Executive Summary

THE Water Research FOUNDATION

Bridging the gap between TMDL and assignment of reuse effluent load allocations

Developing Tools for Surface Water Nutrient Loading Attributable to Reclaimed Water (Reuse-13-11/4758)

The Central Issue

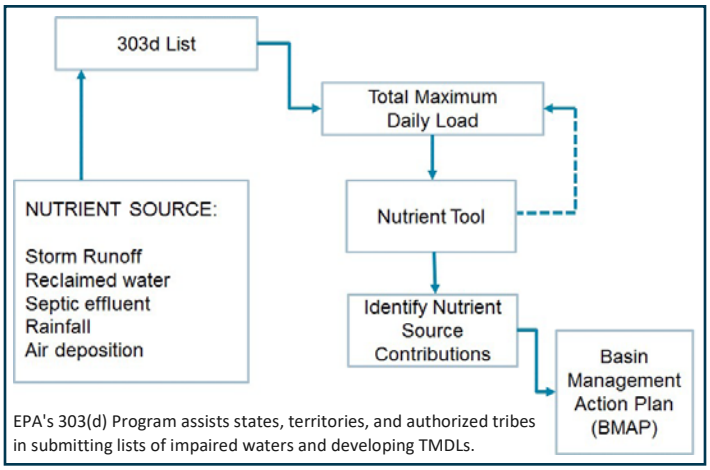
Nutrient loading prevents many surface waters in Florida and other parts of the U.S. from meeting beneficial use criteria. Currently, there is no tool that can effectively discern the source to load relationship to properly assign a certain nutrient load reduction to the responsible party. Water reclamation agencies/utilities could use such a tool to demonstrate the extent to which their reuse practices contribute toward nutrient impairment of surface waters within the watershed.

Context and Background

It was proposed that a signature chemical marker could be used to calculate reclaimed water's fractional volumetric load and nutrient contribution to nearby surface waters. In a previous WRF project (Reuse-09-08), an artificial sweetener "sucralose" was identified as a definitive marker of human wastewater effluent. However, sucralose cannot be used to distinguish between nutrients originating from reclaimed water systems versus nutrients originating from septic tank systems. Therefore, further identification of markers unique to reclaimed water are needed to calculate the nutrient fractional volumetric load to the impaired waterbodies. The marker-based tool should also be able to estimate additional nutrient attenuation that occurs during transport. Thus, the objective of this project was to identify a nutrient marker specific to reuse effluents and to assess the nutrient contribution due to reclaimed water irrigation practices to an impaired surface water (Gordon River Extension in City of Naples, Florida) using the identified marker.

Findings and Conclusions

Iohexol (an angiogram contrast agent) was identified as a reclaimed water marker. The compound was detected in this study only in wastewater treatment plants/reclaimed water and not in septic tank effluent. Iohexol was also found to be relatively inert to conventional wastewater treatment processes and did not substantially absorb to the local soils or biodegrade during environmental transport, although it was susceptible to some degree of photolysis. Due to these factors, a nutrient fractional load estimation using iohexol was conducted. Within this initial proof of concept framework, the nitrate concentration in the Gordon River extension due to reuse irrigation practices appeared to be less than previously estimated.



Conceptual Use of Marker-Based Nutrient Tool.

Management and Policy Implications

This project successfully developed a marker-based nutrient tool that bridges the gap that exists between a total maximum daily load (TMDL) of a nutrient impaired waterbody and assignment of reuse effluent load allocations, for an assigned study location. A signature marker specific to reclaimed water can be used by water agencies to assess reclaimed water load reductions assigned by regulators. The application of this tool could prevent reuse applications from being curtailed or burdened with energy-intensive and costly nutrient reduction technologies unless there is a clear demonstration that these approaches are warranted. This tool will also assist in the development best basin management action plans (BMAPs) that employ reclaimed water nutrient load allocations based on quantifiable fractional load assessments.

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Related WRF Research	
Project Title	**Research Focus**
Evaluation of Potential Nutrient Impacts to Florida's Water Reuse Program (Reuse-09-08)	Provides an alternative methodology for distinguishing between sources of nutrients found in water bodies through the use of selected organic and inorganic microconstituents.
Assessing the Contribution of Water Reuse Practices to Nutrient Impaired Waters (Reuse-17-27)	Demonstrates the applicability of iohexol (a medical contrasting agent) to serve as a universal marker of reuse effluent and includes a guidance manual to assist reclamation agencies and utilities in determining their fractional nutrient loading from their recycling practices.

Principal Investigator:

Joan Oppenheimer
Stantec Consulting Services Inc.

Joe Jacangelo
Stantec Consulting Services Inc.
and Johns Hopkins University

Project Team:

Bingfeng Dong, Ph.D.
Do-Gyun Lee, Ph.D.
Kellogg Schwab, Ph.D.
Johns Hopkins University

Anthony Janicki, Ph.D.
Janicki Environmental

Hal Schmidt, P.E.
Stantec Consulting Services Inc.

Technical Reviewers:

Raj Bhattarai, Ph.D.
Austin Water Utility

Merlynn Bender
U.S. Bureau of Reclamation

Sherry Brandt-Williams, Ph.D.
St. Johns River Water Management District

Andy Canion, Ph.D.
St. Johns River Water Management District

Ted McKim
Reedy Creek Improvement District

Participating Utilities:

City of Naples
City of Orlando
Florida Department of Environmental Protection
Hillsborough County
Orange County Utilities Department
Palm Beach County
Pasco County
Pinellas County
South Florida Water Management District
Southwest Florida Water Management District
St. Johns River Water Management District
Toho Water Authority

For more information, contact:

Stefani McGregor
smcgregor@waterrf.org

The Water Research Foundation

1199 N. Fairfax St., Ste 900
Alexandria, VA 22314-1445
www.werf.org | info@waterrf.org

6666 W. Quincy Ave.
Denver, CO 80235-3098
www.waterrf.org | info@waterrf.org

Reuse-13-11/4758 **July 2018**