Session Objectives

• Principles of septic system operation
• Septic tanks and what they do
• Soil absorption systems and what they do
• Answer your questions about how conventional septic systems work
SEPTIC TANKS
TANK FUNCTIONS

• SOLIDS REMOVAL – SETTLING & FLOTATION
• DECOMPOSITION – ANAEROBIC DIGESTION
• STORAGE OF SOLIDS
Septic Tank Function

IN
SCUM
SLUDGE
OUT
Septic Tank

- Provides primary treatment in an on-site wastewater treatment system
- Wastes enter the first chamber of the tank
- Heavy solids settle to the bottom and form a sludge layer
- Light wastes (grease, hair) float to the top and form a scum layer
TANK SIZING

• GENERALLY PRESCRIBED BY THE HEALTH DEPARTMENT

• CRITERIA: Hydraulic Storage
  – 2-4 days storage of design flow
  – Add Solids Storage Volume
SOME TANKS MAY HAVE OUTLET FILTERS
BIOLOGICAL ACTIVITIES IN THE SEPTIC TANK

- ANAEROBIC = WITHOUT OXYGEN
- ANAEROBIC DIGESTION IS
  - Cheap and easy
  - Reliable
  - Slow and Incomplete
- GASES PRODUCED ARE ODOROUS
- NOT ALL SOLIDS IN THE TANK ARE BIODEGRADABLE
- ACCUMULATION OF SOLIDS
ANAEROBIC DIGESTION

Septic Tank Function

IN

CO₂
CH₄
H₂S
NH₃

OUT
THINGS IN THE TANK THAT DEGRADE SLOWLY

- TOILET PAPER
- HAIR
- LAUNDRY LINT
- OIL and GREASE
TYPICAL SEPTIC EFFLUENT

- $\text{BOD}_5$ 100-250 mg/L
- TSS 80-150 mg/L
- FOG 10-25 mg/L
- TOTAL NITROGEN 45-100 mg/L
- TOTAL PHOSPHORUS 5-8 mg/L
- Fecal Coliform 100,000 – 1,000,000 colonies/100 ml
TANK MATERIALS

• REINFORCED CONCRETE (most tanks in MI)
• FIBREGLASS
• POLYETHYLENE
• OLDER TANKS
  – Steel
  – Concrete Block
  – Etc.
WATER TIGHTNESS

- INFILTRATION
- EXFILTRATION
- WATERTIGHT SEALS
  - ALL JOINTS
  - INLET & OUTLET
  - RISER AND LID
SOIL ABSORPTION SYSTEMS
FEATURES OF SOIL ABSORPTION SYSTEMS

• TRENCHES OR BED
• DISTRIBUTION PIPING
• GRAVITY-FLOW FROM SEPTIC TANK
EXCAVATION OF TRENCH
LEVELING GRAVEL IN TRENCH
ABSORPTION BED SYSTEM
FUNCTIONS OF DISTRIBUTION
PIPING AND STONE

- HYDRAULIC DISTRIBUTION
- DISPERSE EFFLUENT INTO SOIL FOR TREATMENT
GOAL IS UNIFORM DISTRIBUTION

- UNIFORM DISTRIBUTION BETWEEN LINES

- UNIFORM ALONG LINES IN TRENCH OR BED
Progressive Crusting of Infiltrative Surfaces in Subsurface Trenches of Seepage Beds Under Trickle Flow
OWS Soil Treatment

Conventional Soil Absorption Trench

- BOD
- TSS
- Viruses
- Bacteria
- Nutrients
- Unsaturated aerobic zone
- Groundwater

Well
Absorption Field Trench

- Backfill
- Stone
- Air
- Water Table
BIOMAT IS GOOD AND BAD

• Bad
  – Clogs soil pores
  – Gets worse over time
  – Promotes anaerobic conditions
  – Eventually may cause hydraulic failure
BIOMAT CLOGGING EFFECTS CAN BE REDUCED

- By improving effluent quality
- By improving aeration at infiltrative surface
- By physical break-up using compressed air (Terra-Lift™)

- Biomat can be (almost) eliminated with highly treated effluent
GRAVELLESS SYSTEMS

- CHAMBERS
- WRAPPED PIPE
- BUNDLED PIPE
- MANUFACTURED MEDIA
  - CHIPPED STYRFOAM
  - IN-DRAIN™
  - CHIPPED TIRES
CHAMBER SYSTEM
Typical Inspection Pipe

Geosynthetic Fabric

Distribution pipe

Backfill

4” perforated inspection pipe

Open bottom
DISCUSSION AND QUESTIONS?