TRIECA CONFERENCE

LECA Great Lakes Chapter

Toronto and Region Conservation for The Living City

Thank you to all of our 2015 sponsors:

AQUATECH DEWATERING COMPANY

Lake Simcoe Region Conservation Authority

CVC Credit Valley Conservation

GEMS

RM CONSTRUCTION

DYNEX CONSTRUCTION INC Since 1989

filtrexx CANADA SUSTAINABLE TECHNOLOGIES let nature do it.

GEOSTORM

Holland Pioneers in international business

Geosyntec consultants

NILEX CIVIL ENVIRONMENTAL GROUP Unearthing better results.

terrafix geosynthetics inc.

UNILOCK

VERDYOL Biotic Earth AN ORGANIC APPROACH TO SOIL BUILDING

York Region

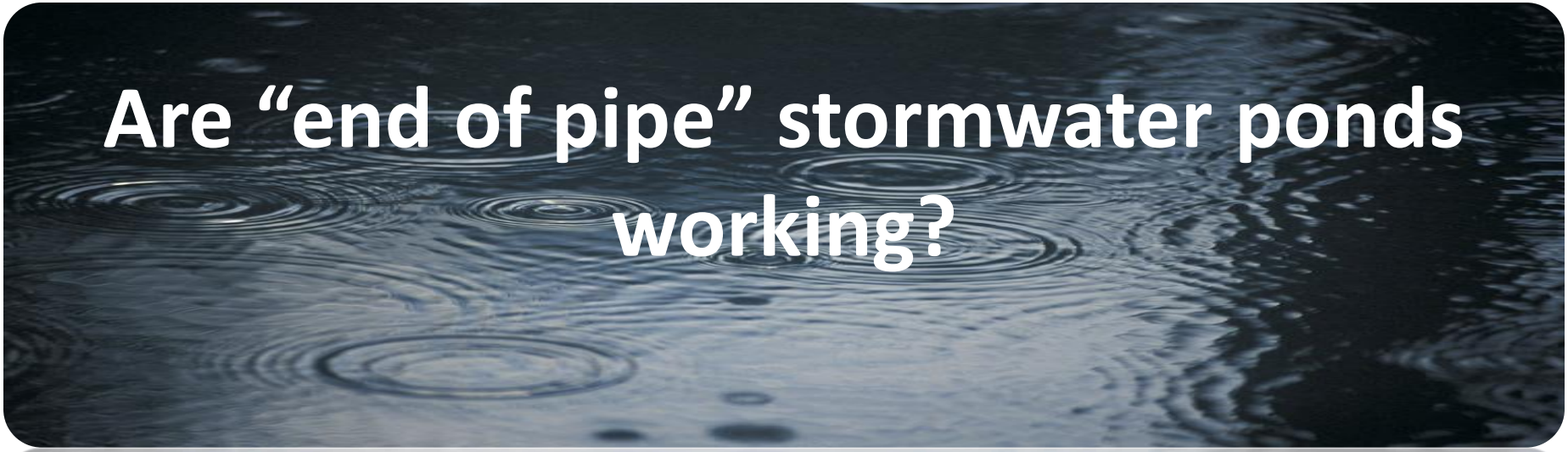
Canada Green Building Council – Conseil du bâtiment durable du Canada – Chapter – Greater Toronto

Media Partner

WATER CANADA THE COMPLETE WATER MAGAZINE

Lake Simcoe Region
conservation authority

A Watershed for Life



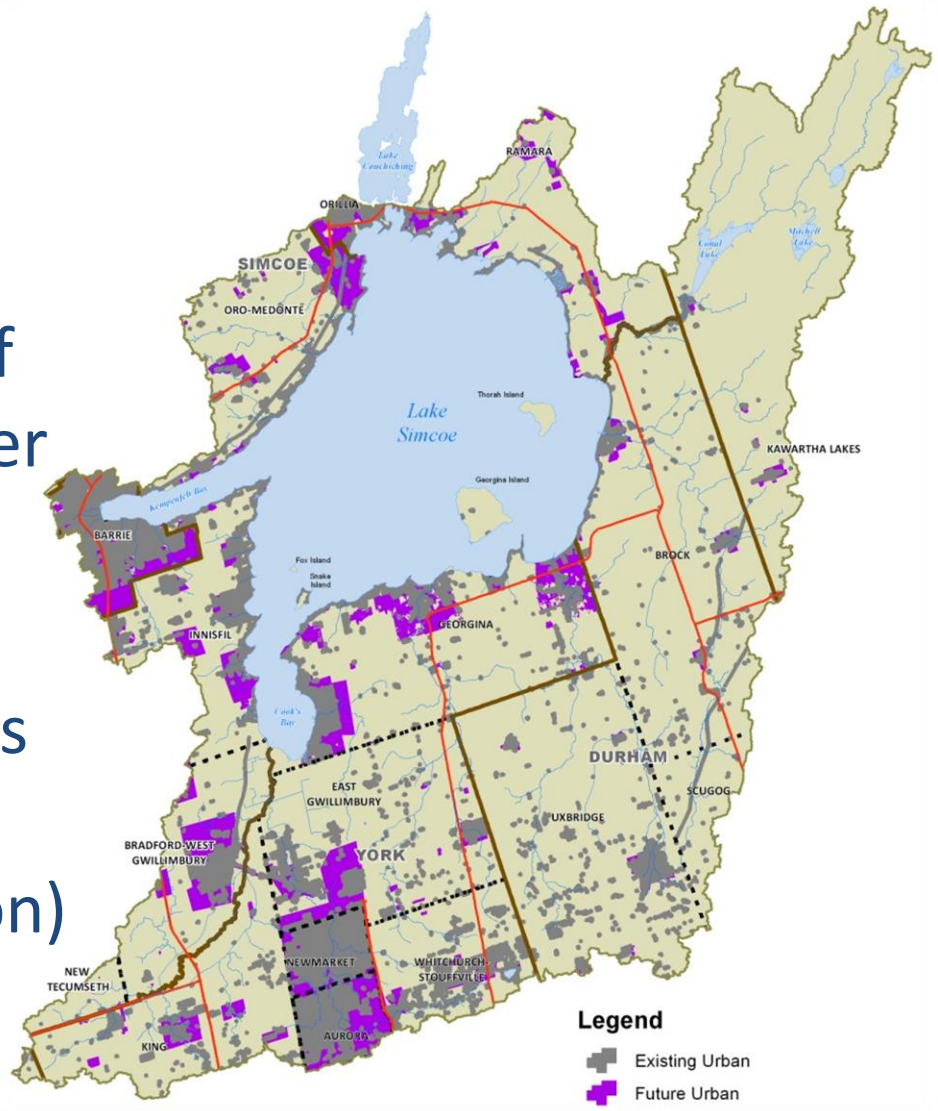
Are "end of pipe" stormwater ponds working?

David Lembcke
Manager, Environmental Science and Monitoring

Brian Ginn
Limnologist, Certified Lake Manager (NALMS)

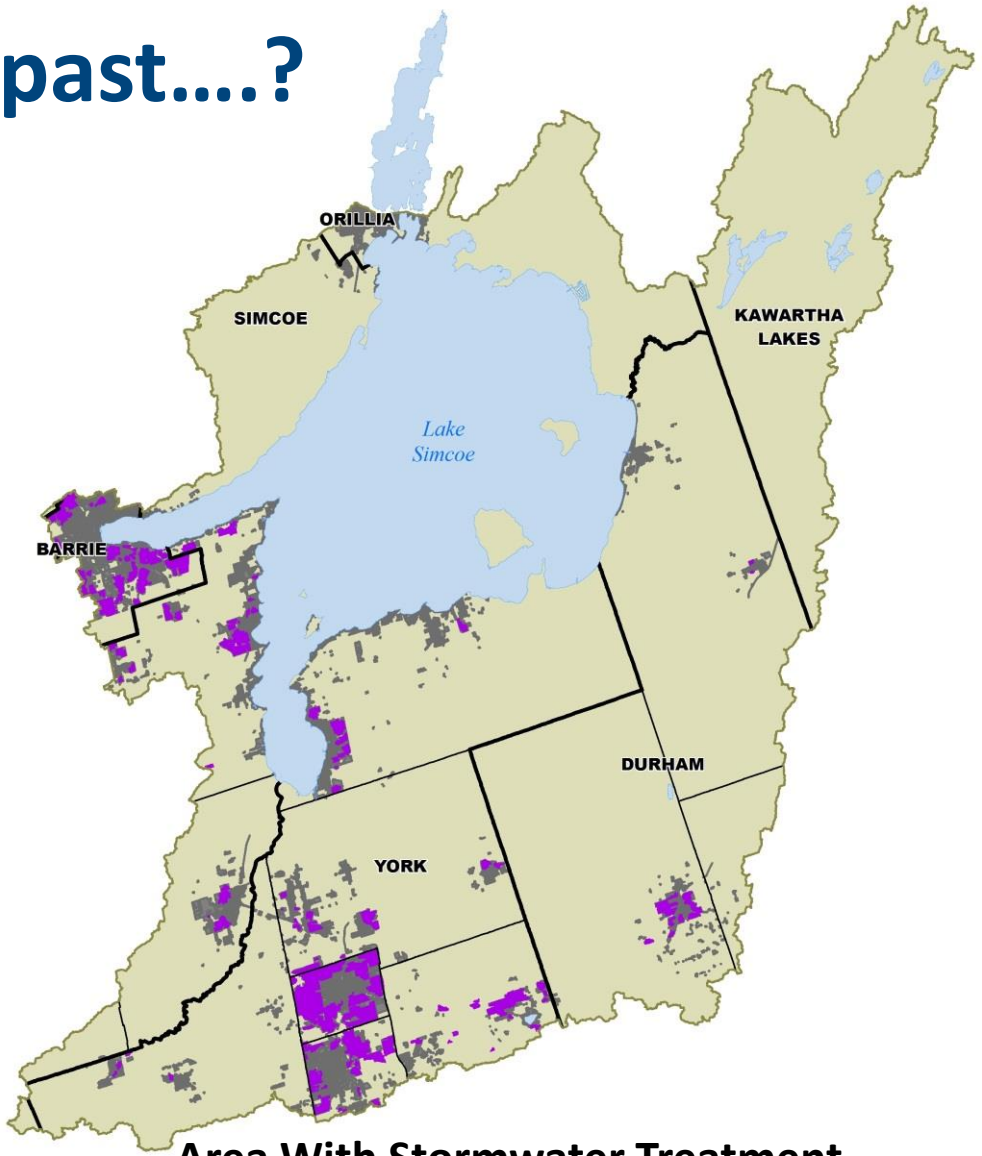
LID: Stormwater Management of the Future

- Existing urban area is ~23,000ha
- An additional 12,000ha of development planned over the next 20 years
- LID is the tool to help mitigate the impact of this development through volume control (infiltration)



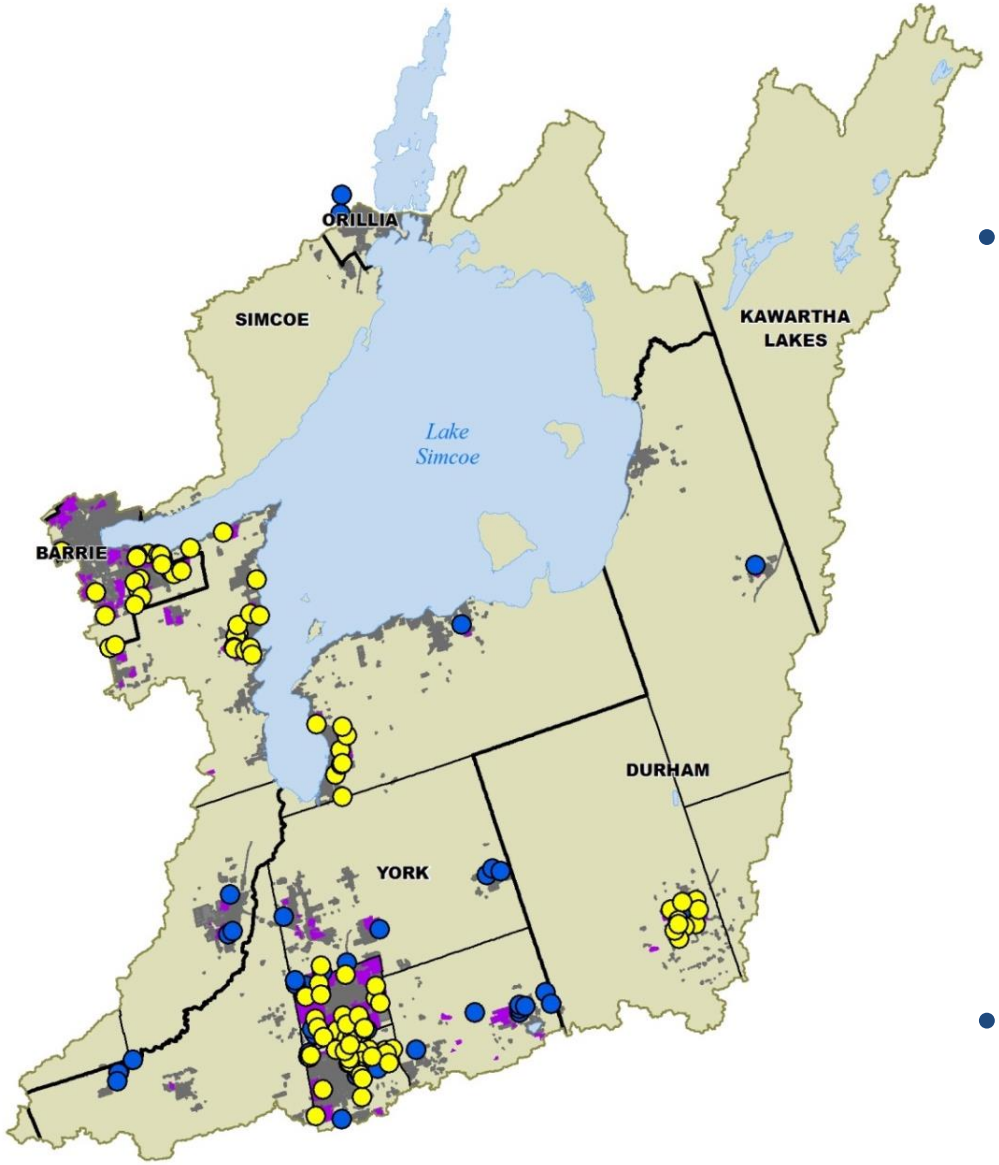
But what about the stormwater management of the past….?

- 277 ponds in the watershed, 135 quality and 142 quantity.
- Area treated by ponds =12,000ha
- Design criteria has the phosphorus removal of these ponds at 4.2 tonnes/year. Plus flood control.
- Are they working?



Area With Stormwater Treatment

Stormwater Pond Assessment



- In 2010, 98 ponds were studied to evaluate physical and chemical function
  - Pond depth
  - Physical parameters (spot and selected logging)
  - Water chemistry
  - Sediment chemistry
  - Sediment fractionation
- Average age of ponds =10, oldest =23, newest =2

Pond Depth

- Assess need for clean out maintenance
- Of 98 ponds, 77 were designed to Level 1 control
- By 2010 only 36 were operating at design level.
- 56 ponds operating a lower level, 12 of which were filled in completely.
- However, 18 ponds had greater volume and depth than design.

Implications to Pond Performance

Reduced flood protection and pollution removal efficiency

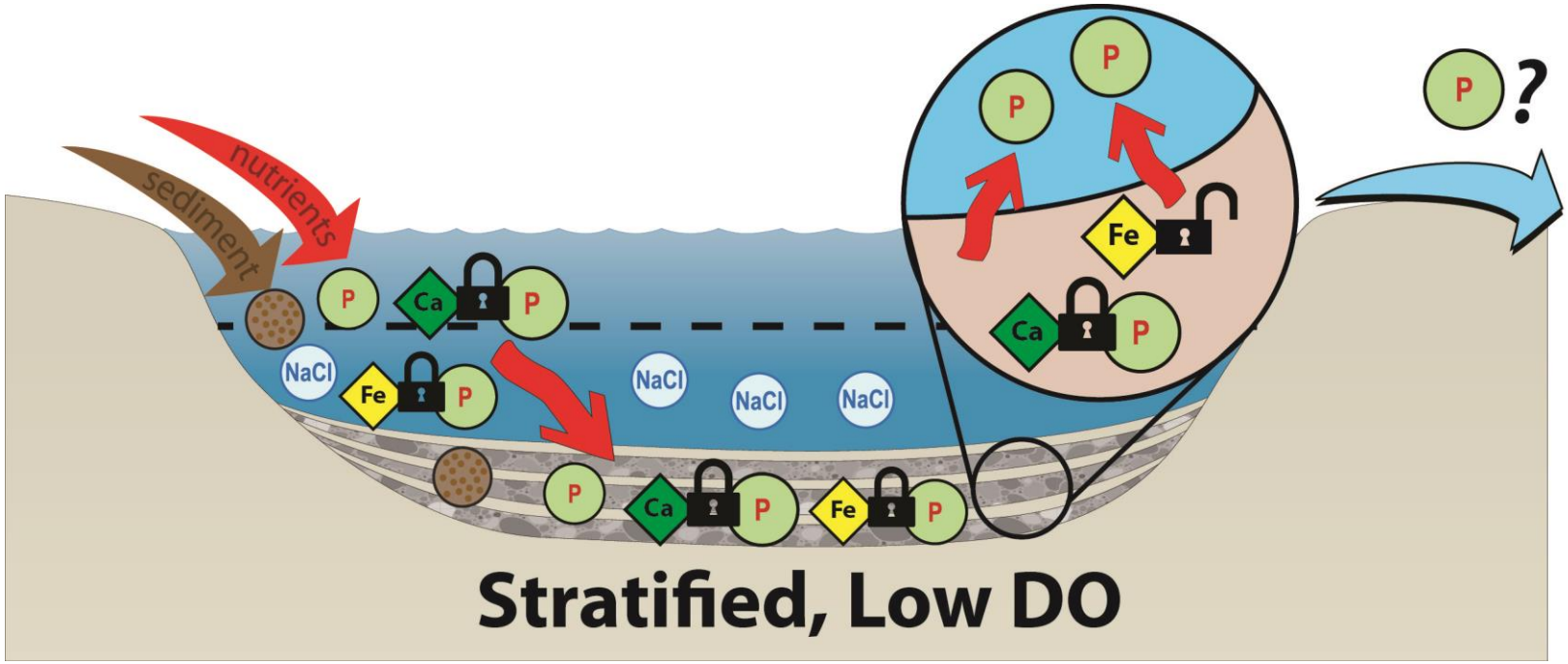
Clean out Timing

- Dropping 1 to 2 Levels
  - ~ 10 years
- Completely filled In
  - ~14 years

Phosphorus Reduction Performance

- 98 ponds studied should reduce 3.2 t/yr as designed.
- Now achieving 2.4 t/yr reduction
- The difference (0.81 t/yr) is ~1% of the annual P load to Lake Simcoe

Assessing Nutrient Capture and Cycling

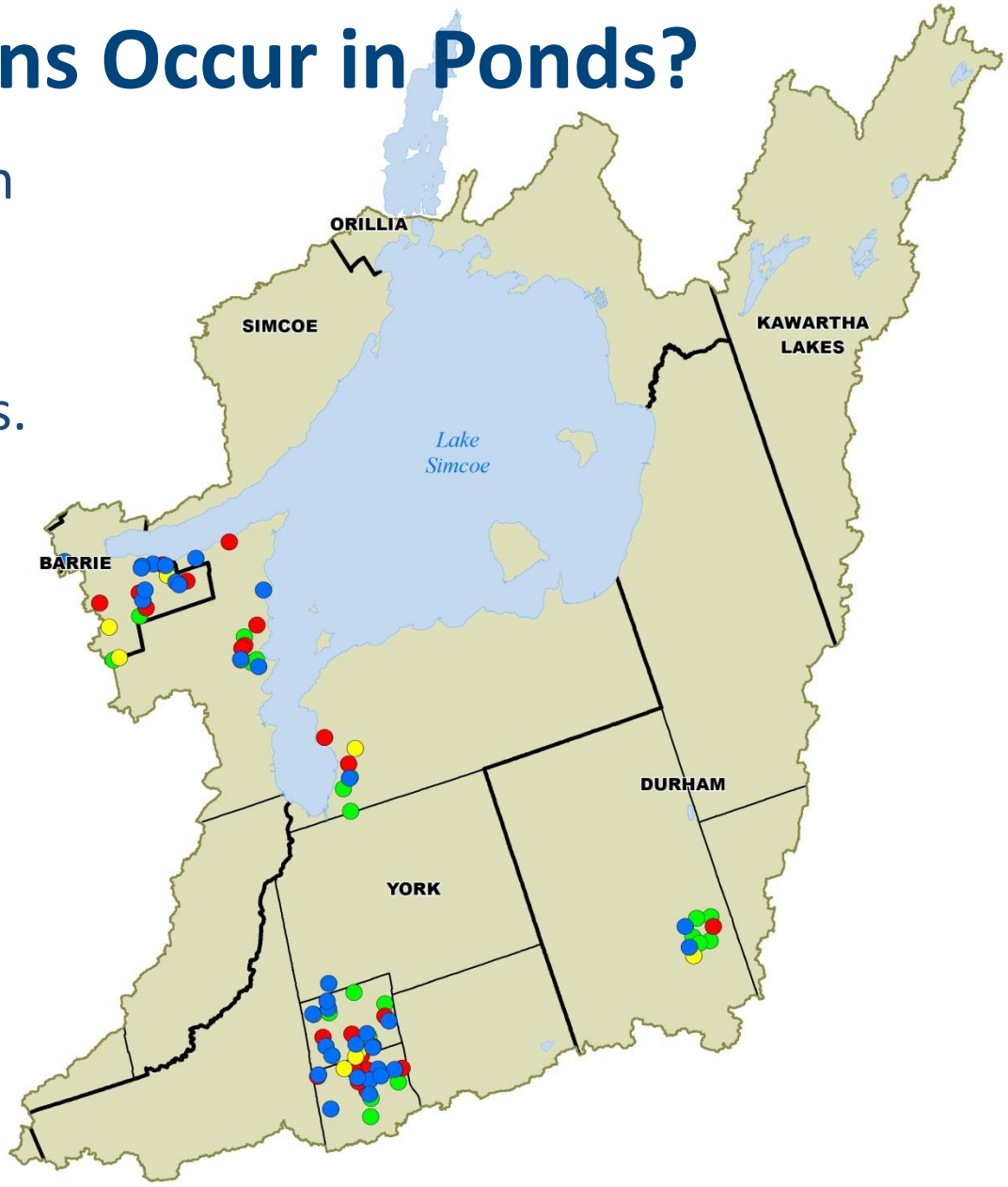


- Stormwater pond function
  - Capture and retain sediment and associated pollutants (e.g. phosphorus)
  - Thermal stratification
  - Dissolved Oxygen (anoxia)
  - Algal growth

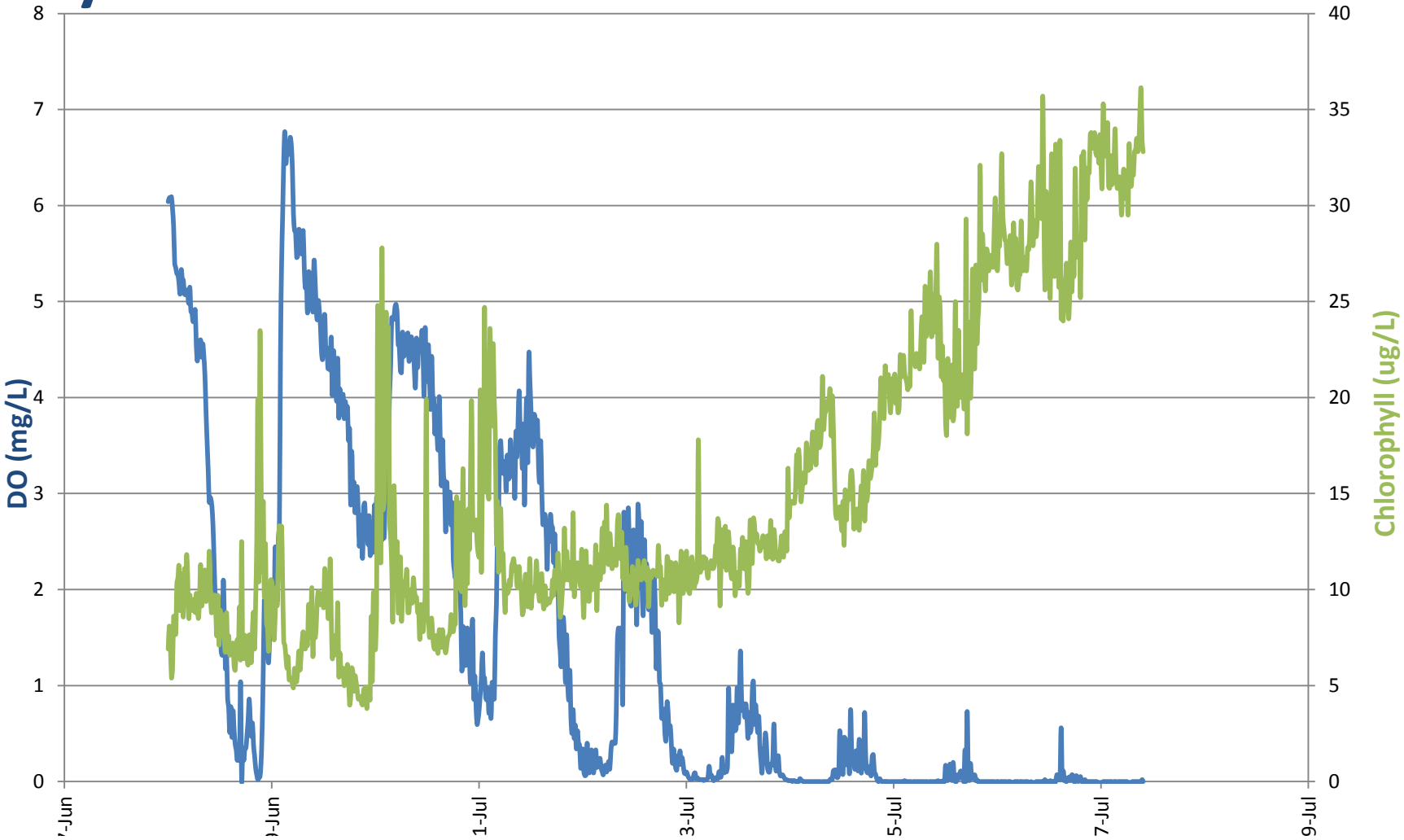
Complicating factors
- Chemical stratification (salt)
- Shallow enough to avoid stratification and low oxygen conditions

Do Anoxic Conditions Occur in Ponds?

- 98 ponds were assessed with daytime spot DO measures June – October 2010.
- A total of 406 measurements.
- 35 ponds = DO <2mg/L
- 10 ponds = DO 2 – 5 mg/L
- 20 ponds = 5 – 12 mg/L
- 36 ponds = DO >12mg/L

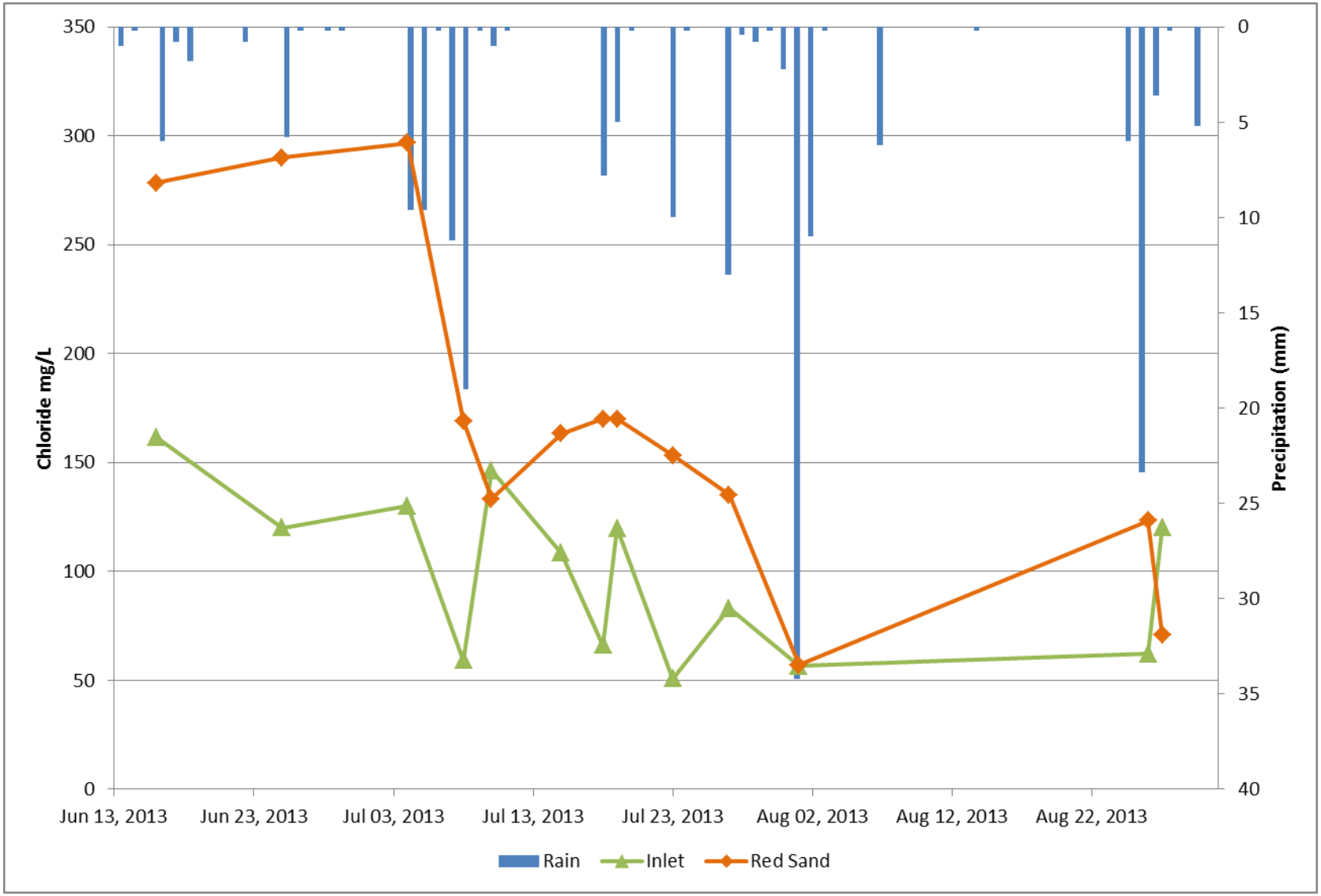


Do We See a Response in…
-Physical Parameters



DO vs Chlorophyll – June 27 to July 9

Do We See the Influence of Chemical Stratification?



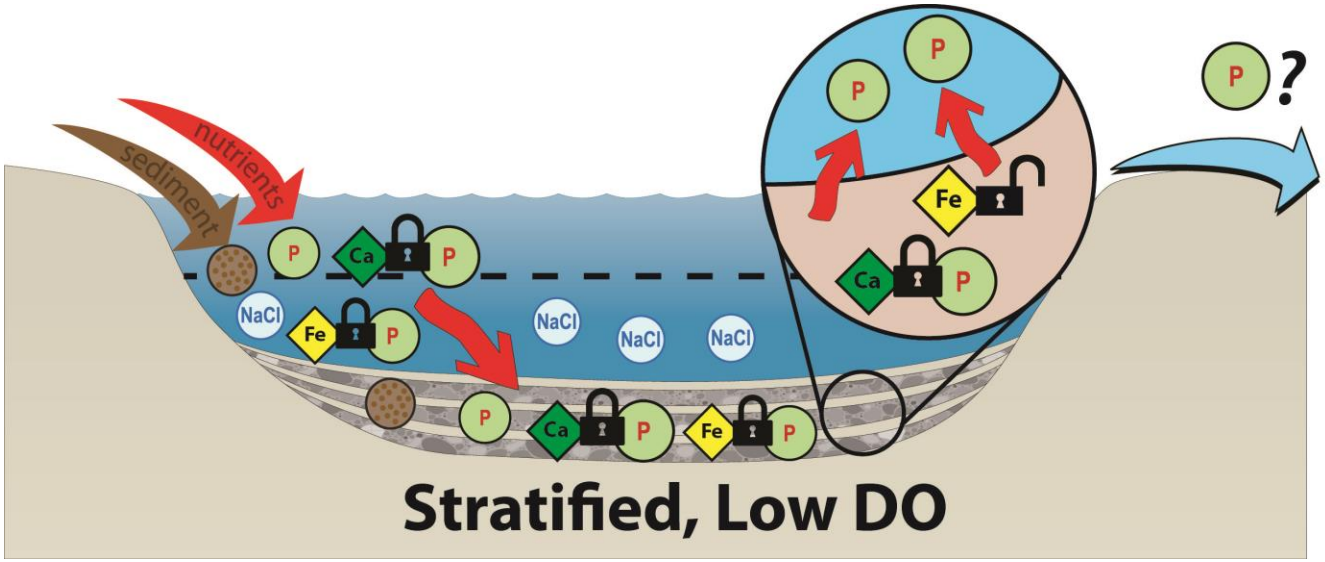
Do We See a Response in..
-Water Quality / Stratification

July 7	Temp (°C)	DO (mg/L)	TP (µg/L)	Ortho-P (µg/L)	NH_3 (mg/L)	TKN (mg/L)	Sp. Cond (µS/cm²)	Sed TP (ug/g)
Top	30.8	17.8	14.0	3.0	0.01	0.5	313.0	
Bottom	18.2	0.8	87.0	15.0	0.39	1.1	513.0	660

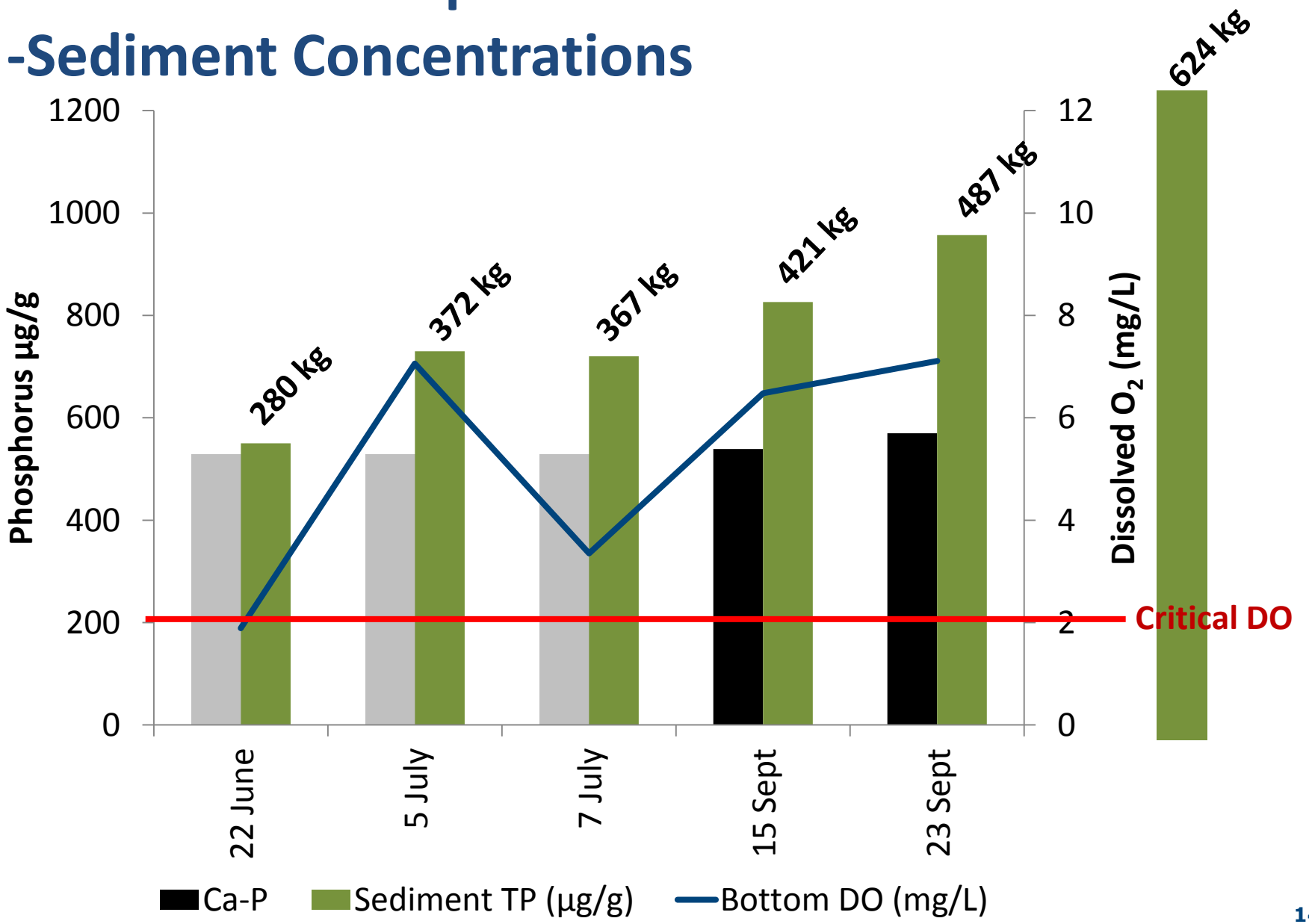
Oct 7	Temp (°C)	DO (mg/L)	TP (µg/L)	Ortho-P (µg/L)	NH_3 (mg/L)	TKN (mg/L)	Sp. Cond (µS/cm²)	Sed TP (ug/g)
Top	15.2	12.6	29	3.0	0.01	0.6	289	
Bottom	13.7	2.8	31	4.0	1.0	3.1	733	748

Do We See a Response in…
-Sediment Concentrations

- Sediment TP data from 38 ponds
- TP values ranged from 550 – 1226 µg/g, median value of 780µg/g
- Calcium bound phosphorus ranged from 404 – 619 µg/g, median value of 530 µg/g



Do We See a Response in…
-Sediment Concentrations



Do Stormwater Ponds Retain Phosphorus?

- Chemical Stratification ✓
- Thermal Stratification ✓
- Anoxia ✓
- P release from sediments ✓
- P release from labile fraction ✓
- Expected P reservoir in sediment ✗
- Where is the phosphorus going?
  - Uptake by algae
  - Storm events

How Can we Optimize Performance?

Physical Function

- Maintenance / pond clean out more regularly
- Design – Engineered wetlands / OGS
- Implementation of upstream LID

Nutrient Capture

- Lock all TP in the sediment
- Break up stratification- mixing or aeration?
- Incorporation of outlet filtration technologies

GR Pond Retrofit: Red Sand Filter

- Large 155ha catchment
- Iron rich sand
- Filters out total suspended solids
- Iron binds dissolved phosphorus
- Great TSS reduction
- Moderate TP and PO4 reduction, but large summer storm events saw PO4 release

Sorbtive Media

- 18ha residential catchment
- Retrofit of a quantity only pond involved excavation of a wetland style pond and Sorbtive®Media chamber

Sorbtive®Media

•oxide-coated, high surface area reactive engineered media that sorbs and retains dissolved phosphorus


Thank You