

Proceedings from the 6th Annual Nutrient Management Conference

**6th Annual
NITROGEN:
MINNESOTA'S GRAND
CHALLENGE & COMPELLING
OPPORTUNITY CONFERENCE**



**Tuesday,
February 18, 2020**

**Arrowwood Conference Center
Alexandria, MN**

 UNIVERSITY OF MINNESOTA | EXTENSION

**6TH ANNUAL
NITROGEN: MINNESOTA'S GRAND CHALLENGE
& COMPELLING OPPORTUNITY CONFERENCE**

Sessions 9:00 a.m.-3:25 p.m.

■ GENERAL SESSION

8:30 a.m.	<i>Registration</i>	
9:00 a.m.	<i>Welcome</i> Tom Rothman	University of Minnesota
9:05 a.m.	<i>Lessons Learned in 2019, Opportunities for 2020</i> Angie Peltier Chryseis Modderman Brad Carlson	University of Minnesota University of Minnesota University of Minnesota
9:55 a.m.	<i>Importance of Urban and Non-urban Nutrient Reductions</i> Dana Vanderbosch	Minnesota Pollution Control Agency
10:30 a.m.	<i>Break</i>	
10:45 a.m.	<i>Modeling the Cost-effectiveness of Practices to Reduce Watershed Nutrient Loads</i> Bill Lazarus	University of Minnesota
11:45	<i>Lunch</i>	

■ BREAKOUT SESSION #1

12:45 p.m.	<i>Evaluating N Stabilizers</i> R. Jay Goos	North Dakota State University
1:25 p.m.	<i>Recent findings in N Management Research</i> Brad Carlson	University of Minnesota
2:05 p.m.	<i>Irrigation and Nitrogen Management for Profitable Corn Production and Groundwater Quality Protection</i> Vasu Sharma	University of Minnesota
2:45 p.m.	<i>Where Do U of M Recs Come From? N Calculator Updates</i> Dan Kaiser	University of Minnesota

■ BREAKOUT SESSION #2

12:45 p.m.	<i>Minnesota's Nutrient Reduction Strategy- Progress Toward Milestone Goals</i> Glenn Skuta	Minnesota Pollution Control Agency
1:25p.m.	<i>Minnesota's Groundwater Protection Rule Update</i> Larry Gunderson	Minnesota Department of Agriculture
2:05p.m.	<i>Cover Crops, N Additions, and Soil Health</i> Anna Cates	University of Minnesota
2:45 p.m.	<i>Urea and Urea Additives</i> Karina Fabrizio	University of Minnesota
3:25 p.m.	<i>Adjourn</i>	

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Minnesota's Agricultural Fertilizer
Research & Education Council














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Working *Together*
to address nitrate in groundwater

Nitrogen Fertilizer Management Plan and Groundwater Protection Rule Update 2020 Nitrogen Conference

February 18, 2020

Key Dates

January 15, 2020

Areas subject to fall application restrictions are posted on MDA website

www.mda.state.mn.us/nfr

September 1, 2020

Fall application restrictions begin



Nitrate Leaching from Fertilizer

- A very challenging problem
- Under row crop production in vulnerable soils, nitrate leaching will occur
- Losses may vary significantly between years due to weather
- May be long lag times (*years*) between changes in practices and changes in groundwater quality
- Enormous variability *between* and *within* aquifers

There is no simple solution

Chapter 103H.001

Degradation Prevention Goal

Under the Groundwater Protection Act (103H)

It is the goal of the state that groundwater be maintained in its natural condition, free from any degradation caused by human activities.

It is recognized that from some human activities this degradation prevention goal cannot be practicably achieved.

Where not currently practicable, the development of methods and technology ...is encouraged.

Nitrogen Fertilizer Management Plan (NFMP)

- It is the state's blueprint for minimizing groundwater impacts from the use of nitrogen fertilizer
- First developed in 1990 as an outcome of the 1989 Groundwater Protection Act
- Has voluntary and regulatory components
- Revised in 2015 after extensive public input
 - Advisory committee of farmers, agronomists, commodity groups, and environmental organizations; 6 public listening sessions across the state; and a public comment period. Process occurred in 2010-2015.



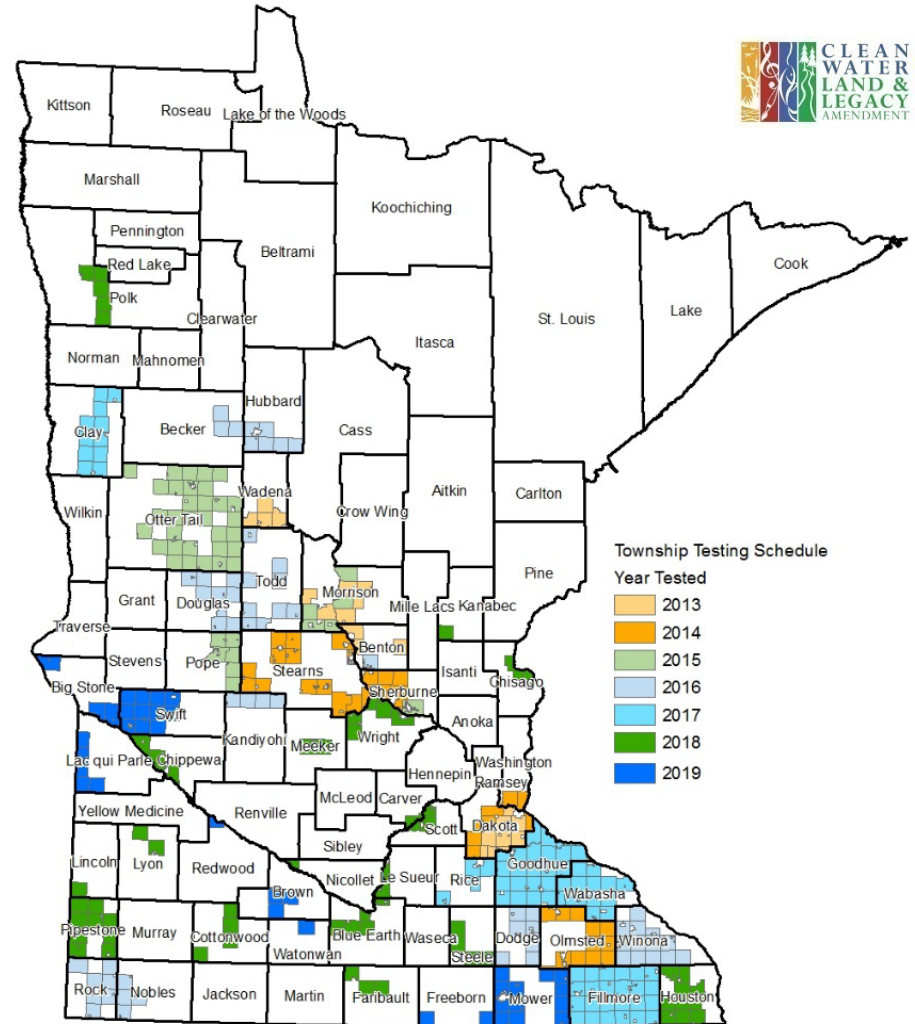
Key Goals of the Nitrogen Fertilizer Management Plan

- To encourage and promote science based practices to reduce nitrate in groundwater while maintaining farm profitability
- To target areas vulnerable to groundwater contamination
- To work with local farmers and agronomists to address local areas with elevated nitrate in groundwater

Emphasis is placed on prevention

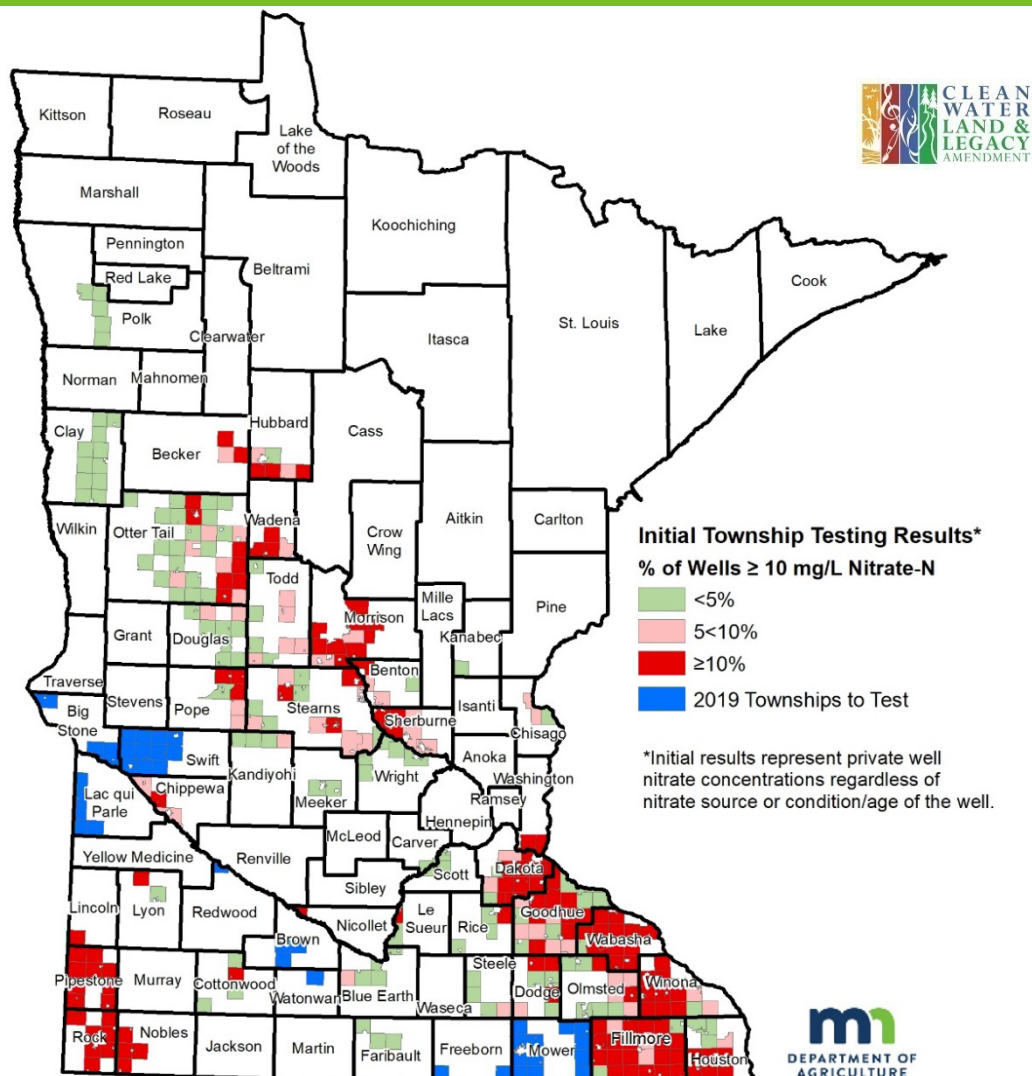
Water Quality Conditions- Township Testing Program

- This was an outcome from the NFMP
- Tested townships with 20% row crop production and 30% vulnerable geology
- Seven year process, over 30,000 wells tested
- 306 townships in 42 counties
- Partner with counties and SWCDs



There are Serious Concerns in Vulnerable Areas

- Approximately 9.2% of MDA tested private wells, in vulnerable areas, exceed the nitrate standard
- In some townships > 40% of the wells exceed the nitrate standard



Groundwater Protection Rule

Developed with extensive public input:

- Summer 2017 – released for informal comment
 - 17 listening sessions across the state with \approx 1,500 attendees
 - Received more than 800 written comments
- MDA made significant changes to the proposed rule based on the comments
- Revised rule published for formal comment April 2018

Groundwater Protection Rule

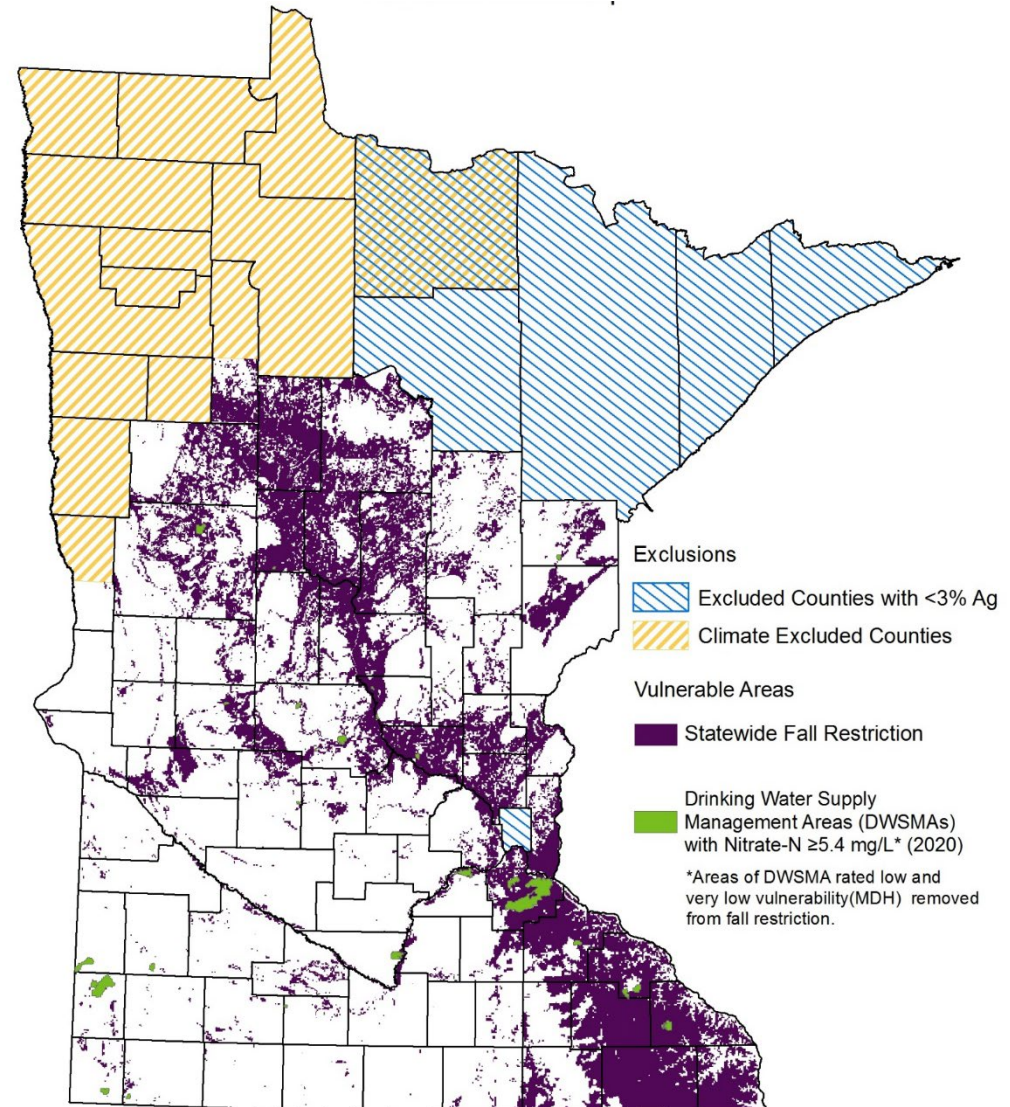
- The Rule applies to the use of nitrogen fertilizer
- It does not regulate manure
- It focuses on protecting groundwater in areas vulnerable to groundwater contamination
- There are two distinct parts of the Rule:
 - Fall application restrictions in vulnerable areas; and,
 - Responding to public wells with high nitrate

Part One: Restrictions on Fall applications of Nitrogen Fertilizer

Part One restricts fall application and application to frozen soil of nitrogen fertilizer in:

- 1) areas with vulnerable groundwater, or
- 2) protection areas around public wells with high nitrate - called DWSMAs (the green areas)

Estimated 2.6 million acres or 12.6% of cropland



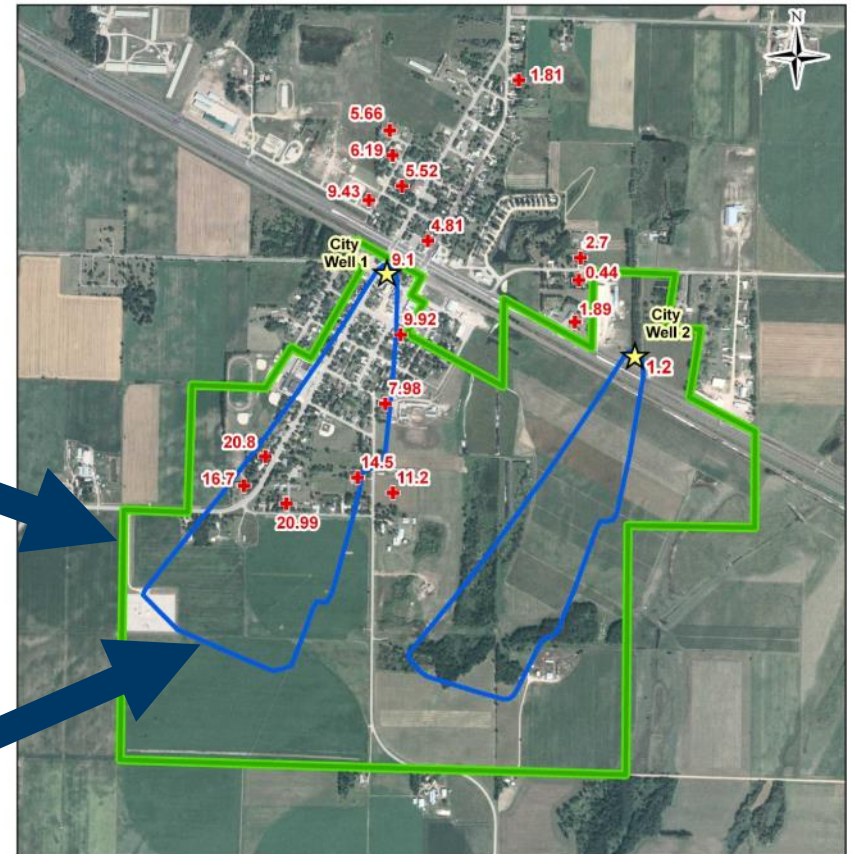
Part One: Vulnerable Groundwater Areas

- Vulnerable groundwater areas includes areas with: coarse textured soils, shallow bedrock, or karst geology
- Determined by quarter-section
- If 50% or more of a quarter-section is vulnerable, fall application will not be allowed in the entire quarter-section
- The MDA website has a zoomable interactive vulnerable area map

What is a Drinking Water Supply Management Area (DWSMA)?

Drinking Water Supply
Management Area
(DWSMA)

10 year time of travel boundary



0 750 1,500 3,000
Feet

Explanation

☆ City Wells

9.1 (nitrate result in mg/l)

+ 2007 Water Sample Location

10-Year Wellhead Protection Area Boundaries

Drinking Water Supply Management Area

DWSMAs Subject to Part One

DWSMAs for municipal water systems with nitrate higher than 5.4 ppm

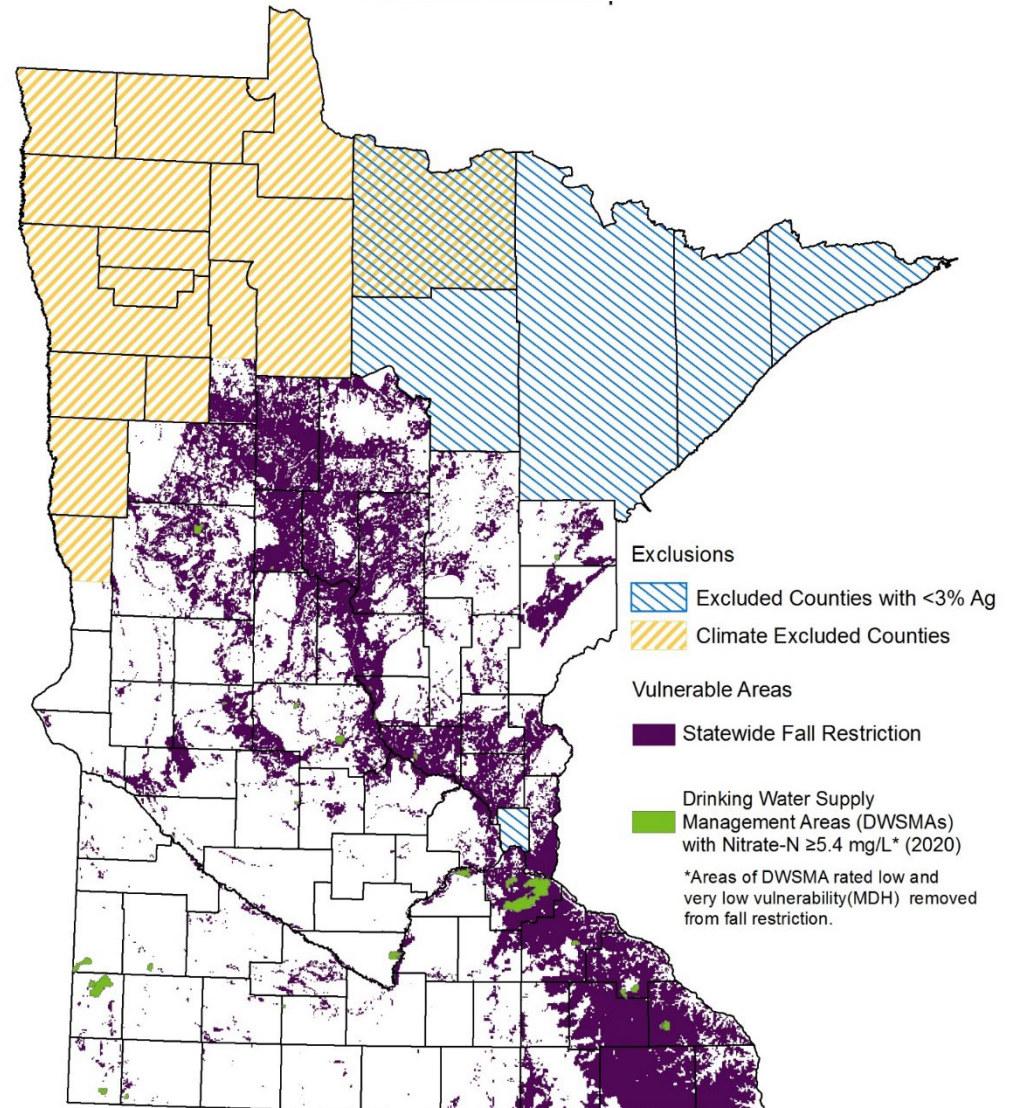
DWSMAs may change year to year



Part One Exclusions

Exclusions to fall application restrictions for:

- Counties with low leaching potential based on precipitation and evapotranspiration rates and a short planting season; and,
- Counties where less than 3% of the land is used for cropland



Part One Exceptions

Exceptions for specific crops including:

- winter grains
- pasture fertilization
- perennial crops
- grass seed
- cultivated wild rice
- cover crops for reducing the application of soil fumigants in a potato rotation

Part One Exceptions

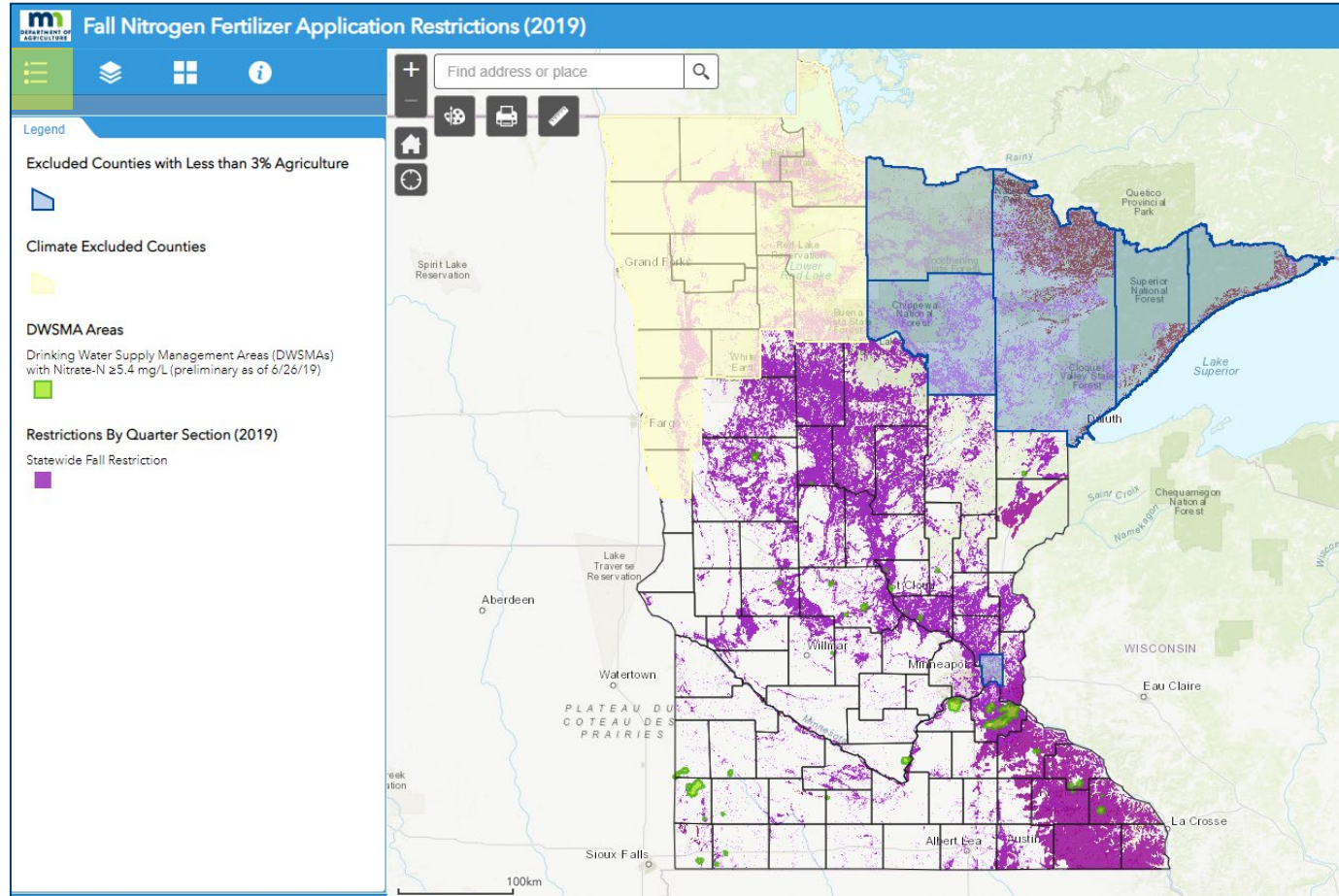
Exceptions for:

- Applying ammoniated polyphosphate (MAP and DAP) or micronutrient formulations, you can apply up to 40 pounds of nitrogen per acre in the fall
- Fields that have very low phosphorus soil test levels are not subject to the 40 pounds per acre total nitrogen rate
- When land applying MDA approved agricultural chemical contaminated media
- For academic research and demonstration sites up to 20 acres, or larger with MDA approval

Interactive Map Online

Map home page

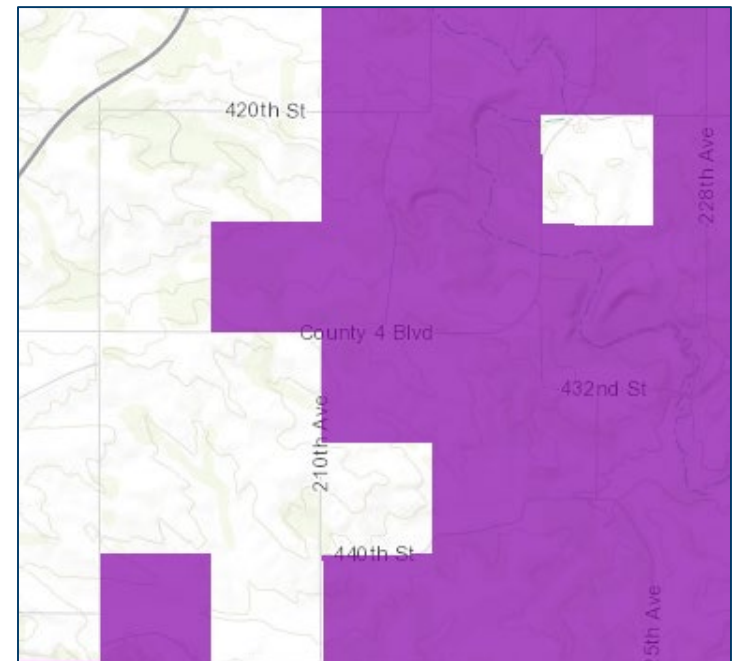
Four initial layers
in the legend



Part One: Nitrogen Fertilizer Application Restrictions in Vulnerable Groundwater Areas

Vulnerable Groundwater Areas:

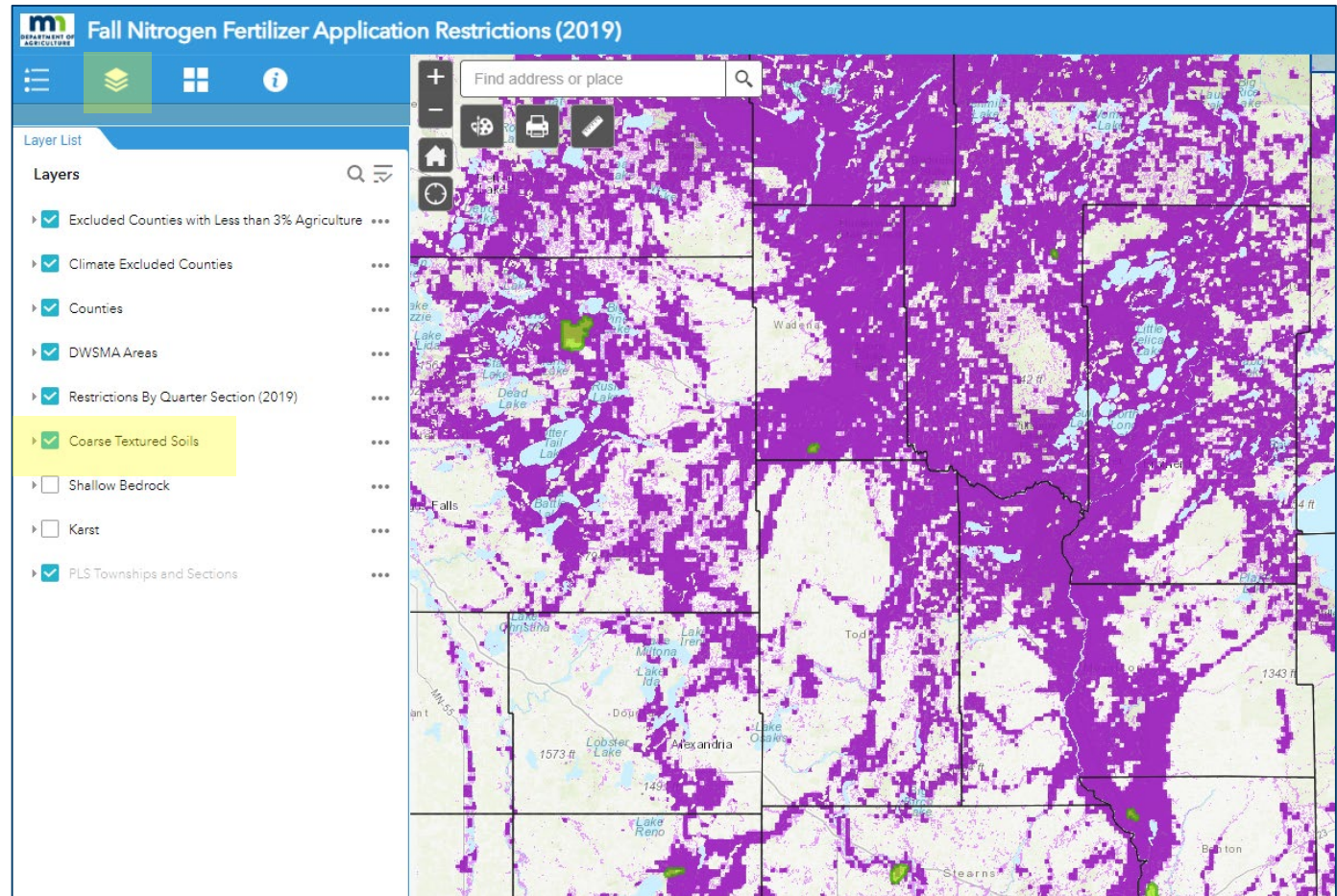
- The map has layers for coarse textured soils, shallow bedrock, karst geology, and DWSMAs
- Designated by quarter-sections



Interactive Map Online – Central MN

Central Minnesota

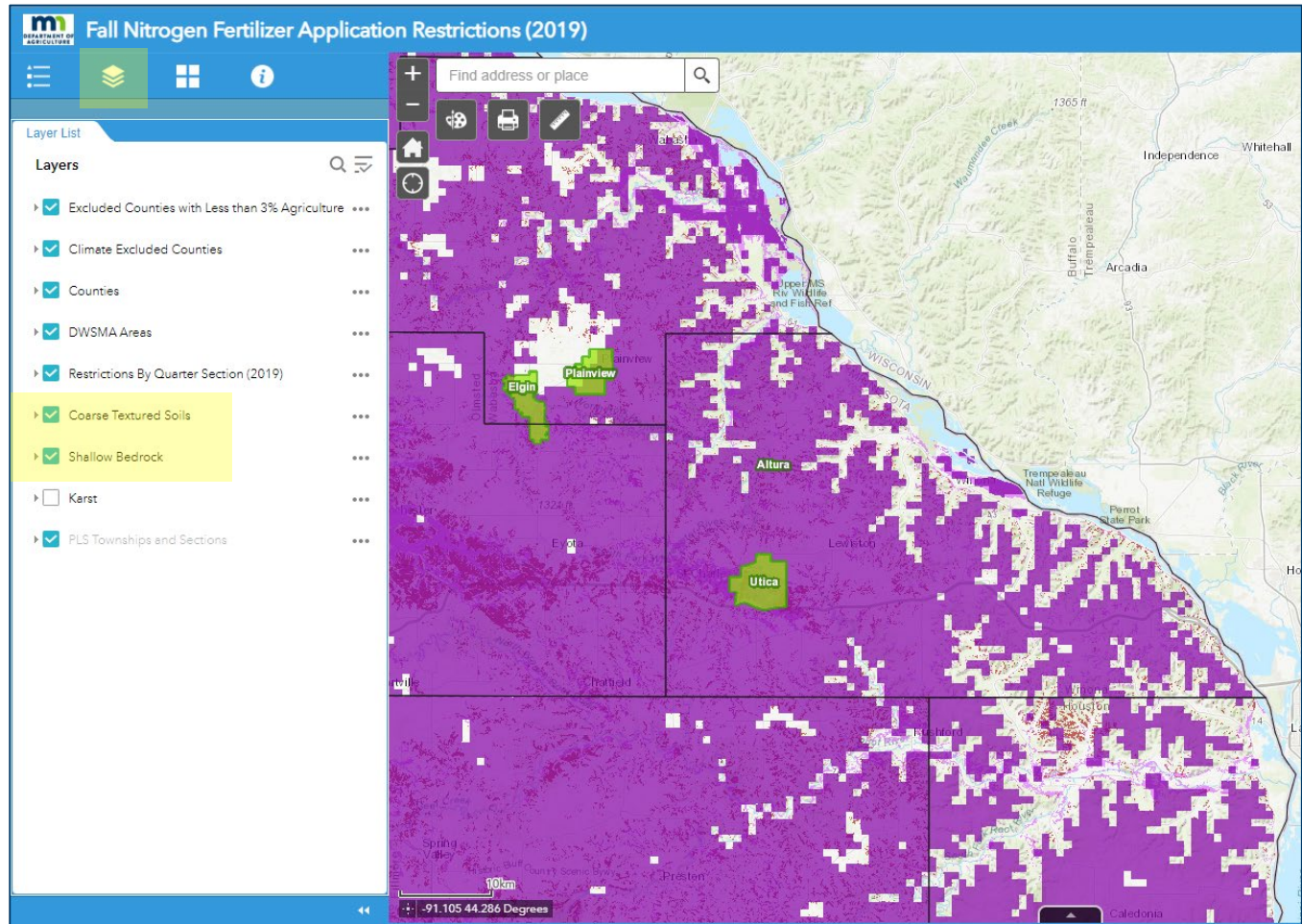
Map has been zoomed in and the “Coarse Textured Soils” layer selected



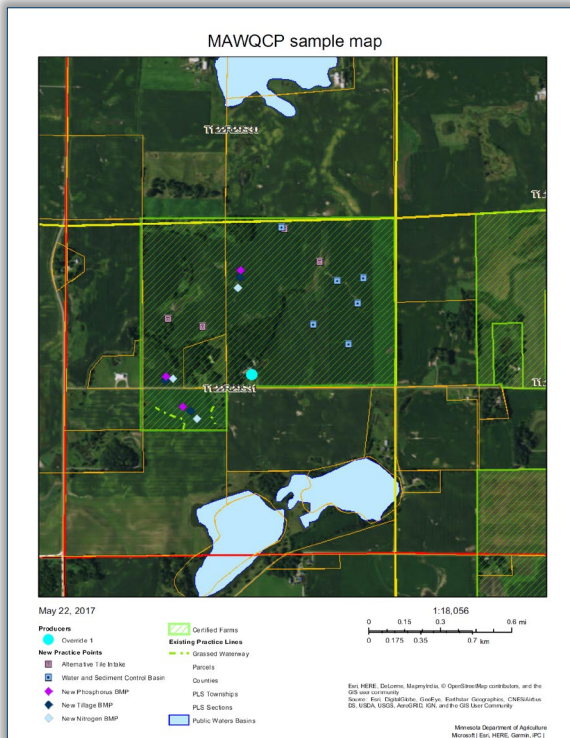
Interactive Map Online –Southeast MN

Southeast Minnesota

Map has been zoomed in and the “Coarse Textured Soils” and “Shallow Bedrock” layers selected



- Certification = deemed to be in compliance with the Rule
- MAWQCP offers producers:
 - Recognition
 - Financial/Technical assistance
 - Regulatory certainty
 - Branding/Marketing opportunity
 - Check-up/Validation for growers
- Whole-farm planning for water quality; risk assessment of every parcel, every crop
- Pairs producers with professionals to develop **site-specific** solutions for risks to water quality



Enforcement

- The responsible party is “the owner, operator or agent in charge of cropland”
- Enforcement will be complaint driven
- The MDA approach is to conduct education and compliance assistance before moving to financial penalties
- Penalty amount is situation specific based on several factors including: willfulness of violation; gravity of damages; history of past violations; and, economic benefit

Part Two of the Groundwater Protection Rule

Part Two applies only to Drinking Water Supply Management Areas (DWSMAs) for public water supply wells that have high nitrate levels



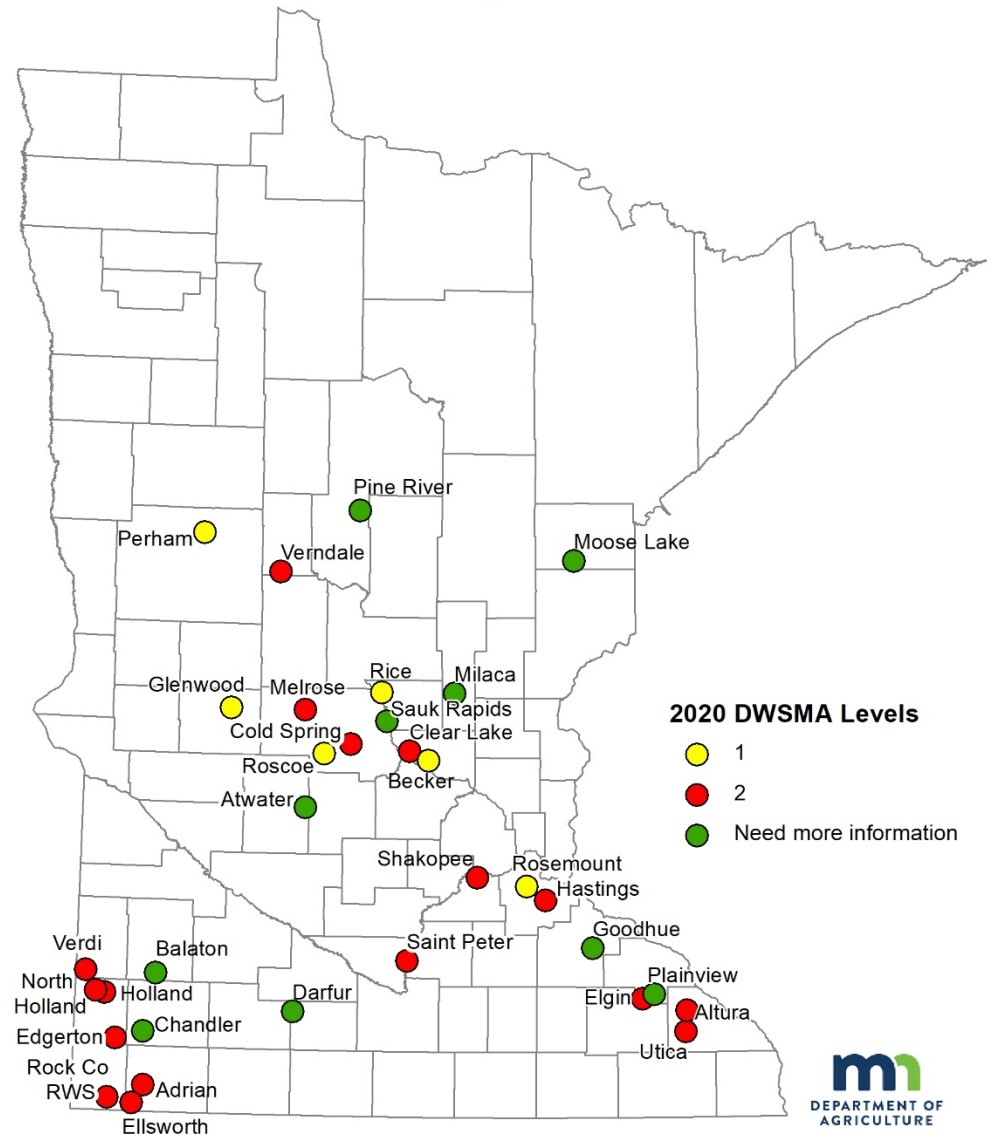
Part Two: Mitigation Efforts in DWSMAs with Elevated Levels of Nitrate

- The goal of Part 2 is to take action before a public water system exceeds the health standard of 10 mg/L nitrate-N (nitrate-nitrogen)
- Two levels are voluntary based on water quality, two are regulatory
- Always starts with one of the voluntary levels
- Becomes regulatory only if BMPs are not voluntarily adopted or if nitrate contamination increases

Mitigation Levels

- Initial levels determined by January 15 deadline
- Level 1
- Level 2
- Need More Information
- Fall restrictions apply in all 33 DWSMAs on map

Drinking Water Supply Management Area Mitigation Levels
as of January 15th, 2020



Local Advisory Teams

For level 2 DWSMAs MDA will form a local advisory team with local farmers and agronomists and others to consider and advise on appropriate practices

The goal is to work with local farmers and agronomists to promote science-based and economically viable practices to reduce nitrate in groundwater



Alternative Management Tools (AMTs)

A major goal of this approach is to promote practices that go beyond the fertilizer BMPs. These are called AMTs.

- Increased low nitrogen vegetative cover (perennial crops, forages, and cover crops)
- Taking targeted land out of production
- Methods to reduce or manage nitrogen precisely – precision Ag, new hybrids, management software, inhibitors
- Approved AMTs can substitute for BMPs



Part Two: Mitigation Efforts in DWSMAs with Elevated Levels of Nitrate

Voluntary Levels:

- Level 1: DWSMAs that are at 5.4 to less than 8 mg/L nitrate-N
- Level 2: DWSMAs with 8 mg/L or greater at any point during the previous 10 years **or** are projected to exceed 10 mg/L in the next 10 years

SWAT and EPIC models: Introduction

Robust process-based computer models that simulate the physical and chemical processes that occur in soil and water under agricultural management.

The objectives of these models are to predict:

- 1) Effects of management decisions on soil, water and nutrient movements
- 2) Impact of changes to soil, water, and nutrient flux on water quality and crop yields

Commonly used in studies involving:

- Nutrient cycling and loss
- Climate change effects on crop yields
- Wind and water erosion
- Soil carbon sequestration
- Soil water management - Irrigation and drainage

SWAT and EPIC MODELS: Previous uses in MN

- SWAT and EPIC have been calibrated and validated in multiple regions of MN by the University of Minnesota
- Examples of U of M applications of these models:
 - Deep water percolation
 - Movement below rootzone
 - Lag time to reach water table
 - Nitrate-N leaching
 - Benefits of different cropping systems including cover crops
- Example U of M model research →
 - Location: Rosholt Farm (Pope County)
 - Management evaluated:
 - N rates/sources
 - Irrigation methods
 - Crop rotations
 - Compared measured vs. model predicted values

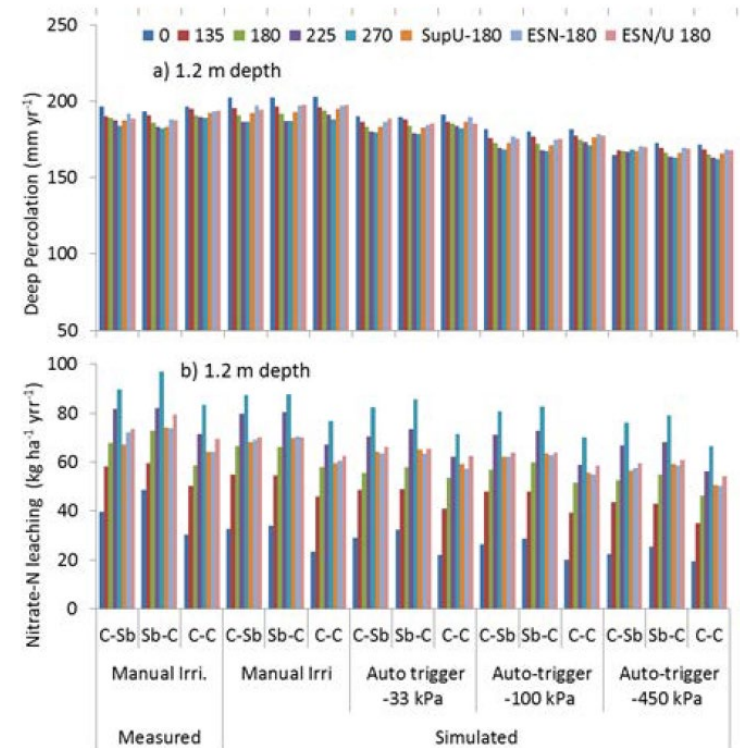


Fig. 1 a) Deep percolation and b) NO₃-N leaching measured with manual irrigation/checkbook, and simulated for manual irrigation and auto triggered irrigation at -33, -100, and -450 kPa.

SWAT and EPIC MODELS: MDA planned uses

Within DWSMAs and Townships that require a reduction in nitrate-N in the groundwater we will use these models to estimate, under the current farming practices, the:

- 1) Annual amount of nitrate-N leaching below the rootzone
- 2) The amount of time it takes the water and subsequent nitrate-N to move below the rootzone to reach the water table (lag time)

We will then simulate and quantify the benefits of different crops and agricultural practices which are recommended to reduced environmental N loss

With this analysis we can provide information on:

- 1) What management options could reduce nitrate-N entering groundwater
- 2) How much of a nitrate-N reduction could be achieved based on the adoption of different practices

The goal is to provide a tool for producers to evaluate options for reducing nitrate losses that they can consider for their farm.

Part Two: Advancing to Mitigation Level 3

Same water quality criteria as Level 2; and,

- After three growing seasons or the estimated lag time, whichever is longer:
 - the nitrate levels continue to increase; or
 - BMPs are not adopted on 80% of the cropland acres (excluding soybean acres); or,
- After three or more growing seasons the residual soil nitrate below the root zone increases.

Level 3 Order:

- May include N fertilizer BMPs, record keeping, education, and information related to N management; and
- May include AMTs if they are funded.

Part Two: Advancing to Mitigation Level 4

Level 4:

- Nitrate-N in the public water supply well exceeded 9 mg/L for any three samples in the previous 10 years; or
- After not less than three growing seasons or the estimated lag time, whichever is longer, the nitrate levels continue to increase; or,
- After not less than three growing seasons the residual soil nitrate below the root zone increases.

Level 4 Order:

- Requirements from Level 3;
- Water resources protection requirements as defined in statute. Must consider economics, practicability, and other factors; and
- Nitrogen fertilizer rate requirements. Cannot restrict the selection of the primary crop or go below the low end of U or M recommended rates.

Key Dates

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to address nitrate in groundwater

Thank you!

For more information visit:

www.mda.state.mn.us/nfr