

# Best Management Practices to keep nutrients in the field and out of the tile

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# **Drain tile Water quality is not a new issue**

- **Manure in tile (96/97), Kewaunee/Manitowoc**
- **Manure storage and drain tile problems**
  - **Small leaks to 300,000+ gallons**
- **Elevated P in Drain Tile**  
**(1993) (McIntosh**



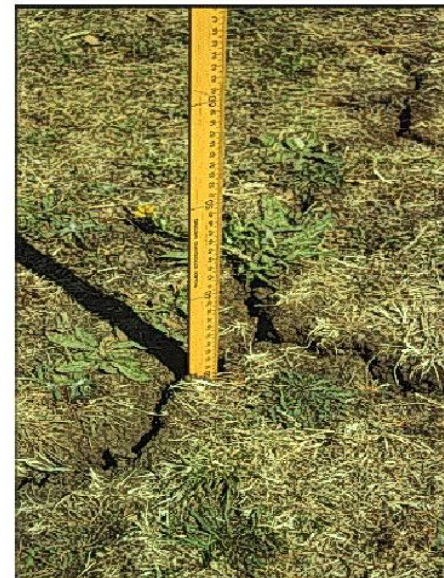
# Manure in Tile Lines

- **Problem documented in Ohio / Michigan / Indiana in late 1990's.**
- **21% of manure runoff tile-related in Ohio (Hoorman)**
- **> 50% of Indiana fish kills are tile-related (Smith)**
- **Greater Realization that what happens on the surface is directly linked to the drainage tile outfall**



# How does Manure end up in Tile Lines

- **Preferential Flow Pathways**
  - Root Channels
  - Earthworm burrows
  - Cracks
  - Soil porosity
- **Type of injection equipment / rate**
  - Injection points and sweeps





# Earthworm Macropores Intersect Tile Lines



**Smoke blower  
attached to tile  
line, immediately  
up from surface  
water outlet.**

**Manitowoc  
County, WI,  
2005**

# Soil Crack Preferential Flow



Smoke  
being forced  
through  
drain tile,  
(3 ft deep).

Escaping  
from cracks  
in the soil.



# Earthworm Macropores Intersect Tile Lines



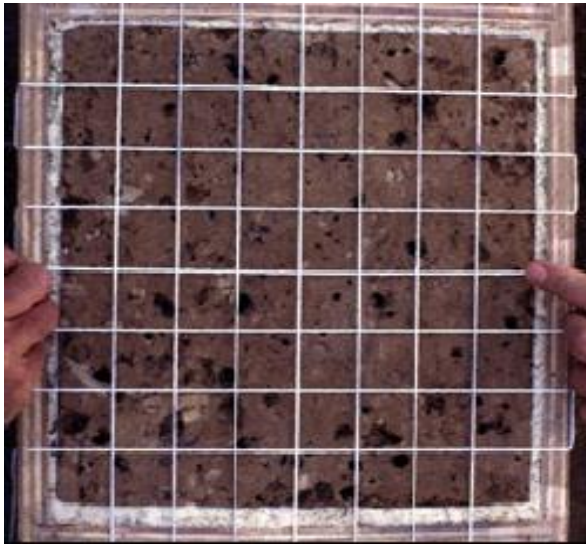
Smoke  
being  
forced  
through  
drain tile,  
(3 ft deep).

Escaping  
from  
earthworm  
burrow.

Crop:  
alfalfa, 3<sup>rd</sup>  
crop  
regrowth.

# Earthworm Burrows

- 727,000 per acre  
(long term no till)
- Higher velocity of water  
and solute movement
- Less contact time



(Shipitalo and Gibbs, 2000)





# Not just earthworms...

- **Wisconsin clay soils crack when dry**
- **Smoke seen 10 feet either side of drain tile from soil cracks**
- **Manure movement down 15 ft.+ in cracks**



# What is in drain tile water?

- **Sediment**
  - Fine particles from normal operation
  - Larger particles from blowouts/partial collapses
- **Nutrients (N, P)**
- **Pathogens**



# Preventing losses to tiles

## Not always Simple

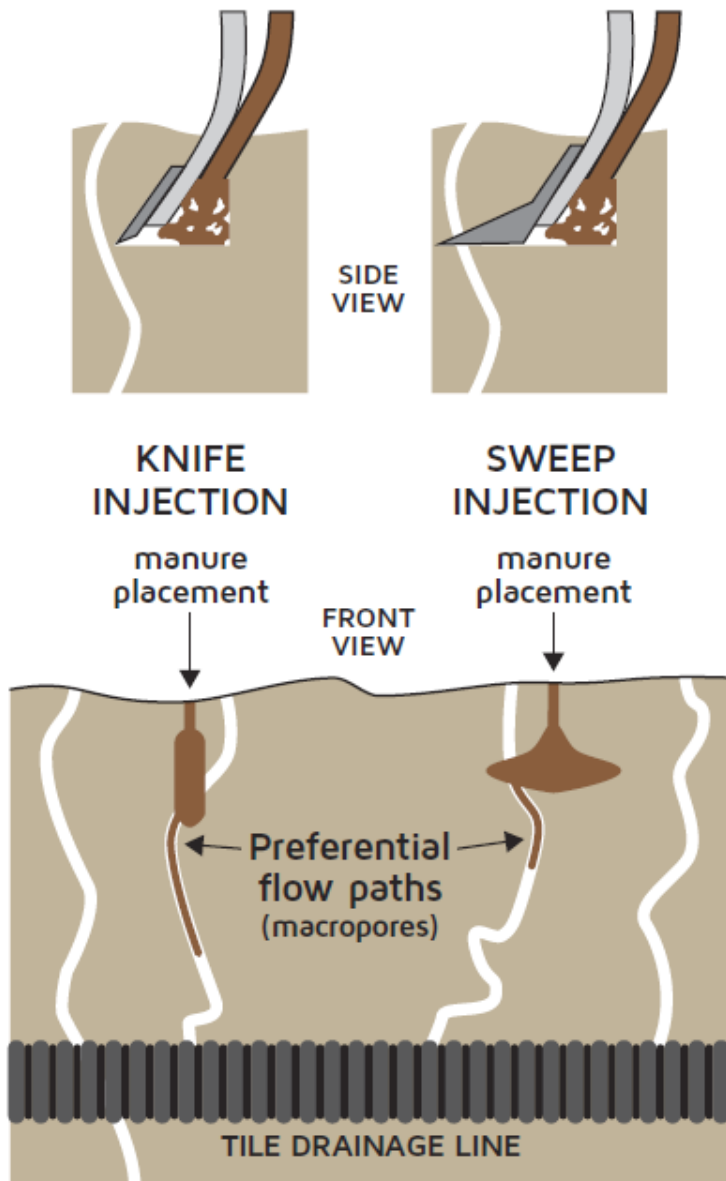
- Target application to uptake/lower rates
- Fall applications greatest risk for loss
- Late season applications when soils are cooler ( <50 ) to reduce nitrates
- Low Disturbance Manure Application
- Cover Crops
- Take precautions when surface applying liquid manure to land under no-till or perennial crops...

Tillage to reduce macropores

- Evaluate type of injection equipment / rate



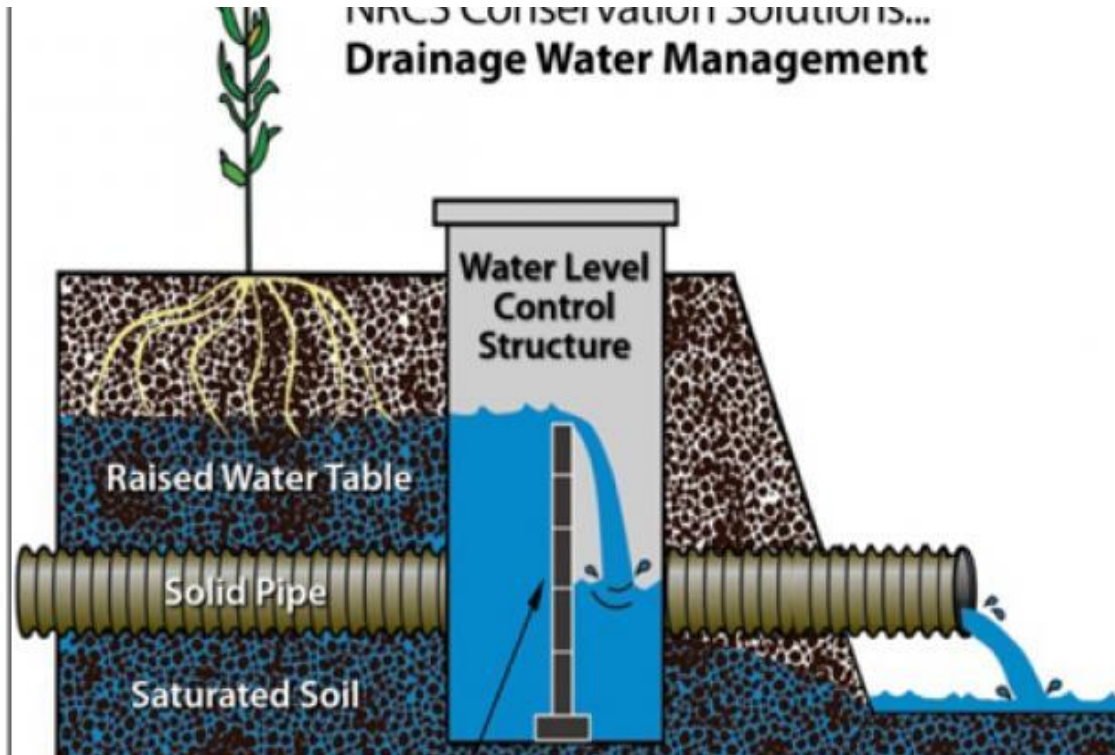
Use tillage to break up preferential flow paths prior to or concurrent with application



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



# Control water levels and N in tile systems – NRCS

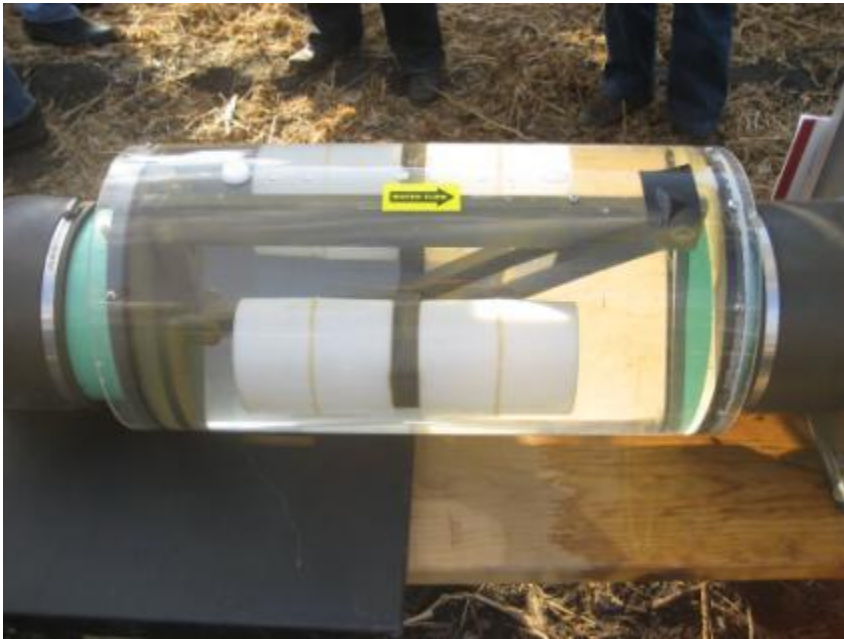


## Manage water levels

- shut valve in fall, open in spring
- Doesn't work on fields w/  $> 0.5\%$  slopes

# Stair- Step Drainage

## Better Option for Wisconsin





# Manure in Tile lines

- Clay soils that crack when drying
- Manure solids less than 5%,
- $< 2\frac{1}{2}$  % solids are greatest risk (Shipitalo – ARS)



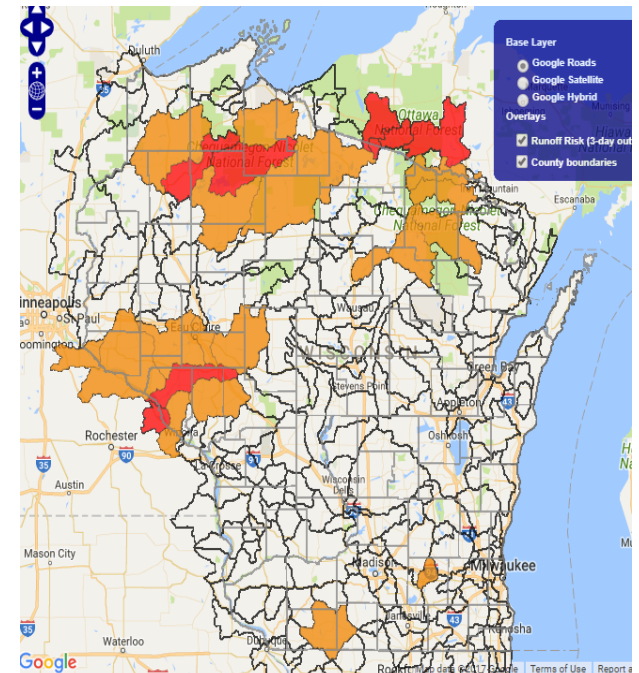
# Assess soil conditions prior and review forecasted weather prior to liquid manure applications

1. Both high and low soil moisture contents can be problematic for liquid manure applications to tile-drained land

- High –tiles flowing
- Low –soil cracking

2. Avoid applications when rainfall is predicted to occur after application

- Soil moisture levels are increased by liquid manure applications
- 7,000 gal =  $\frac{1}{4}$  inch
- Can the soil take it?



# Consider Low Disturbance Manure Applications

- Lower applications rates
- Use of Cover Crops
- Flip the sequence ...cover crops first then manure applications





# Understand and Locate Tile Features



# Ensure precautions are taken for manure applications in fields with tile surface 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





# Manure flowed under road, reached tile inlet





# Situation:

- Manure injected according to WPDES permit at 20,000 gal/acre.
- Solids content <3%
- 2 days after application first started, manure flowing in tile.









# Guiding Principles for Improved Tile Water Quality

- Till or fracture the soil before manure application
  - If cracks/pathway exists
- Consider low disturbance application
- Application made into cover crops
- Be aware of tile locations, inlets and outlets
- Tile line control structures
- Monitor tile line outfalls
- Have manure response team & equipment ready

# Thank you!

## Questions

