THE INTERSECTION BETWEEN NUTRIENT REDUCTION AND URBAN STORMWATER CONTROLS

Importance of MS4 Programs as a Vehicle to Reduce Nutrients in Urban Watersheds

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I. CURRENT NUTRIENT CONTROLS FOR POINT SOURCES IN URBAN AREAS

A. For the most part, focused on NPDES permits issued for POTWs

1. Nutrient limits derived from one or combination of different existing sources:

a. Great Lakes Water Quality Agreement (GLWQA) (U.S./Canada)

(1) Lake Erie basin only

(2) OAC 3745-1-37, Table 37-1 and OAC 3745-33-06(C)(1) (1.0 mg/l TP current limit)

(3) Annex 4 to the GLWQA

(a) Ohio's June 2015 commitment to achieving 40% reduction in current loadings into Lake Erie by 2025, with an aspirational goal of a 20% reduction by 2020

(b) August 2018 Ohio Domestic Action Plan designed to achieve the reductions

b. Total Maximum Daily Loads (TMDLs)

(1) Statewide program to address water quality-impaired waters in specific waterbodies, including nutrient-related impairments manifested by:

(a) low biological (fish/bug) scores;

(b) nuisance conditions (fish kills, algal blooms)

(c) elevated microsystins (cyanobacteria)

(2) TP limits recommended for point sources, usually 1.0 mg/l TP, but some as low as 0.8 mg/l TP

(3) 2018 impairment listing for Western Basin of Lake Erie

(a) Relationship to the GLWQA 40% reduction commitment and the separate Maumee River (main stem) TMDL

c. Individual nutrient limits (typically TP only) to address site-specific nuisance conditions or biological nonattainment in the absence of a TMDL

d. Technology-based nutrient limits

   (1) OAC 3745-33-05(E) (PTI-based design criteria)

e. Antidegradation-based nutrient limits (OAC 3745-1-05)

   (1) Once nutrient limits are in place, strict application of the antidegradation rule rachets the limits down each time the treatment plant increases its capacity, in order to keep nutrient loadings constant

II. POTENTIAL NEW SOURCES OF NUTRIENT CONTROLS ON POINT SOURCES IN URBAN AREAS

A. SNAP – Stream Nutrient Assessment Procedure for small rivers and streams

1. Basically a weight of evidence, numeric matrix of variables that indicate nutrient enrichment and potential for biological impairment
2. Draft completed in 2017, but not yet implemented through rulemaking

B. Large river nutrient matrix – Early stakeholder outreach (ESO) issued by OEPA in September 2018

1. Similar to SNAP but some different variables
2. Interested party review and/or preliminary draft rule expected mid to late 2019

III. CURRENT NUTRIENT CONTROLS FOR NONPOINT SOURCES IN URBAN AREAS

A. Basically limited to BMP-based guidance issued by U.S. EPA and other sources that indirectly reduce nutrients in urban runoff

1. Example – "National Management Measures to Control Nonpoint Source Pollution from Urban Areas" U.S. EPA 2005 (available at https://www.epa.gov/sites/production/files/2015-9/documents/urban_guidance_0.pdf)

a. Focus on ways to reduce impervious surfaces, increase pervious surfaces and reduce hydraulic connectivity between impervious surfaces; promote urban forestry, vegetative buffers, rooftops and rain gardens; increase on-site retention/detention; reduce erosion; and provide education and training to the community

IV. ARE POINT SOURCE CONTROLS (POTWS) AND NONPOINT SOURCE BMP GUIDELINES SUFFICENT TO ADEQUATELY CONTROL NUTRIENT IMPAIRMENTS IN URBAN AREAS?

A. According to OEPA, the answer is clearly "no":

"Point source nutrient controls at POTWs will not solve Ohio's nutrient problems. Solutions must integrate overall watershed management….[P]ollutant laden stormwater degrades water quality and results in unnatural flow regimes that result in loss of sensitive faunal species, increased dominance of pollutant tolerant species, increased algal biomass, and increased dominance of eutrophic algal species." [Point Source & Urban Runoff Nutrient Workshop Final Report and Recommendations, p. 9 Ohio EPA August 2012]

B. Ranking of urban runoff as a source of water quality impairment:

Table 0.1: Leading sources[b] of water quality impairment related to human activities for rivers, lakes, and estuaries (USEPA, 2002b).

Rivers and Streams	Lakes, Ponds, and Reservoirs	Estuaries
Agriculture (48%) [a]	Agriculture (41%) [a]	Municipal point sources (37%)[a]
Hydrologic modifications (20%)	Hydrologic modifications (18%)	Urban runoff/storm sewers (32%)
Habitat modifications (14%)	Urban runoff/storm sewers (18%)	Industrial discharges (26%)
Urban runoff/storm sewers (13%)	Misc. nonpoint source pollution (14%)	Atmospheric deposition (24%)

[a]Values in parentheses represent the percentage of assessed river miles, lake acres, or estuary square miles that are classified as impaired. States assessed 19% of stream miles, 43% of lakes, ponds, and reservoirs, and 36% of square mileage of estuaries.
[b] Excluding unknown, natural, and "other" sources.

C. Sources of nutrients in an urban watershed:

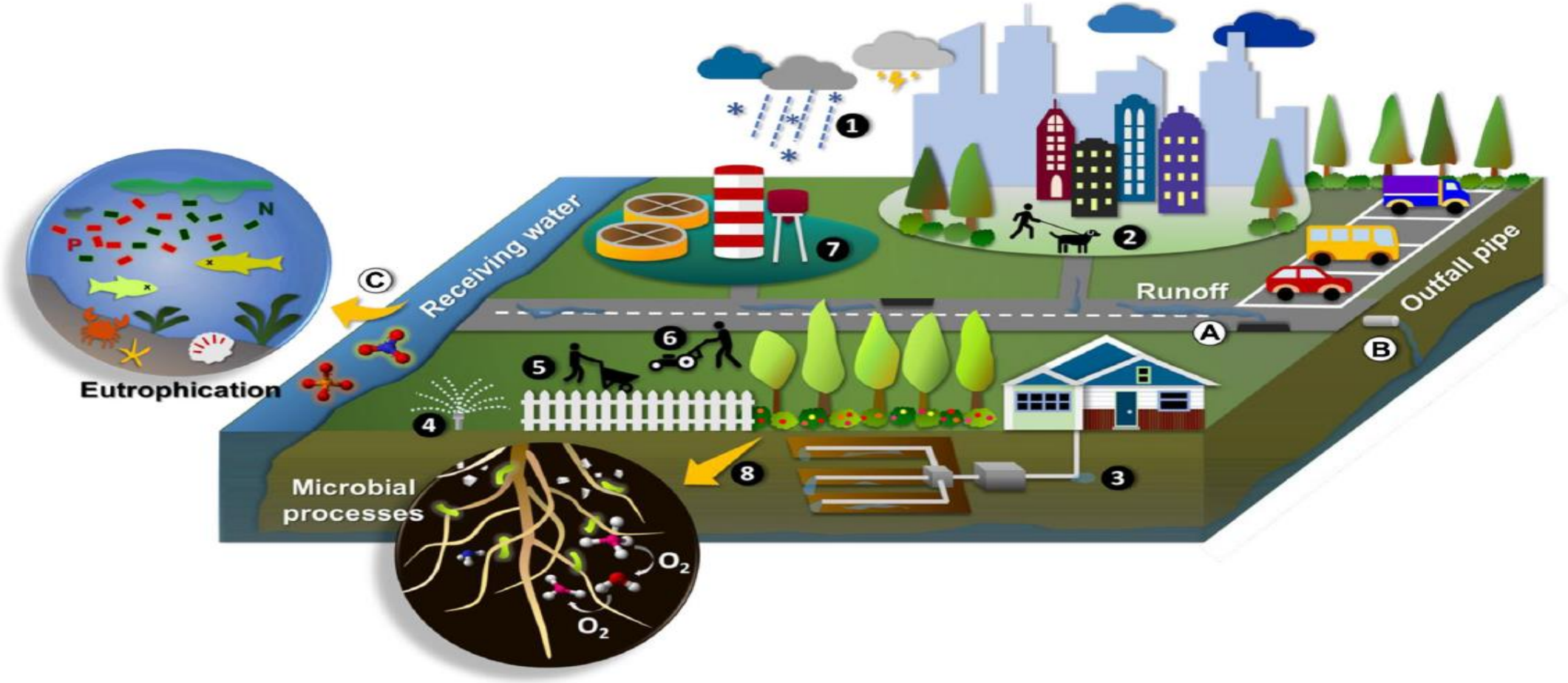

Fig. 1 Overview of pathways and sources of nutrients in urban environment. (A) Urban stormwater runoff is generated when precipitation from rain/snowmelt events over impervious surfaces. (B) Runoff water then makes its way into storm drains and discharges into streams, rivers, and estuaries untreated. (C) Excessive amounts of nutrients in water bodies can cause eutrophication, often leading to fish kills. The potential nutrient sources in urban stormwater runoff include (1) atmospheric deposition, (2) pet waste, (3) improperly functioning septic systems, (4) landscape irrigation, (5) use of chemical fertilizers on lawns, (6) soil and decomposition plant materials, (7) leaking sanitary sewers, and (8) microbial sources

[Nutrients in Urban Stormwater Runoff: Current State of the Science and Potential Mitigation Options, Yun-Ya Yang and Mary G. Lusk, Current Pollution Reports (2018) 4:112-127]

D. How point source nutrient limits for POTWs are impacted by urban stormwater runoff:

1. In Ohio, point source nutrient limits (phosphorus and nitrogen) for POTWs are ***not*** driven by the need to comply with numeric water quality standards for nutrients (at least so far….). Instead, they are driven primarily by:

   a. The need to comply with OEPA's numeric biological water quality standards for fish and bugs (macroinvertebrates) applicable to the river or stream that runs through the urban watershed, and

   b. Scientific studies demonstrating that excessive amounts of nutrients cause abnormal growth in aquatic plants and algae (referred to as eutrophication or enrichment) that leads to depleted dissolved oxygen levels that stress aquatic populations, resulting on lower scores for fish and bugs

2. Two components of urban stormwater runoff (sediments and high flows) also significantly contribute to nutrient enrichment and depressed biological scores in an urban river or stream:

   a. Sediments

      (1) Phosphorus and nitrogen are two of the three primary ingredients in fertilizers applied in all urban landscapes

      (2) Phosphorus is rapidly adsorbed onto soil particles, even when fertilizer is applied at low application rates, particularly in soils of the type found in Ohio with high clay content

      (3) Excessive sediments in urban runoff carry a substantial nutrient load to urban rivers and streams

(4) Effect of sediment nutrient loading is not just short-term

(a) As summertime temperatures increase and instream flows decrease, stratification of water occurs, creating an anoxic (low oxygen) zone at the bottom, which promotes certain heterotrophic bacteria whose feeding cycle releases phosphorus and nitrogen from sediments into the water column

(b) Excessive springtime sediment loadings from urban runoff can be the single greatest cause of late summer enrichment conditions (algal blooms, high chlorophyll levels, and low DO or wide daily DO swings) in an urban stream

(c) Compounded by the fact that biological scores are almost always collected in late summer, low flow conditions

(5) Excessive sediment loads also cause external deformities, erosion, lesions, and tumors (DELT anomalies) in fish (which is a separate biological score), and degrade natural substrates used by bugs to populate, leading to depressed bug scores

b. Excessive flow

(1) Every waterbody has a natural watershed drainage area and natural carrying capacity

(2) Excessive flow is detrimental even when the water is clean

(a) Scouring the natural substrates

(b) Widening the stream and eroding the banks and the natural canopy

(c) Increasing pooling/stagnation of flows

(d) Increasing temperature during summertime low-flow conditions

(3) While reducing/controlling impervious surfaces and increasing stormwater retention/detention reduce excessive flow, arguably the single greatest contributor to flow-induced impacts is the failure to reduce the hydraulic connectivity of the urban landscape as a whole

(a) Still too much emphasis on treating the collection of stormwater the same as treating the collection of wastewater, i.e., a network of connected conveyances designed only to move the flow to a single endpoint (receiving stream or POTW)

(4) Can stormwater flow be regulated under the Clean Water Act?

  (a) Currently, the answer is no. Virginia Department of Transportation v. U.S. EPA, No. 1:12-CV-775 (E.D. Va. Jan. 3, 2013)

    (i) Stormwater flow rate limitations in a TMDL struck down because "flow" is not a "pollutant" as defined under the statute

  (b) But the statute allows the use of surrogate parameters

    (i) BOD is a prime example (conductivity, TDS, TOC, turbidity)

(5) Why excessive stormwater flow rate is a significant cause of poor urban water quality even when the water is clean

THIS:

TURNS THIS:

INTO THIS:

E. Because biological attainment is a primary objective of OEPA's nutrient control program, point source controls (POTWs) and stormwater runoff controls in urban areas are dependent on one another for success

1. Evidence demonstrates that significantly reducing, and at times even eliminating, nutrient discharges from POTWs in urban areas will not eliminate biological nonattainment in urban waterways in the absence of a comprehensive, multifaceted, and carefully planned stormwater runoff control program

a. Lower Great Miami River Nutrient Model

(1) Eliminating all phosphorus from 10-15 POTWs along the LGMR and removing all eight lowhead dams in the Metropolitan Dayton area not enough to "move the biological needle" in the LGMR

(a) Combination of many factors:

(i) Urbanization of the watershed

(ii) Scouring and loss of natural banks and substrates

(iii) Loss of natural sinuosity

(iv) Loss of natural canopy

(v) Widening/shallowing, increased pooling of waters, and increased summertime temperatures stressing aquatic communities

(vi) Upstream nutrient loadings from the ag community

V. USING MS4 STORMWATER CONTROL PROGRAMS AS AN EFFECTIVE PARTNER IN URBAN NUTRIENT REDUCTION

A. Finding more ways to break the hydraulic connectivity cycle in the transport and delivery of stormwater to the receiving stream

B. Reducing flow rate impacts (scouring, erosion, siltation, etc.) by delivering runoff to the stream from multiple locations

C. Increasing retention/detention, but understanding that more is needed to reduce nutrient loading from seasonal application of fertilizers

1. Dissolved phosphorus and nitrogen are not removed by simple retention/detention of stormwater

a. Require large scale sources of fertilizers (parks, schools, universities, stadiums, etc.) to:

(1) Have employees trained in proper use/application of fertilizers

(2) Test soils before selecting/applying fertilizers

(3) Limit application rates and timing/seasonal application

(4) Prohibit fertilizer application when top two inches of soil is saturated, or when local weather forecast is for greater than 50% chance of precipitation exceeding one inch in a 12 hour period

(5) Incorporate fertilizers into the soil with the application

b. These requirements already in place for NW Ohio farmers due to SB 1 (2015)

c. Similar controls on residential fertilizer application

(1) Education

2. Even retention/detention systems that effectively remove particulate phosphorus and nitrogen in sediments will, if not regularly cleaned out or dredged, release those nutrients to the water column in dissolved form during mid to late summer stagnant conditions

D. BETTER COORDINATION BETWEEN URBAN WASTEWATER AND STORMWATER CONTROL PROGRAMS

1. In Ohio many MS4 programs managed by the County Engineer
    a. Historically, the County Engineer's focus on stormwater is to coordinate its collection and conveyance as part of the construction and management of roadways and bridges
2. Working together to promote a healthy urban watershed for fishing, canoeing, bikeways, trails, etc.

E. What will the next MS4 permit look like in Ohio?

1. OEPA's 5-year permit set to expire in September 2019
2. OEPA's MS4 ESO Workshops (Spring 2019)
    a. Not much by way of specifics, but lots of questions/discussions about potential ways to improve water quality through a revised permit
    b. At a minimum, Agency intends to require nutrient-reduction BMPs when an urban watershed is the subject of a TMDL that requires point and nonpoint source nutrient reductions
3. After the series of workshops, OEPA accepted comments on the current MS4 permit
    a. Draft revised MS4 permit expected to be issued for public comment sometime late summer 2019

VI. QUESTIONS???

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