

# Targeted Control of Agricultural Sources of Phosphorus and Lessons Learned

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The Nature Conservancy

AWRA Conference

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The Nature  
Conservancy



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# Outline

- Background
- Soil Test Results
- SNAP-Plus Modeling
- SNAP – Results
- Examples of Practices
- Lessons Learned
- Application to Adaptive Mgmt. / P Trading

# Sheboygan River Partners

## Partners for Clean Water

Conservation organizations, landowners and farm operators in two watersheds in Sheboygan County are testing a more efficient and effective way to improve water quality in area streams.

The partners are testing the idea that a handful of fields in a given watershed contribute comparatively large amounts of nutrients like phosphorus to nearby streams. Too much phosphorus in a stream fuels the growth of plants and algae that can decrease water clarity and deplete oxygen, suffocating fish and affecting outdoor recreation including swimming, boating and fishing.

The partners will target conservation practices on those agricultural fields and pastures in the Otter Creek watershed with the greatest potential for

contributing phosphorus to streams. Conservation practices could include different types of tillage and manure applications as well as restoring wetlands or keeping livestock out of streams. Fisher Creek is also part of the project and will serve as the control watershed where no action will be taken.

The U.S. Geological Survey (USGS) and Wisconsin Department of Natural Resources are gathering baseline data on stream flow, water quality and fish populations in both watersheds. As the study proceeds, the agencies will continue to collect data so that differences between the two watersheds can be compared. The gauge you see here is one of two USGS gauges collecting the stream flow and water quality data.



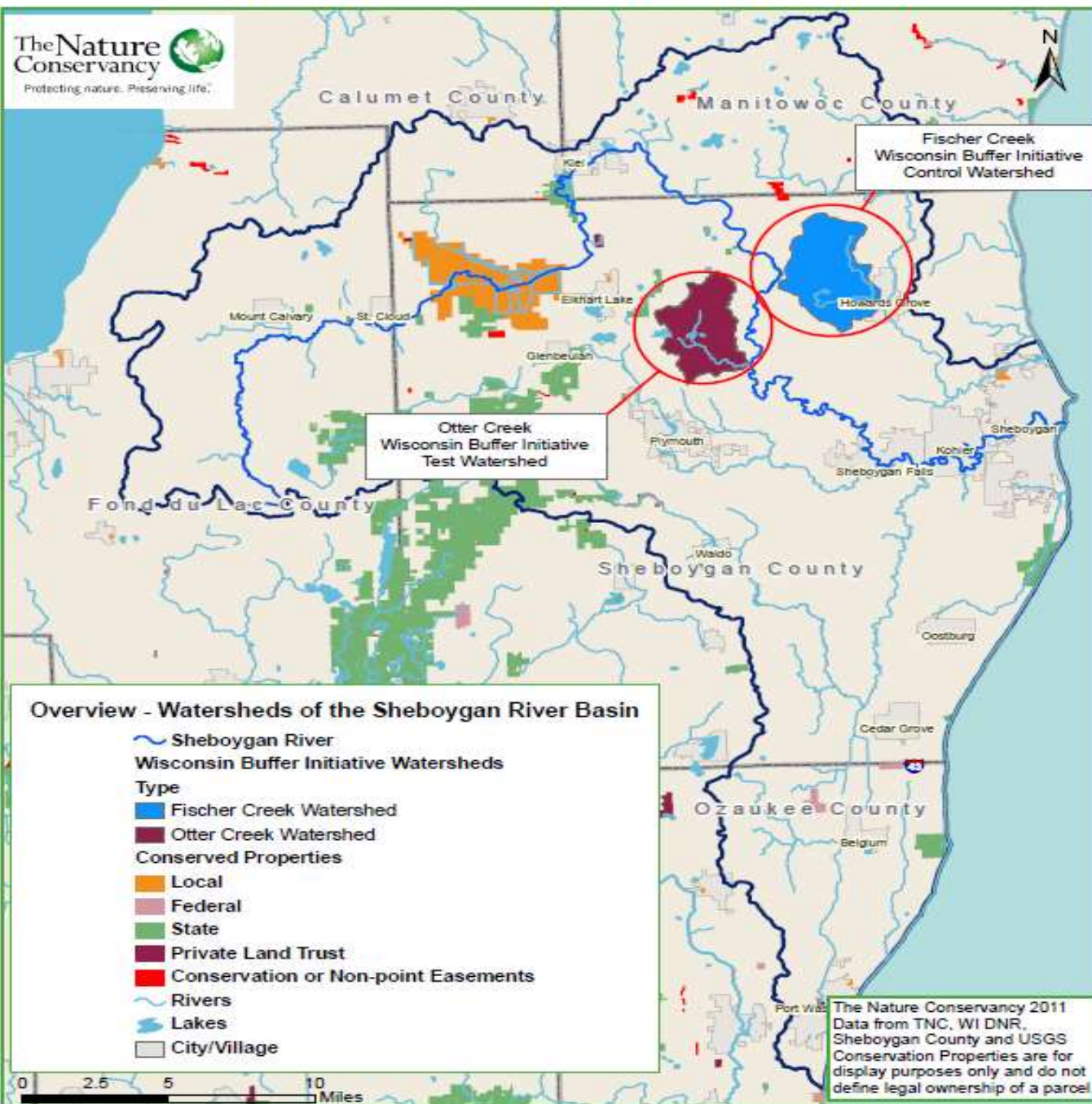
KOHLER TRUST  
FOR PRESERVATION



COLLEGE OF  
AGRICULTURAL & LIFE SCIENCES  
University of Wisconsin-Madison



# Wisconsin Buffer Initiative Watersheds





# Otter Creek – Test Watershed

- 2,590 Hectares
- Sampled 233 Fields (96%)
- Predominately Kewaunee Soils
- Average P of 28.4 mg/l
- Fairly Stable Base Flow
- Groundwater input





# Fisher Creek – Control Watershed

- 2,850 Hectares
- Sampled 180 Fields ( 81%)
- Predominately Kewaunee Soils
- Average Soil P of 25.0 mg/l
- Less stable base flow
- Substantial Wetland Drainage
- Less groundwater input



# Monitoring



Photos by Heather Baker

# SNAP – Plus Modeling

## Significant Inputs

- Individual Field Soil Characteristics - Soil Type, Average P
- Slope, proximity to surface water
- Crop Rotation
- Tillage Strategy
- Nutrient Application
- Presence/Absence of Buffers
- Calculates Phosphorus Index (**PI**) value



Farm Name:  Farm data directory: D:\

Farm Field Soil Tests Nutrient Sources Cropping

Field Name: 248 26   County: WI-Sheboygan Acres: 9 Slope: 9 Soil Name: KEWAUNEE Symbol: KpC2 Restrictions: ? Soil Group: C Soil Texture: CLAY\_LOAM

Subfarm:  pH: 7.2 OM %: 3.2 P (ppm): 21 K (ppm): 146

Rotation Wizard NPM Fast Facts Calculate all years 2016 soil test date: 9/21/2011

	First Year			Page Back			Prev Year			Next Year			Page Fwd			Last Year			
	2014			2015			2016			2017			2018						
Crop:	Alfalfa			Corn silage			Corn silage			Barley grain + straw			Oat-Pea Forage w/ A						
Yield Goal:	4.6-5.5			16-20			16-20			51-75			2-3.5						
Tillage:	None			Fall MB Plow			Fall MB Plow			Fall MB Plow			Fall MB Plow						
Soil Test Date:	9/21/2011			9/21/2011			9/21/2011			9/21/2011			9/21/2011						
Lime Rec:	0			0			NA			NA			NA						
Irrigation / MRTN info:	<input type="checkbox"/> Irrigated			<input type="checkbox"/> Irrigated 0.05/MRTN			<input type="checkbox"/> Irrigated 0.05/MRTN			<input type="checkbox"/> Irrigated			<input type="checkbox"/> Irrigated						
Season notes:																			
(lbs/acre)	N	P205	K20	N	P205	K20	N	P205	K20	N	P205	K20	N	P205	K20	N	P205	K20	
Recommendation:	0	65	75	170	65	40	170	65	40	50	45	0	10	30	0				
Prior years' extra:		0	0		0	0		0	5		42	178		43	238				
Adjusted recommendation:	0	65	75	170	65	40	170	65	35	50	3	0	10	0	0				
1st & 2nd year legume credit:	0			190			50			0			0						
Ext. manure credits (unused):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
This year's manure:	24	24	56	0	0	0	84	72	168	0	0	0	0	0	0				
This year's fertilizer:	0	0	0	14	35	45	14	35	45	18	46	60	14	35	45				
Total credits & applications:	24	24	56	204	35	45	148	107	213	18	46	60	14	35	45				
Over(+)/Under(-) adj UW rec:	24	-41	-19	34	-30	5	-22	42	178	-32	43	60	4	35	45				
Annual Total PI	2			9			13			8			5						
<input type="checkbox"/> Details																			

Field notes:

## Rotation Settings

7 year crop rotation starting in

  2012  

Contouring

☒ None☐ On contour☐ Strip cropping

Filter strips

☒ None☐ Designed, field edge☐ Designed, in-field

## Rotation Summary Results 2012 - 2018

Avg soil loss 5.4 t/acre/yr

Field "T" 3 t/acre/yr

Avg P Index 6

P205 removal 385 lb/acre

K20 removal 1345 lb/acre

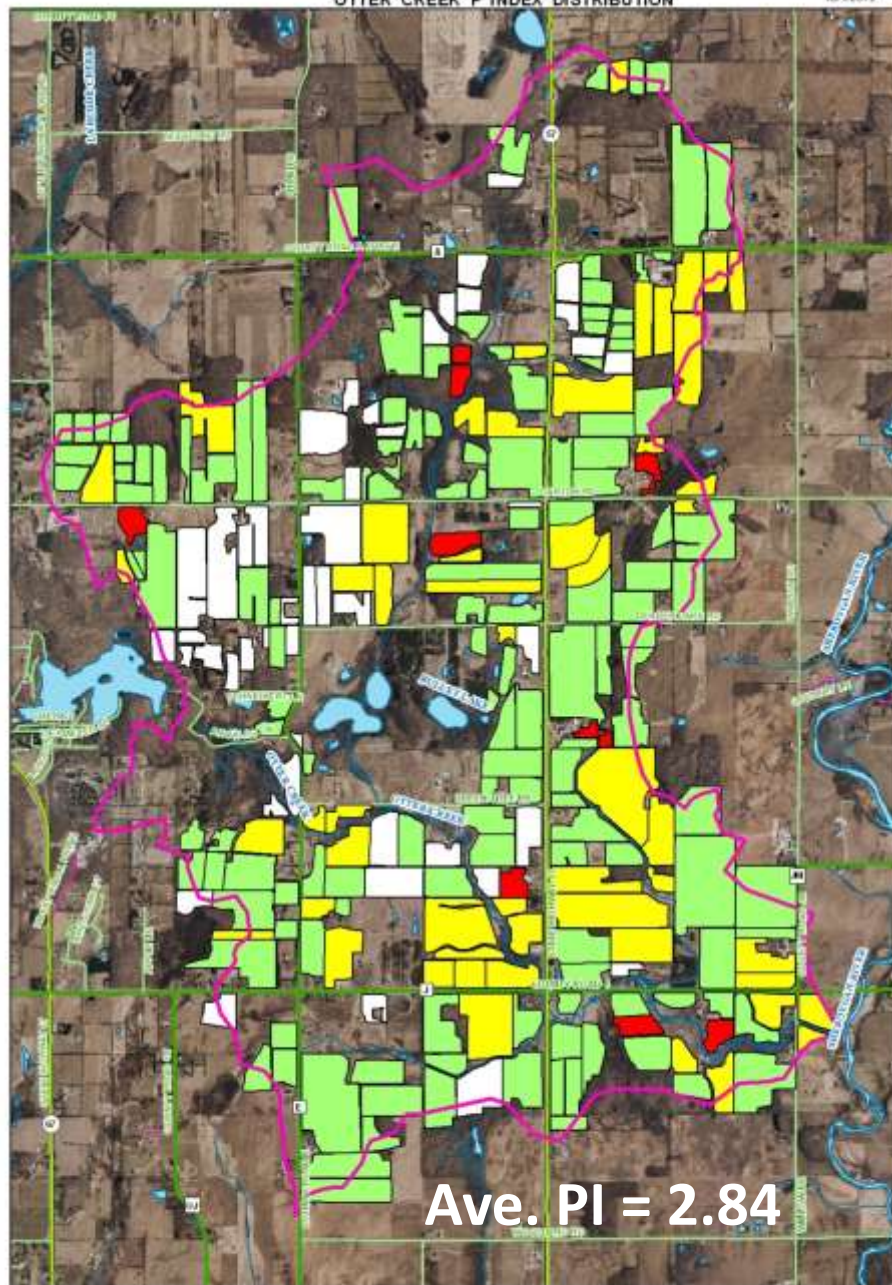
P205 balance -138 lb/acre

K20 balance -926 lb/acre

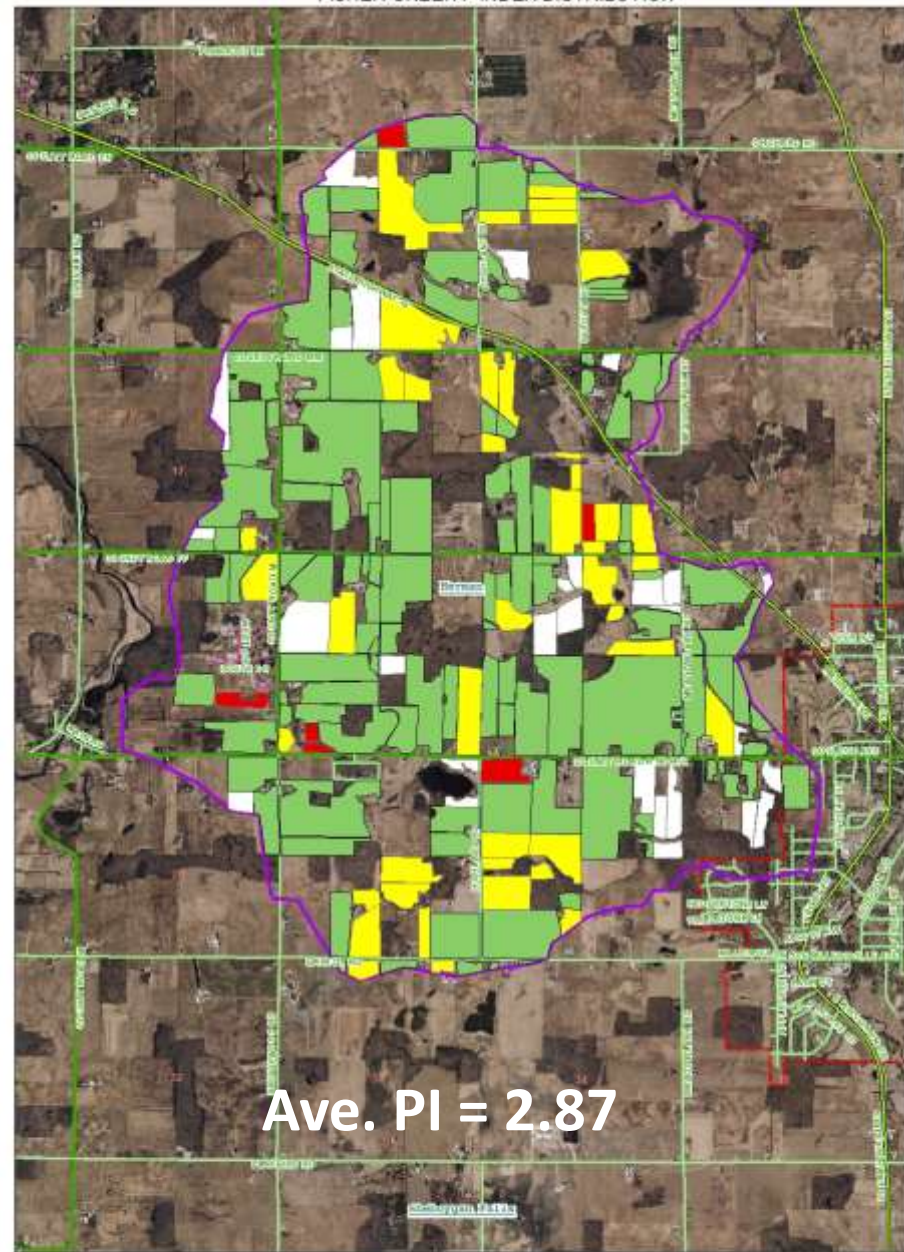
Soil test P is 50 or less so no P205 balance target is needed.

OTTER CREEK P INDEX DISTRIBUTION

10/4/2013



FISHER CREEK P INDEX DISTRIBUTION



0 900 1,800'

This map is intended for advisory purposes only. The information has been obtained from sources believed to be reliable, based on plans, surveys, and aerials. In areas where the information source becomes uncertain, legal records, the discrepancy is allowed to remain until such time as it is addressed. Shaded areas are not shown on the map as they are not shown. Shaded areas are not shown on the map as they are not shown. Shaded areas are not shown on the map as they are not shown.



# Nutrient Management



Heather Baker Photo



# Cover Crops



Mike Ballweg Photo

# Crop Rotation





# No-Till Planting



Heather Baker Photo



# Grassed Waterways & Buffers



Heather Baker Photo

# Tillage and Residue Management





# Managed Grazing



Photos by Chris Ertmann



Farm Name:  Farm data directory: D: 

Farm Field Soil Tests Nutrient Sources Cropping

Field Name: 248 26

County Acres Slope Soil Name Symbol Restrictions Soil Group Soil Texture

WI-Sheboygan 9 9 KEWAUNEE KpC2 ? C CLAY\_LOAM

Subfarm:

Rotation Wizard NPM Fast Facts Calculate all years 2016 soil test date: 9/21/2011

pH OM % P (ppm) K (ppm)

7.2 3.2 21 146

	-	+	First Year	Page Back	Prev Year	Next Year	Page Fwd	Last Year	+	-					
	2014			2015			2016			2017			2018		
Crop:	Alfalfa			Corn silage			Corn silage			Barley grain + straw			Oat-Pea Forage w/ A		
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Lime Rec:	0			0			NA			NA			NA		
Irrigation / MRTN info:	<input type="checkbox"/> Irrigated			<input type="checkbox"/> Irrigated 0.05/MRTN			<input type="checkbox"/> Irrigated 0.05/MRTN			<input type="checkbox"/> Irrigated			<input type="checkbox"/> Irrigated		
Season notes:															
( lbs/acre )	N	P205	K20	N	P205	K20	N	P205	K20	N	P205	K20	N	P205	K20
Recommendation:	0	65	75	170	65	40	170	65	40	50	45	0	10	30	0
Prior years' extra:		0	0		0	0		0	5		42	178		43	238
Adjusted recommendation:	0	65	75	170	65	40	170	65	35	50	3	0	10	0	0
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Ext. manure credits (unused):	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
This year's manure:	24	24	56	0	0	0	84	72	168	0	0	0	0	0	0
This year's fertilizer:	0	0	0	14	35	45	14	35	45	18	46	60	14	35	45
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Annual Total PI	2			9			13			8			5		
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Field notes:

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Yield Goal:	4.6-5.5	16-20	16-20	51-75	2-3.5
Tillage:	None	No Till	Fall Chisel, no disk	Fall Chisel, no disk	No Till
Soil Test Date:	9/21/2011	9/21/2011	9/21/2011	9/21/2011	9/21/2011
Lime Rec:	0	0	NA	NA	NA
Irrigation / MRTN info:	<input type="checkbox"/> Irrigated	<input type="checkbox"/> Irrigated 0.05/MRTN	<input type="checkbox"/> Irrigated 0.05/MRTN	<input type="checkbox"/> Irrigated	<input type="checkbox"/> Irrigated
Season notes:					
(lbs/acre)	N P205 K20	N P205 K20	N P205 K20	N P205 K20	N P205 K20
Recommendation:	0 65 75	170 65 40	170 65 40	50 45 0	10 30 0
Prior years' extra:	0 0 0	0 0 0	0 5	42 178	43 238
Adjusted recommendation:	0 65 75	170 65 40	170 65 35	50 3 0	10 0 0
1st & 2nd year legume credit:	0	190	50	0	0
Ext. manure credits (unused):	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0
This year's manure:	24 24 56	0 0 0	84 72 168	0 0 0	0 0 0
This year's fertilizer:	0 0 0	14 35 45	14 35 45	18 46 60	14 35 45
Total credits & applications:	24 24 56	204 35 45	148 107 213	18 46 60	14 35 45
Over(+)/Under(-) adj UW rec:	24 -41 -19	34 -30 5	-22 42 178	-32 43 60	4 35 45
Annual Total PI	1	1	3	2	1

☐ Details

Field notes:

## Rotation Settings

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Contouring

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☐ Strip cropping

Filter strips

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## Rotation Summary Results 2012 - 2018

Avg soil loss and sed del 2.6/0.4 t/acre/yr

Field "T" 3 t/acre/yr

Avg P Index 1

P205 removal 385 lb/acre

K2O removal 1345 lb/acre

P205 balance -138 lb/acre

K2O balance -926 lb/acre

Soil test P is 50 or less so no P205 balance target is needed.

# Soil & P Savings

- Before

After

$$5.4 \text{ t/ac/yr} - 2.6 \text{ t/ac/yr} = 2.8 \text{ t/ac/yr}$$
- $$2.8 \text{ t} \times 9 \text{ ac} = \mathbf{25.2 \text{ t}}$$
 of soil saved

- Before

After

$$6 \text{ lbs P} - 1 \text{ lbs P} = 5 \text{ lbs P/ac}$$
- $$5 \text{ lbs} \times 9 \text{ ac} = \mathbf{45 \text{ lbs}}$$
 P reduced



# P Savings to Date

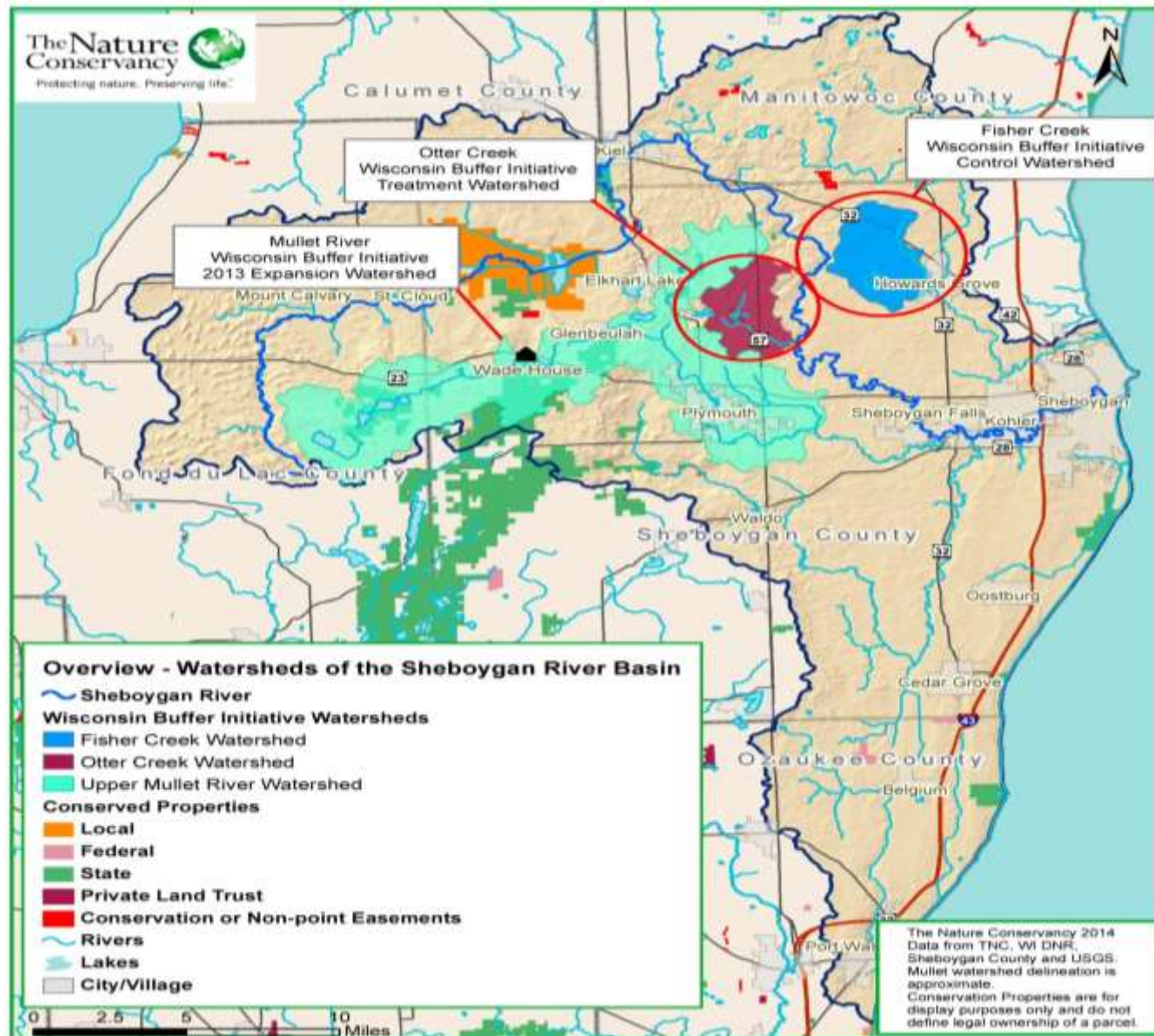
- Farm 1 NMP 155 lbs.
- Farm 2 NMP 31 lbs.
- Farm 3 Buffer 11 lbs.
- Farm 4 Buffer/WW 90 lbs.
- Farm 5 NMP 40 lbs.
- Farm 5 Rot. Grazing 211 lbs.
  
- Total **538 lbs.**

# Lessons Learned

- Field by Field Evaluations
- Other Models may be Useful – eg. EVAAL
- Voluntary Cooperation – Building Trust
- Success depends on watershed condition
- Cost Sharing Opportunities
- Adaptation dependent on Bottom Line
- Acceptance of New Practices Slow
- Access to Equipment



# Adaptive Management/P Trading Opportunity



# Can Targeting help?

- Whole Watershed Evaluation consumes time & money
- Other models available – EVAAL
- Need support of respected entities
- Cost-sharing available
- May require some WWTP changes also

# Summary

- Small percentage of fields exceed standard
- Targeting helps focus/success
- SNAP-Plus a good tool
- Practice changes make a difference
- Working with farmers requires Trust
- Potential to support AM/WQT efforts



# Soil Conservation

- *“The nation that destroys its soil, destroys itself”* Franklin Delano Roosevelt
- *“While a farmer holds the title to the land, actually it belongs to all the people because civilization itself rests upon the soil”* Thomas Jefferson