

Too Much of a Good Thing: The Problem of Nutrient Pollution

Nicole Zacharda, Program Manager, Great Lakes Commission

September 14, 2019

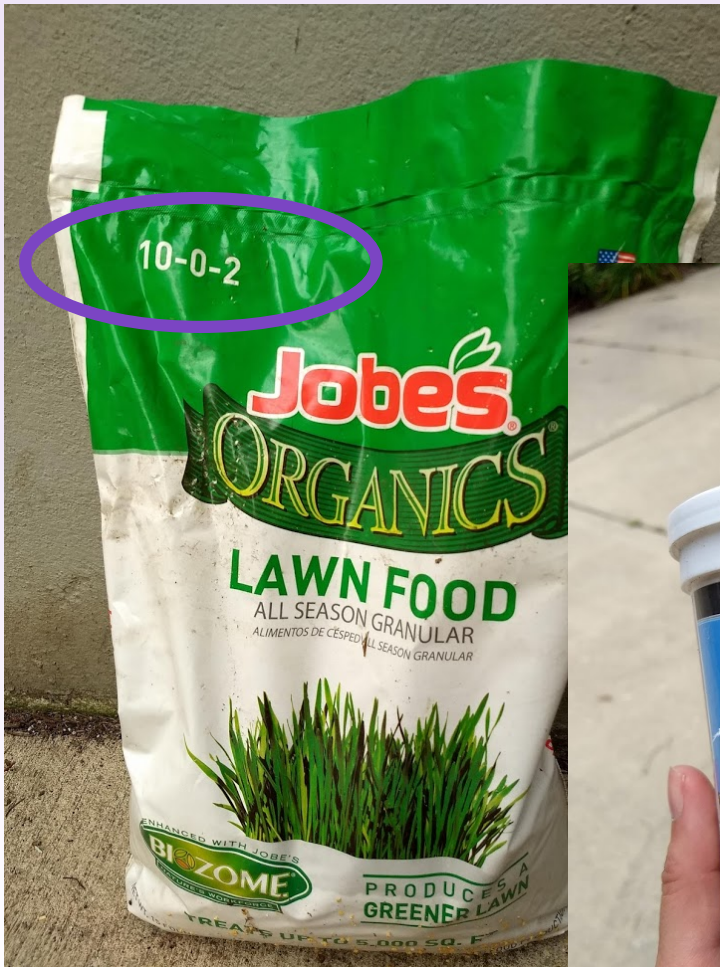


Great Lakes-St. Lawrence
Legislative Caucus



MIDWEST

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Osmocote® Smart-Release® Plant Food Plus Outdoor & Indoor 15-9-12

GUARANTEED ANALYSIS		F643	Molybdenum (Mo)†	0.02%
Total Nitrogen (N)†	15%	8.4% Ammoniacal Nitrogen	Zinc (Zn)	0.05%
6.6% Nitrate Nitrogen		0.015% Water Soluble Zinc (Zn)		
Available Phosphate (P ₂ O ₅)†	9%			
Soluble Potash (K ₂ O)†	12%			
Magnesium (Mg)†	1.3%			
0.9% Water Soluble Magnesium (Mg)				
Sulfur (S)†	6.0%			
6.0% Combined Sulfur (S)				
Boron (B)†	0.02%			
Copper (Cu)†	0.05%			
0.05% Water Soluble Copper (Cu)				
0.00% Water Soluble Iron (Fe)†	0.46%			
0.01% Coated Iron (Fe)				
0.00% Water Soluble Manganese (Mn)	0.06%			
0.01% Water Soluble Manganese (Mn)				

†The Nitrogen, Phosphate, Potash, Magnesium, Sulfur, Boron, Iron, Manganese, Molybdenum, and Zinc sources have been coated to provide 12-17% coated slow-release Nitrogen (N), 7.6% coated slow-release Available Phosphate (P₂O₅), 10.2% coated slow-release Soluble Potash (K₂O), 1.1% coated slow-release Magnesium (Mg), 0.1% coated slow-release Sulfur (S), 0.015% coated slow-release Boron (B), 0.35% coated slow-release Iron (Fe), 0.05% coated slow-release Manganese (Mn), 0.015% coated slow-release Molybdenum (Mo), 0.016% coated slow-release Zinc (Zn).

**KEEP OUT OF REACH OF CHILDREN
MANTENER FUERA DEL ALCANCE DE LOS NIÑOS**

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Nitrogen

Phosphorus

Potassium?



THE PERIODIC TABLE

1 H HYDROGEN 1.008																	2 He HELIUM 4.002
3 Li LITHIUM 6.941	4 Be BERYLLIUM 9.012											5 B BORON 10.811	6 C CARBON 12.011	7 N NITROGEN 14.007	8 O OXYGEN 15.999	9 F FLUORINE 18.998	10 Ne NEON 20.180
11 Na SODIUM 22.990	12 Mg MAGNESIUM 24.305											13 Al ALUMINUM 26.982	14 Si SILICON 28.086	15 P PHOSPHORUS 30.974	16 S SULFUR 32.065	17 Cl CHLORINE 35.453	18 Ar ARGON 39.948
19 K POTASSIUM 39.098	20 Ca CALCIUM 40.078	21 Sc SCANDIUM 44.956	22 Ti TITANIUM 47.88	23 V VANADIUM 50.942	24 Cr CHROMIUM 51.996	25 Mn MANGANESE 54.938	26 Fe IRON 55.845	27 Co COBALT 58.933	28 Ni NICKEL 58.693	29 Cu COPPER 63.546	30 Zn ZINC 65.39	31 Ga GALLIUM 69.723	32 Ge GERMANIUM 72.61	33 As ARSENIC 74.922	34 Se SELENIUM 78.96	35 Br BROMINE 79.904	36 Kr KRYPTON 83.80
37 Rb RUBIDIUM 85.468	38 Sr STRONTIUM 87.62	39 Y YTTORIUM 88.906	40 Zr ZIRCONIUM 91.224	41 Nb NIOBIUM 92.906	42 Mo MOLYBDENUM 95.94	43 Tc TECHNETIUM 98.906	44 Ru RUTHENIUM 101.07	45 Rh RHODIUM 102.905	46 Pd PALLADIUM 106.42	47 Ag SILVER 107.868	48 Cd CADMIUM 112.411	49 In INDIUM 114.818	50 Sn TIN 118.71	51 Sb ANTIMONY 121.757	52 Te TELLURIUM 127.6	53 I IODINE 126.905	54 Xe XENON 131.29
55 Cs CESIUM 132.905	56 Ba BARIUM 137.327	57-71 LANTHANIDE SERIES	72 Hf HAFNIUM 178.49	73 Ta TANTALUM 180.948	74 W TUNGSTEN 183.85	75 Re RHENIUM 186.207	76 Os OSMIUM 190.23	77 Ir IRIDIUM 192.22	78 Pt PLATINUM 195.08	79 Au GOLD 196.967	80 Hg MERCURY 200.59	81 Tl THALLIUM 204.383	82 Pb LEAD 207.2	83 Bi BISMUTH 208.980	84 Po POLONIUM 209	85 At ASTATINE 208.987	86 Rn RADON 222.018
87 Fr FRANCIUM 223	88 Ra RADIUM 226	89-103 ACTINIDE SERIES	104 Rf RUTHERFORDIUM 261	105 Db DUBNIUM 262	106 Sg SEABORGIUM 263	107 Bh BOHRIUM 264	108 Hs HASSIUM 265	109 Mt MEITNERIUM 266	110 Ds DARMSTADTIUM 267	111 Rg ROENTGENIUM 268	112 Cn COPECHEVIUM 269	113 Uut UNUNTRIUM 270	114 Fl FLEROVIUM 270	115 Uup UNUNPENTIUM 271	116 Lv LIVERMORIUM 273	117 Uus UNUNSEPTIUM 273	118 Uuo UNOCTIUM 277

57 La LANTANUM 138.905	58 Ce CELESIUM 140.116	59 Pr PRASEODYMIUM 140.908	60 Nd NEODYMIUM 144.24	61 Pm PROMETHIUM 144.913	62 Sm SAMARIUM 150.36	63 Eu EUROPIUM 151.964	64 Gd GADOLINIUM 157.25	65 Tb TERBIUM 158.925	66 Dy DYSPROSIUM 162.50	67 Ho HOLMIUM 164.930	68 Er ERBIUM 167.26	69 Tm THULIUM 168.934	70 Yb Ytterbium 173.04	71 Lu LUTETIUM 174.967
89 Ac ACTINIUM 227.028	90 Th THORIUM 232.038	91 Pa Protactinium 231.036	92 U URANIUM 238.029	93 Np NEPTUNIUM 237.048	94 Pu PLUTONIUM 244.064	95 Am AMERICIUM 243.061	96 Cm CURIUM 247.070	97 Bk BERKELIUM 247.070	98 Cf CALIFORNIUM 251.080	99 Es EINSTEINIUM 252	100 Fm FERMIUM 257.103	101 Md MEISENERIUM 258	102 No NOBELIUM 259	103 Lr LAWRENCIUM 262

ALKALI METAL	ALKALINE EARTH	TRANSITION METAL	HALOGEN	SEMI-METAL	NON-METAL	BASIC METAL	LANTHANIDE	ACTINIDE	NOBLE GAS
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Nutrients & Water Quality Impacts

Phosphorus

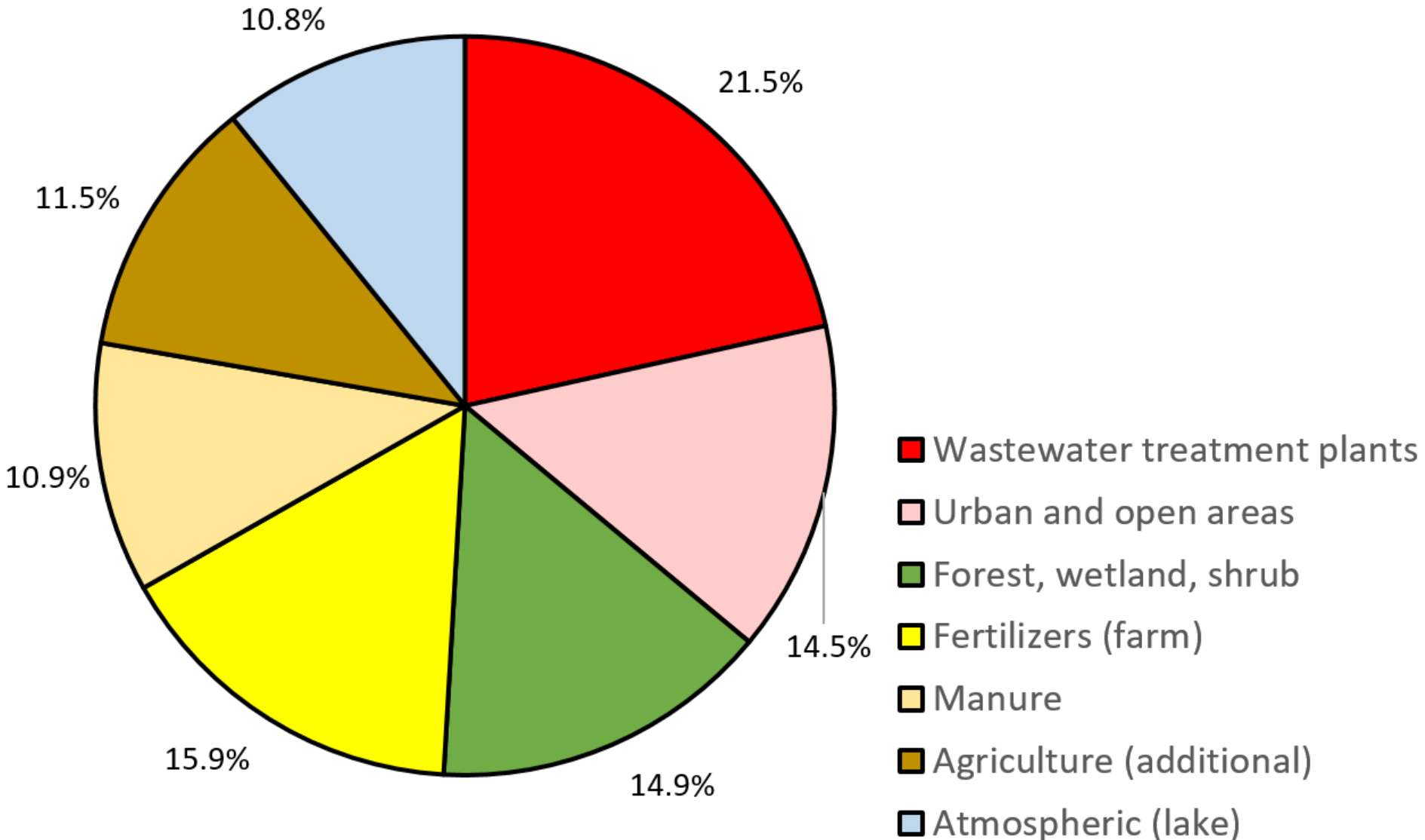
- ✓ Algae (harmful & nuisance)
- ✓ Harmful algae may produce algal toxins
- ✓ Decomposing algae depletes oxygen, creating hypoxia or dead zones

Nitrogen

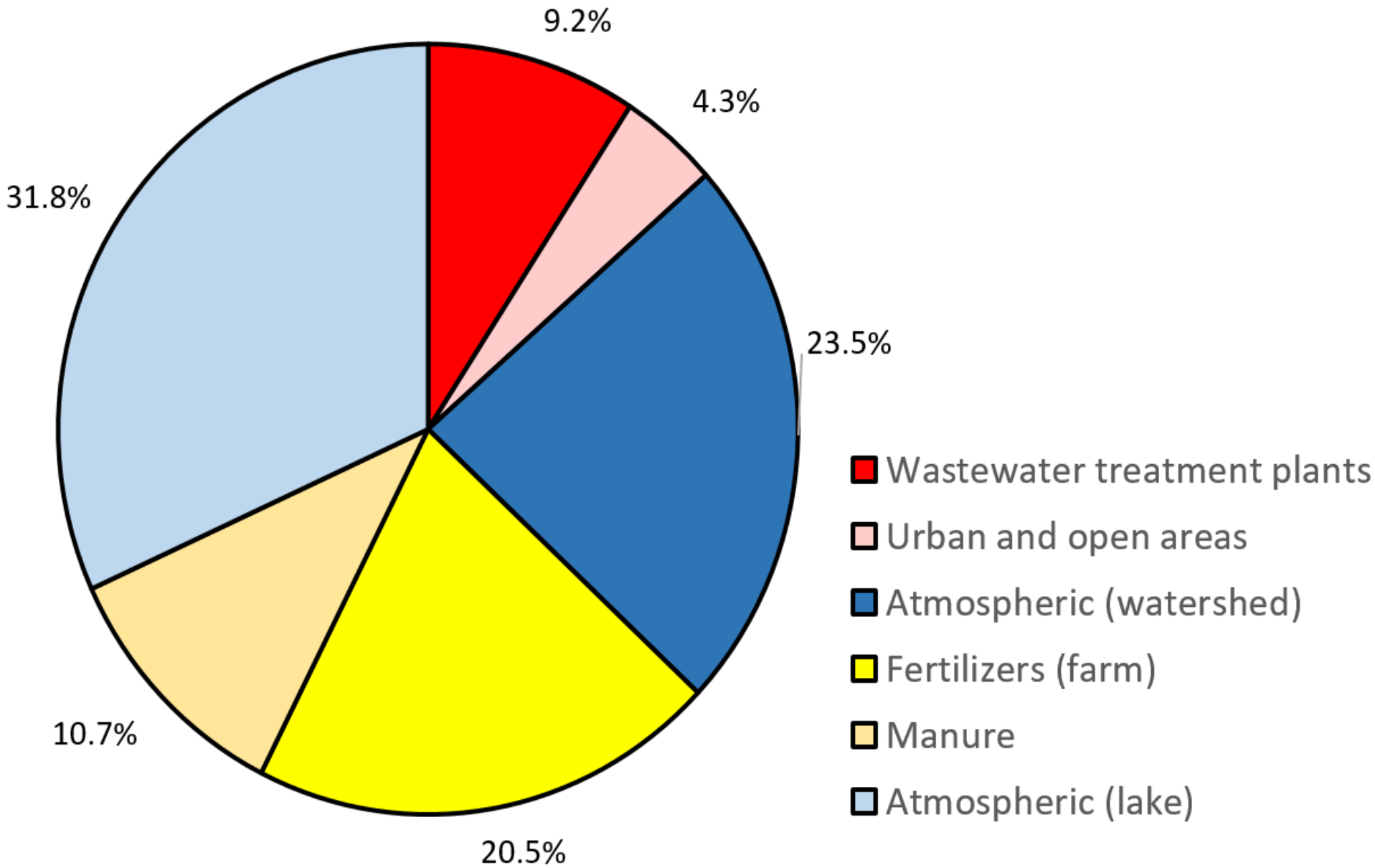
- ✓ Also contributes to algal bloom formation & toxicity
- ✓ Acute threat to drinking water ("Blue Baby Syndrome," *methemoglobinemia*)

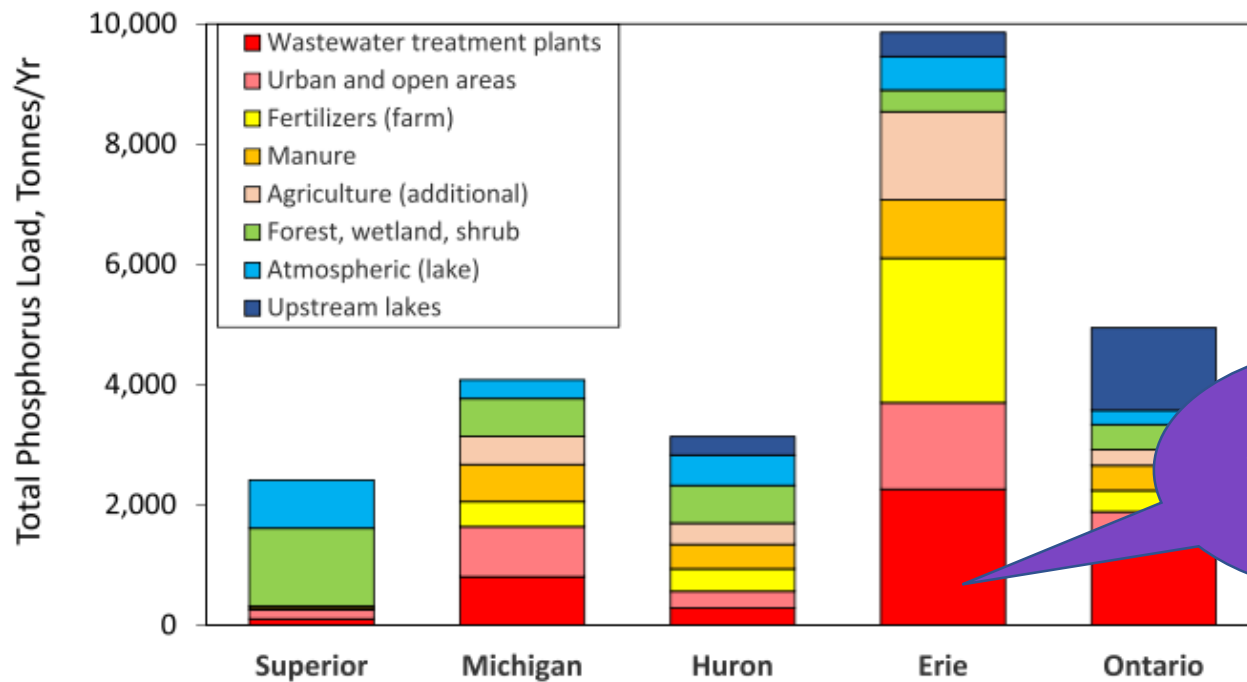
Total Phosphorus Contributions to the Great Lakes

2002 data sources, presented by Robertson et al., 2019; JAWRA

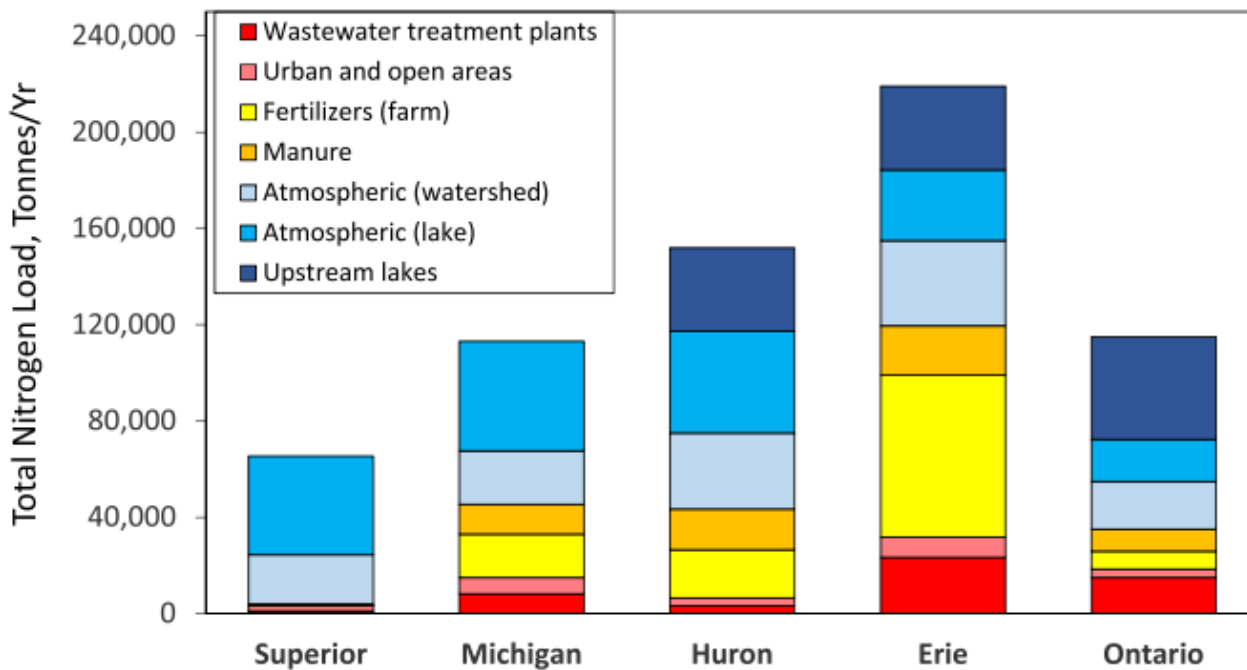


Total Nitrogen Contributions to the Great Lakes





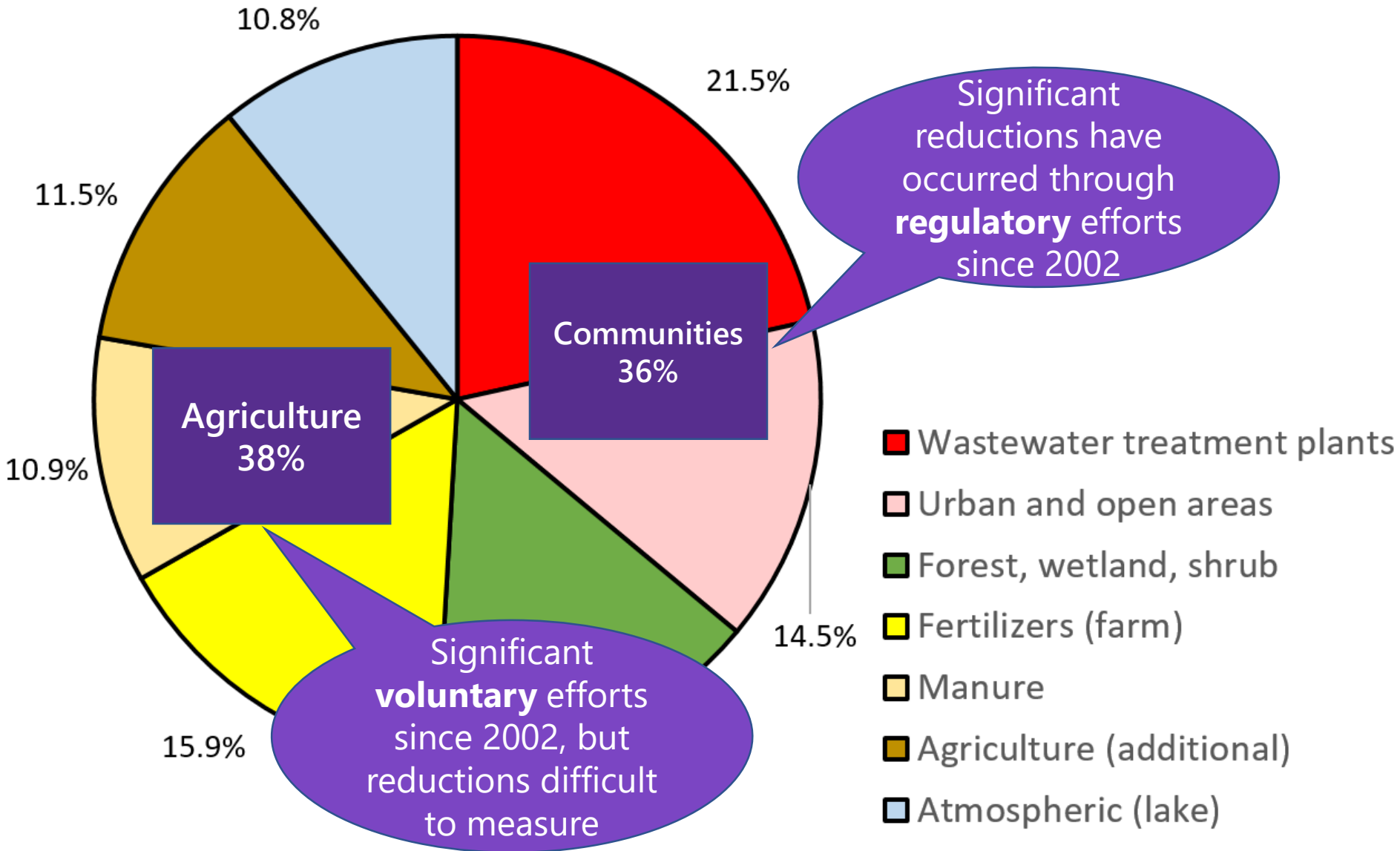
65% reduction at Great Lakes Water Authority announced this year



Robertson et al., 2019;
JAWRA

Total Phosphorus Contributions to the Great Lakes

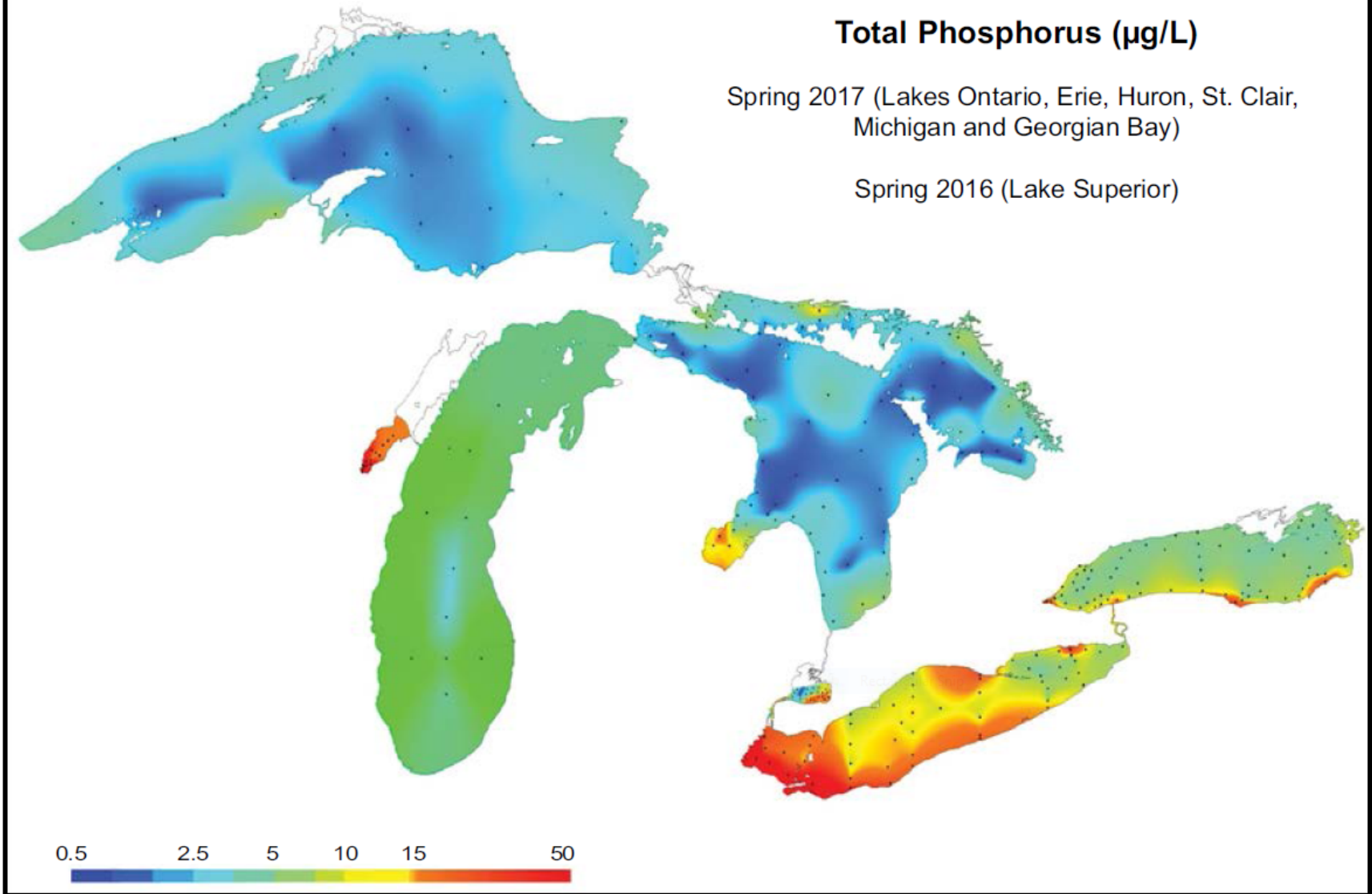
2002 data sources, presented by Robertson et al., 2019; JAWRA



Total Phosphorus ($\mu\text{g/L}$)

Spring 2017 (Lakes Ontario, Erie, Huron, St. Clair,
Michigan and Georgian Bay)

Spring 2016 (Lake Superior)



Source: Environment and Climate Change Canada, and United States Environmental Protection Agency, 2019.

Maumee River Loads

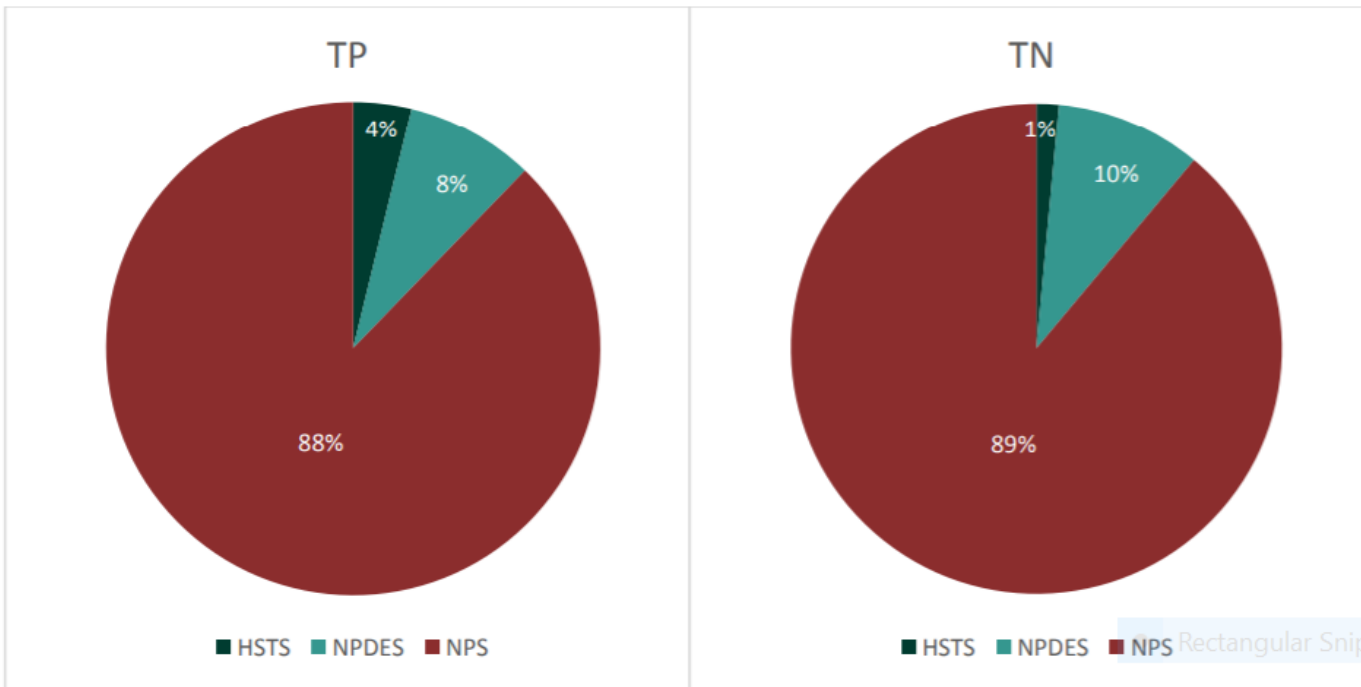


Figure 10 — Proportion of total phosphorus and nitrogen load from different sources for the Maumee watershed, average of 5-years (wy13-wy17).

Fox River Basin

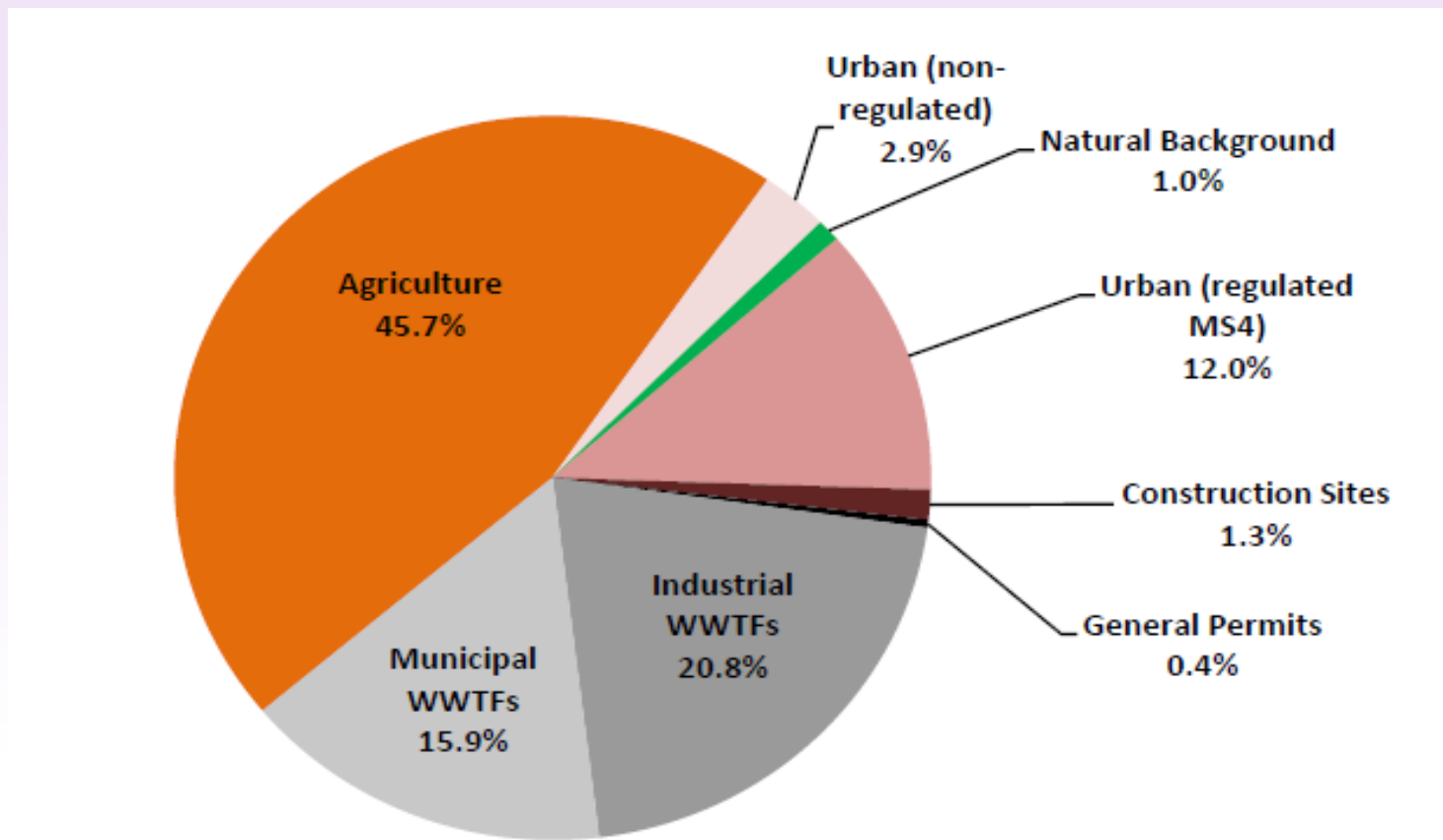
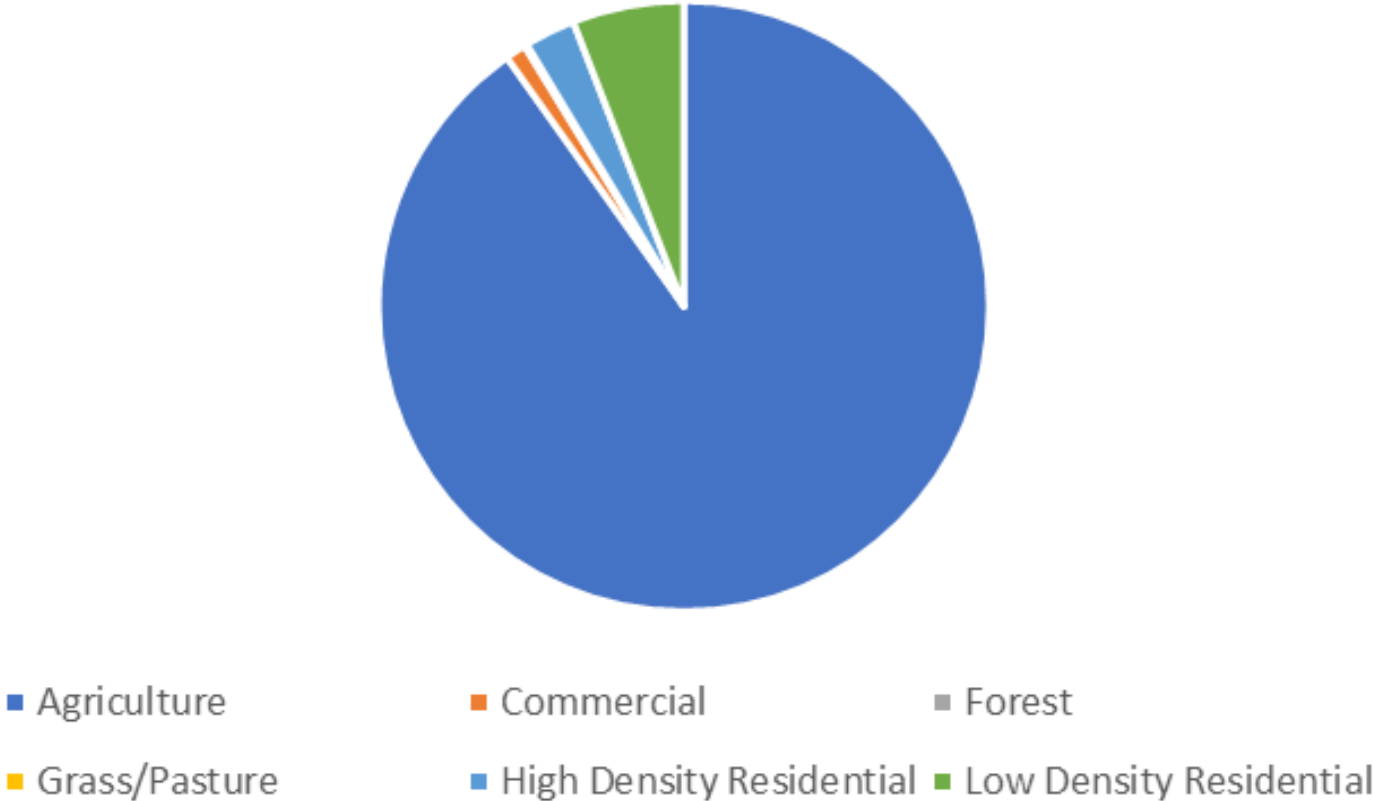


Figure 19. Sources of baseline TP loading in the LFR Basin

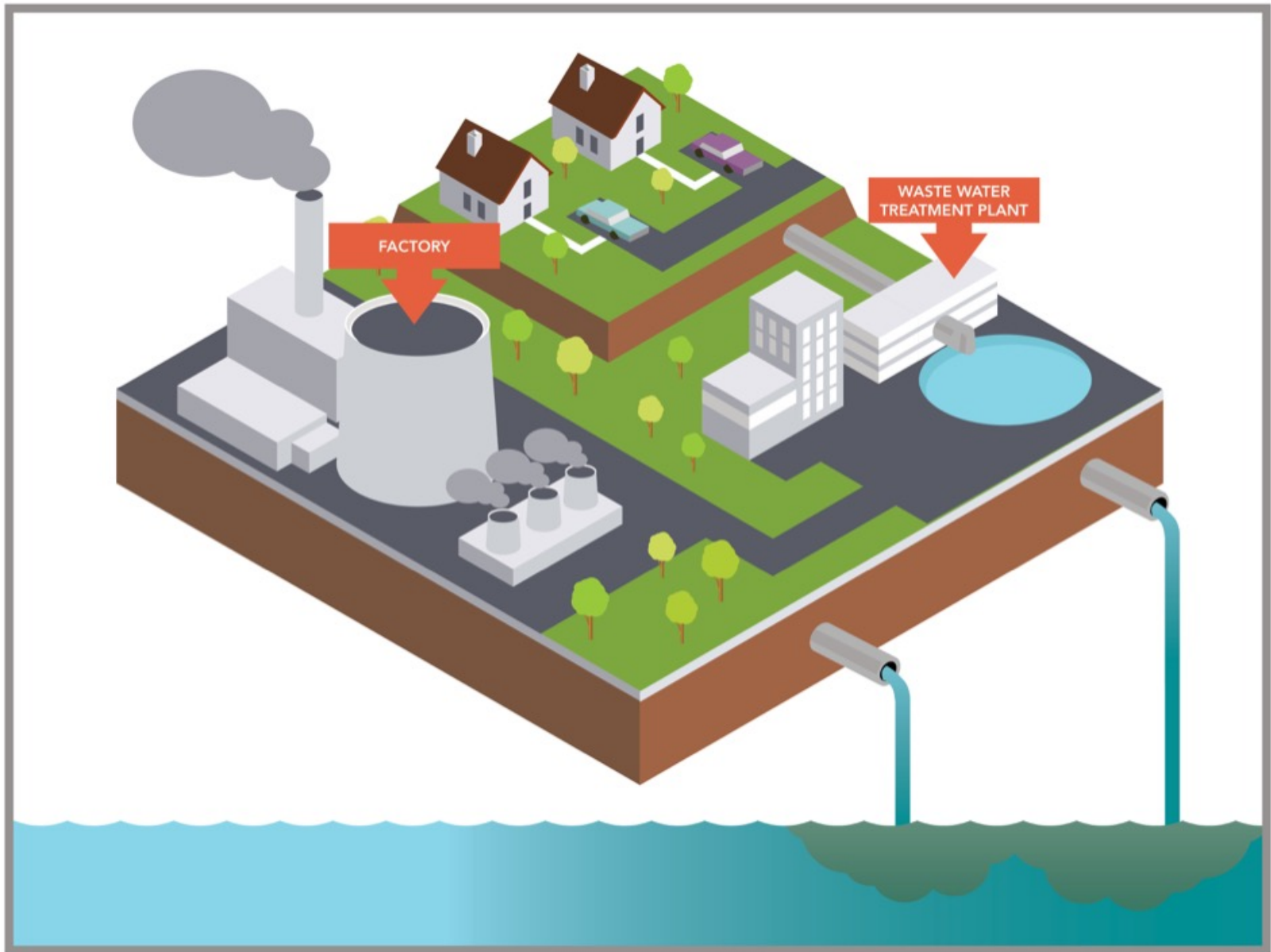
From Wisconsin DNR's TMDL Report

Saginaw Bay

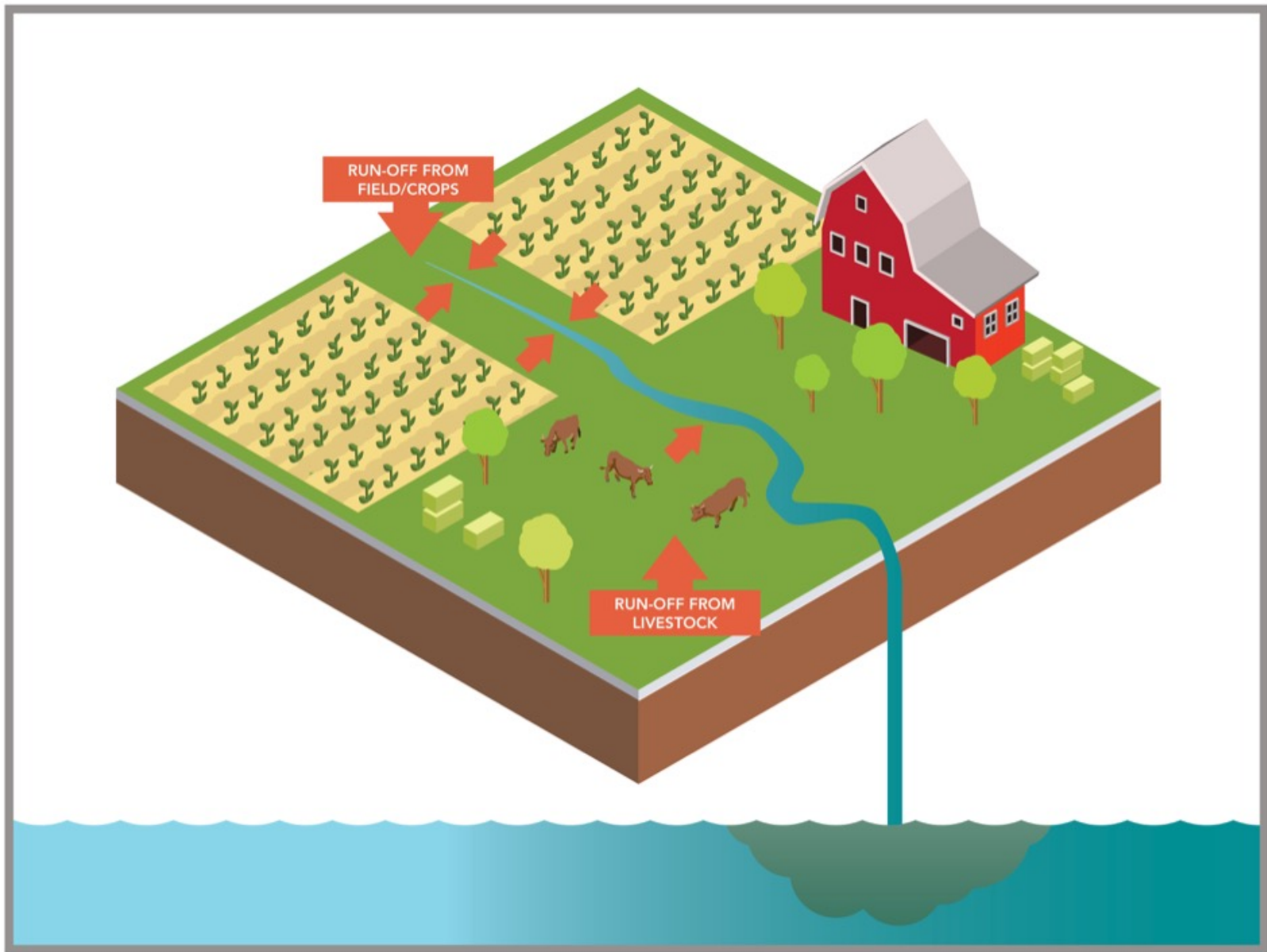
Percent of Phosphorus Load



Adapted from a 2010 Michigan DEQ study



Graphic courtesy of Heidelberg University



Graphic courtesy of Heidelberg University

“For over forty years, the Great Lakes Water Quality Agreement has served as a **guidepost for the binational management of the Great Lakes and as a model of international cooperation for the protection of water quality in other large lakes of the world.”**

From www.binational.net

The agreement, between the U.S. and Canada, is overseen by a Great Lakes Executive Committee

The 2012 GLWQA & Annex 4

Interim Substance Objectives for Total Phosphorus Concentration in Open Waters (ug/l) (as represented by Spring means)

Lake Superior	5
Lake Huron	5
Lake Michigan	7
Lake Erie (western basin)	15
Lake Erie (central basin)	10
Lake Erie (eastern basin)	10
Lake Ontario	10

Interim Phosphorus Load Targets (Metric Tonnes Total P Per Year)

Lake Superior	3400
Lake Michigan	5600
Saginaw Bay	440
Lake Erie	11000
Lake Ontario	7000

New target established in 2016
for western & central basins:
6000 MT (aka the 40% reduction
goal)

State & Provincial Leadership

- Permit limits for point sources
- Non-traditional “point sources” (concentrated animal feeding operations & storm water)
- Environmental certification programs for farms
- Restrictions on fertilizer use and application
- Support for green or natural infrastructure
- Water quality standards for nutrients
- Funding for research initiatives
- Grant programs for nonpoint source control
- Identification of high-quality (or at risk) waterbodies
- Water Quality Trading

A word cloud centered around the text "Great Lakes & St. Lawrence regulation". The words are in various colors and sizes, arranged in a roughly circular shape. The most prominent words are "Great Lakes & St. Lawrence regulation" in large blue letters. Other significant words include "voluntary" in blue, "TMDL" in red, "funding" in blue, "fishable" in green, "tools" in green, "nature" in blue, "environment" in purple, "pointsource" in green, "water" in green, "MS4" in purple, "stormwater" in green, "spreading" in blue, "swimmable" in blue, "Communities" in red, "nitrogen" in red, "pollution" in purple, "authority" in purple, "city" in green, "NPDES" in purple, "setbacks" in purple, "farm" in blue, "licensing" in blue, "research" in purple, "clean" in blue, "CSO" in red, "nonpoint" in blue, "drinkable" in blue, "phosphorus" in green, "groundwater" in green, "certification" in green, "manure" in green, "rivers" in blue, "solution" in purple, "nutrient" in blue, "fertilizer" in purple, "buffers" in blue, and "drinking" in blue.

Great Lakes & St. Lawrence regulation

voluntary

TMDL

funding

fishable

tools

nature

environment

pointsource

water

MS4

stormwater

spreading

swimmable

Communities

nitrogen

pollution

authority

city

NPDES

setbacks

farm

licensing

research

clean

CSO

nonpoint

drinkable

phosphorus

groundwater

certification

manure

rivers

solution

nutrient

fertilizer

buffers

drinking

Two overused (yet valid) sayings... and one opinion

- ✓ What gets measured, gets managed
- ✓ Don't let the perfect be the enemy of the good
- ✓ None of this is going to be easy, but it is necessary



www.blueaccounting.org

FILTER BY

Nutrients x Jurisdiction Locality APPLY

LIST VIEW GRID VIEW

The Minnesota Buffer Law

Updated on: June 13 2019

The Minnesota Buffer Law requires landowners to establish perennial vegetation buffers of up to 50 feet along lakes, rivers, and streams and buffers of 16.5 feet along ditches in order to reduce nutrient and

LEARN MORE

Erie County Pennsylvania's PA VinES Program

Updated on: June 14 2019

PA VinES (Pennsylvania Vested in Environmental Sustainability) is a voluntary program that promotes self-assessment of on-farm operations in Erie County's vineyards and provides a pathway for grape growers to access

LEARN MORE

The Michigan Agriculture Environmental Assurance Program (MAEAP)

Updated on: June 13 2019

The Michigan Agriculture Environmental Assurance Program (MAEAP) is a voluntary verification program that helps farmers reduce environmental impacts from their operations by providing technical

LEARN MORE

Healthy Urban Waters' Huron-to-Erie-Real-Time Drinking Water Protection Network

Updated on: June 13 2019

The Huron-to-Erie Real-time Drinking Water Protection Network collects data on source water quality in real time to promote collaborative water research and community education, and as a tool to aid emergency

LEARN MORE

The Indiana Agriculture Nutrient Alliance

Updated on: June 13 2019

The Indiana Agriculture Nutrient Alliance (IANA) is a non-profit organization that brings together agriculture groups, government agencies, conservation organizations and academics working to improve

LEARN MORE

The Wisconsin Nutrient Strategy

Updated on: June 13 2019

The Wisconsin Nutrient Strategy is a framework that brings together diverse nutrient management activities for point sources and nonpoint sources across the state. It documents the progress of ongoing

LEARN MORE



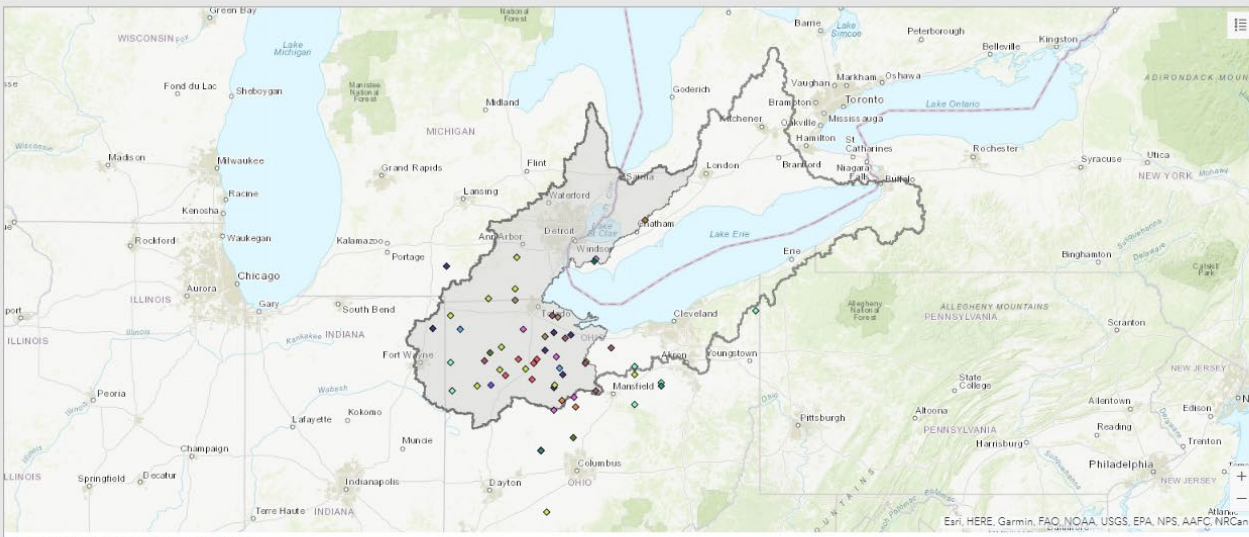
Blue Accounting Source Water

Protecting Drinking Water at its Source



This map shows retailers participating in the 4R Nutrient Stewardship Certification program. The program encourages agricultural retailers, service providers, and other certified professionals to implement proven best practices through the 4Rs, which refers to using the Right Source of Nutrients at the Right Rate and Right Time in the Right Place. ErieStat is helping participants track progress in terms of acres being managed consistent with the 4Rs, numbers of clients working with 4R certified professionals, and retailer certifications in the Lake Erie Basin over time. Use the tabs to select for either the Western Lake Erie Basin (WLEB) or Lake Erie Basin to view progress.

For more information visit:
[ErieStat Strategies - Agriculture](#)
[ErieStat Investments - Agriculture](#)



Sources: 4R Ontario, Nutrient Stewardship Council

44

Certified Facilities in the Western Lake Erie Basin

WLEB Total

2.02M

Acres in WLEB

WLEB Total

4,900

Customers in WLEB

WLEB Total

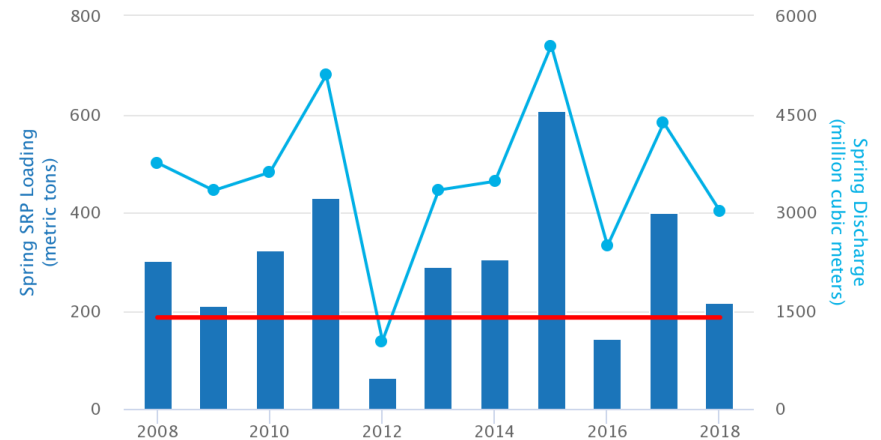


Blue Accounting ErieStat

Tracking Progress Toward a Healthier Lake Erie

Maumee River Spring SRP Loading and Spring Discharge

*SRP: Soluble reactive phosphorus



● Spring SRP Loading ● Spring Discharge — Spring SRP Loading Target

Dr. Seuss
7301 Encelia Drive
La Jolla, California 92037

January 27, 1986

Dear Claudia Melear and Margie Pless:

You must think me terribly rude for not answering your very pleasant letter of December 6. The fault, however, is not mine. It just arrived this morning, having been somewhat circuitously forwarded from New York via pony express.

Although I will be unable to accept your kind invitation to come to Cleveland, I do agree with you that my 1971 statement in the Lorax about the condition of Lake Erie needs a bit of revision. I should no longer be saying bad things about a body of water that is now, due to great civic and scientific effort, the happy home of smiling fish.

I can assure you the process of purifying my text will commence immediately. Unfortunately, the purification of texts, like that of lakes, cannot be accomplished over night. The objectionable line will be removed from future editions. But it could possibly take more than a year before the existing stock of books has moved out of the book stores.

In the meantime, thank you for your letter and for all the great Loraxian work you have been doing.

Dr. Seuss

Theodor S. Geisel

Ohio State
University
Graduate
Students

Letter found
on Ohio Sea
Grant's blog,
3/2/19

A “great civic and scientific effort”
(that “cannot be accomplished
overnight”)...



Birkholz Fellows’ Path to an Action Agenda for Nutrients

The Institute Agenda

1. Introductory Web Meetings:

- ✓ September 20
- ✓ October 4

2. Briefing Book delivery

- ✓ Week of October 7
- ✓ Also available as a pdf.

3. Weekend Retreat in Detroit

- ✓ Friday afternoon tour of the Great Lakes Water Authority Water Resource Recovery Facility
- ✓ Evening session to understand different perspectives on nutrient control
- ✓ Saturday morning farm tour
- ✓ Action Agenda creation



