

# Improving the MN River: The BMP CHALLENGE<sup>SM</sup> & Water Quality Credit Trading

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# THE MINNESOTA RIVER WATERSHED

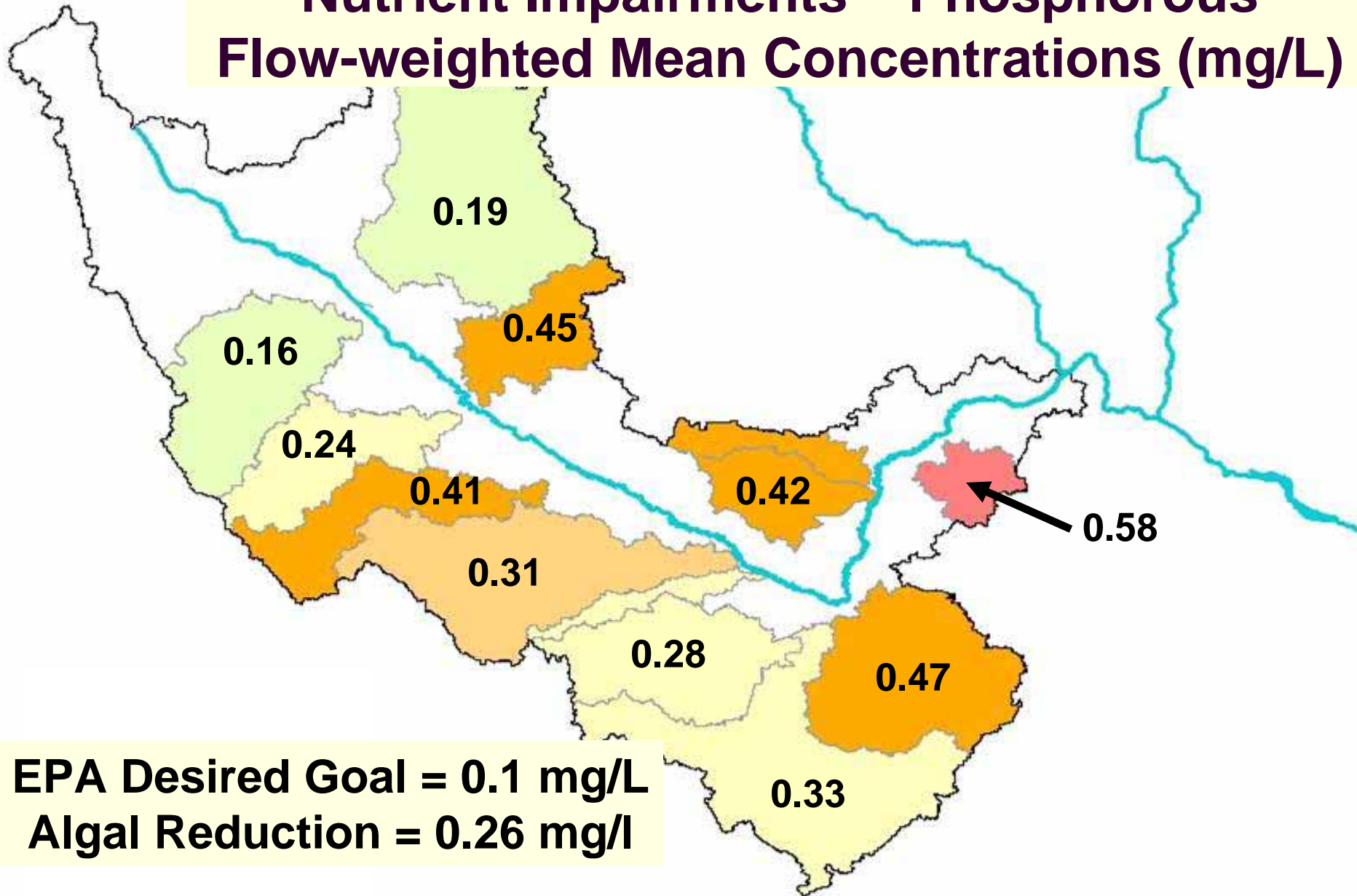
- All or portions of 38 MN counties
- 13 major watershed management units
- ~92% in agriculture
- >15,000 miles<sup>2</sup> in MN, IA, ND, & SD
- 335 miles of flow
- Increases MS River flow by 50%
- Nutrient Issues?
  - Impairments!



# THE MINNESOTA RIVER WATERSHED

## Nutrient Impairments – Phosphorous

### Flow-weighted Mean Concentrations (mg/L)

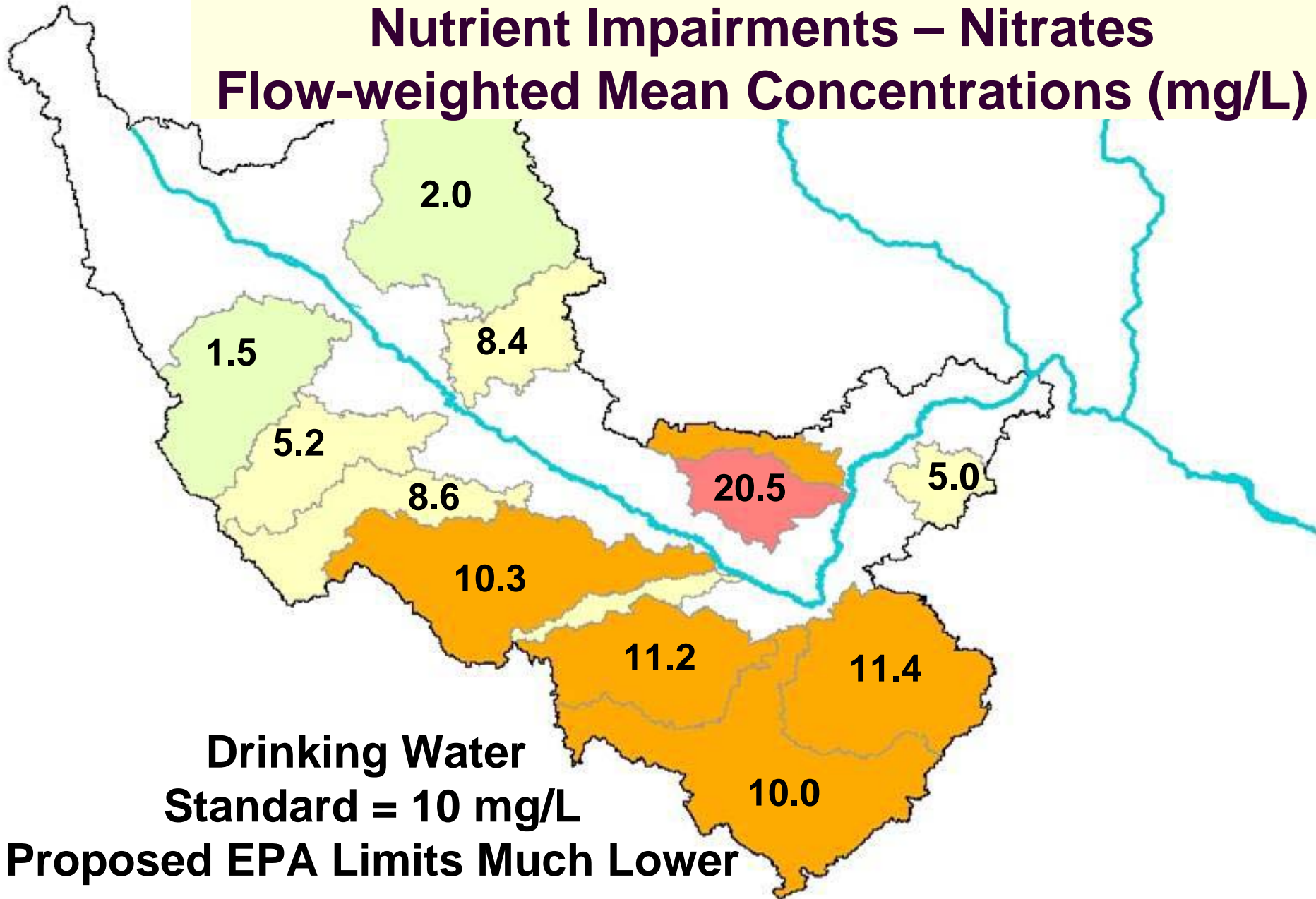


**EPA Desired Goal = 0.1 mg/L**  
**Algal Reduction = 0.26 mg/l**

# THE MINNESOTA RIVER WATERSHED

## Nutrient Impairments – Nitrates

### Flow-weighted Mean Concentrations (mg/L)



# ***THE MINNESOTA RIVER WATERSHED***

## ***Who do we impact?***

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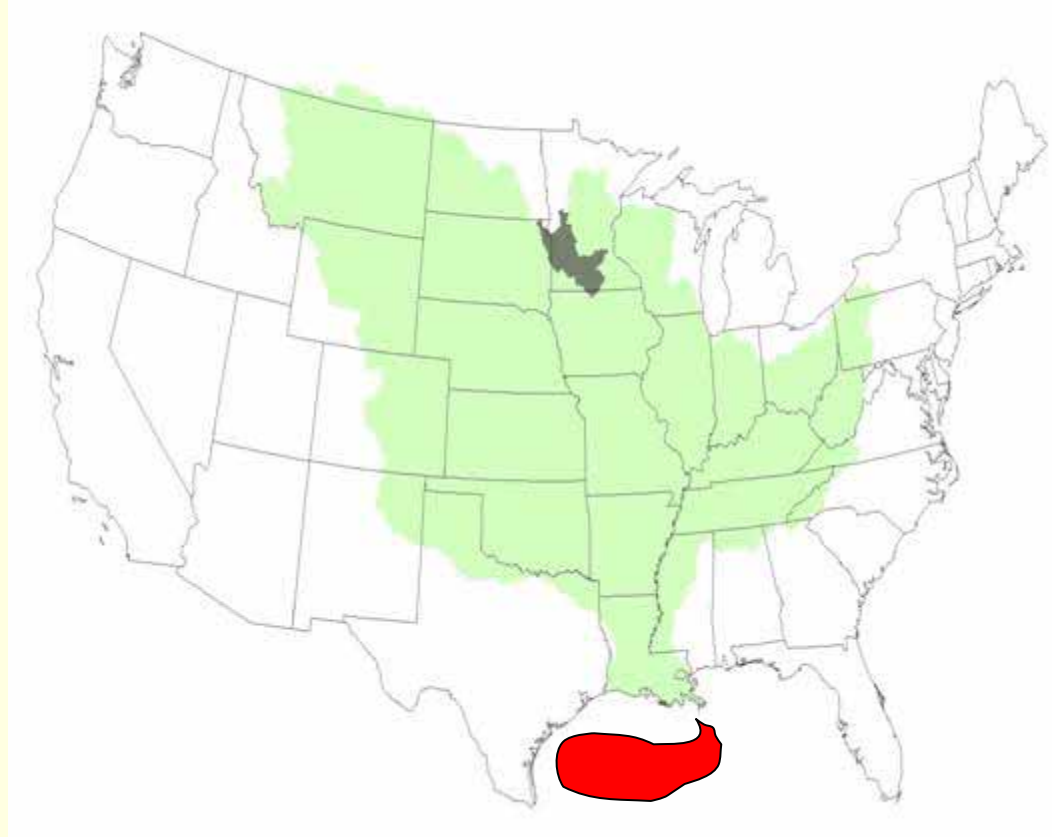
- **Impacts – Phosphorous**
  - **Drinking water quality – health/economics**
  - **Freshwater eutrophication**
  - **Toxic algae blooms**
  - **Loss of recreational value**
  - **Impairments – e.g., lower MN River DO**
  - **Tied to sediment issues (e.g., Lake Pepin)**
  
- **Impacts – Nitrogen**
  - **Drinking water quality – health/economics**
  - **Blue Baby Syndrome**
  - **Potential link to some cancers/birth defects**
  - **Weight gain suppression in livestock**
  - **Saltwater eutrophication**
  - **Impairments – e.g., Gulf of Mexico hypoxia**

# ***THE MINNESOTA RIVER WATERSHED***

## ***Who do we impact?***

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- **~1% of the Mississippi River Watershed**
- **IATP estimated  
Upper MS basin  
~50%  $\text{NO}_3$**
- **USGS estimated  
MN ~6-9%  $\text{NO}_3$**
- **Up to 8,000 miles<sup>2</sup>**



# ***THE MINNESOTA RIVER WATERSHED***

## ***What Needs to be Done?***

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- **EPA – 40% reduction in nitrate-nitrogen**
- **Voluntary measures FIRST**
  - **Program Support (nutrient trading, BMPs)**
- **Mandated measures IF NECESSARY**
  - **Farm Bill requirements**
  - **Clean Water Act enforcement**
  - **TMDL**



# ***THE MINNESOTA RIVER WATERSHED***

## ***Progress is being made.....***

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- **State Funded BMPs include**
  - **Residue Management - 52,768 Acres**
  - **Nutrient Management - 26,977 Acres**
  - **Conservation Crop Rotation - 15,527 Acres**
  - **Critical or Sensitive Area Protection - 2,717 Acres**
  - **Wetland Restoration - 1,134 Acres**
  - **>227 miles - drainage, buffer, & windbreak improvements**



# ***THE MINNESOTA RIVER WATERSHED***

## ***Opportunities for improvement.....***

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- **Alternative Crops – cellulosic ethanol production**
- **Certified Crop Consultants – expertise**
  - **Field-specific applications**
  - **Soil Testing**
  - **Prudent manure mgmt**
  - **Crop rotations**
  - **Application timing**
- **Nutrient Trading**
  - **Credit Trading (Point-Point trading)**
  - **Future for Non-Point – Point Trades?**
- **Nutrient application reduction demonstrations**
  - **BMP Challenge**
  - **Minnesota Nutrient Management Initiative**



# Water Quality Credit Trading 101

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## Improving Conservation & Agricultural Economics with Water Quality Credit Trading



*Prepared by:  
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and Laurence Picq, Project Scientist*

**KIESER & ASSOCIATES**  
ENVIRONMENTAL SCIENCE & ENGINEERING

# Learning Objectives

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- **How Does It Work?**
- **What is the Value?**
- **How does it Pay?**

# Water Quality Credit Trading

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- Uses a *Watershed Approach*
- Wastewater treatment plants achieve a minimum level of performance before being allowed to trade
- Allows flexibility and cost savings
- Provides greater WQ protection than conventional wastewater treatment alone

# Watershed Approach

- **Most effective & comprehensive water quality method**
  - Builds a broad-based community understanding
  - Community-developed goals
  - Applies many tools to solve water quality concerns
- **Nutrients and sediments are two significant concerns affecting water bodies:**
  - Loading from many sources (cumulative WQ impacts)
  - Persistent in the environment: transported throughout the watershed with little or no chemical/physical losses
  - Diminished aesthetics, recreation and fisheries



# Watershed Approach

<b>Benefits with Trading</b>	<b>Treatment Plant Upgrades</b>	<b>Agricultural Management Practices</b>
<b>Pollutant of concern reduced</b>	<b>Yes</b>	<b>Yes</b>
<b>Other pollutants reduced</b>	<b>Maybe</b>	<b>Yes</b>
<b>Habitat improved</b>	<b>No</b>	<b>Yes</b>
<b>Canopy enhanced</b>	<b>No</b>	<b>Yes</b>
<b>Streambanks stabilized</b>	<b>No</b>	<b>Yes</b>
<b>Flow velocity decreased</b>	<b>No</b>	<b>Yes</b>
<b>Wetlands created</b>	<b>No</b>	<b>Yes</b>
<b>Floodplains preserved</b>	<b>No</b>	<b>Yes</b>
<b>Assimilative capacity increased</b>	<b>No</b>	<b>Yes</b>

# **Water Quality Trading**

## ***How does it work?***

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- **Case Example:**

- **Municipal wastewater treatment plant**

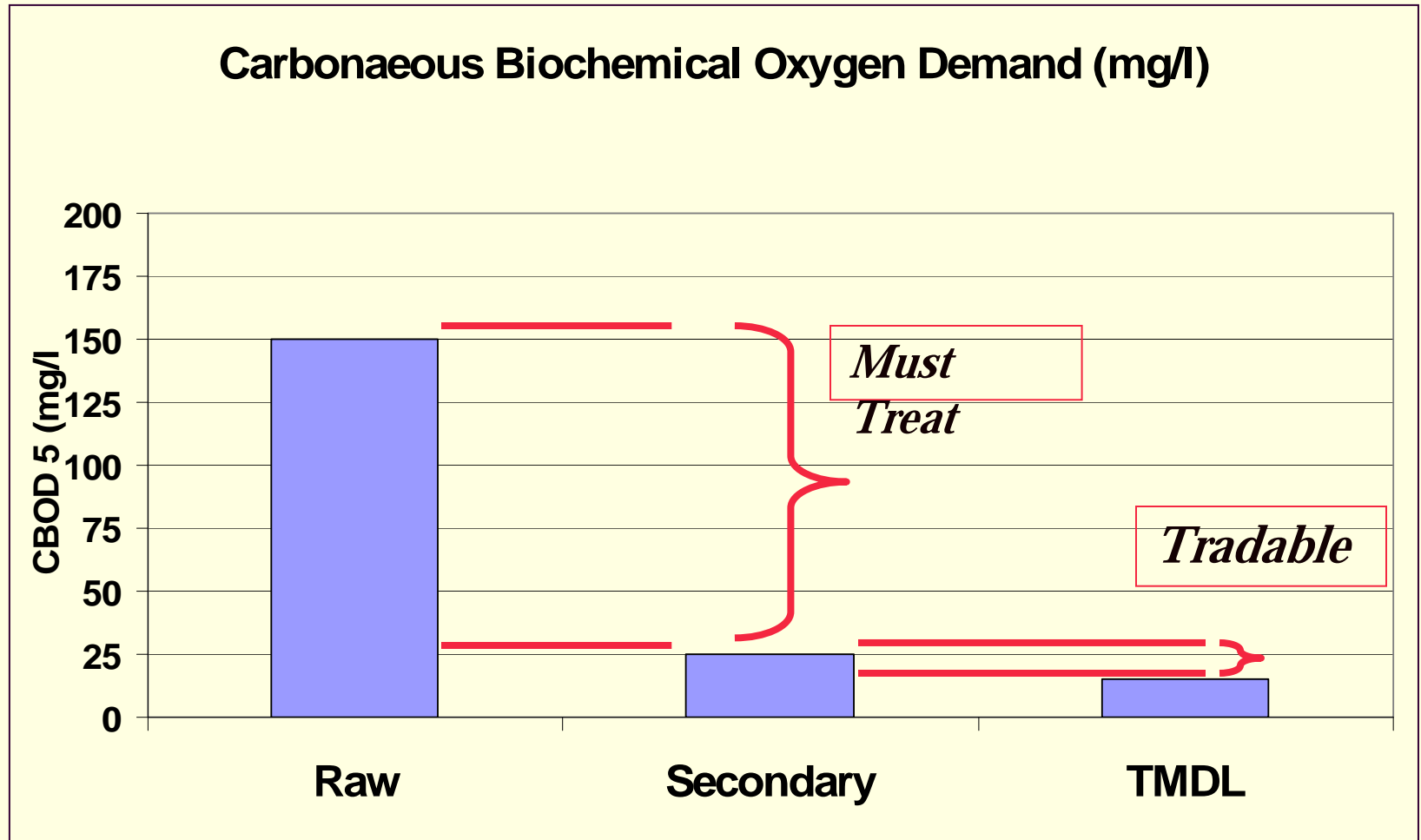
- **Minimum treatment levels:**

- 25 mg/l Carbonaceous Biochemical  
Oxygen (CBOD) Demand**

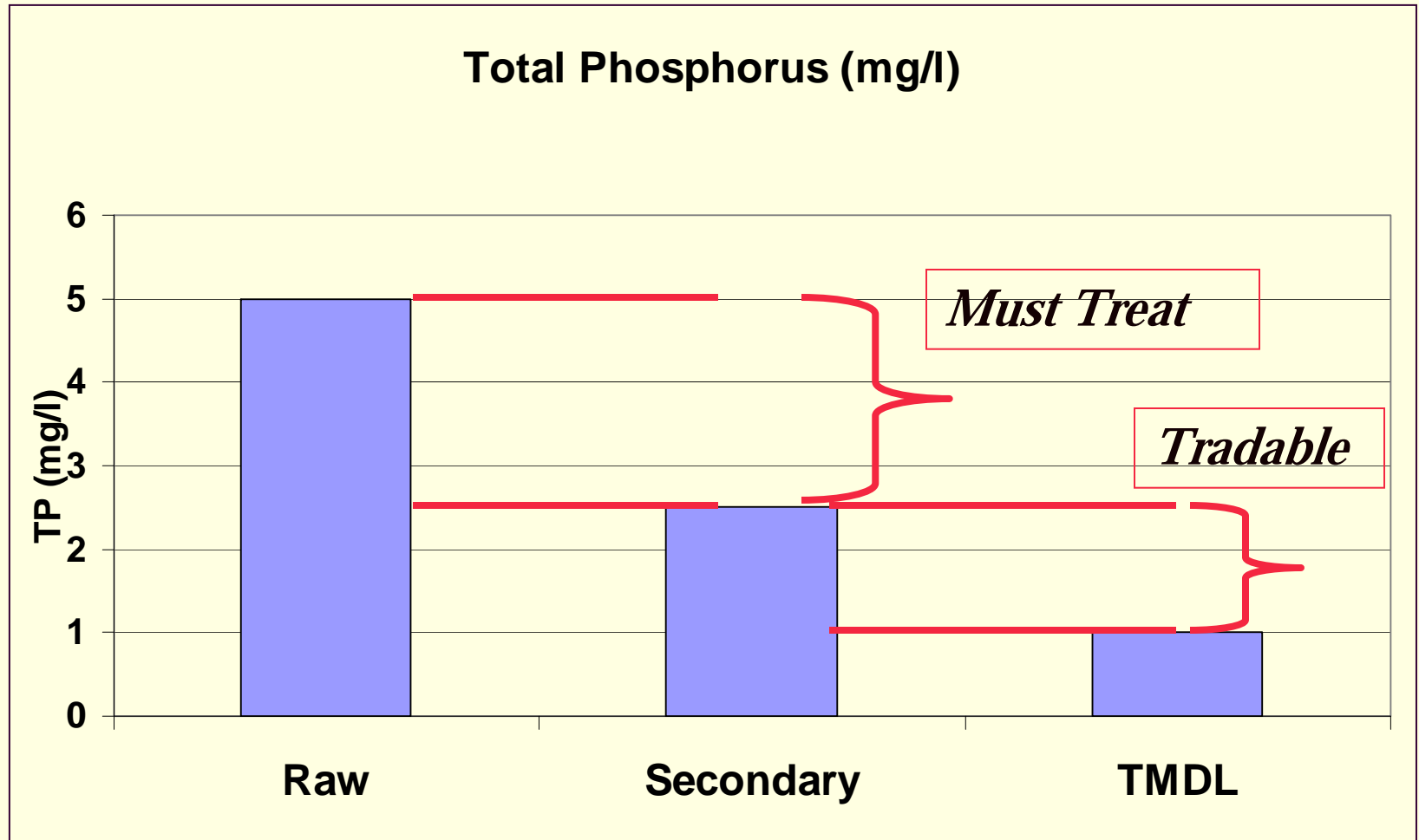
- 30 mg/l Total Suspended Solids (TSS)**

- 1 mg/l Total Phosphorus (TP) (all new or  
upgrading plants)**

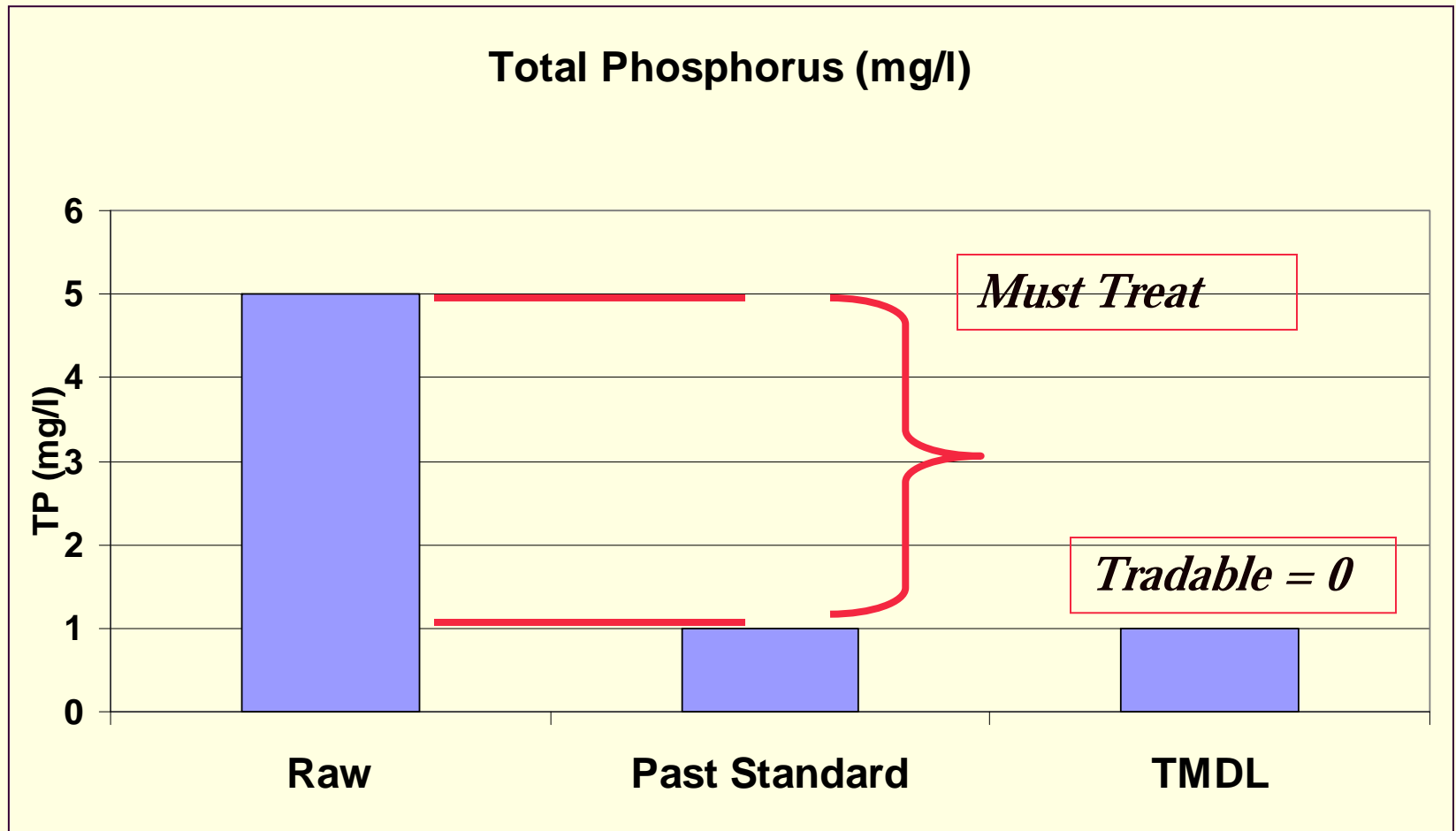
# Wastewater Minimum Requirements



# Minimum Wastewater Requirements (existing discharges)

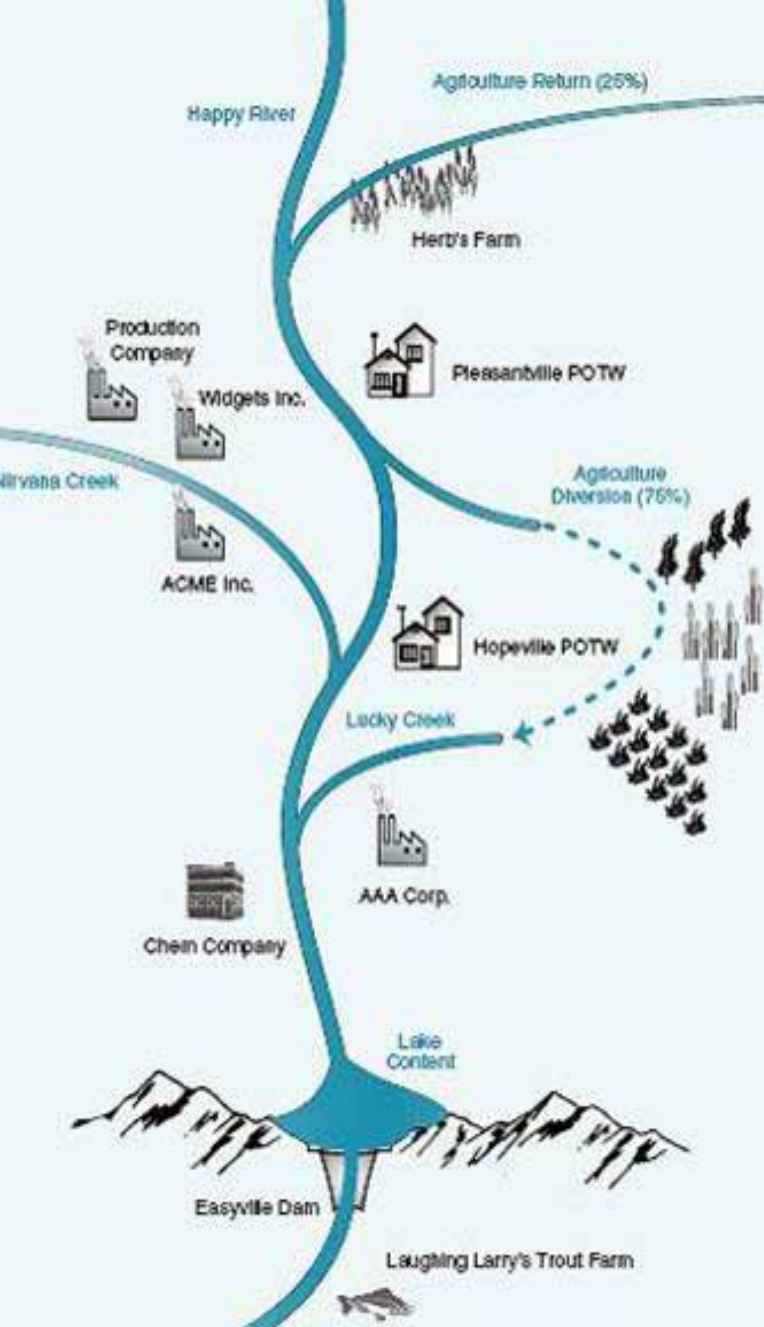


# Minimum Wastewater Treatment Requirements



# Water Quality Credit Trading is:

- 1 One of the tools used in the watershed management approach to achieve water quality goals efficiently
- 2 Not available for every watershed. The type of impairment, pollutants of concern and presence of potential buyers and sellers all must fit for WQT



# Potentially Tradable Pollutants

- Pollutants that:
  - come from both point and nonpoint sources
  - tend to be transported through stream network without assimilation
  - have a water-quality based effluent limit

**For agriculture, most commonly traded pollutants: Phosphorus, Sediment, Nitrogen**

**In some watersheds, physical variables are also being traded: flows, temperature**

***Lethal toxins and bioaccumulation pollutants (such as mercury) are typically NOT traded***

# What is a Credit?

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## The Trading Currency

Surplus Pollutant Reductions = “Credits”

(Unit of mass over a period of time; for example Pounds/year)

- 1) **Real:** Actual non-point source reduction is made to generate a credit that can be traded
- 2) **Surplus:** Load reduction is greater than required by permit and/or TMDL allocation goals
- 3) **Quantifiable:** Load reduction can be measured or calculated by a standard method/equation
- 4) **Watershed-based:** Credits can only be produced and traded within the same, pre-defined watershed
- 5) **Net improvement (trading ratio):** Trading ratio must be greater than 1:1 (accounts for uncertainty, provides net water quality benefit)

# How do you generate credits?

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Farmer achieves baseline performance prior to generating a credit

- Must meet TMDL allocation goals first
- Watersheds without TMDL goals:
  - Policy formation for minimum baseline
  - Rule may require minimum baseline
  - History may set minimum baseline
  - Local program authority should set the baseline

# What is the credit value?

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- **Market-driven**
- **Price can reflect actual cost to generate credit**
- **“Credits” exchanged with a Trading Ratio (e.g., Buyer purchases 20 pounds of TP to offset 10 pounds of permitted discharge)**
- **Demand driven (TMDL or other obligation)**
- **What the buyer (WWTP) is willing to pay**

# WWTP Treatment Costs

<b>Wastewater Treatment</b>	<b>Size (Million Gallons/Day)</b>	<b>Type of Treatment Typically Applied</b>	<b>Treatment Costs (\$/lb P)</b>
<b>Blue Lake</b>	<b>55</b>	<b>Continuous</b>	<b>\$0.20</b>
<b>Mankato</b>	<b>10</b>	<b>Continuous</b>	<b>\$2.00</b>
<b>Industrial</b>	<b>1.5</b>	<b>Continuous</b>	<b>\$14-\$18</b>
<b>Mid Size Rural</b>	<b>0.2</b>	<b>Continuous</b>	<b>\$5-\$18</b>
<b>Small Rural</b>	<b>0.05</b>	<b>Ponds</b>	<b>\$60</b>

# Emerging Market Information

<b>Trading Program Location</b>	<b>Buyer Treatment Costs (\$/lb TP)</b>	<b>Ag Credit Price Range (\$/lb TP)</b>	<b>Average Credit Price (\$/lb TP)</b>
<b>Michigan</b>	<b>292</b>	<b>3 – 652</b>	<b>--</b>
<b>Ohio</b>	<b>23.37</b>	<b>1 – 12</b>	<b>1.50</b>
<b>PA</b>	<b>30 - 3,000</b>	<b>6 – 113</b>	<b>9.27</b>
<b>Ontario</b>	<b>775</b>	<b>156</b>	<b>--</b>
<b>Minnesota</b>	<b>0.2-60</b>	<b>3-24</b>	<b>--</b>

# What are the contractual terms?

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- **Farmer signs a legally binding contract with WWTP**
  - **Description of BMP**
  - **Life of contract**
  - **Payment schedule**
  - **BMP Operation & Maintenance requirements**
- **Contract is NOT a permit**
- **Civil contract**

# Trading Program Participation

## (assuming baselines are met)

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- ❑ **Step 1** – Farmer selects an approved trading BMP(s) from their conservation plan or a crop consultant and estimates pollutant load reduction using standard calculation method such as RUSLE2 (a NRCS soil erosion model).
- ❑ **Step 2** - Farmer installs new BMP(s) and calculates credits using approved crediting methods.
- ❑ **Step 3** – Farmer connects with a credit buyer via an aggregator, broker or individual contact, and signs private contract to provide credits.
- ❑ **Step 4** – Buyer applies “Trading Ratio” to his reduction needs to determine volume of credits needed from farmer.
- ❑ **Step 5** – Buyer or seller registers credits with the state regulatory agency (MPCA, or third party).

# MN Point Source-Nonpoint Source Trading



# MN Point Source/Non-point Source Trading (Example 1)

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## Rahr Malting Company

- **Goal:** Malt producer wanted to expand by operating its own wastewater treatment plant.
- **Issues:**
  - Minnesota River waste load allocation for CBOD fully allocated to other dischargers.
  - Previously high sanitary sewer fees forced Rahr towards other options
- **Solution:** Point source/non-point source permit trade. Trades with agriculture offset Rahr's CBOD loading by reducing several parameters causing WQ problems in river upstream of facility.

# Rahr Malting: 8 Mile Creek



**Rahr installed four erosion control sites:**

**8 Mile Creek – Channel stabilization, livestock exclusion**



# Rahr Malting: Rush River Site



## Results:

- Discharge of up to 150 lbs CBOD/day
- 212 lbs of CBOD reductions/year from erosion control sites



# MN Point Source/Non-point Source Trading (Example 2)

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## Southern MN Beet Sugar Co-op

- **Goal:** Cooperative wanted to expand but faced air & water quality compliance issues
- **Issues:**
  - Expanded wastewater discharge difficult to obtain because of Minnesota River D.O. problems
  - Prohibitive costs for expanding spray irrigation treatment process
- **Solution:** Point Source/Non-point Source trade:
  - Allows continuous discharge of treated wastewater
  - Requires 2.6 times TP offset reductions from upstream NPS

# Spring Cover Crops



**58,832 acres planted in 2005**


# West Fork Beaver Creek



## Results:

- Trading requirements exceeded
- West Fork Beaver Creek: channel stabilization, livestock exclusion
- Spring cover crop contracts with shareholders over 50,000 acres.





# Common Questions

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*Can conservation practices I've implemented in the past be used to generate credits?*

**Will Depend on MPCA Rules and Guidance.**

*What is the life of my credits and what are they worth?*

**Annually renewable/saleable for the life of the practice with a value that is market driven.**

*If I sell credits, will I eventually be regulated?*

**No. But credits are used by someone who is regulated.**

*What happens if I default on implementing my practices?*

**You may have liability within your contract and MN rules.**

*Who could buy my credits?*

**Any regulated facility within your watershed.**

# The BMP Challenge - Goals

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- The “Input Paradox”
- BMP Challenge
  - Eligibility and Requirements
  - Application
  - Check Strips
  - Yield Assessment
  - Net Returns Analysis and Examples
- Past Results



# Input paradox?

**EPA, National Academy of Sciences and more than 20 other studies identify **ECONOMIC RISK** as a major barrier to BMP adoption.**

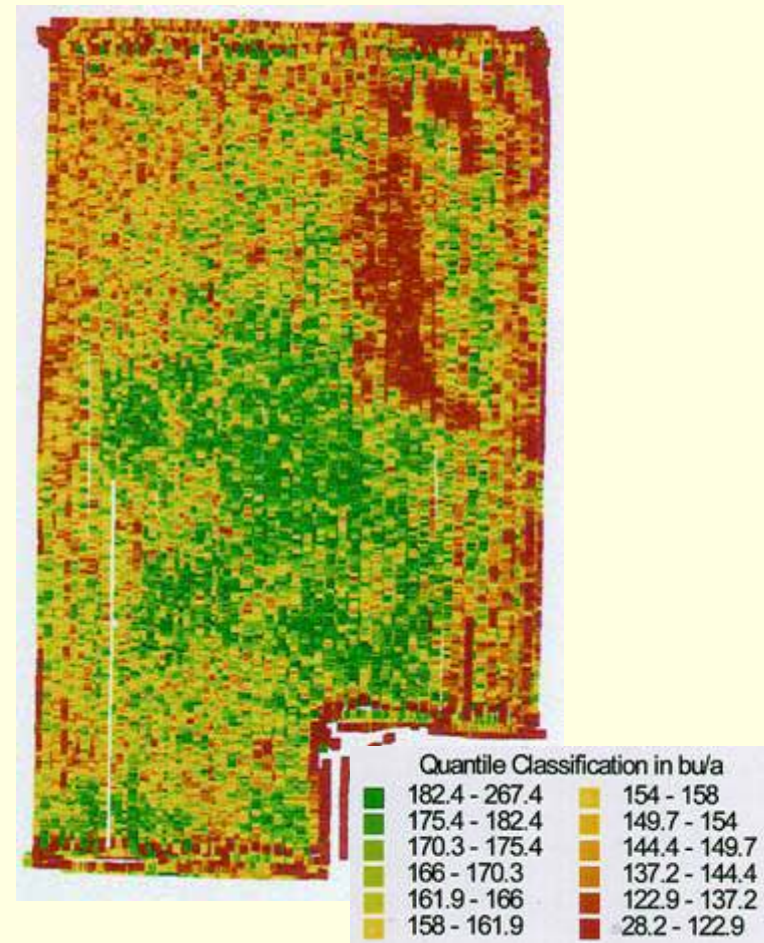
*“We’ve used a crop consultant in the past...*

*...if he’s wrong, the cost of him being wrong is much more than the cost of that additional insecticide or herbicide.”*



# “EXTRA” is a Rational Defense Against Economic Uncertainty!

- *Nutrient mgt is an uncertain science - 1.2# N/bu no longer*
- *Nutrients may be lost if heavy spring rains occur*
- *Bumper crop conditions may call for more nutrients*
- *Minn. corn farmers apply an avg. of 43# extra N after legume; 69# after legume and manure*



# 2005 corn farmer survey

- 700 farmers, each planting 850 acres/year on average
- Progress in some areas
  - 54% have reduced fertilizer over past five years, 18% by 15% or more
- Enormous potential for practice adoption
  - 16% do not credit N from soybeans
  - 25% do not credit nutrients in manure
  - 67% do not use variable rate
  - 88% do not use in-season testing/application



# 2005 corn farmer survey

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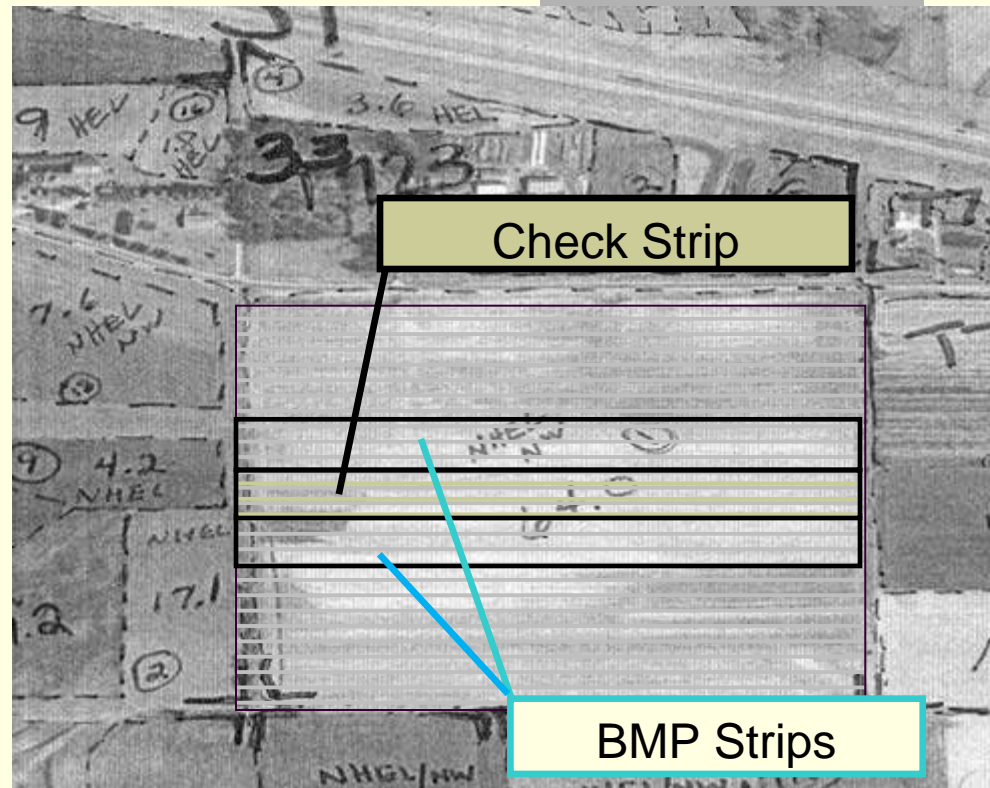
- **46% want to see proof before changing practices**
- **80% would be interested in reducing fertilizer rates if income were guaranteed**

**ENTER THE...**



# BMP CHALLENGE

- How will BMPs perform in my field?
- Risk-free opportunity to find out.



# Who can participate?

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- Owner/operators must be NRCS EQIP-eligible
  - not exceeding the \$450,000 Payment Limitation (during term of Farm Bill)
  - not exceeding the Adjusted Gross Income provision (2.5 million per year)
  - complying with the Highly Erodible Land (HEL) and Wetlands Conservation provisions.
- Grow corn for grain or silage
  - sweet corn, popcorn, wildlife plots ineligible
- Certified crop advisor must certify BMP, set out check strip and oversee yield assessment

# A simple application is required

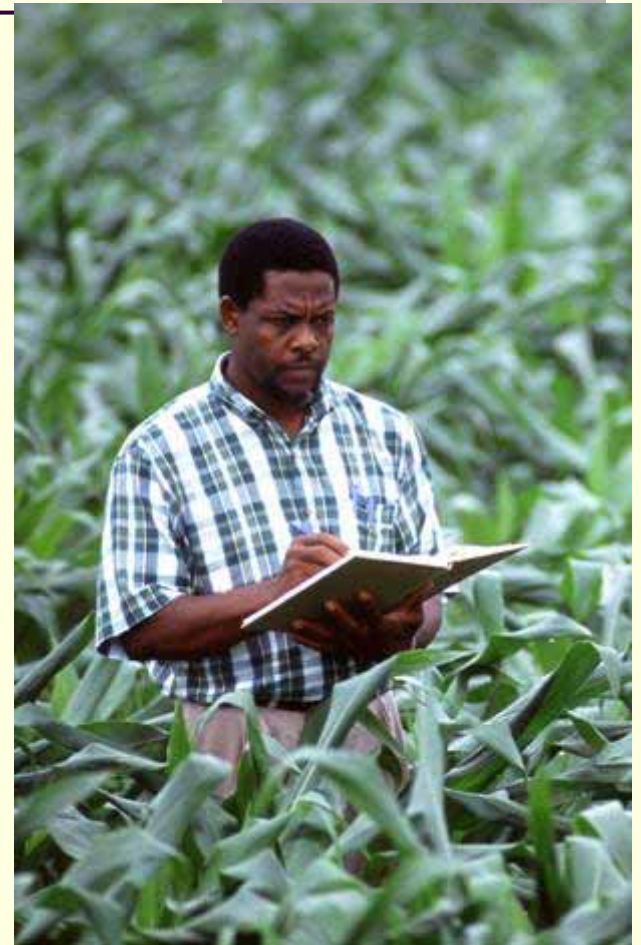
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## Information required prior to planting:

- **Farmer contact information**
- **Certified advisor contact info, certification, certification number**
- **Field information: location, yield history, soil test results (if covering P and K), yield goal, BMP information (including recommended rate and amount applied), or reduced tillage practice**
- **Check strip information: N, P and K rates or conventional tillage practice, location, how marked, aerial photo**

# Setting out check strips

- When: Prior to fertilizer application or tillage.
- Who: Certified crop advisor (CCA, NAICC or Agflex approval) must set out check strip.
- Where: Representative location within one or more fields in the management unit.
- What: 40' to 80' wide (depending on equipment width) and running the length of the field.



# Assessing yield at harvest

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- **When: After crop maturity (black layer)**
- **Who: Certified Crop Advisor**
- **Where: Check strips and adjacent BMP strips**
- **How: Weigh wagon, portable scale, stationary scale, yield monitor**

# Net returns: The bottom line

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- Calculate gross returns for check strip and BMP strips using RMA-APH corn price (\$3.50 in 2007, \$? In 2008)
- Subtract fertilizer or tillage costs from gross returns to calculate net returns
- If net returns to BMP are negative, farmer receives guarantee payment equal to the difference
- If net returns to BMP are positive, farmer contributes 1/3 of savings back to BMP Challenge program, up to a maximum of \$6 per acre

# Example from 2006: N only

	Conventional	BMP
Total Nutrients	140# N	92# N
Fertilizer Cost	\$51.80	\$34.04
Planning Cost	\$0	\$0
<b>Savings</b>	<b>\$17.76/acre, 48# N</b>	

Yield	164 bu/acre	169 bu/acre
Value (\$2.20/bu)	\$360.80	\$371.80
Yield Gain (loss)	\$11.00/acre	
<b>Guarantee payment</b>	<b>\$0</b>	

Farmer contribution	\$5.88 per acre (1/3 of \$17.76)
FARMER NET	\$22.88 per acre (17.76+11-5.88)
27 acre field	<b>+\$617.76</b>

# Example from 2006: N only

	Conventional	BMP
Total Nutrients	189# N	133# N
Fertilizer Cost	\$66.22	\$50.17
Planning Cost	\$0	\$0
<b>Savings</b>	<b>\$16.05/acre, 56# N</b>	

Yield	156.5 bu/acre	146.4 bu/acre
Value (\$2.20/bu)	\$344.30	\$322.08
Yield Gain (loss)	(\$22.22 per acre)	
<b>Guarantee payment</b>	<b>\$6.17 per acre</b>	
<b>Total payment</b>	<b>\$215.95 (35 acres)</b>	

Farmer contribution	\$0.00
<b>FARMER NET</b>	<b>\$344.30 per acre</b>

# Results 2002 - 2006

- Avg. farmer benefit from BMP: **(\$0.05)** per acre
  - 74 replicates, 3227 acres in seven states
  - BMP rate averaged 6 bu per acre less than traditional rate, offset by over \$12 per acre in fertilizer savings
- Average fertilizer savings
  - 23% or 41# N/acre
  - Over \$12 per acre



# BIG THANKS to:

## Funders, Partners, Collaborators

Agflex ♦ Altria Group ♦ City of Decatur (IL)

Great Lakes Protection Fund

Illinois Council on Best Management Practices

Illinois Department of Agriculture

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Iowa Department of Economic Development

IPM Institute of North America ♦ Joyce Foundation

LeSueur County (MN) ♦ McKnight Foundation

Minnesota Department of Agriculture

National Fish and Wildlife Foundation

Alex C. Walker Foundation

National Foundation for IPM Education ♦ Ohio State Extension

PA Dept of Agriculture ♦ Seven Mile Creek Watershed Project

US EPA ♦ University of Wisconsin ♦ USDA CSREES

USDA Small Business Innovative Research Program

USDA Natural Resources Conservation Service

USDA Risk Management Agency

Wisconsin Department of Natural Resources



**Partners  
Wanted!**

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