Quality Monitoring and Surveillance Division, Environment and Climate Change Canada, Burlington, Ontario, Canada L7R 4A6
[c] Natural and Applied Sciences, University of Wisconsin-Green Bay, Green Bay, WI 54311, USA

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ABSTRACT

Information about the loads of total and soluble reactive phosphorus entering Lake Erie is required in order to support commitments made under Annex 4 of the Great Lakes Water Quality Agreement. For these purposes, annual (water year) total phosphorus loads to Lake Erie are updated (2003–2013) and soluble reactive loads are reported on a lakewide basis for the first time (2009–2013). Complete documentation including input data and error estimates are provided. The results confirm previously documented long-term declining TP loads and show how these are driven by early and recent improvements in point source discharges, but are confounded by recent increases in nonpoint source loads that may in turn be due to increasing trends in precipitation and river discharge. The record since 2009 for SRP indicates high interannual variability and no discernible change in loadings over time. Recent TP loads are dominated by nonpoint sources (71%), with lower contributions from point sources (19%) and the balance comprising atmospheric deposition and loads from the upstream Great Lakes. Approximately one-half (48%) of the load of SRP is contributed from nonpoint sources, approximately 39% comprises point sources, and atmospheric deposition and upstream loads comprise 6% each. Loads are highest to the western basin for TP and highest to the Huron–Erie corridor for SRP. U.S. sources account for a majority (>80%) of the phosphorus loads entering the lake. Recommendations for improvements to the study approach are made including the identification of monitoring gaps and the testing of assumptions that require independent verification.

1. Introduction

The 2012 Protocol to the United States–Canada Great Lakes Water Quality Agreement (GLWQA) calls for the review and revision of nutrient-related targets for the Great Lakes, including the establishment of nearshore and offshore water quality and tributary concentrations or loadings goals in order to meet the General and Specific Objectives as outlined in the Agreement. For Lake Erie, the commitments are time-bounded; phosphorus loadings targets have recently been approved, and the establishment of programs and policies needed to attain these targets is to be completed by 2017.

The existing nutrient targets, set forth in the 1978 Amendment to the GLWQA, were based on mass balance models that related in-lake total phosphorus (TP) concentrations to TP loadings. Given the desired trophic status of Lake Erie's western and central basins as mesotrophic and its eastern basin as oligotrophic, the loadings needed to achieve the corresponding in-lake concentrations were established. The programs and measures that were instituted by both the United States and Canada to meet these targets were largely successful at reducing loadings to the Great Lakes, and in-lake concentrations have declined (DePinto et al., 1986). Indeed, in all of the Great Lakes, with the exception of Lake Erie, the offshore environments have shown evidence of phosphorus declines that have overreached their targets, resulting in offshore oligotrophication (Dove and Chapra, 2015). Lake Erie phosphorus concentrations are now lower than maximum values observed in the early 1970s, but they remain higher than targets, show high interannual variability, and persistent nutrient issues remain. Symptoms of excessive nutrient inputs include a resurgence of algal blooms including harmful cyanobacteria in the western basin of Lake Erie (Michalak et al., 2013; Stumpf et al., 2012) and increased hypoxia in the central basin (Zhou et al., 2013). There is also some evidence that, despite a reduction in overall loadings of TP to Lake Erie over time, the proportion comprised by the more bioavailable soluble reactive phosphorus (SRP) component may be increasing (Daloğlu et al., 2012; Richards et al., 2010; Scavia et al., 2014). In Lake Erie, the target TP load of 11,000 metric tonnes per annum (MTA) (GLWQA, 1978) was achieved by 1981 (DePinto

* Corresponding author.
E-mail addresses: maccmj03@gmail.com (M.J. Maccoux), alice.dove@canada.ca (A. Dove), sean.backus@canada.ca (S.M. Backus).
[1] Deceased 18 June 2013.

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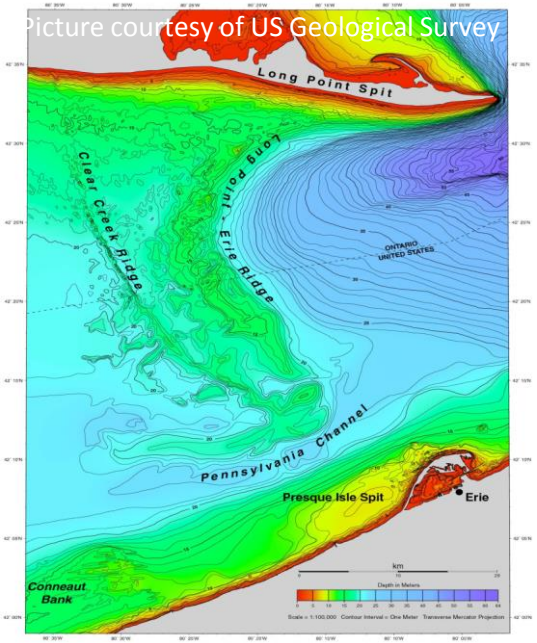

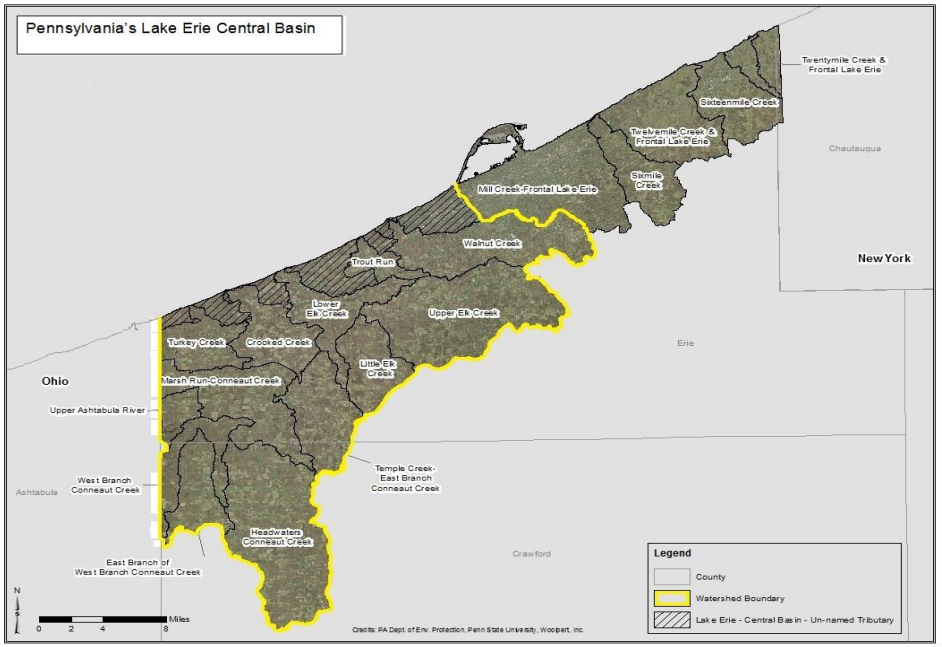

Defining Central Basin:

- Utilized existing information from multiple sources.

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Point Sources

237 NPDES permitted discharges in Central Basin watershed.

- 2 Concentrated Animal Feeding Operations
- 5 MS4 Permits: 4 General, 1 Individual, 1 waived
- 7 POTWs: 5 Minor (>1 MGD), 2 Major (1<5)
- 33 Industrial: 27 Minor, 5 No Discharge
- **166+ Private Wastewater Discharges**

Picture courtesy of Washington State Dept. of Ecology

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Estimating non-point sources:

- Pennsylvania tributaries Ashtabula Creek or Conneaut Creek are combined into Ashtabula-Conneaut Complex, others lumped into "Direct Discharge" when they were modeled.
- Used Ashtabula-Conneaut Complex as a reference watershed for loading characteristics.

*Table 1: Estimated Pennsylvania Annual TP Loading to the Ashtabula-Conneaut Complex (2008-2013)**

Year	Complex Total TP Loading (MTA)	Prorated PA Complex TP Loading (MTA)	PA Percent TP Reduction Over 2008 Baseline
2008	69	32.0	
2009	26	12.1	62.20%
2010	24	11.1	65.30%
2011	40	18.6	41.80%
2012	52	24.1	24.70%
2013	13	6.0	81.30%

Statistics and percent reductions derived from data presented by Maccoux.

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PA Total Phosphors Loading to Central Basin:

- Total Ashtabula-Conneaut Complex comparable to entire PA Central Basin watershed.
- Used the Ashtabula-Conneaut Complex to estimate PA Central Basin loading.
- Based on this assessment, PA averages 40.7 MTA, or 0.51% of the total HEC, WB, CB load for the years 2008-2013.

Table 2: Estimated Pennsylvania Annual TP Loading to the Central Basin (2008-2013)

Year	Complex Total TP Loading (MTA)	Estimated PA Central Basin TP Loading (MTA)
2008	69	75.2
2009	26	28.3
2010	24	26.2
2011	40	43.6
2012	52	56.7
2013	13	14.2
2008-2013 Average Annual TP Loading	37.3	40.7

Table 3: Estimated Pennsylvania Annual Percent TP Loading to the Central Basin (2008-2013)

Year	Maccoux Central Basin TP Loading (MTA)	Estimated PA Central Basin TP Loading (MTA)	Estimated PA Central Basin % of Total Loading
2008	9736	75	0.77
2009	7637	28	0.37
2010	5352	26	0.49
2011	10092	44	0.43
2012	7045	57	0.80
2013	7493	14	0.19
2008-2013 Estimated Average PA Percentage of Total CB Loading			0.51

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PA Central Basin Loading Conclusions:

- PA's phosphorus contributions to CB are de minimus and have little overall effect on the hypoxia/anoxia being observed in CB.
- Even if it were possible for PA to reduce tributary loading from current levels, those reductions would only relieve hypoxia/anoxia in the Central Basin by a small fraction of a percent.
- Pennsylvania's loading contributions to the Central Basin of Lake Erie are likely already attaining the 40% reduction in TP over the 2008 baseline.
- Additionally, the loading estimations suggest that any large-scale phosphorus reductions in many Pennsylvania tributaries may affect the biologic productivity of the stream systems.

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Draft PA Lake Erie DAP

Measuring Progress and Achieving Consensus

- PA DEP will compile NPDES discharge loading data.
- PADEP will report known phosphorus contributions and reductions on a frequency to be mutually determined between PA DEP and U.S. EPA.
- PADEP will participate in the submission of phosphorus contribution and reduction data for the purposes of tracking and accounting for total lakewide phosphorus reductions.

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Public Participation

Public Comment on the PA DAP was announced in the May 27, 2017 edition of the Pennsylvania Bulletin. Comments will be accepted between May 27, 2017 and June 26, 2017. Comments can be provided via the eComment system, by email, or by mail.

- eComment and Draft DAP Document Access: www.ahs.dep.pa.gov/eComment
- Written comments accepted by email at ecomment@pa.gov or by mail to Department of Environmental Protection, Policy Office, Rachel Carson State Office Building, P.O. Box 2063, Harrisburg, PA 17105-2063

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Pennsylvania Commitments

Provide Greater Assurance of Pennsylvania Phosphorus Loading Estimations - Pennsylvania will conduct the following activities by the year 2021 to attain greater confidence in the loading estimations:

- **Research and Assemble all Available Water Quality Data for Central Basin Tributaries**

- **Evaluate and Assess Applicability of Existing Data and Report**

- **Conduct Tributary Land Use Assessment and GIS-based Nutrient Modeling**

  During the years 2021 and 2022, Pennsylvania will evaluate the existing data, land use and land cover assessments, any available pollutant transport modeling, and determine additional data needs.

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Pennsylvania Commitments

Prioritize Delivery of PA DEP Nutrient Reduction Programs to Central Basin Tributaries

- **PADEP Clean Water**
  - SWM Associated with Construction Activities
  - Small Flow Treatment Facilities
  - Concentrated Animal Feeding Operations
  - MS4 Permitting
  - Act 537 Sewage Facilities Planning Program
  - NPDES E&S Control Permitting
  - Manure and Nutrient Management
  - Agricultural Erosion and Sediment Management

- **PADEP Coastal Resource Management Program**
  - Coastal Zone Management Program

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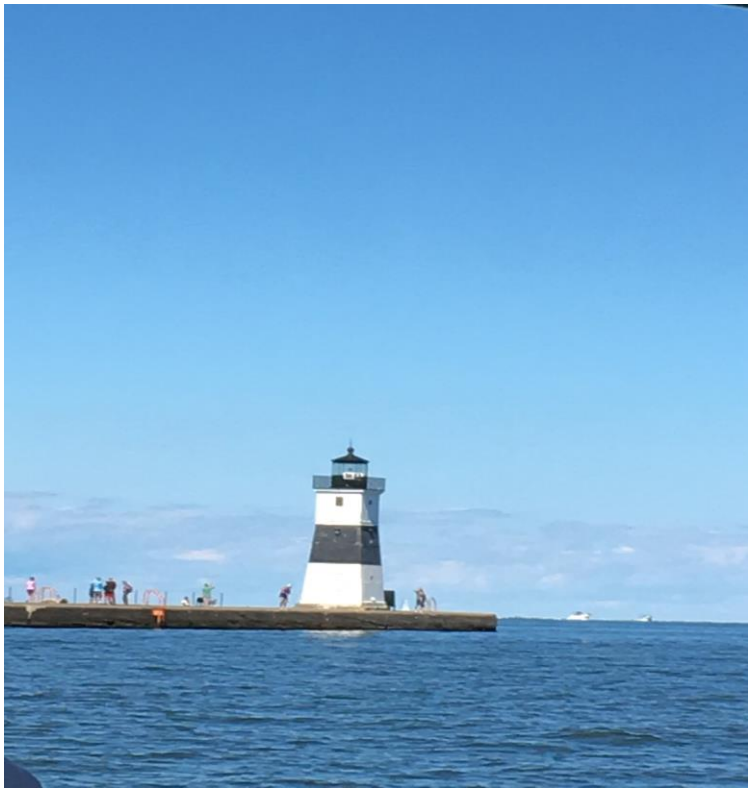
Pennsylvania Commitments

DEP Partnerships with County/Local Governments and Non-Governmental Orginizations

- PA Vested in Environmental Sustainability Program (VinES)
  - Erie County Conservation District
- Erie County Small Flow Treatment Facility Program
  - Erie County Department of Health
- Urban Stormwater Management and Green Infrastructure Initiatives
  - Erie County Department of Planning and NGO Partners



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DEP's Mission

"To protect Pennsylvania's air, land and water from pollution and to provide for the health and safety of its citizens through a cleaner environment. We will work as partners with individuals, organizations, governments, and businesses to prevent pollution and restore our natural resources."

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