

Evaluation of Riverbank Filtration Systems to Optimize Removal of Bulk Organic Matter, Emerging Organic Micropollutants, and Nutrients

Funding Agency:

- Water Research Foundation
- City of Aurora

Principal Investigator:

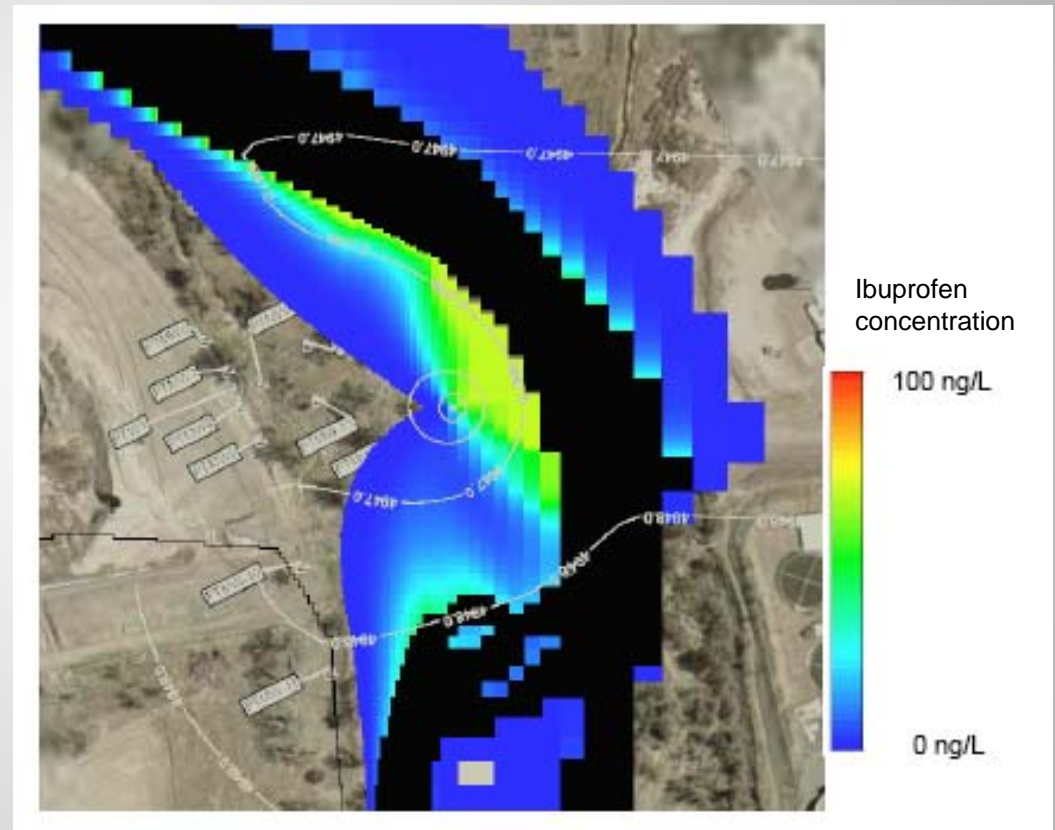
- Dr. Jörg Drewes

Students Participating:

- Christiane Hoppe-Jones
- Gretchen Oldham
- Uwe Hübner

Start date: 03 - 2006

End Date: 09 - 2008



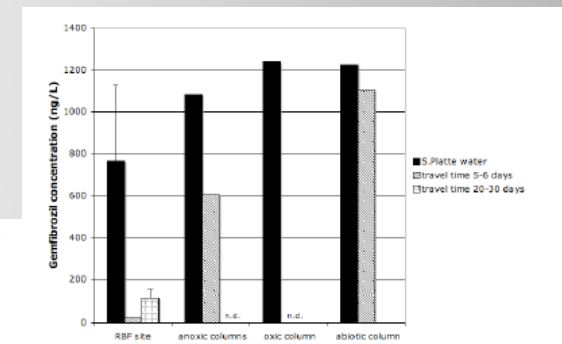
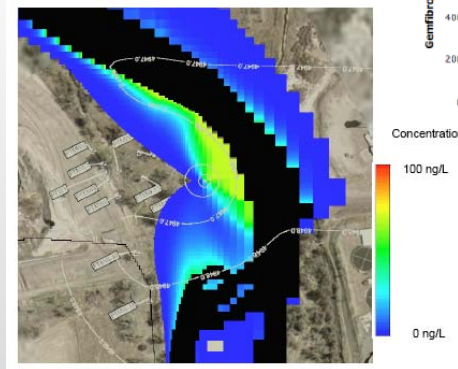
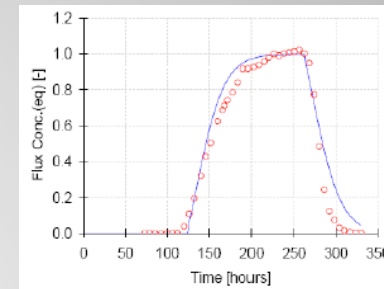
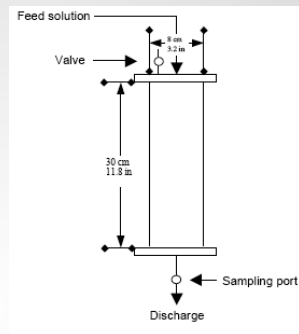
Project Objectives

- To quantify the degree of removal of key water quality constituents such as total organic carbon (TOC), unregulated organic micropollutants (PPCPs, EDCs), and nutrients (ammonia, nitrate and phosphorus) in full-scale RBF systems as a function of geo-hydrological, operational, and water quality conditions.
- To understand at the mechanistic level the boundary conditions and relevant transport parameter for the attenuation of PPCPs and EDCs during RBF.
- To develop recommendations for design and operation of RBF systems to enhance the removal of PPCPs and EDCs.



Methodology

- **Small scale column experiments**
 - Determine transport parameter
 - Retardation coefficients, decay constants, dispersivity
- **Large scale column experiments**
 - Determine boundary conditions
 - Biodegradable dissolved organic carbon (BDOC), redox conditions, decay constants
- **Field site investigation**
 - Evaluate field sites for hydro-geological conditions and determine water quality constituents
 - Develop contaminant transport model



Micropollutant Removal Dependency on Boundary Conditions

good removal $\lambda > 0.53 \text{ day}^{-1}$ > 90%	intermediate removal		poor removal $\lambda = 0 \text{ day}^{-1}$ < 25%
	$\lambda = 0.12-0.048 \text{ day}^{-1}$ 90 - 50%	$\lambda = 0.048-0.12 \text{ day}^{-1}$ 50 - 25%	
17 β -Estradiol Estriol	Atrazine NPIP ¹	Clofibric acid Nitrosodiethylamine (NDEA) ¹ NMEA ¹ NPYR ¹	Carbamazepine Primidone
Testosterone Ibuprofen Gemfibrozil Ketoprofen Naproxen DEET Mecoprop Nitrosodimethylamine (NDMA) ¹ NDPA ¹ NDBA ¹ Dichloprop Diclofenac			TCEP TCPP TDCPP Propyphenazone

TOC: 5-10 mg/L
BDOC: 2 mg/L
Micropollutants: 100-500 ng/L
Redox cond.: oxic followed by anoxic
Travel times: 25-30 days

good removal > 90%	intermediate removal		poor removal < 25%
	90 - 50%	50 - 25%	
Ibuprofen Gemfibrozil Ketoprofen Naproxen DEET Mecoprop Sulfamethoxazole Clofibric acid Dichloprop	Diclofenac	TCEP	TCPP TDCPP Carbamazepine Primidone Propyphenazone

TOC: 3 mg/L
BDOC: < 0.5 mg/L
Micropollutants: 100-500 ng/L
Redox cond.: anoxic
Travel times: 10 days

