Hybrid treatment systems for water management in greenhouses and nurseries

> Farm & Food Care Agricultural Water & Nutrient Professionals Community of Practice April 7, 2016

> > Hybrid Treatment System Project FCO-OMAFRA-CAAP-SRG-UofG



Objective for the industry

• Looking for effective sustainable solutions to -

- Decrease N/P in horticultural discharges, and/or
- Decrease plant pathogens in recycled water
- Goal to discharge 'clean' water, or to safely re-use water



Combining what we've learned and what we need to find out

What have we looked at in the past 8 years?

- Woodchip denitrification bioreactors how well do they remove nitrogen?
- **Mineral media** –can we effectively remove phosphorus?
- Constructed wetlands do they remove nutrients and for how long?
- Which system(s) remove **plant pathogens**?

Our question now is can we combine them to make flexible **"hybrid" treatment systems.**



Putting it all together: Project Plan

• Site 1 – Floriculture Greenhouse

- 2 portable pilot hybrid treatment systems (HTS) to compare media types, flow rates, temperature etc.
- Permanent system to be installed after 1st year of data collection

• Site 2 – Container Nursery

 install permanent system; challenges with space, fluctuating/stormwater volumes



Site 1 overview

fff

A CONTRACT



Pilot Hybrid Treatment

Systems

Delivery of shipping containers with pilot hybrid treatment systems





Treatment tanks in series and "plumbing"



What's in the tanks?

- Wood chips +/- shavings
 - (NO3-N removal; pathogen removal)
- Steel manufacturing slag mixed with pea gravel
 - (P removal; high pH; pathogen reduction?)
- Wollastonite (CaSiO₃)
 - (P removal; pathogen reduction?)
- Pea gravel
 - (BOD removal, some P removal, buffer)
- Filter sand

to start!

• (filter, some P removal, buffer)





Site 1 – successes & next

• 2015

- Pilot systems installed and running
- >90% removal of nitrate-N, total and soluble P, and total and pathogenic fungi when run in current series at low flow rates
- 2016 & 2017
 - Challenging the system to find the limits:
 - Flow rates
 - Media singly and in series
 - Changing the treatment sequence
 - High versus low nutrient concentrations





Recycle Pond 1

On-Farm Drain

Source Creek-



Site 2 Design & Construction

- Treat on-farm drain water
- During periods when drains are not running, pond water can be treated to maintain flows
- 3 cells
 - Woodchips remove NO₃-N
 - Pea gravel reduce BOD and bring up oxygen level
 - Pea gravel + filter sand remove P
- Capacity: 100,000 200,000 L/day
- Cost: approx \$150,000
 - (part funding through research program)

Location of HTS construction....



A view of construction from across the

pond





Laying the distribution manifold



Landscape cloth covering on the woodchip cell



Potted day lilies on surface of first cell



Pots covered for the winter





- No significant loss in production space
- Sampling plan... chemistry and plant pathogen removal over the next 2 years.

And...

- Developing a 'Guidance Document' for water treatment best management practices
- KTT for Ontario and across Canada

Thanks to: Floriculture Greenhouse & Nursery Farmers **OMAFRA** CAAP Flowers Canada (ON) Landscape Ontario **HMGA-LSGBCUF** project



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