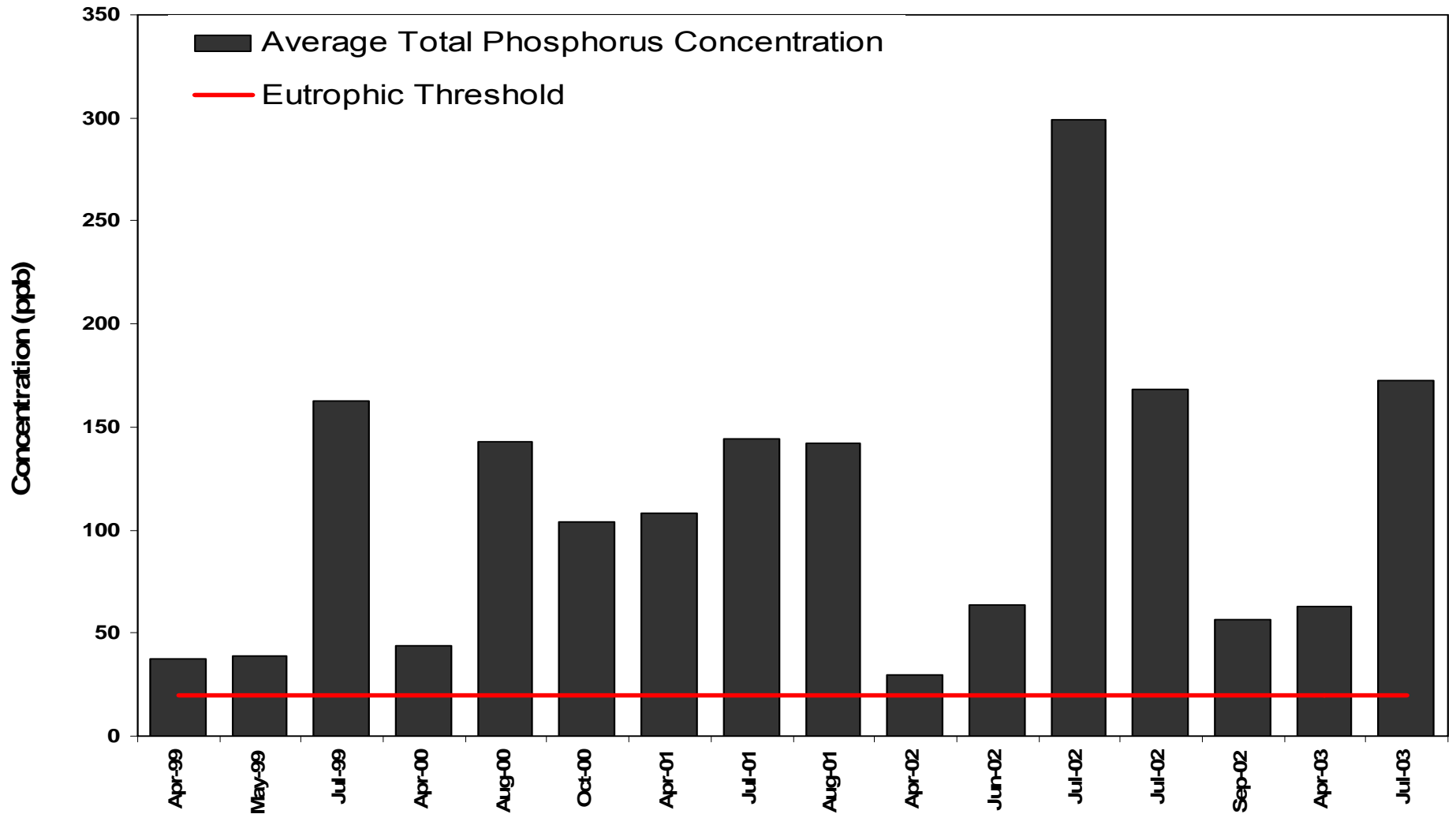


Stormwater Management in Spring Lake

Alan Steinman
Annis Water Resources Institute
Grand Valley State University

Total Phosphorus: Spring Lake



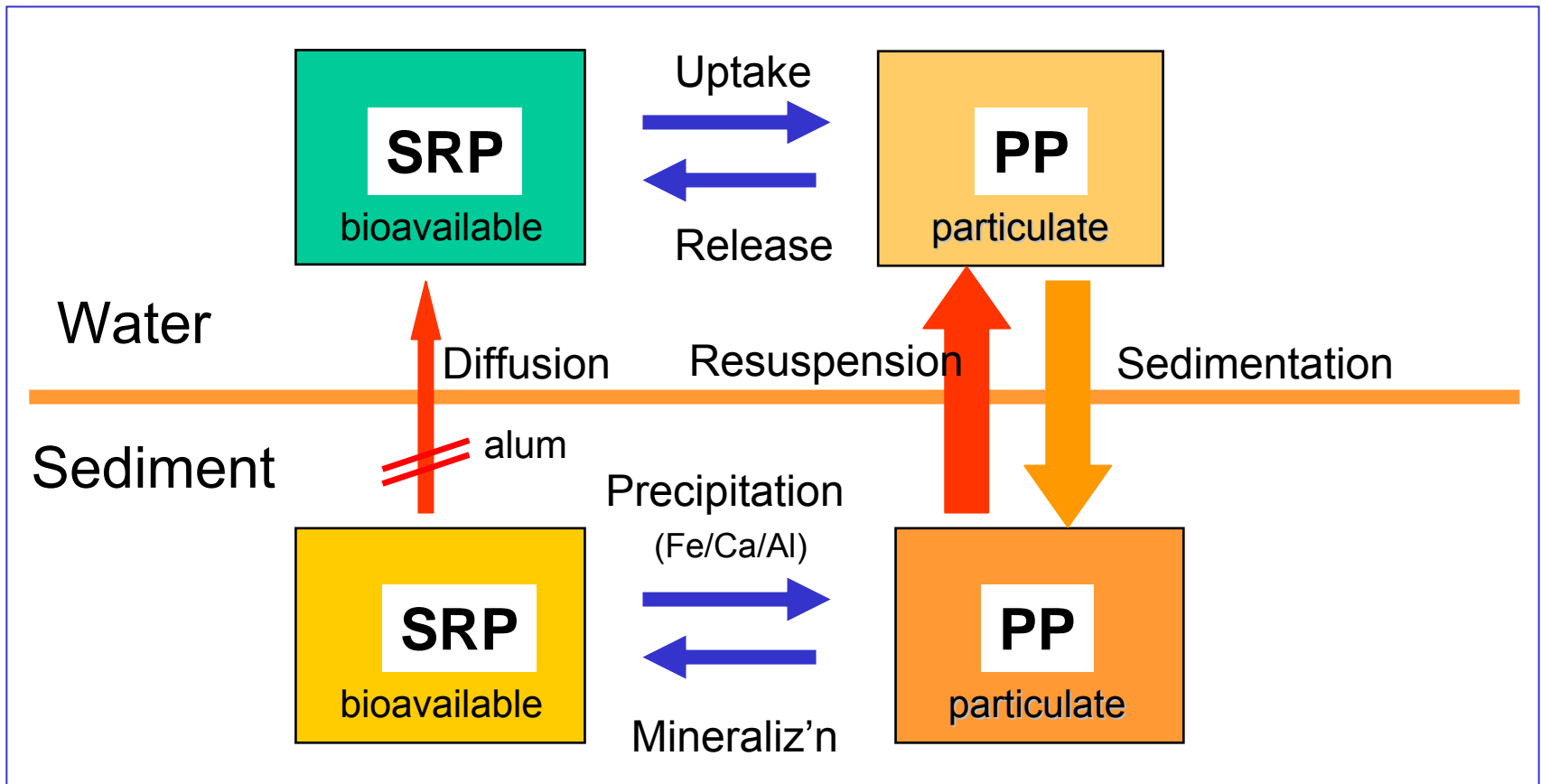
Data: Progressive AE



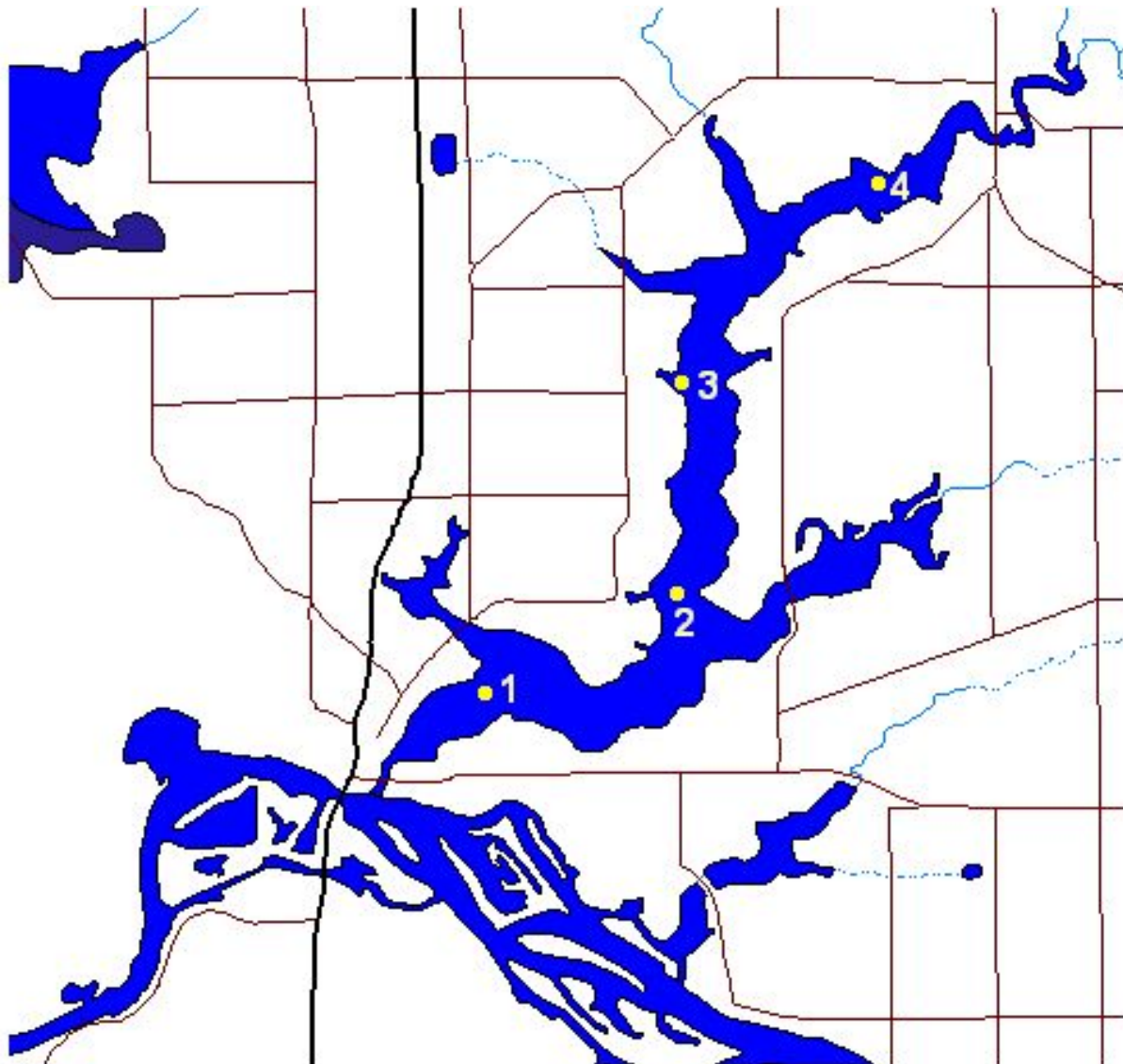
Objectives: Spring Lake Studies

- Compare external vs internal P loading rates
- Determine the effectiveness of alum in reducing internal P loading (lab studies)
- Based on lab studies, assess whole-lake alum application

Sediment-Water Interactions



Sampling Sites – Spring





UVM

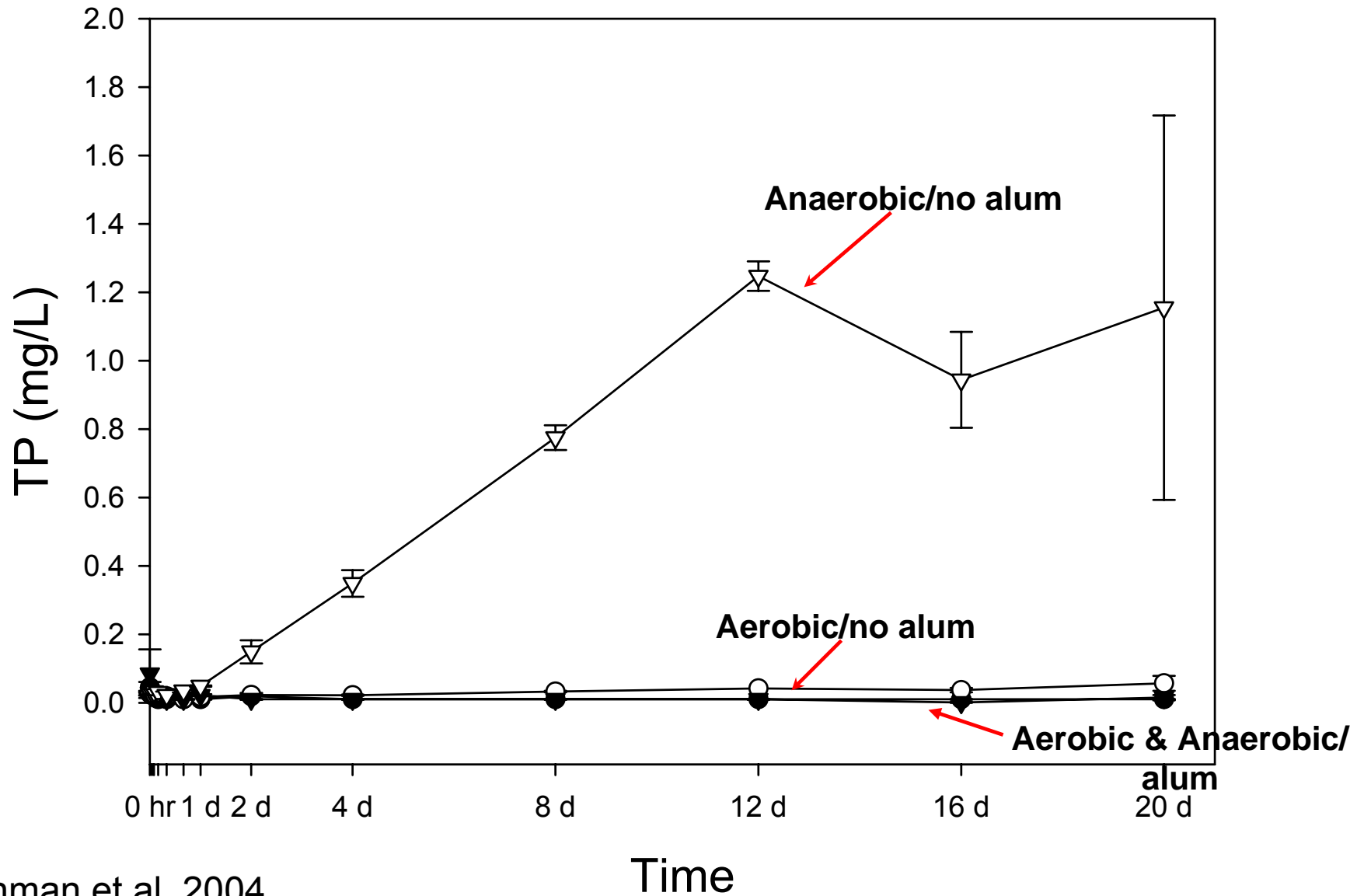


Experimental Design

Treatment	O ₂ vs N ₂	Alum vs. no alum	Prediction
1	O ₂	Alum	Lowest P
2	O ₂	No alum	Low P
3	N ₂	Alum	Very low P
4	N ₂	No alum	High P

- 3 replicates per treatment

Total Phosphorus: Site



TP Load Estimates (tons/yr)

Scenario	External Load*	Mean Internal Load**	Internal:Total Load (%)
Low	2.2	2.7	55%
Medium	3.1	6.2	67%
High	4.7	6.4	58%

*Lauber (1999)

**Steinman et al. (2004)

Alum Application

- Application date: Oct—Nov, 2005
- Total application: 1,163,000 gallons
- Surface application using spray nozzles
- Treatment area: $\sim 2.4 \text{ km}^2$ ($\sim 46\%$)
- Treatment dose: $\sim 80 \text{ g Al/m}^2$

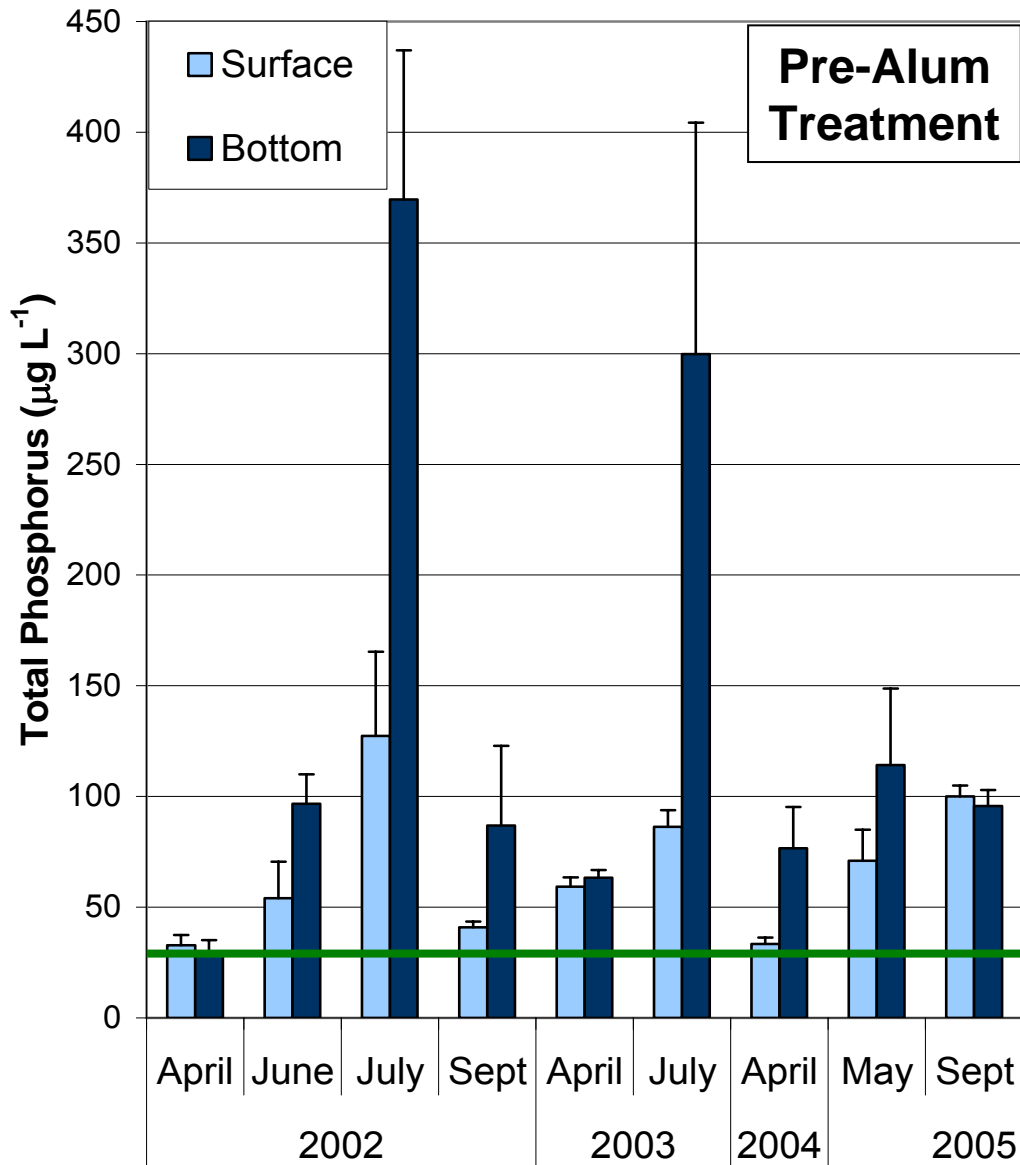
Treatment Barge

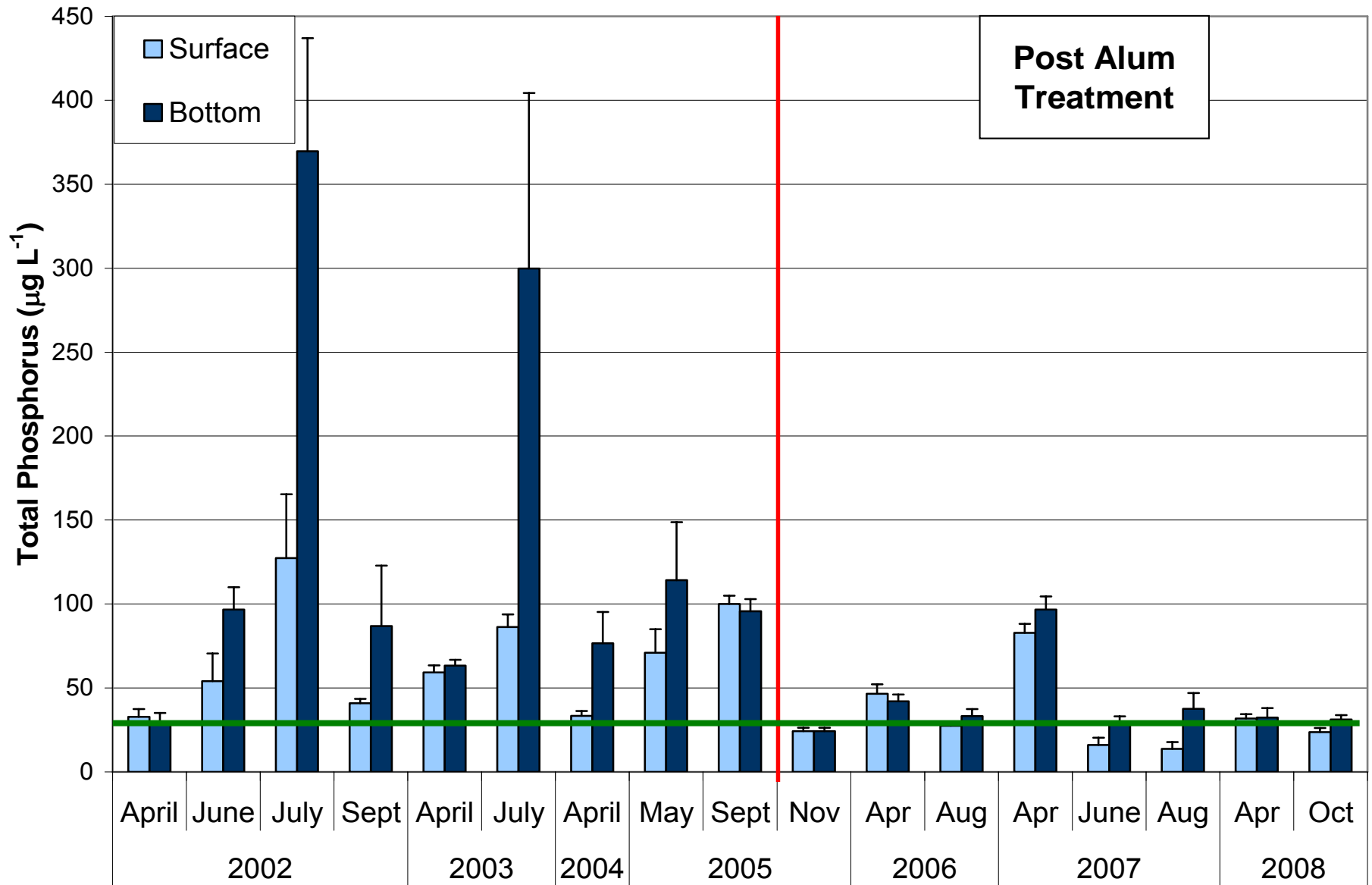


Photo: Progressive AE

Maximum TP Flux Rates (mg P/m²/d)

Site	2003 (pre-alum)	2006 (post-alum)
1	26.71	0.33
2	16.02	0.88
3	9.04	0.49
4	10.64	-0.05





Concluding Points

- Alum application is not a panacea—it treats the symptom, not the disease
- Controlling the external loading is the ultimate solution to eutrophication in lakes. The more control you have, the longer the alum treatment will last

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MENARDS® PREMIUM FERTILIZERS

Phosphate Free!

Apply Early Spring

26-0-8 Premium Crabgrass Preventer

USA Sale 7⁹⁹ 5,000 sq. ft. bag

Controls crabgrass, foxtail and other annual weed grasses. Greens up lawn and feeds up to two months. 535-1590

Apply To New Lawns

19-8-14 Premium Lawn Starter

USA Sale 9⁹⁹ 10,000 sq. ft. bag

Formulated to stimulate early growth, thickening and green-up of seeded or sodded lawns. Feeds up to two months. 535-1615

Phosphate Free!

Apply Anytime!

30-0-5 Premium Lawn Food

USA Sale 10⁹⁹ 10,000 sq. ft. bag

Timed release fertilizer promotes thick, deep green lawns. Special formula prevents surge growth and burning. Feeds up to two months. 535-1593

Apply Late Spring

28-0-8 Premium Weed & Feed

USA Sale 12⁹⁹ 10,000 sq. ft. bag

Trimec® herbicide controls dandelions and up to 2 broadleaf weeds. Greens lawn and feeds up to two months. 535-1603

Get National Performance At Low MENARDS Prices

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Spring Lake Stormwater Integrated Assessment Project Update

Rein in the Runoff





Stormwater Impacts

- Impervious surfaces (e.g., roads) increase runoff volume, velocity, & pollutants
- Reduced recharge to aquifers
- Increased erosion & sedimentation
- Potentially toxic to stream biota

Policy Question

What stormwater management alternatives are available to the Village of Spring Lake and Spring Lake Township that allow for future development and also mitigate the impacts of stormwater and improve the quality of Spring Lake, the Grand River and Lake Michigan?



Photo credit: E. Isely



Photo credit: Progressive AE



Photo credit: E. Isely

Project Objectives

- ❖ Increase understanding of the causes and consequences of stormwater runoff
- ❖ Model build-out scenarios and link to water quality impacts
- ❖ Increase stakeholder participation in stormwater control and management
- ❖ Identify regulatory mechanisms to improve local stormwater management and control
- ❖ Provide alternative BMPs for stormwater mgm't
- ❖ Serve as model for other Great Lakes communities

Stakeholder Process

- ❖ Stakeholder involvement in all aspects of Integrated Assessment:
 - Public education events
 - Representation on Stakeholder Steering Committee
 - Community group meeting presentations
 - Project website:
<http://www.gvsu.edu/wri/reininth runoff>
 - Opportunities to provide feedback, survey cards and on-line survey
 - Review of completed integrated assessment

Project Website

❖ <http://www.gvsu.edu/wri/reininth runoff>

❖ Web-Pages

- Introduction
- Project Description
- Stakeholders
- Stormwater Education page

- Water Quality Survey:
<http://www.gvsu.edu/wri/waterqualitysurvey>

The screenshot shows the website for the Annis Water Resources Institute (AWRI) at Grand Valley State University. The header includes the university logo and navigation links: home, search, apply, library, people finder, email, blackboard, contact us. The main navigation menu includes: Introduction, Project Description, Stakeholders, Stormwater Education, and Contacts. The page title is "Stormwater Management in Spring Lake 'Rein in the Runoff' Stormwater Education". A central message asks "What do you know about stormwater?" and encourages taking the "Rein in the Runoff" Water Quality Survey. The content area is titled "THE BASICS" and includes sections for "WHY IS STORMWATER RUNOFF A PROBLEM?", "HOW DO YOU MANAGE STORMWATER RUNOFF?", "WHAT CAN YOU DO TO REDUCE STORMWATER POLLUTION?", and "REFERENCES". A sub-section "THE BASICS:" defines stormwater and stormwater runoff. A photo shows a residential street with a stormwater runoff grate. A sub-section "Nonpoint source pollution" explains that it is another term for polluted stormwater runoff. A photo shows a construction site with a red barrier. A sub-section "Impervious surfaces" explains that they prevent stormwater from soaking into the ground. A photo shows a residential street with a stormwater runoff grate. The photo credit is: E. Sterrett Isely.

Zoning Ordinances/Master Plans

CITY OF FERRYSBURG

ZONING ORDINANCE

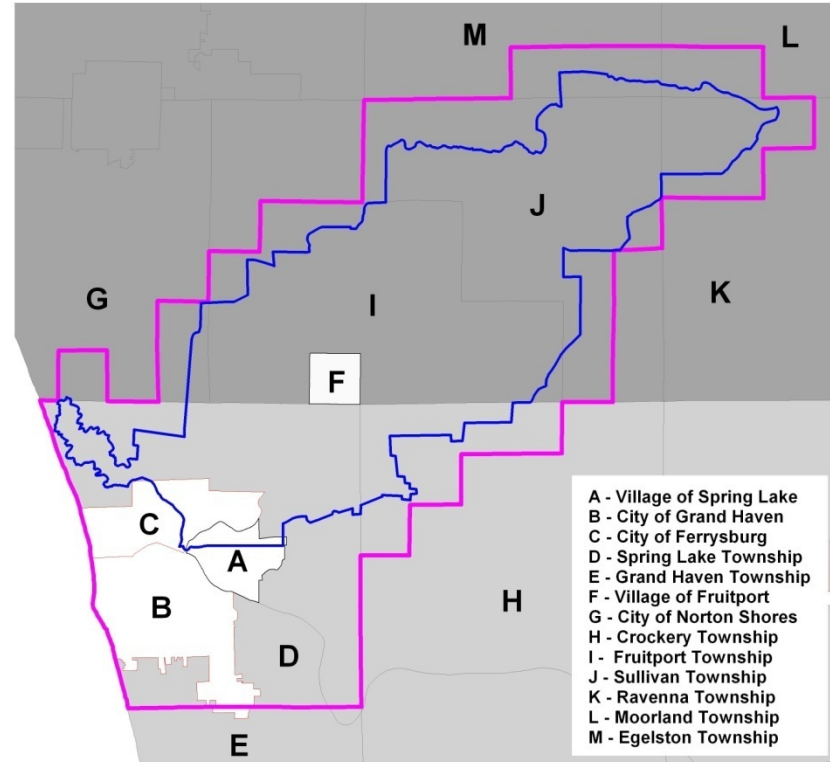
Ordinance No. 174
Adopted April 5, 1999

With Amendments
through August, 2007



COMMUNITY MASTER PLAN

Spring Lake Township Community Master Plan



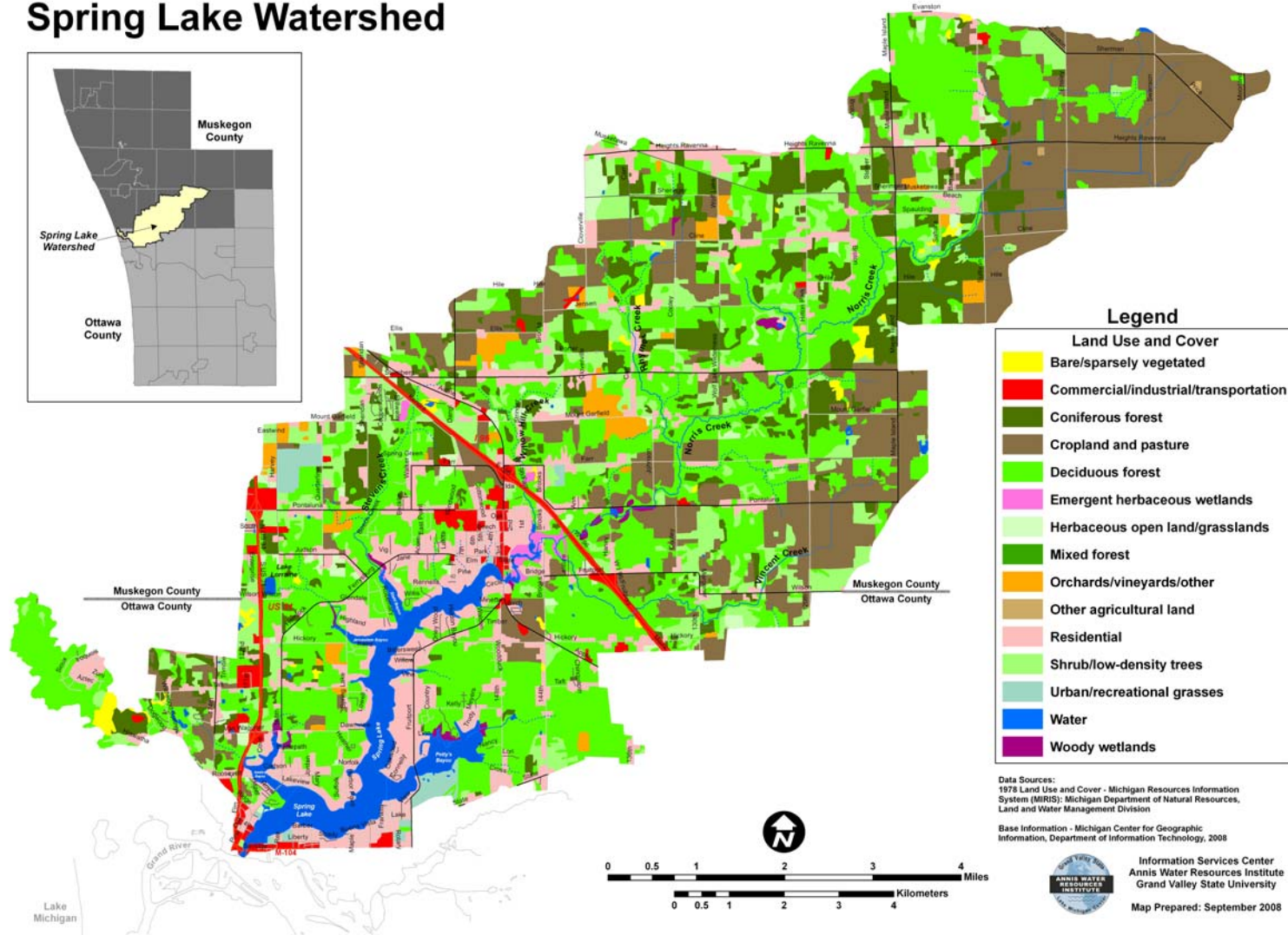
Spring Lake Watershed Political Boundaries

- Spring Lake Watershed Boundary
- Spring Lake Stormwater LULC Update Project Area
- Village Boundaries
- City Boundaries
- Ottawa County Political Boundaries
- Muskegon County Political Boundaries



Land Use Change - Then

1978 Land Use and Cover Spring Lake Watershed



Legend

Land Use and Cover	
	Bare/sparsely vegetated
	Commercial/industrial/transportation
	Coniferous forest
	Cropland and pasture
	Deciduous forest
	Emergent herbaceous wetlands
	Herbaceous open land/grasslands
	Mixed forest
	Orchards/vineyards/other
	Other agricultural land
	Residential
	Shrub/low-density trees
	Urban/recreational grasses
	Water
	Woody wetlands

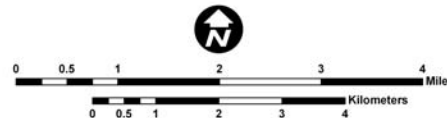
Data Sources:
1978 Land Use and Cover - Michigan Resources Information System (MRIS); Michigan Department of Natural Resources, Land and Water Management Division

Base Information - Michigan Center for Geographic Information, Department of Information Technology, 2008



Information Services Center
Annis Water Resources Institute
Grand Valley State University

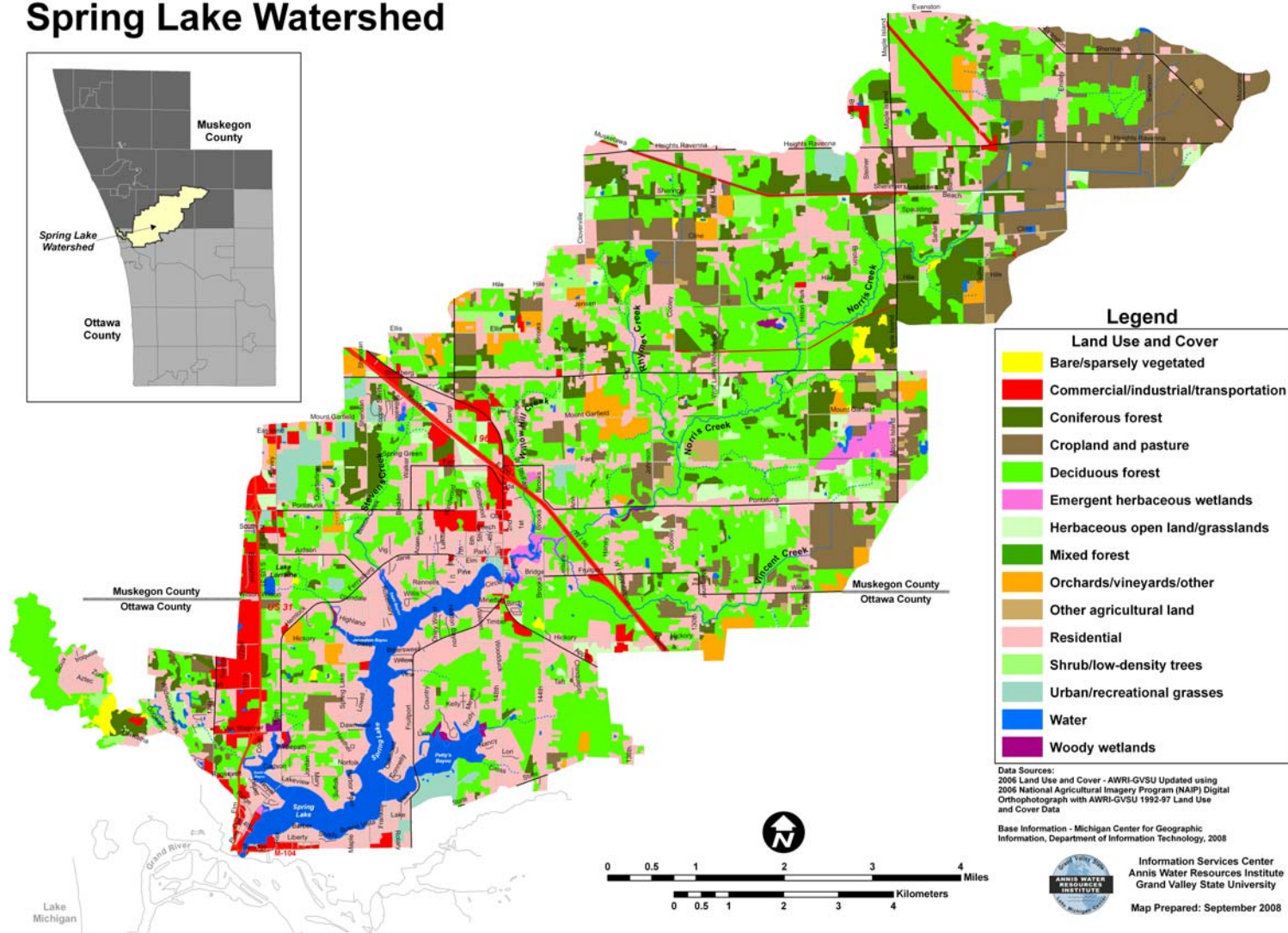
Map Prepared: September 2008



Lake Michigan

Land Use Change - Now

2006 Land Use and Cover Spring Lake Watershed



Legend

Land Use and Cover

- Bare/sparsely vegetated
- Commercial/industrial/transportation
- Coniferous forest
- Cropland and pasture
- Deciduous forest
- Emergent herbaceous wetlands
- Herbaceous open land/grasslands
- Mixed forest
- Orchards/vineyards/other
- Other agricultural land
- Residential
- Shrub/low-density trees
- Urban/recreational grasses
- Water
- Woody wetlands

Data Sources:
 2006 Land Use and Cover - AWRI-GVSU Updated using
 2006 National Agricultural Imagery Program (NAIP) Digital
 Orthophotograph with AWRI-GVSU 1992-97 Land Use
 and Cover Data

Base Information - Michigan Center for Geographic
 Information, Department of Information Technology, 2008

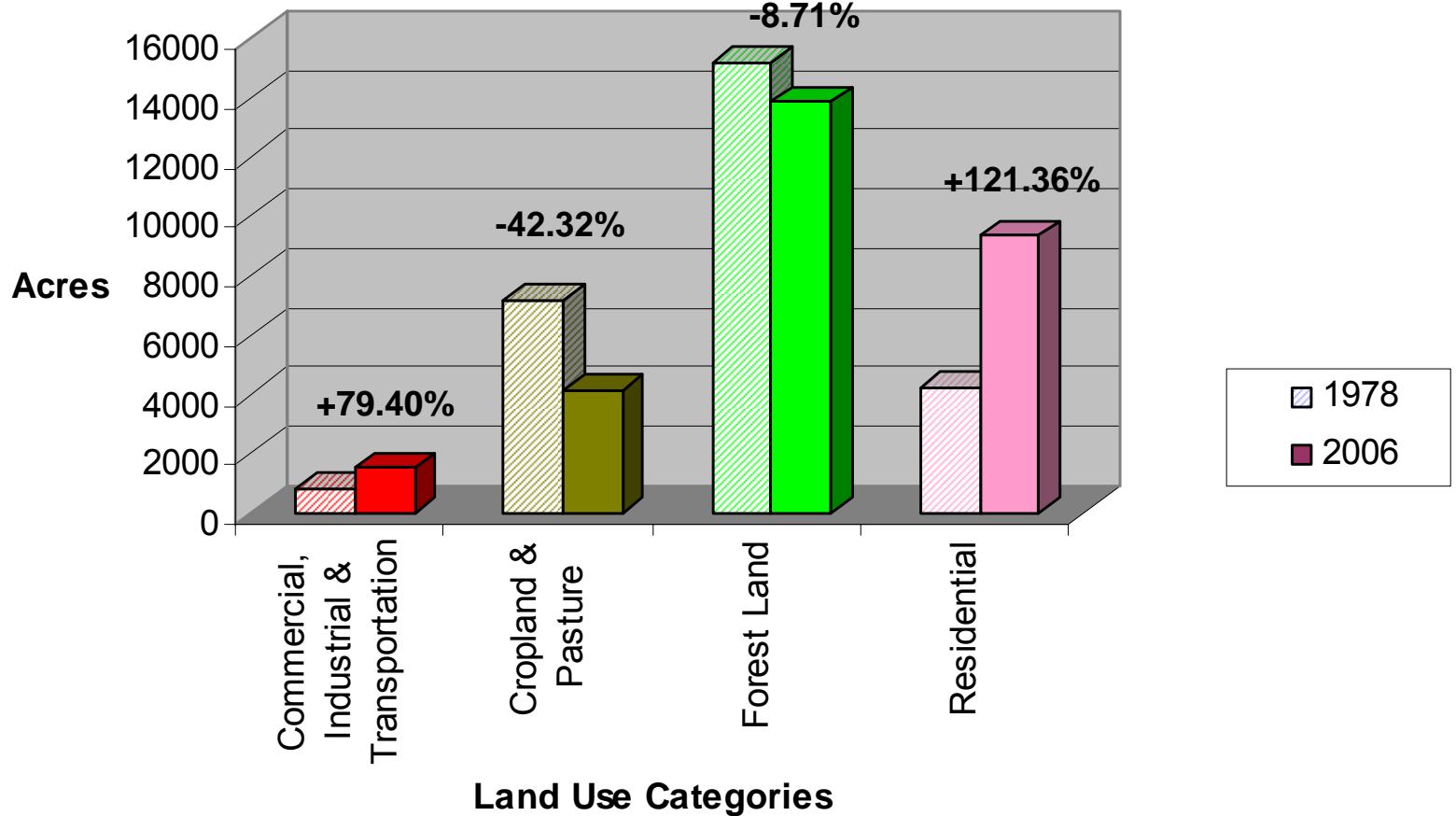


Information Services Center
 Annis Water Resources Institute
 Grand Valley State University

Map Prepared: September 2008

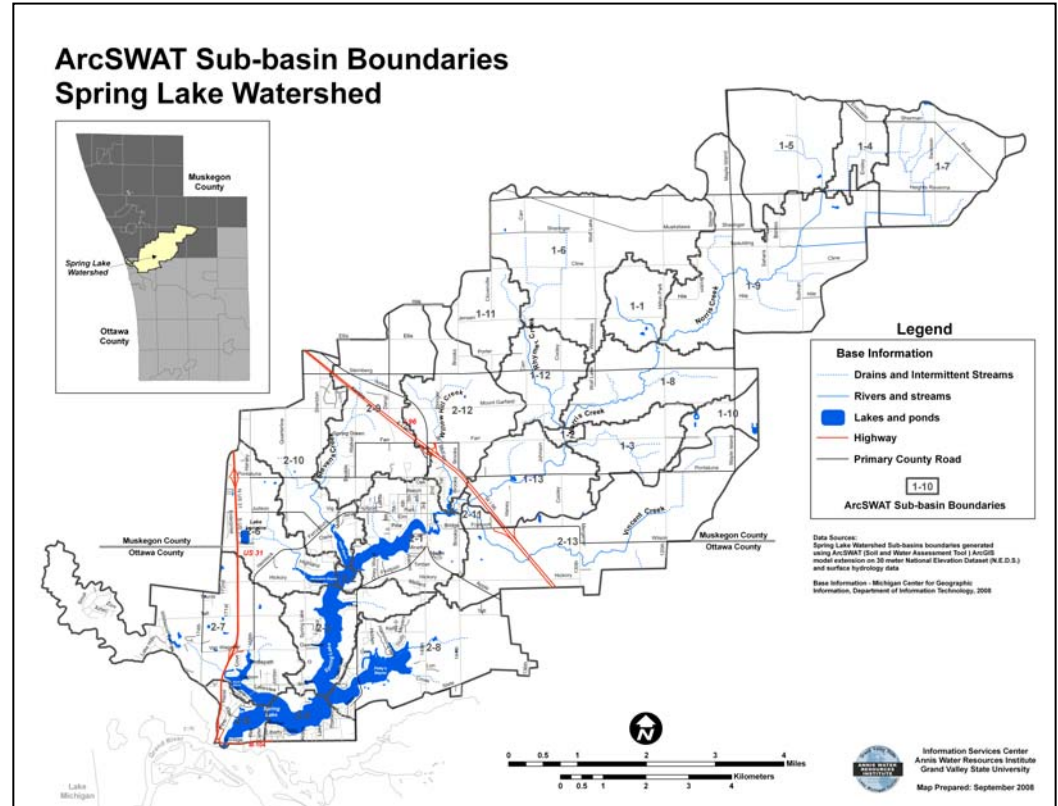
Land Use Change Analysis

Spring Lake Land Use Change 1978-2006

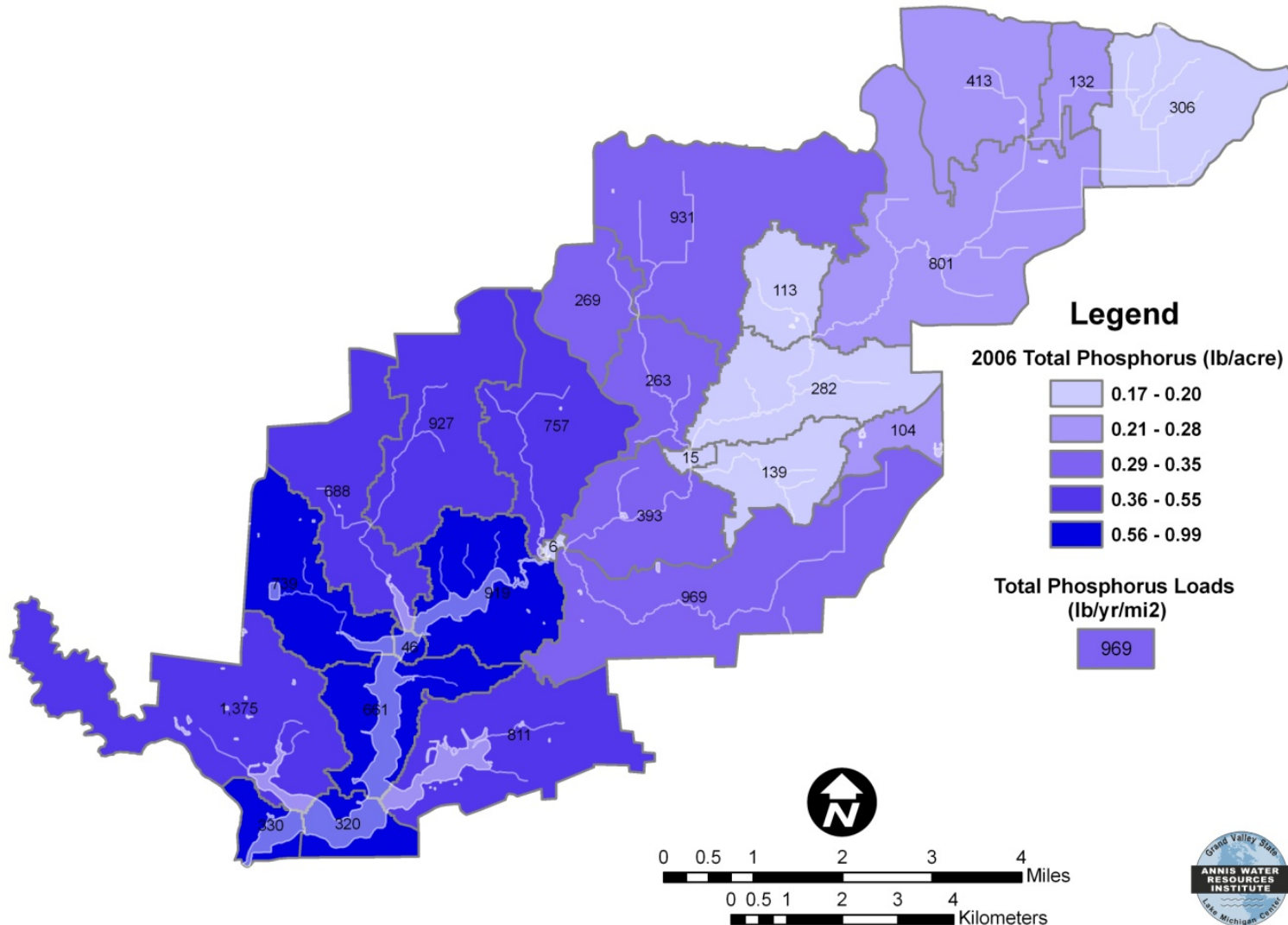


PLOAD

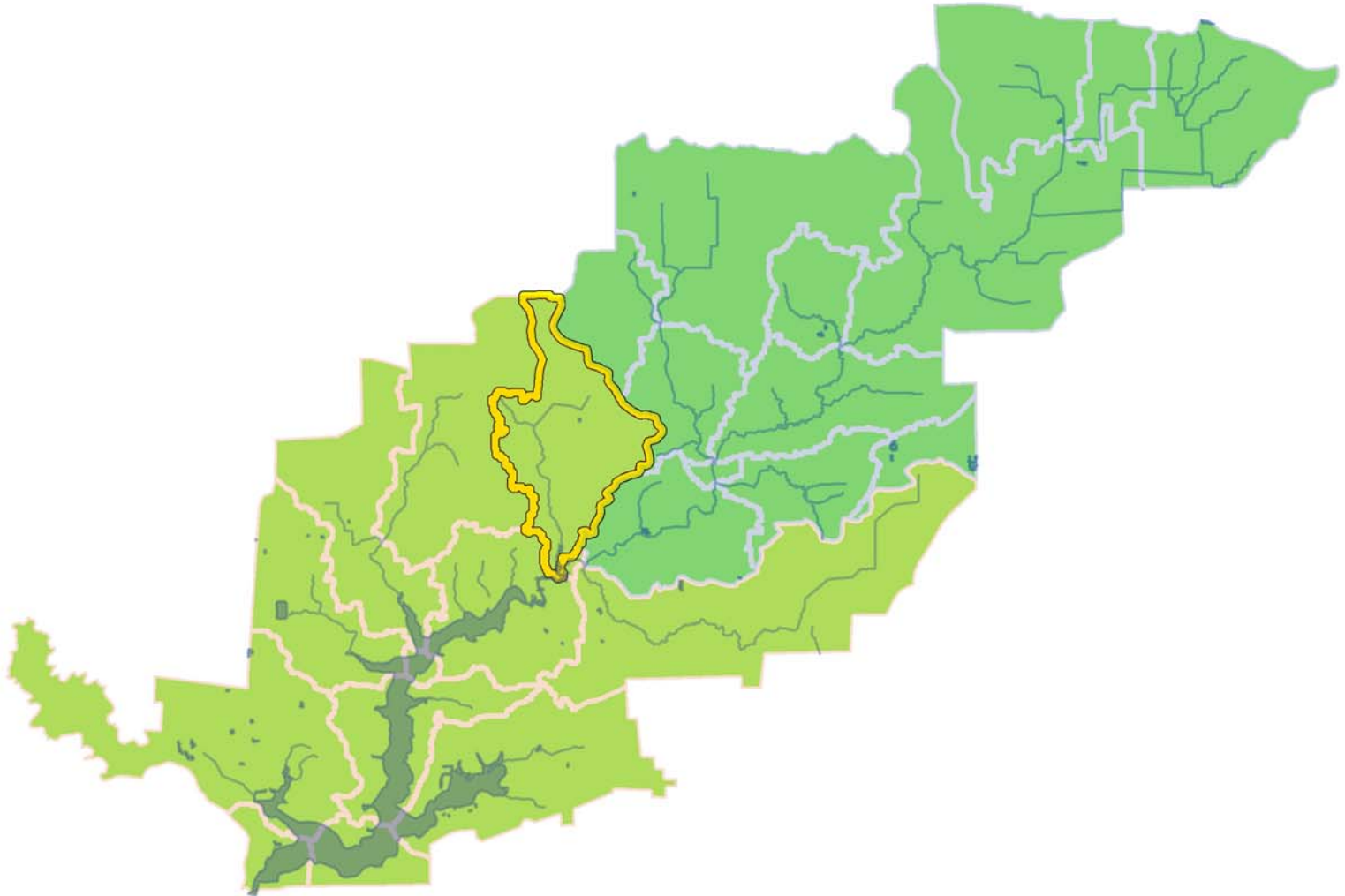
- Simplified GIS-based model
- Estimates annual average nonpoint source pollution
- Can take BMPs into account



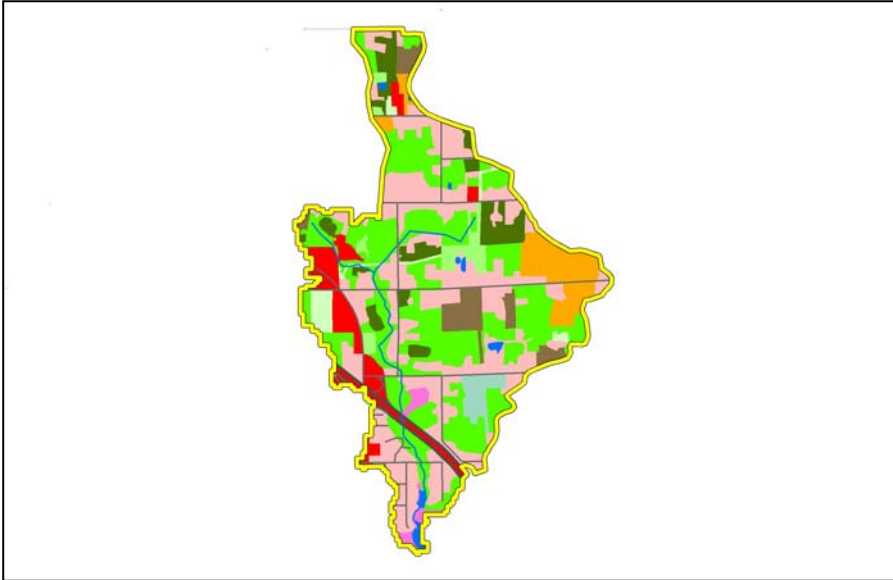
Total Phosphorus



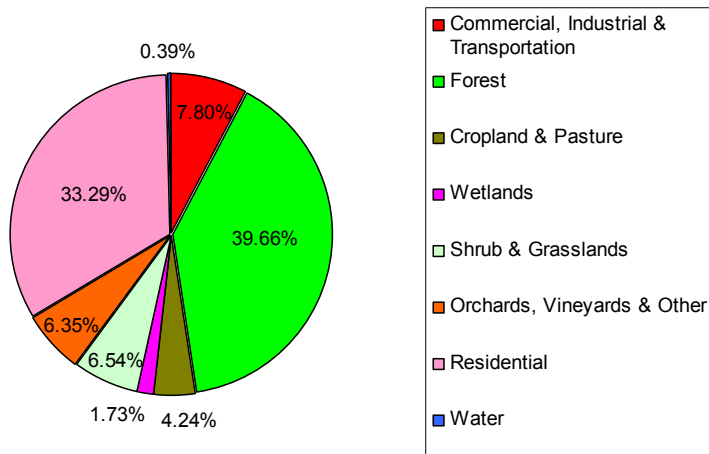
Willow Creek Sub-Basin (2-12)



Willow Creek Land Use (2006)



Willow Creek Sub-Basin Land Use Breakdown



Land Use & Cover Category	Acres
Commercial, Industrial & Transportation	125.65
Forest	638.64
Cropland & Pasture	68.34
Wetlands	27.82
Shrub & Grasslands	105.39
Orchards, Vineyards & Other	102.23
Residential	536.15
Water	6.21
TOTAL	1610.43

BMP Application

- ❖ Riparian buffers (15 m width): 32.9 acres
- ❖ Bioretention (rain gardens): 9.5 acres
- ❖ Bioswales (filtering practices): 29.7 acres



Results

Pollutant	Pollutant Load Reduction
Total Nitrogen	↓ 1.82%
Total Phosphorus	↓ 3.31%
Total Suspended Solids	↓ 2.89%

❖ Pollutant load reductions will vary

- Different BMPs
- Combination of BMPs
- Amount of BMPs

Work Plan / Next Steps

Step 1: Document status/trends of stormwater problem

Step 2: Describe environmental, social, economic causes

- ✓ Presentations to stakeholders/Stakeholder Steering Committee
- Public meetings (Ongoing)
- Feedback and input (Ongoing)

Step 3: Generate forecasts

- ✓ Model simulations (PAM, L-THIA, Pload)
- Stakeholders review future development scenarios

Step 4: Provide technical guidance implementing BMPs

- Develop menu of site-specific BMPs

Step 5: Present final options

- Review and revise findings
- Final report and presentations

Acknowledgements

Colleagues:

- Elaine Sterrett Isely
- Tony Groves
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- Paul Isely
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- Tim Penning
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- Chuck Pistis

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- Michigan DEQ