Milkhouse Wastewater Treatment Options

ENTSC Netmeeting
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Topics Covered

- Waste production and characteristics
- Pre-treatment options
- Wastewater treatment alternatives
- References and Resources

Milkhouse Waste Components

- Residual milk
- Water
- Cleaning chemicals
- Manure
- Bedding
- Feed
- Grit/dirt
- Other materials

So, What's The Problem?

Wastewater Parameter	Milkhouse (mg/L)	Household (mg/L)
Suspended Solids	996	290
Total Solids	3506	1000
Total Volatile Solids	2389	500
Oil & Grease	330	150
BOD	1530	400

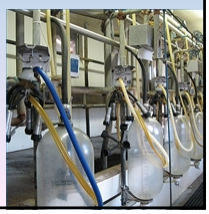
Factors Affecting Milkhouse Waste Characteristics

- Number of animals milked
- Type of facility
- How long animals are confined
- Cow preparation methods
- Feed access
- Waste milk management
- Clean up
- O&M

Special Note:

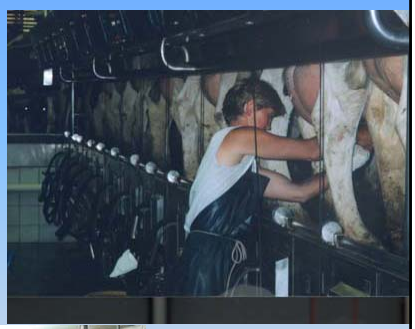
Waste milk is the greatest contributor to BOD for milkhouse wastewater
Raw milk BOD ~ 100,000 mg/L

Systems handle a limited amount of residual milk
System cannot handle waste milk from fresh or treated cows
Bulk tank dumps



Wastewater Contaminants

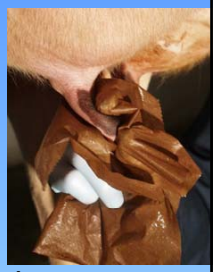
- Solids
- Phosphorus
- Ammonia-nitrogen
- Chlorides



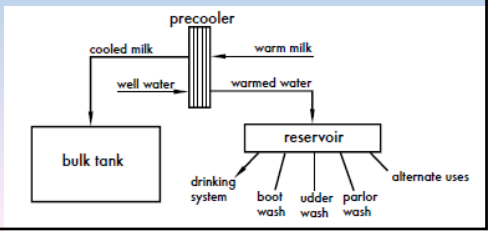
Methods of Source Control

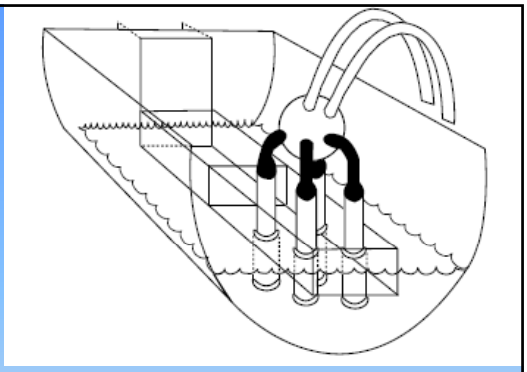
- Water conservation
- Manage waste milk
- Reduce phosphorus

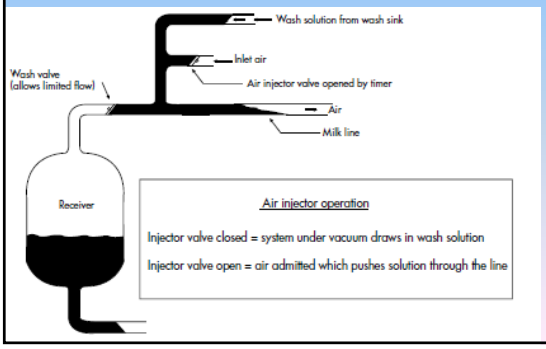
Water Conservation



- Water efficient cow-prepping methods
- Reduce washwater volume for tasks
- Reuse cleaning water
- Scrape floors prior to wash down
- High pressure sprayers to clean floors and walls
- Install air injectors
- Reuse milk pre-cooler water
- Reuse water softener wastewater

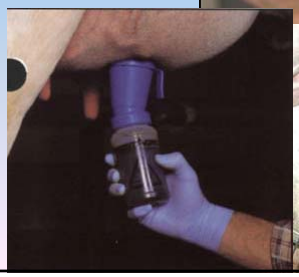






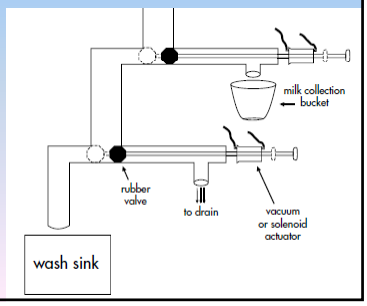
Typical Cleaning Process

- First rinse
- Detergent wash
- Acid rinse
- Sanitizing rinse



Waste Milk Management

- Prevent mastitic milk and cow treated milk from entering treatment system
- Dispose of colostrum and transitional milk
- Capture pre-rinse milk from pipelines
- Divert major spills and rejected bulk tank loads from treatment system
- Remove milk from transfer line with compressed air



Phosphorus Reduction

- Install water softener or increase softening time
- Use low phosphorus detergents and acid rinses

Cleaning Chemical	Phosphorus Content
Liquid detergent, sodium hydroxide base	0
Liquid detergent, potassium hydroxide base	2-5
Powdered detergent	5-15
Acid rinse, phosphoric acid base	10-20
Acid rinse, phosphoric acid plus other acids	5-15
Liquid sanitizer, sodium hypochlorite base	0
Powdered general purpose cleaner	5-15
Liquid general purpose cleaner	0
Iodine udder wash	3-5
Non-iodine udder wash	0-1

Solid Separation Pretreatment Options

- Flocculation systems
- Settling/flotation tank
- Septic tank

Milk house

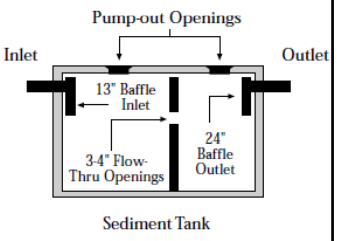
Flocculation System

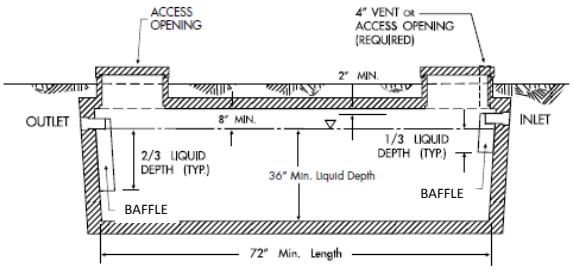
•Use hydrated lime
•Other flocculates may be used in combination
•~3 pounds per 400 gallons of wastewater

•Milk, soap solids, suspended and dissolved solids settle
•Clear water is released to treatment area
•Settled solids – land applied or added to manure storage

Settling/Flotation Tank

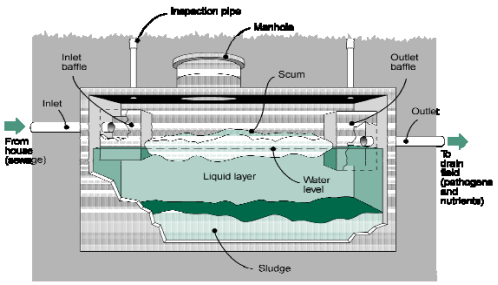
- Heavy solids settle to bottom
- Milk fats and greases float
- Periodic sludge and scum removal





Septic Tank

- 3-day Hydraulic Retention Time (HRT)
- Removes some solids and fats
- Pumped annually (or as needed)
- Only handles limited amounts of residual milk



WASTE TRANSFER

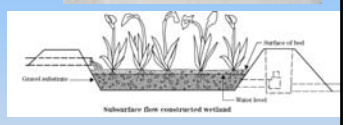
Flout
Outlet Flow Control

Gravity

Sump Pump

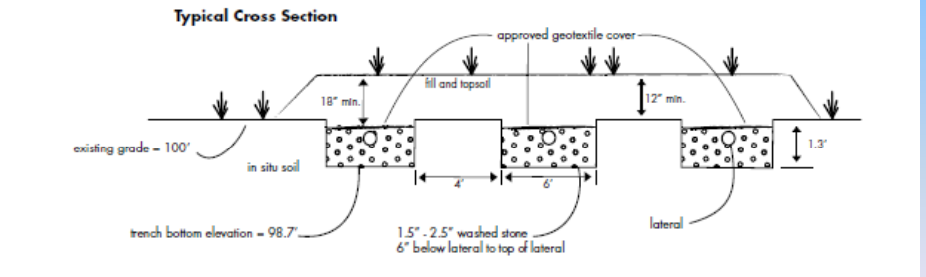
Typical Treatment Systems

- Soil Absorption
- Aerobic Treatment
- Constructed Wetlands
- Vegetative Treatment Area
- Bioretention / Bark Bed Filter
- Irrigation



Soil Absorption

(Septic Field)



Soil Absorption

- Requires pretreatment to reduce solids and reduce BOD
  - Otherwise clogging will result
- Typically designed similar to a septic drain field

Aerobic Treatment of Wastewater

- Aeration system is generally used to provide mixing
  - displacement of water as air is injected causes turbulence

Aerobic Treatment of Wastewater

- Designed to reduce BOD5 to 200 mg/L
  - similar to household septic wastewater
  - allows use of standard sized septic soil infiltration system.

Aeration not Stand Alone

- Typically used to allows use of Soil Absorption
- Could also be followed by
  - Bark Bed Filter
  - Vegetated Treatment Area
  - Irrigation

Aeration Considerations

- Cost of Electricity
- Rule of thumb
  - three pounds of oxygen transfer per horsepower-hour
- Requires solid settling
  - minimize non-degradable solids
- Strong biocides can disrupt performance
  - Bleaches, antibiotics, chemical cleaners
- Nutrients conserved

Constructed Wetland (Ac.) (656)

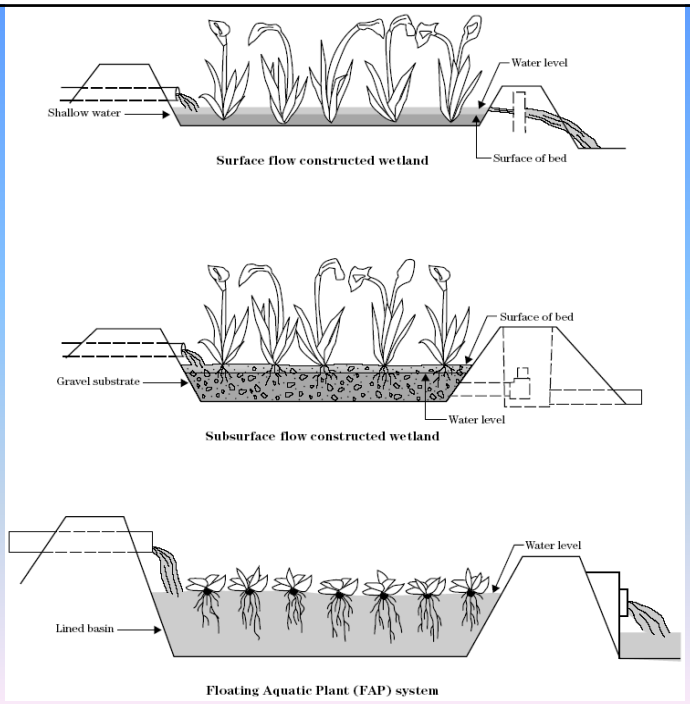
"Constructed wetlands for waste treatment shall **not be designed to discharge** to waters of the state unless permitted by state laws and regulations, and appropriate permits have been obtained to do so."

United States Department of Agriculture

Natural Resources Conservation Service

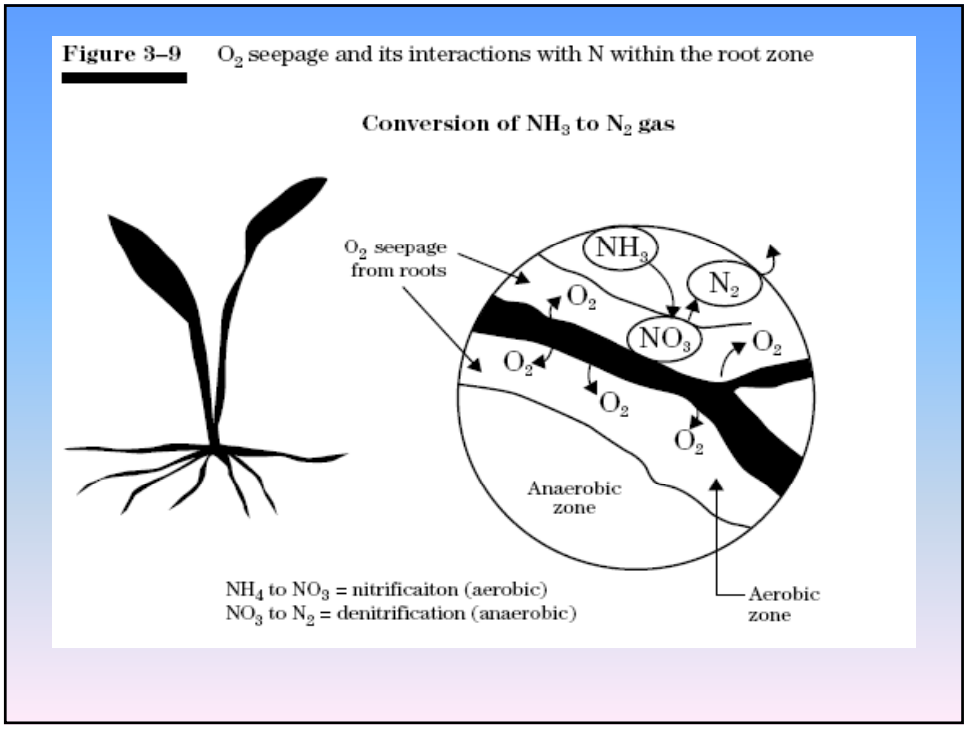
Part 637 Environmental Engineering
National Engineering Handbook

Chapter 3 Constructed Wetlands



Wastewater Treatment Processes

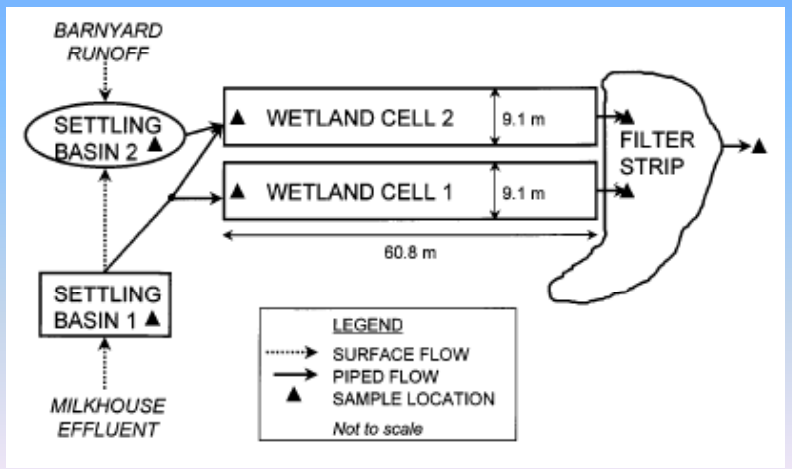
Microbial Action
Nitrification / Denitrification
Volatilization
Evaportranspiration
Filtration / Settling
Accretion
Interaction with Soils
Nutrient Up-take of Plants
Winter Operation



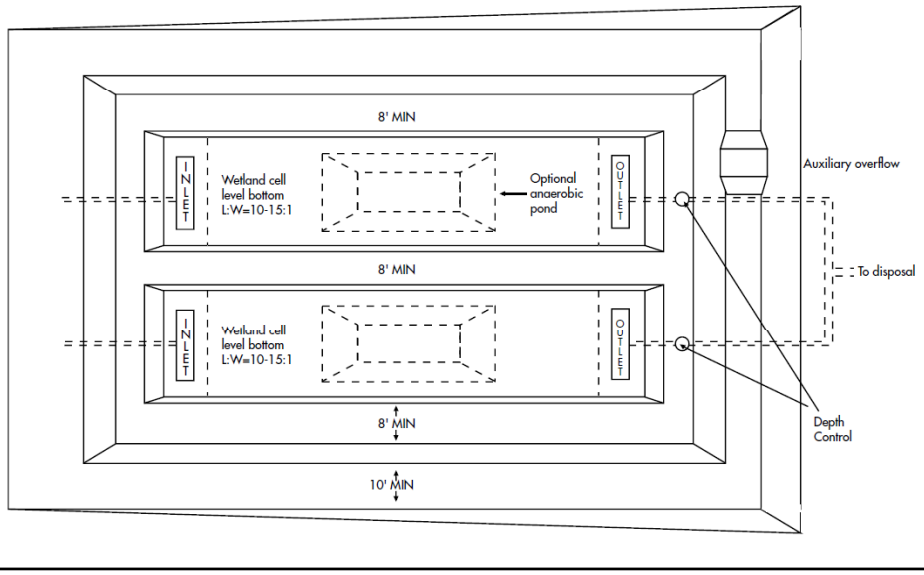
Wetland Design

- Maximum loading rate of 65-80 pounds of BOD5 per acre per day
- Impermeable soil or with an impermeable liner
- Alternate deep with shallow to promote nitrogen removal
- Parallel systems to promote maintenance
- Capture outflow and treat
  - Why?

Plan


BARNYARD RUNOFF
SETTLING BASIN 2
WETLAND CELL 2
9.1 m
WETLAND CELL 1
9.1 m
FILTER STRIP
60.8 m
SETTLING BASIN 1
MILKHOUSE EFFLUENT
LEGEND
SURFACE FLOW
PIPED FLOW
SAMPLE LOCATION
Not to scale

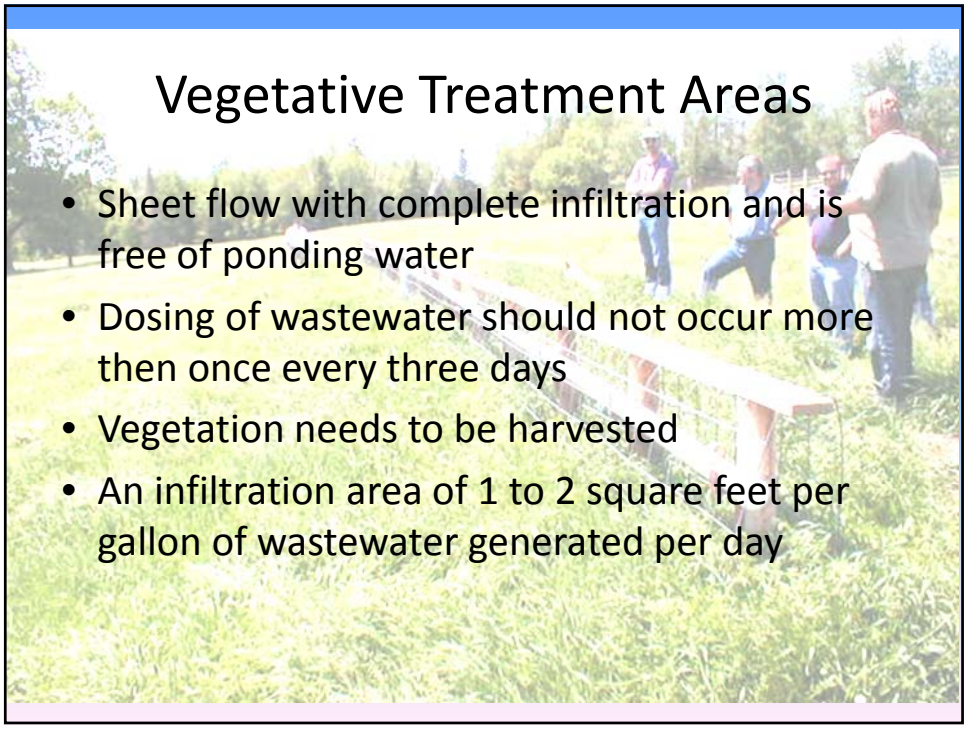
Layout


8' MIN
INLET
Wetland cell level bottom L:W=10-15:1
Optional anaerobic pond
OUTLET
Auxiliary overflow
8' MIN
To disposal
INLET
Wetland cell level bottom L:W=10-15:1
OUTLET
8' MIN
Depth Control
10' MIN

Limitations

Need Pre-treatment
Site Characteristics
Water Management Requirements
Plant Maintenance
Nutrient Harvesting
Treatment Limitations
Discharge Management
Vector Control

Vegetative Treatment Areas



- Sheet flow with complete infiltration and is free of ponding water
- Dosing of wastewater should not occur more then once every three days
- Vegetation needs to be harvested
- An infiltration area of 1 to 2 square feet per gallon of wastewater generated per day

Vegetated Treatment Areas

- Minimum flow length of 100 feet
- Slope of 0.3 to 6 percent
  - Entrance slope not flatter than 1 percent
- Use parallel VTAs

635 - 1

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

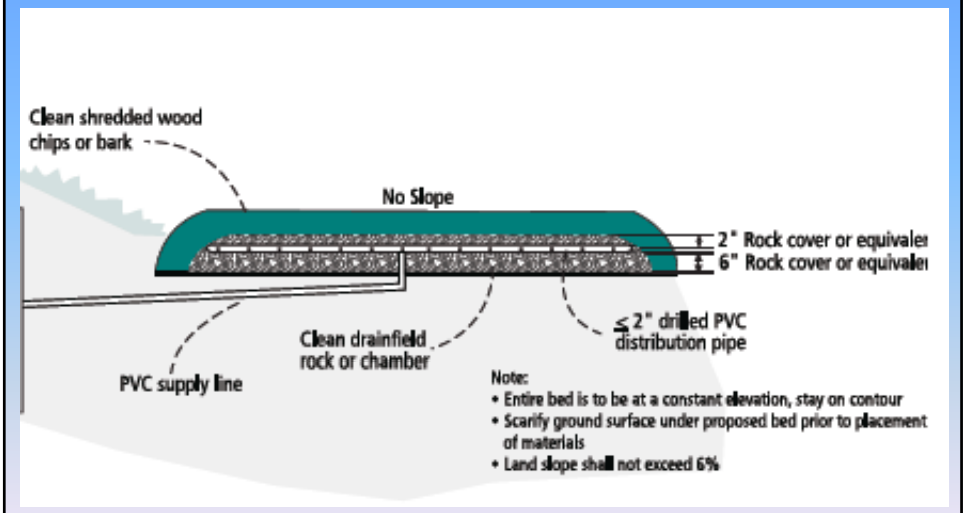
VEGETATED TREATMENT AREA

(Ac.)

CODE 635

Bioretention / Barkbed Filter

Wastewater is distributed to an infiltration area covered with 18-24 inches of wood chips or shredded bark


Clean shredded wood chips or bark
No Slope
2" Rock cover or equivalen
6" Rock cover or equivalen
≤ 2" drilled PVC distribution pipe
Clean drainfield rock or chamber
PVC supply line
Note:
• Entire bed is to be at a constant elevation, stay on contour
• Scarify ground surface under proposed bed prior to placement of materials
• Land slope shall not exceed 6%

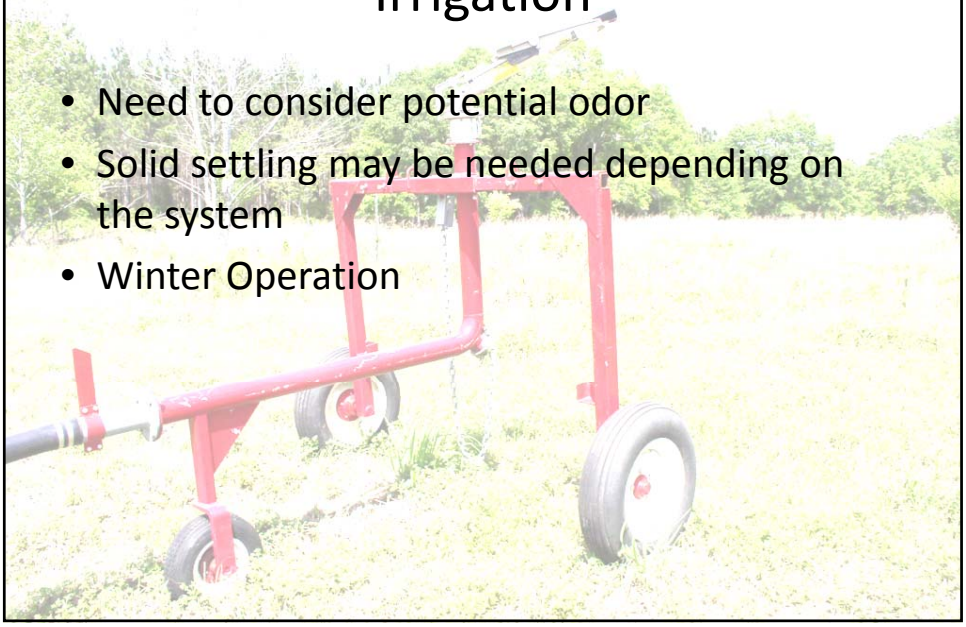
How it works

- Uses biological activity to treat wastewater
  - Bark/wood provides carbon
- Contact with the ground and warmth from biological activity prevents freezing
- Excess water evaporates or infiltrates

Irrigation

Irrigation

- Need to consider potential odor
- Solid settling may be needed depending on the system
- Winter Operation



Available Resources

- Minnesota Extension
- Wisconsin Extension
- NRCS Standards (WI and MN)
- Wisconsin NRCS spreadsheets
- New York Extension

Helpful Resources

- Milking Center Wastewater Guidelines
  - http://clean-water.uwex.edu/pubs/pdf/farm.milking.pdf
- Milkhouse Wastewater and Manure Management
  - http://www.manure.umn.edu/applied/milkhouse_waste.html#Publications
- Wisconsin Animal Waste Spreadsheets
  - http://www.wi.nrcs.usda.gov/technical/eng_spreads.html
- Virginia Farmstead Assessment System Milking Center Wastewater Treatment - #11
  - http://pubs.ext.vt.edu/442/442-911/442-911.pdf

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The End
Questions?