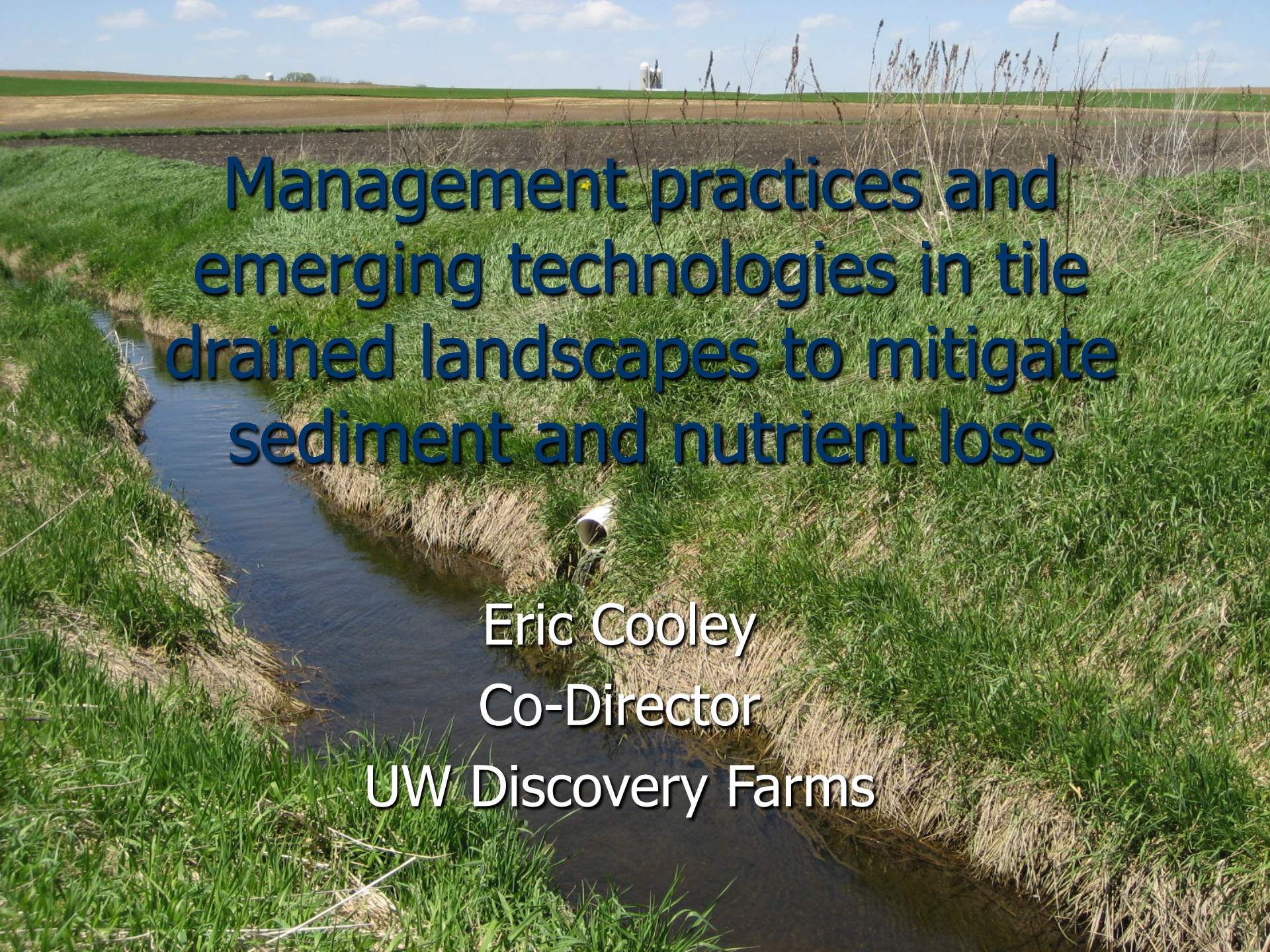


Management practices and emerging technologies in tile drained landscapes to mitigate sediment and nutrient loss

Eric Cooley
Co-Director
UW Discovery Farms

Tile Drainage

Proper management in tile drained landscapes is key to reducing losses

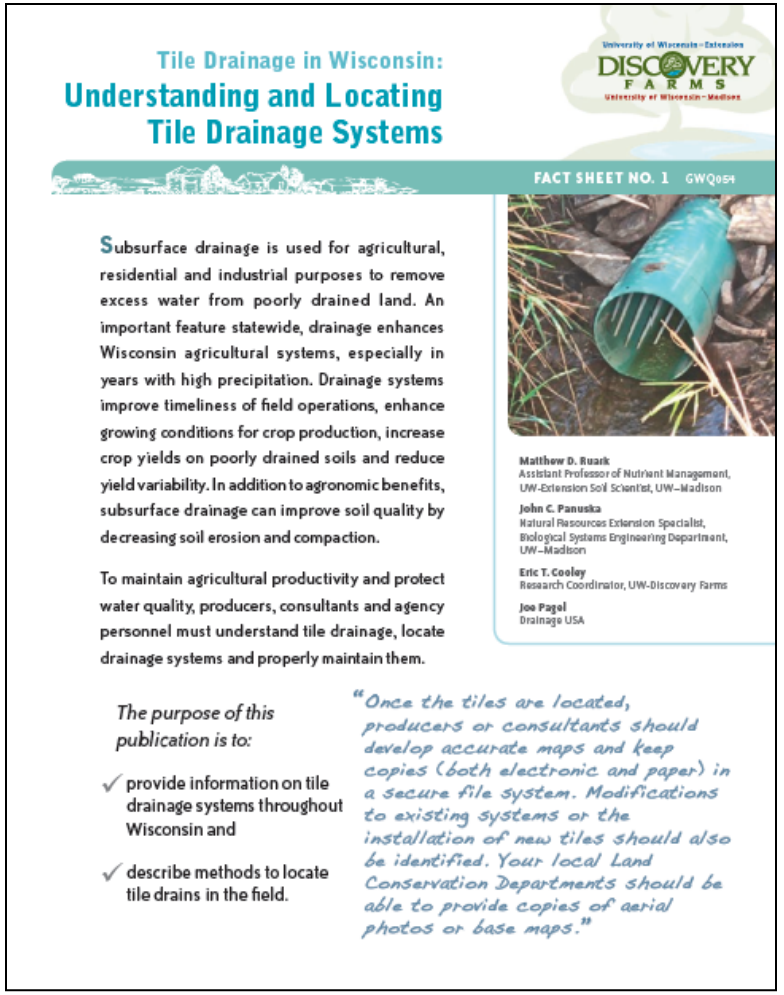
Measures to prevent nutrient loss to tiles are much less expensive and are more effective than treatment

Tile Drainage

Twelve key elements for managing tile-drained land to minimize the potential to transmit nutrients to tile drains

1. Understand and locate tile drainage system features

- Working knowledge of tile drainage systems
- Identification of tile outlets, surface inlets, vents, and other components



Tile Drainage in Wisconsin:

Understanding and Locating Tile Drainage Systems

University of Wisconsin–Extension DISCOVERY FARMS University of Wisconsin–Madison

FACT SHEET NO. 1 GWQ054

Subsurface drainage is used for agricultural, residential and industrial purposes to remove excess water from poorly drained land. An important feature statewide, drainage enhances Wisconsin agricultural systems, especially in years with high precipitation. Drainage systems improve timeliness of field operations, enhance growing conditions for crop production, increase crop yields on poorly drained soils and reduce yield variability. In addition to agronomic benefits, subsurface drainage can improve soil quality by decreasing soil erosion and compaction.

To maintain agricultural productivity and protect water quality, producers, consultants and agency personnel must understand tile drainage, locate drainage systems and properly maintain them.

Matthew D. Ruark
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John C. Panuska
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Eric T. Cooley
Research Coordinator, UW-Discovery Farms

Joe Pagel
Drainage USA

The purpose of this publication is to:

- ✓ provide information on tile drainage systems throughout Wisconsin and
- ✓ describe methods to locate tile drains in the field.

"Once the tiles are located, producers or consultants should develop accurate maps and keep copies (both electronic and paper) in a secure file system. Modifications to existing systems or the installation of new tiles should also be identified. Your local Land Conservation Departments should be able to provide copies of aerial photos or base maps."

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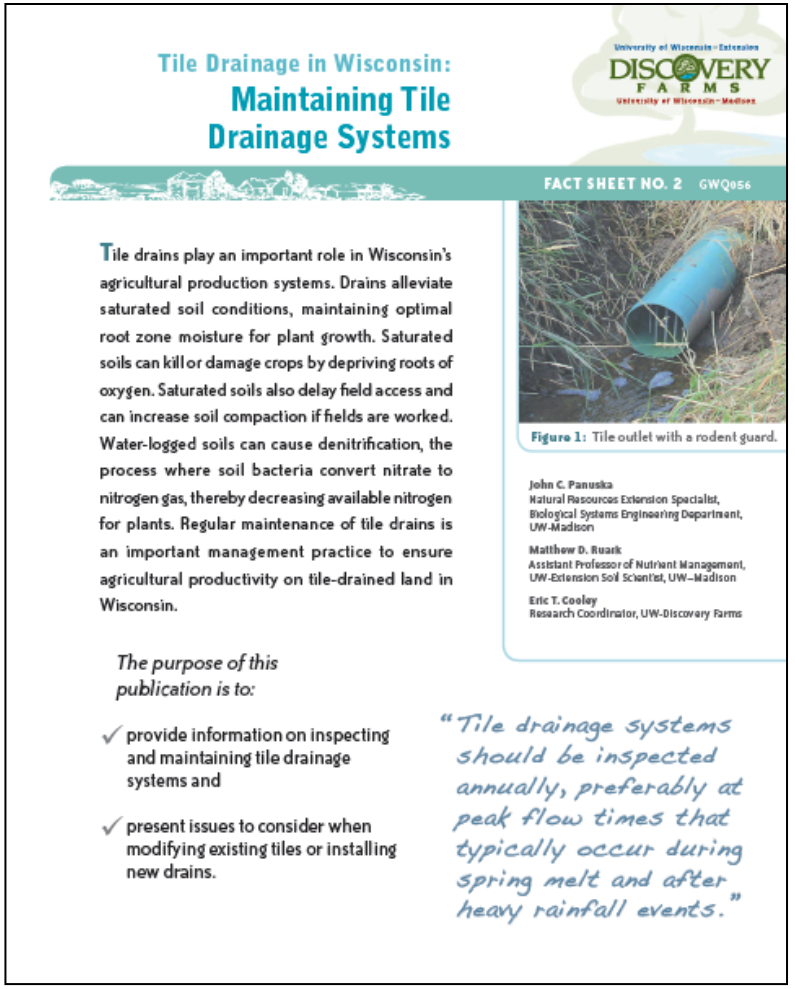
2. Maintain tile drainage systems

- Routine inspection and maintenance to ensure proper function
- Annual inspection to identify tile blowouts and outlet blockages



Tile Drainage in Wisconsin:
Maintaining Tile Drainage Systems

University of Wisconsin–Extension DISCOVERY FARMS University of Wisconsin–Madison

FACT SHEET NO. 2 GWQ056

Tile drains play an important role in Wisconsin's agricultural production systems. Drains alleviate saturated soil conditions, maintaining optimal root zone moisture for plant growth. Saturated soils can kill or damage crops by depriving roots of oxygen. Saturated soils also delay field access and can increase soil compaction if fields are worked. Water-logged soils can cause denitrification, the process where soil bacteria convert nitrate to nitrogen gas, thereby decreasing available nitrogen for plants. Regular maintenance of tile drains is an important management practice to ensure agricultural productivity on tile-drained land in Wisconsin.

Figure 1: Tile outlet with a rodent guard.

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Eric T. Cooley
Research Coordinator, UW-Discovery Farms

The purpose of this publication is to:

- ✓ provide information on inspecting and maintaining tile drainage systems and
- ✓ present issues to consider when modifying existing tiles or installing new drains.

"Tile drainage systems should be inspected annually, preferably at peak flow times that typically occur during spring melt and after heavy rainfall events."

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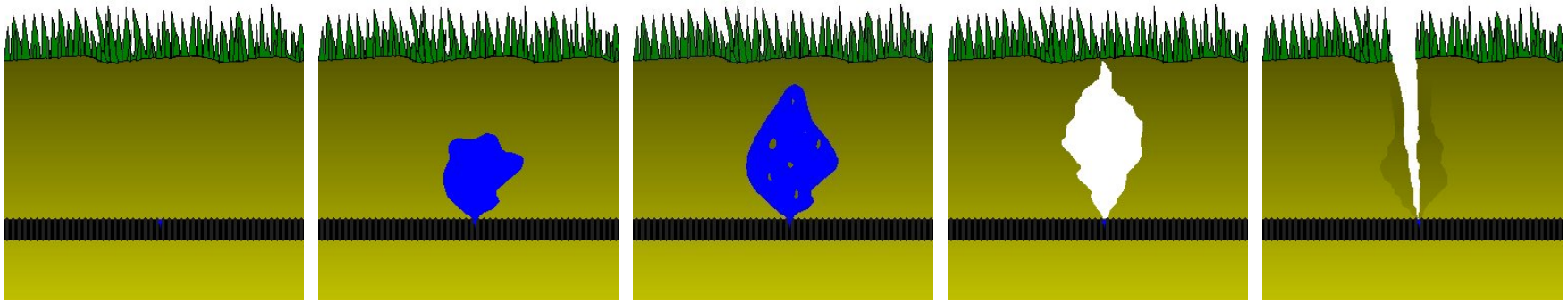
Tile Blowouts



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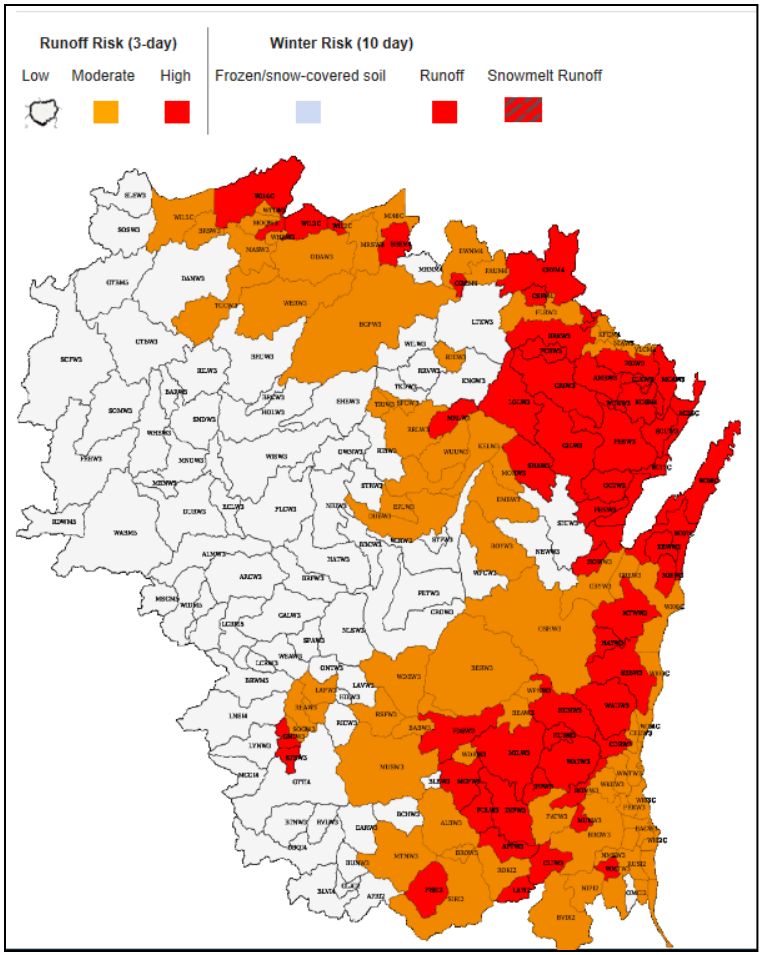
3. Assess soil conditions prior to liquid manure applications

- Both high and low soil moisture contents can be problematic for liquid manure applications to tile-drained land
- High – tiles flowing
- Low – soil cracking

4. Review forecasted weather prior to liquid manure applications

- Avoid applications when rainfall is predicted to occur after application
- Soil moisture levels are increased by liquid manure applications



www.manureadvisorysystem.wi.gov

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5. Monitor tile outlets when applying liquid manure

- Tiles should be monitored before, during, and after liquid manure applications for potential discharge of manure

- In most circumstances, applications should be avoided when tiles are flowing

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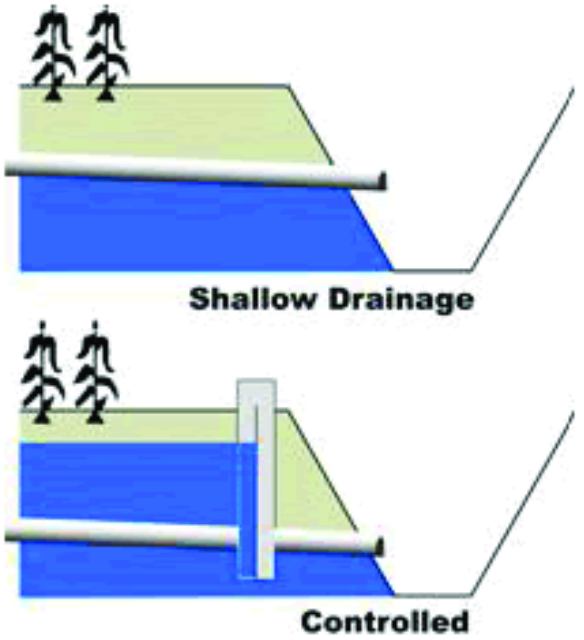
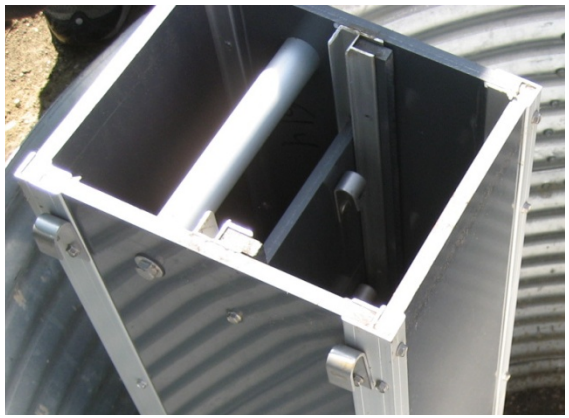
6. Restrict tile discharge prior to manure application

- If water level control structures are installed in tile systems, insert stoplogs to prevent flow from tile drains before application



Source: Mark Dittrich - Minnesota Dept. of Agriculture

- Tile plugs can also be used but often fail

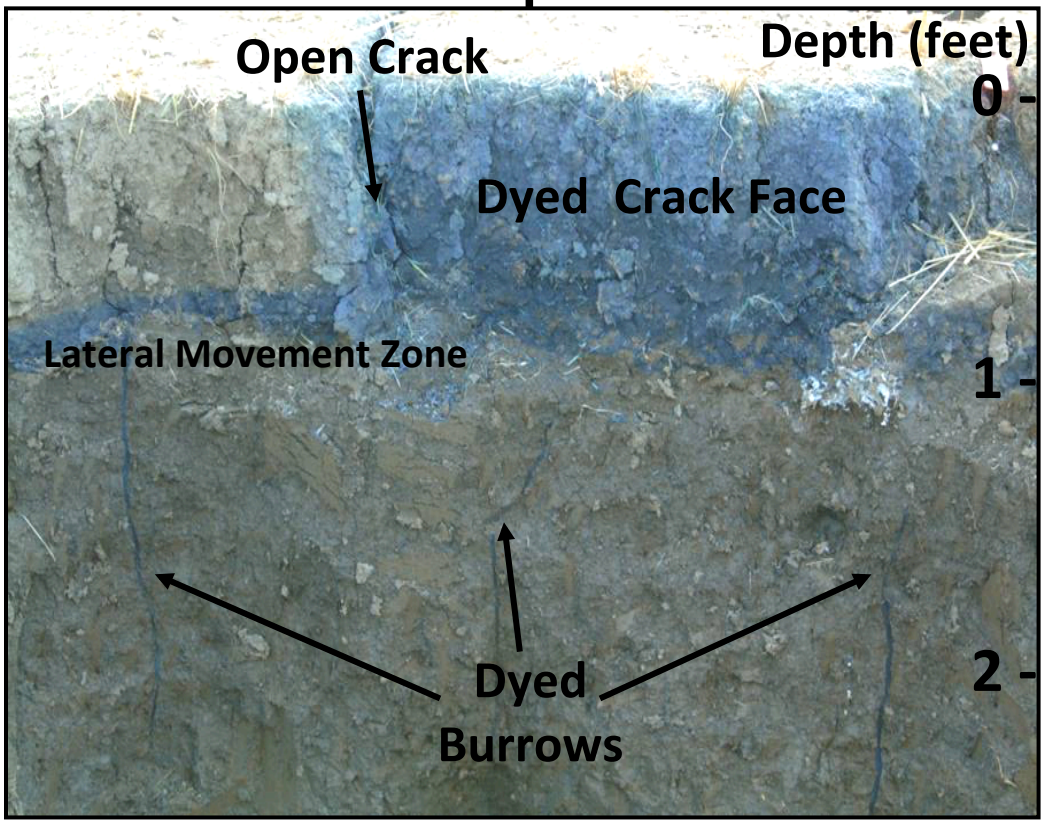


7. Take precautions when surface applying liquid manure to land under no-till or perennial crops

Preferential flow paths are well developed

- Earthworm burrows
- Root channels
- Shrinkage cracks
- Structural porosity

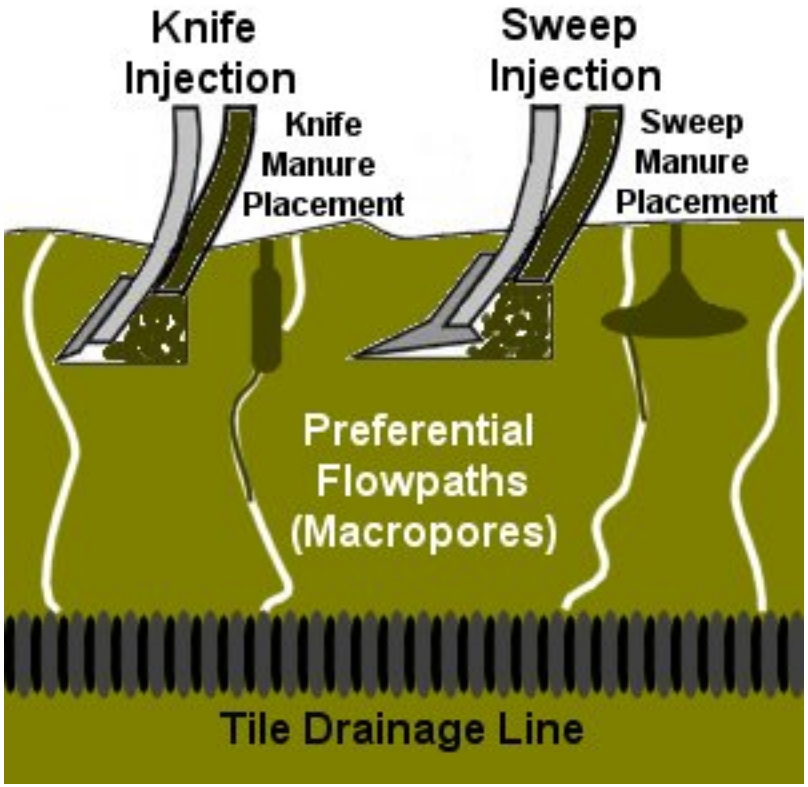
- Macropores -



(Shipitalo et al., 2004)

8. Use tillage to break up preferential flow paths prior to or concurrent with application

- If performed improperly, knife injection or horizontal sweep injection can force manure through macropores



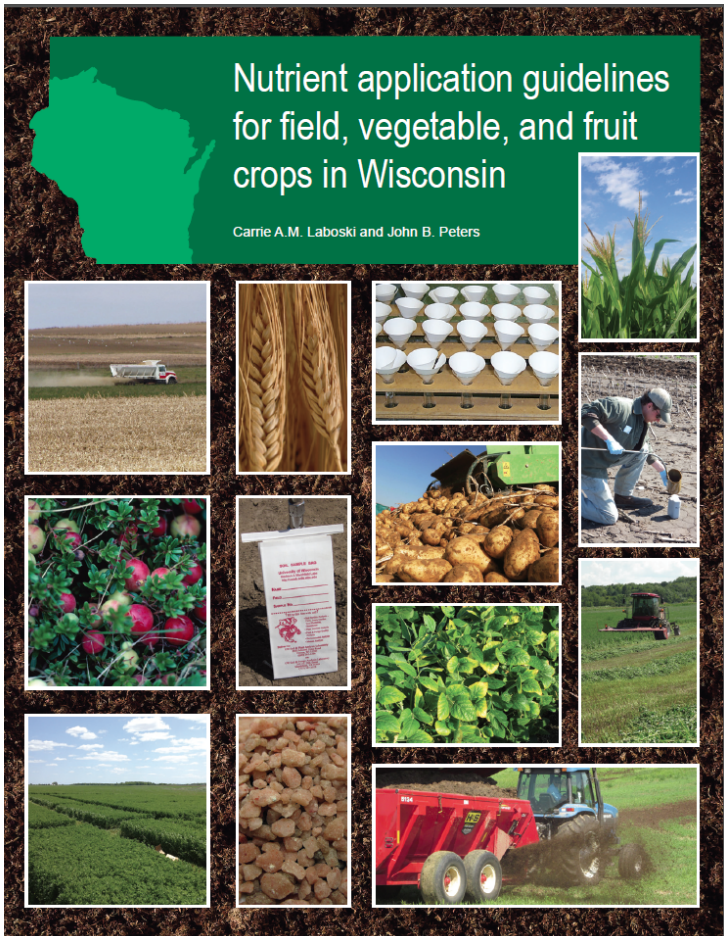
9. Ensure precautions are taken for manure and pesticide applications in fields with surface tile inlets

- Surface inlets are commonly used in fields with closed depressions - areas without an outlet for surface water

- Extra precautions need to be taken in proximity of surface tile inlets because they are a direct conduit to tile drainage systems

10. Use best management practices for fertilizer and manure management

- Apply nutrients based on A2809 guidelines
- Delay or split nitrogen fertilizer applications
- Waiting to apply manure or anhydrous ammonia in the fall until soil temperatures are less than 50°F (or use nitrification inhibitors)



(Laboski and Peters, 2012)

11. Utilize conservation management practices such as cover crops, conservation tillage, and planting of grassed waterways

- Increases nitrogen conservation in the soil and reduces erosion
- Reduces soil loss and sediment-attached nutrient movement on the soil surface and will also help to reduce the potential of loss to tile drains

12. Have an emergency plan in place

- If manure enters tile drains, take immediate steps to stop the flow and prevent discharge to fresh water systems
  - ✓ block or divert the tile outlet
  - ✓ intersect the tile system, and dig a pit directly downstream of the spill site to collect manure

- Contact the Wisconsin DNR Spills Hotline at 1-800-943-0003 to report the spill and get assistance with subsequent remedial actions.

REPORT SPILLS IMMEDIATELY

1-800-943-0003

dnr.wi.gov

Wisconsin's 24-Hour Spill Emergency Hotline

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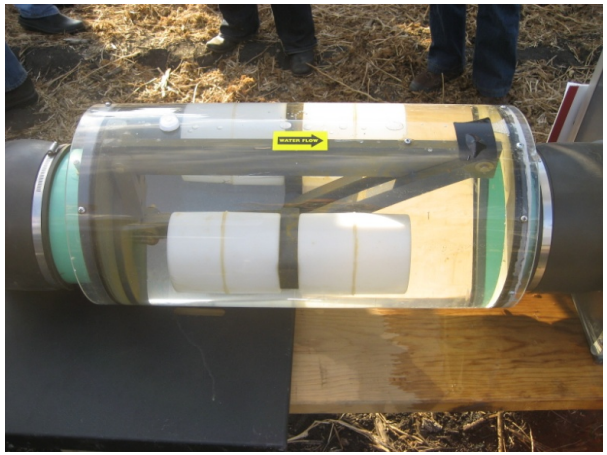
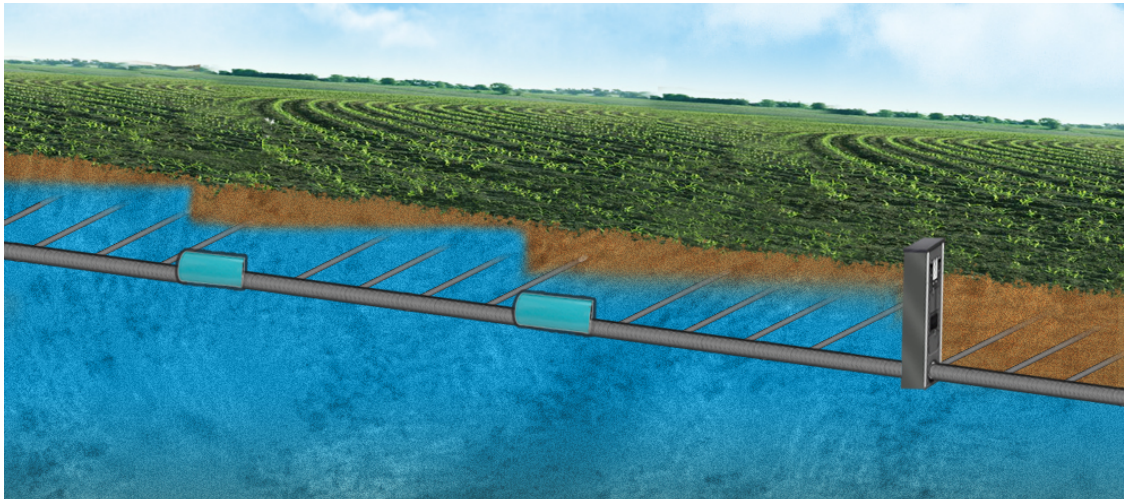
Emerging Technologies and Treatment Options

Controlled drainage - Water Gate™



- Effective on slopes up to 2%
- Expensive ($750)



(Image courtesy of AgriDrain, Adair, IA)

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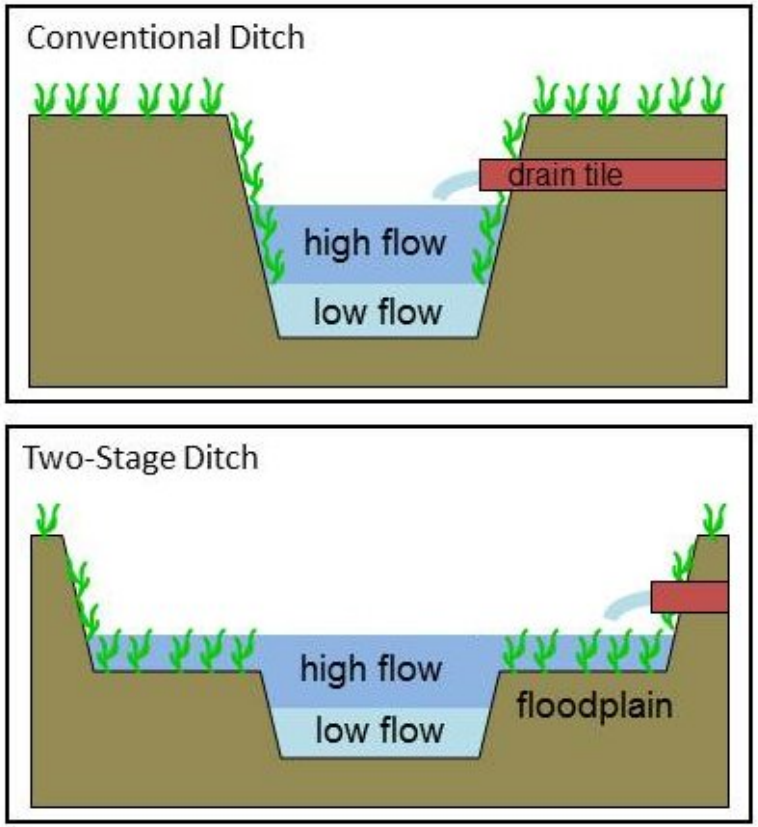
Constructed wetlands

- Effective for both nitrogen and phosphorus removal
- Take large amounts of land out of production

Drainage ditch treatment (Two stage drainage ditch)

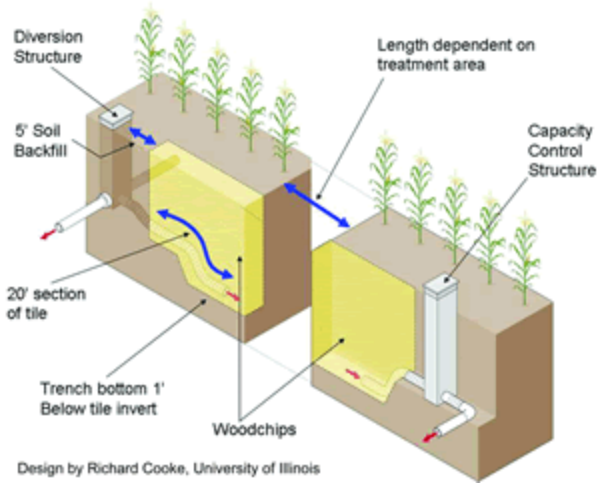
- Reduce drainage bank erosion, sediment, and nutrients from surface and tile drainage water



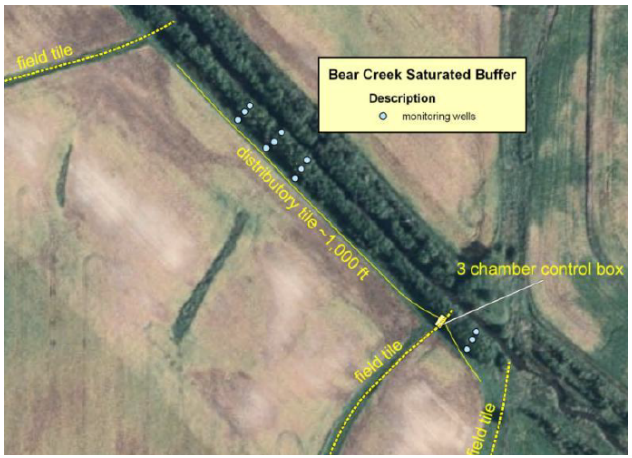
(Image courtesy of Sarah Roley)

Other Emerging Practices

- Alternatives to surface inlets



- Woodchip bioreactors - 30 to 100% nitrate removal



- Saturated riparian buffers

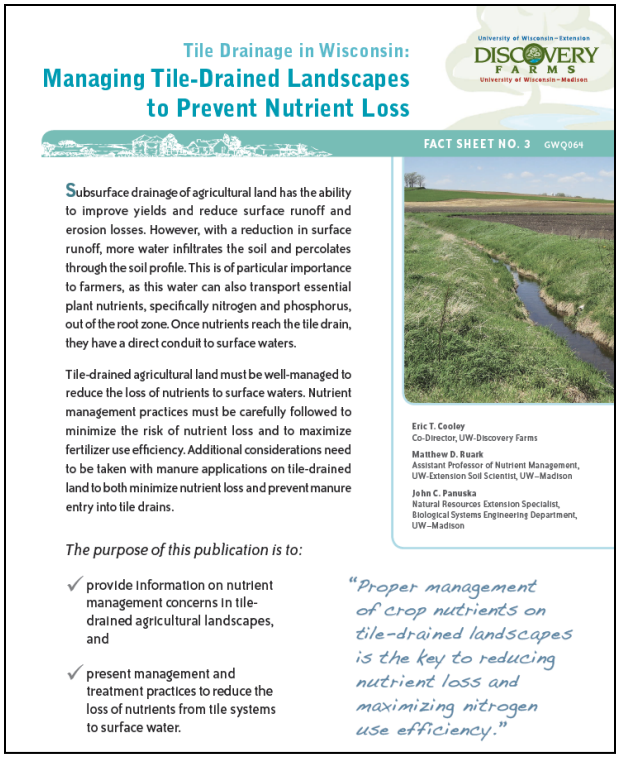
  Dan Jaynes National Laboratory for Agriculture and the Environment, USDA-ARS

Informed management is the key!

- Know timing and mechanisms for loss
- Know critical conditions
- Make informed manure management decisions

updated website!

www.uwdiscoveryfarms.org



Tile Drainage in Wisconsin:

Managing Tile-Drained Landscapes to Prevent Nutrient Loss

University of Wisconsin–Extension DISCOVERY FARMS University of Wisconsin–Madison

FACT SHEET NO. 3 GWQ064

Subsurface drainage of agricultural land has the ability to improve yields and reduce surface runoff and erosion losses. However, with a reduction in surface runoff, more water infiltrates the soil and percolates through the soil profile. This is of particular importance to farmers, as this water can also transport essential plant nutrients, specifically nitrogen and phosphorus, out of the root zone. Once nutrients reach the tile drain, they have a direct conduit to surface waters.

Tile-drained agricultural land must be well-managed to reduce the loss of nutrients to surface waters. Nutrient management practices must be carefully followed to minimize the risk of nutrient loss and to maximize fertilizer use efficiency. Additional considerations need to be taken with manure applications on tile-drained land to both minimize nutrient loss and prevent manure entry into tile drains.

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John C. Panuska
Natural Resources Extension Specialist, Biological Systems Engineering Department, UW–Madison

The purpose of this publication is to:

- ✓ provide information on nutrient management concerns in tile-drained agricultural landscapes, and
- ✓ present management and treatment practices to reduce the loss of nutrients from tile systems to surface water.

"Proper management of crop nutrients on tile-drained landscapes is the key to reducing nutrient loss and maximizing nitrogen use efficiency."

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