Tile Drains as a Source of Bioavailable Phosphorus in the Macatawa Watershed

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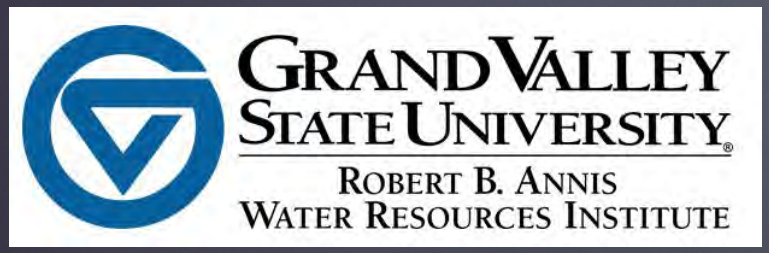
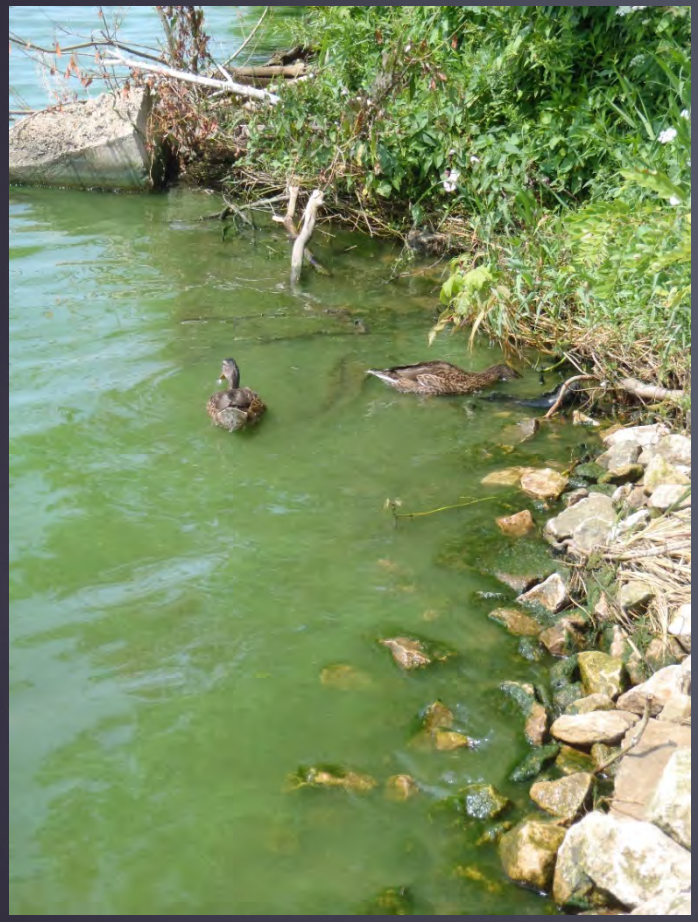


Outline

- Introduction
- Study Site: Lake Macatawa Watershed
- Objectives
- Methods
- Preliminary Results
- Preliminary Conclusions
- Next Steps

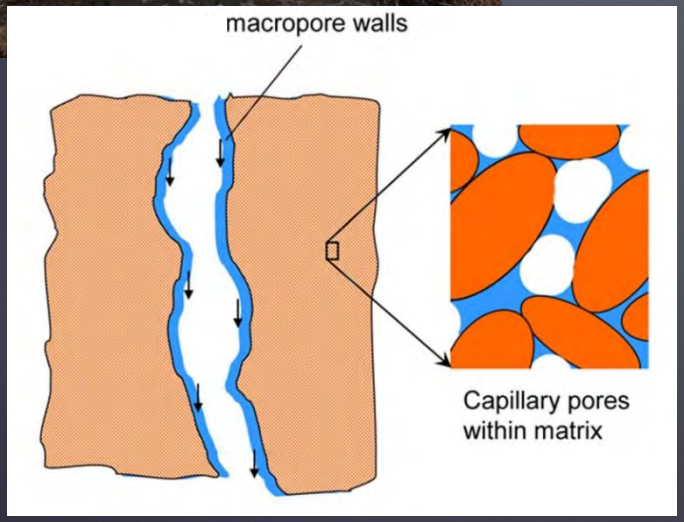
Introduction



Mary Ogdahl, GVSU - AWRI

- Phosphorus (P) enrichment → eutrophication
- Algal Blooms
- Agriculture is a Nonpoint Source of P
- High flow events = ↑ P transport

Introduction



- Tile drains decrease surface runoff
- Soil matrix flow: slower
- Macropore flow: faster
- P transport highly dependent on local factors
  - Soil Type
  - Crop Regime
  - Tillage
  - Type & Timing of Fertilizer

Study Site

- Lake Macatawa Watershed
- 90% of wetlands were lost to development
- Lake TMDL for 70% TP reduction
  - 1997: 125ppb → Goal 50ppb
  - 2014: 111ppb

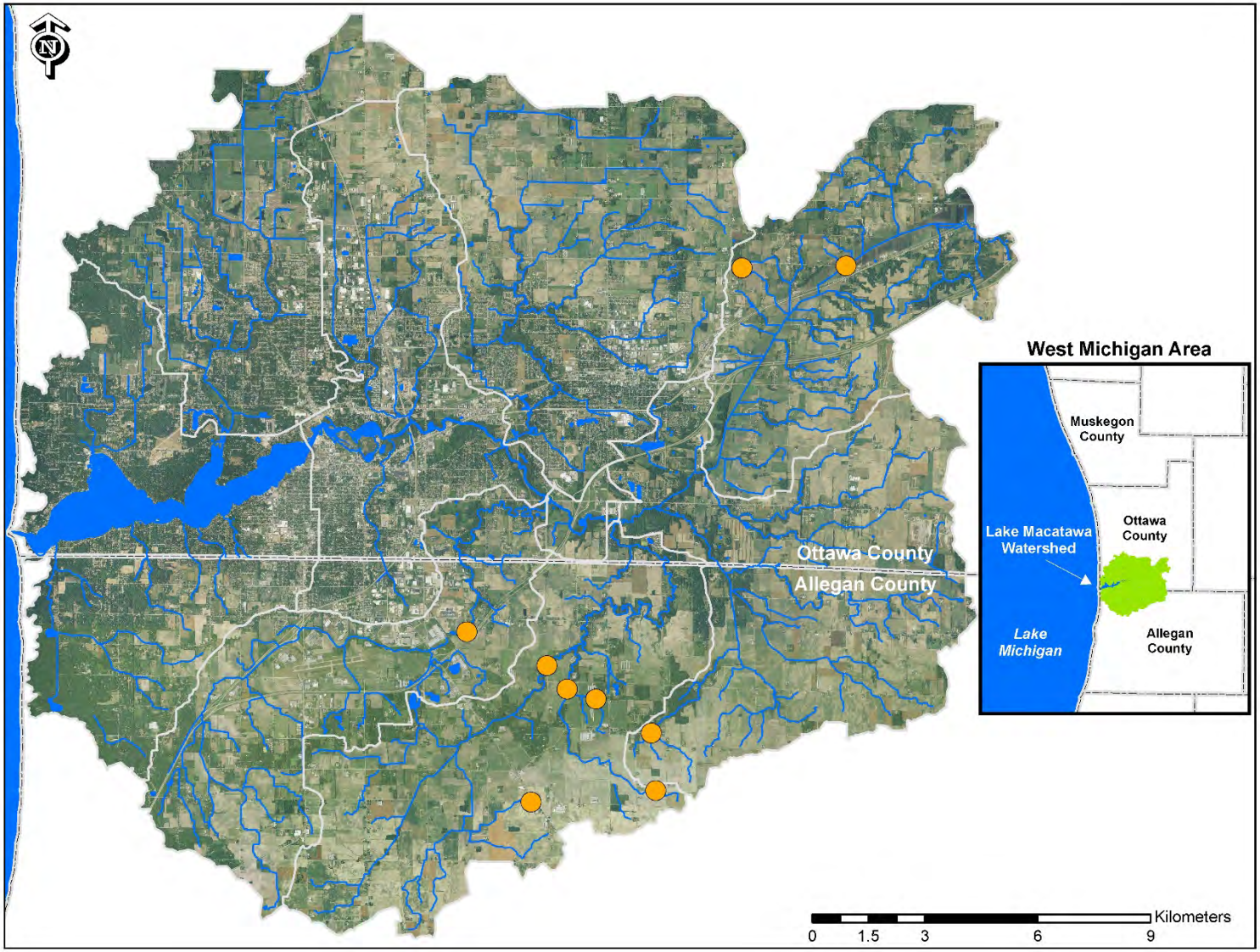
Objectives

1) Conduct a tile drain effluent sampling survey of the Macatawa Watershed (SRP and TP Analysis)

2) Use bioassays to measure the bioavailability of P found within the tile drains

3) Investigate the seasonal changes in tile drain P

Study Site: Lake Macatawa Watershed



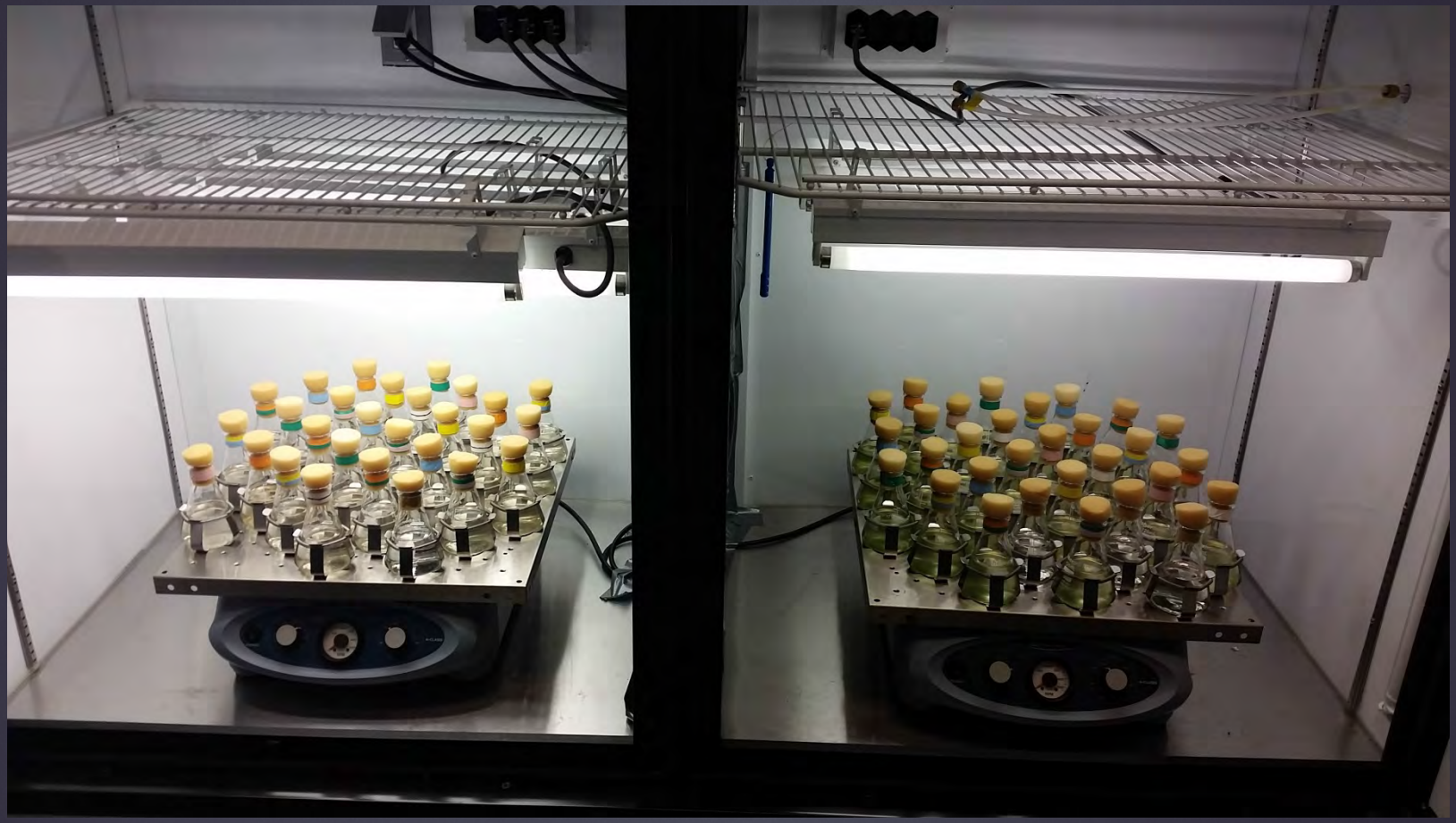
Tile Drain Sampling Site

Methods

Sampling Site

- Record Land Management Factors
- Collect Tile Drain Effluent
  - Measure SRP and TP
    - Bioassay 1 *Selenastrum*
      - Measure chlorophyll-*a*
    - Bioassay 2 Lake Mac Inoculum
      - Measure chlorophyll-*a*
      - Determine Algal Community
- Record Discharge

Methods



Lake Mac Algae

Selenastrum

Methods

	2015										2016	
	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Tile Drain Sampling	x	x	x	x	x	x	x	x	x	x	x	x
Bioassays		x			x			x				

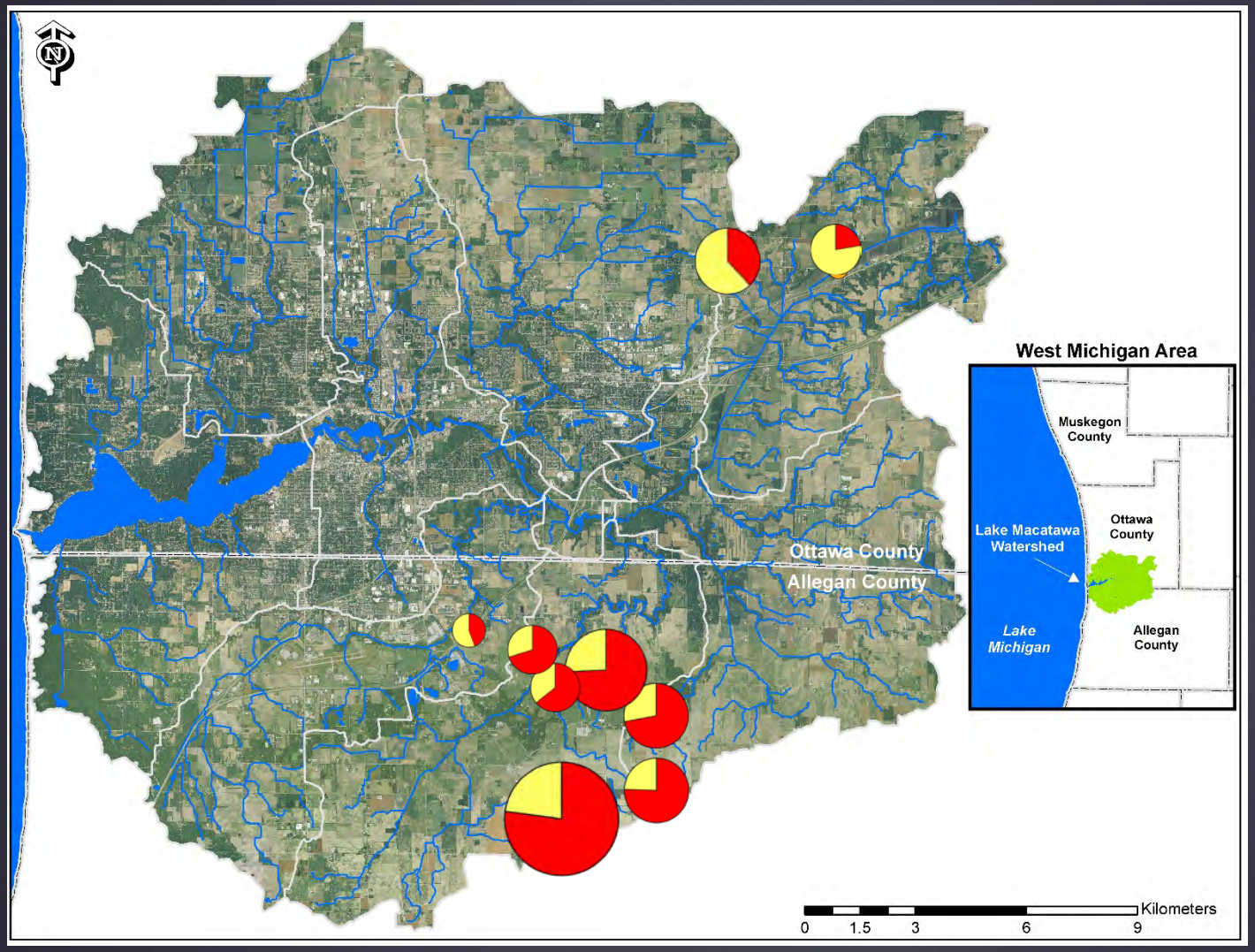
Preliminary Results

March 23 – September 24, 2015

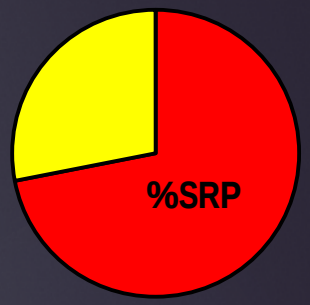
	Low	High	Mean	Median
SRP (ppb)	<5	265	83 ± 72	68

- Tile drain phosphorus is highly bioavailable

Preliminary Results



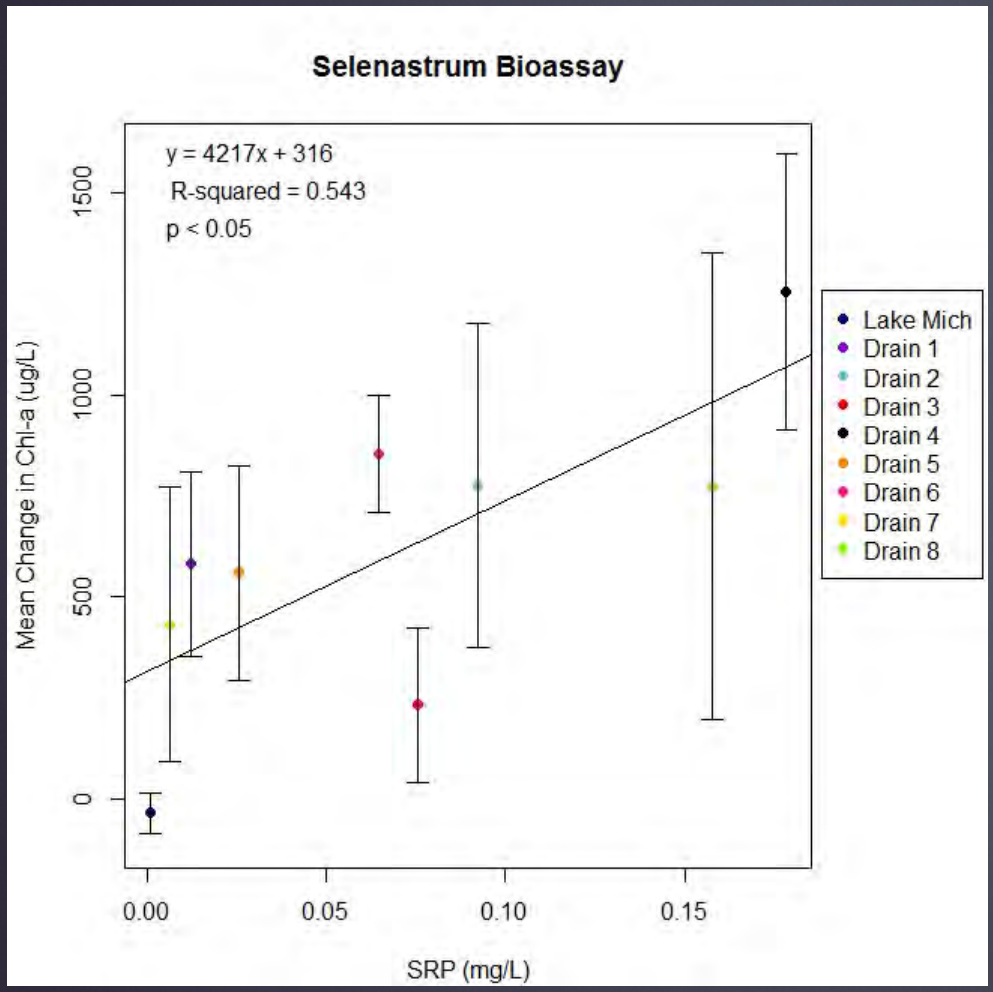
Macatawa Watershed with tile drain sampling sites.



Mean TP (ppb)

- 0 < 50
- 50 < 100
- 100 < 150
- 150 < 200
- 200 < 250
- 250 < 300

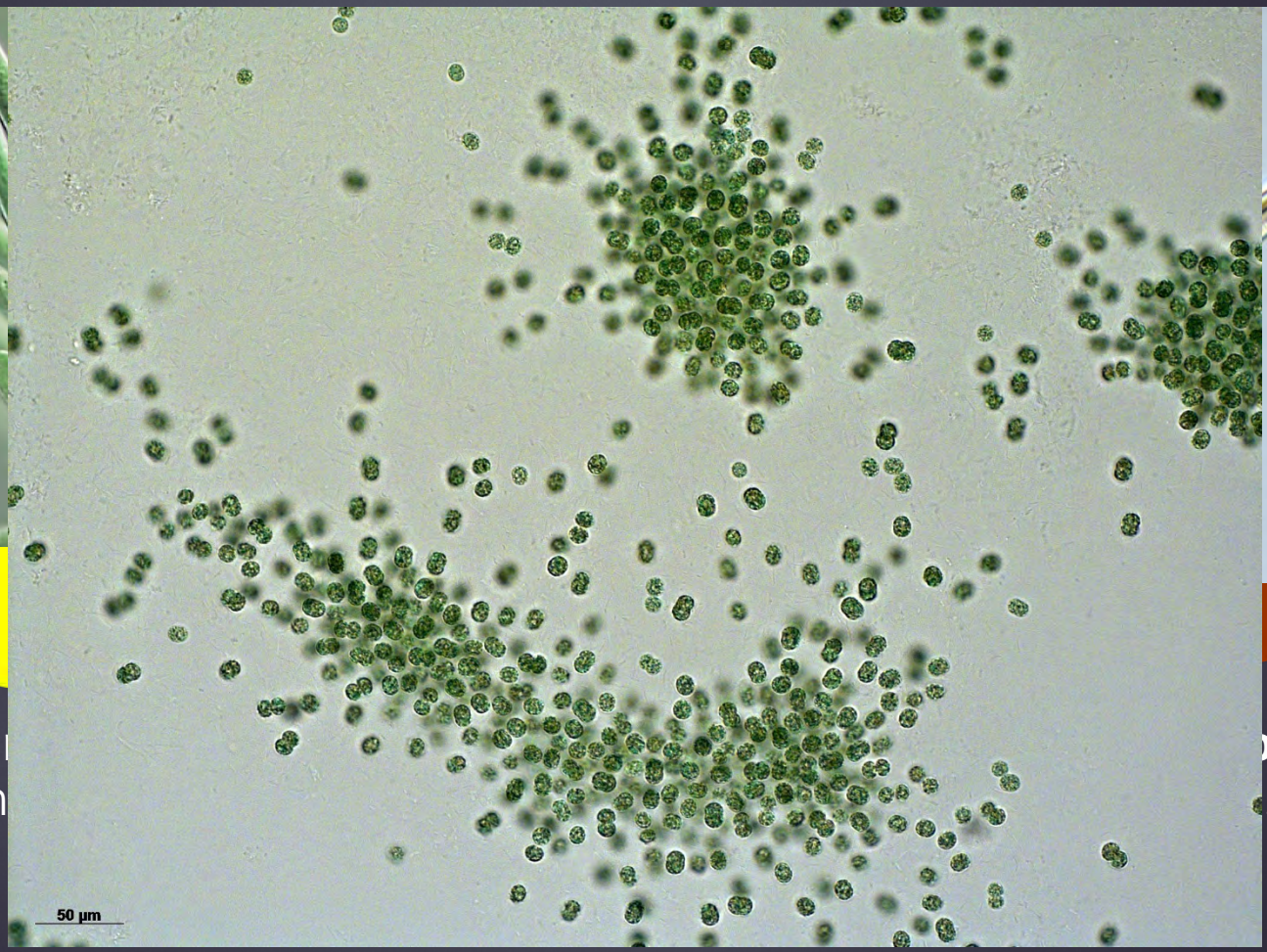
Preliminary Results



- Spring Bioassay
- Chl_{D7} - Chl_{Int}
- Significant positive relationship

Preliminary Results

Summer Bioassay Algal Community



Initial Co **on**

Biovolum .8x10^{8} µm^{3}/L

Preliminary Conclusions

- Tile drain P concentrations vary temporally and spatially
- Tile drains are a source of bioavailable P to the watershed
  - Cannot determine P budget to Lake Macatawa
- Positive relationship between SRP and *Selenastrum* growth
- Response of Lake Macatawa algae

Next Steps

- Winter sampling of tile drains
- Compare P concentration variation to land management practices
- Fall bioassay analysis

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Questions?