yowa
Yankee Onsite Wastewater Association

Inspection & Troubleshooting of Septic Tanks

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Presentation Overview

- Septic tank function
- Background info: users, occupied, maintenance
- Locating tanks
- Evaluating tanks
- Troubleshooting

Septic Tank Treatment

- Anaerobic (without Oxygen)
- Anaerobic digestion is
  - Incomplete
  - Cheap and easy
  - Reliable
- Gases produced are odoriferous
- Not all solids in the tank are biodegradable

Septic Tank Functions

- Solids removal by settling & floatation
  - 60-80% solids removal
- Anaerobic digestion
- Storage of solids

Literature Review of Raw and Septic Tank Effluent

Parameter	Source	Median Value (mg/L)	Range (mg/L)	Removal %
$CBOD_5$	Raw	337	30 - 598	~60
	STE	158	39 - 861	
COD	Raw	905	495-2,404	~60
	STE	325	157-1,931	
TSS	Raw	280	18-2,233	~75
	STE	61	20 - 276	
TN	Raw	63	44 - 189	~10
	STE	54	26 – 124	
TP	Raw	19	13 - 26	~50
	STE	10	3 – 40	

System Users

- Number of people
  - Sellers
  - Anticipated
- Number of bedrooms
  - Customer
  - Permit
  - Listing

Occupied or Vacant?

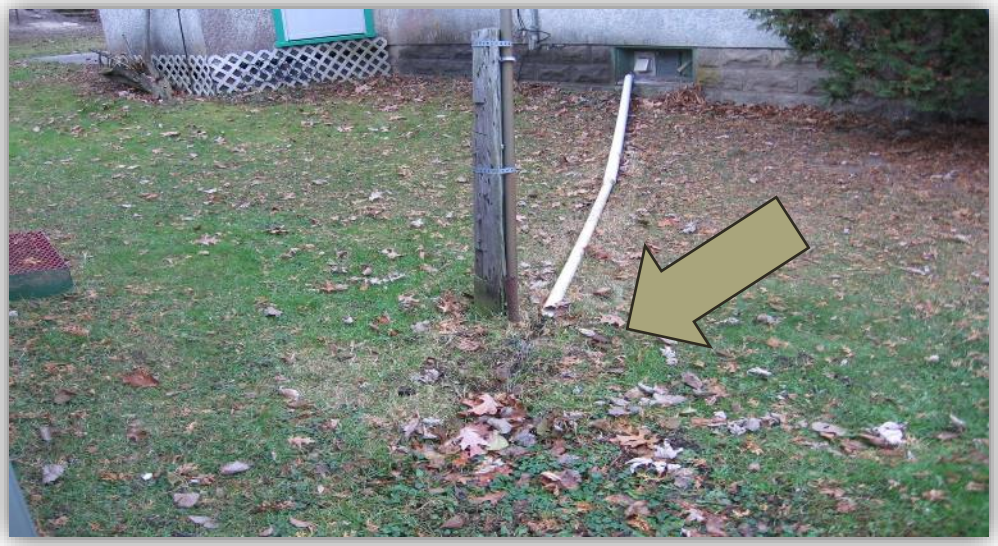
- Occupied
- Have owner sign-off on back-up related questions
- Vacant? How long has it been vacant?
  - Surfacing concerns
    - 0-1 week, may be still wet
    - 1 week, but < 1 month, vegetation may still be lush
    - > 1 month, vegetation likely NOT indicated a problem, look for surges inside the tank

Maintenance

- When
- Frequency
- Check with the maintainer
  - Problem statements
    - *Great customer*
    - *I am there every week*

All Sewage Entering System

- Greywater
  - Laundry
- Out buildings
  - Toilets or sinks?
  - Shop
  - Garage
  - Milk house



Tank Inspection

Tough to Check

Locate Tank

- Downhill from house
- Locate roof stack
- Impression
- Different shade of grass
- Landscaping

Locating Tanks

- Probe
- Snake
- Camera
- Witching
- Records

Locating Tools - Prototek

AR-1 "Ardy"

- **Nonmetallic lines**
- Analog receiver locates tanks and nonmetallic lines
- Flushable Transmitters
- ~$650

FR-1 "Ferris"

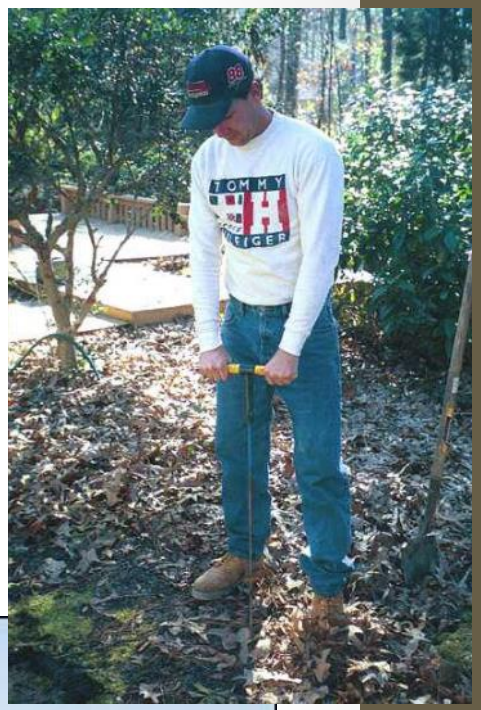
- **Cast iron & nonmetallic**
- Locates in cast iron and nonmetallic lines
- $750

www.prototek.net
800.541.9123

Locating Toils - Camera

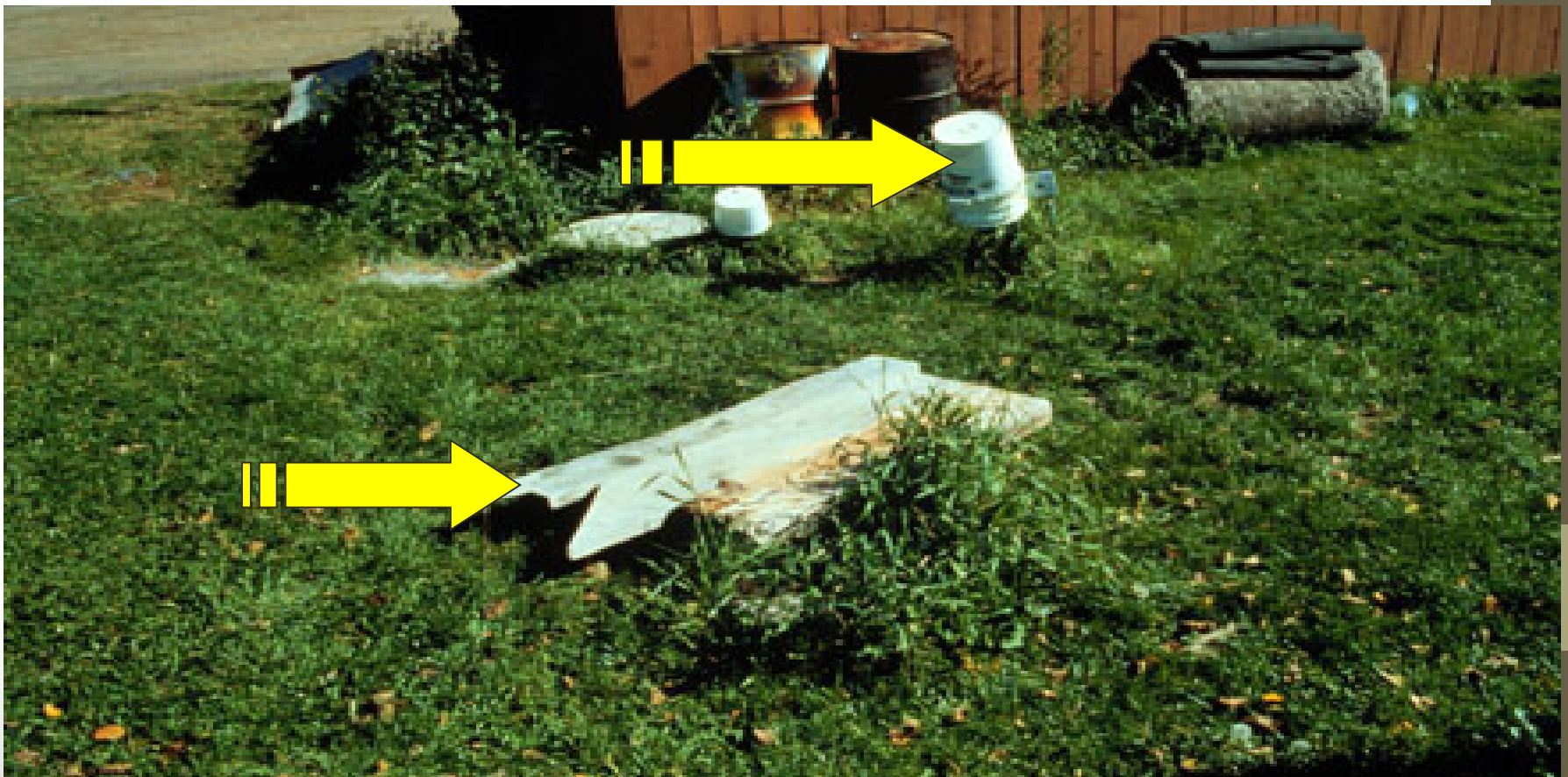
- Probe
- Small diameter access
- Manhole access

Evaluate Conditions



Conditions at the Tank

Problems: Could make system a public health threat

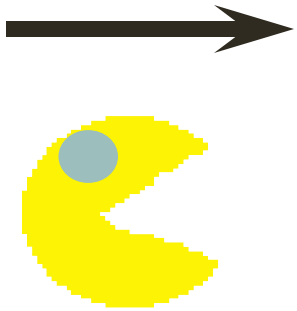


Septic Tanks

Tank Access

- Operable
- At-grade
  - Securely fastened
  - Recommend secondary constraint?
- Buried
  - Recommend risers to grade?

ORGANIC MATTER



CO_2
CH_4
H_2S
NH_3

BACTERIA

GASES + HUMUS

Septic tank should smell "septic" when you open the lid

Anaerobic Digestion

Evaluate Risers

- Evidence of infiltration on risers?

Check Inlet Baffle
Is it clear of debris?

Indication of Problems

Checking from the Surface

Mirror & flashlight

Camera

Current Operating Condition

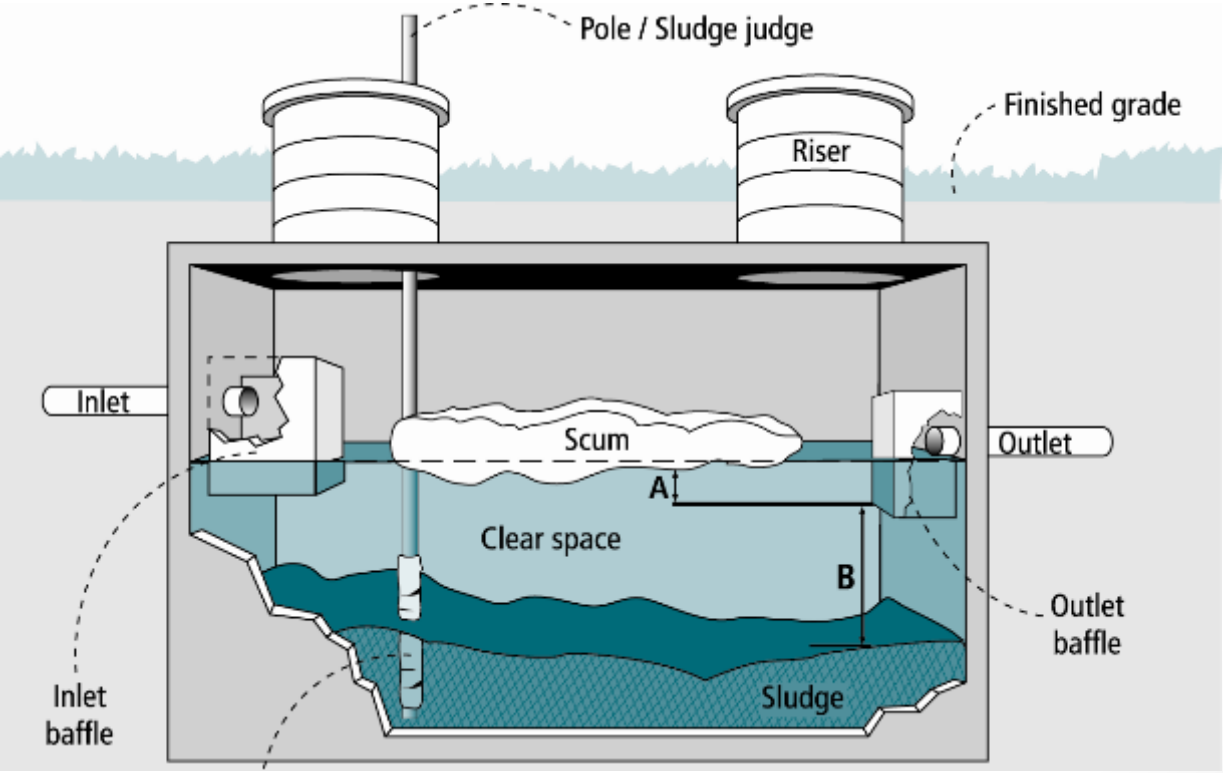
- Below the outlet elevation
  - Leaking
  - Pumped recently

Current Operating Distance

- Above the outlet elevation
  - Effluent screen plugged
  - Soil treatment plugged
  - Pump broke

Does the Tank Need Maintenance?

- Full when total solids reach 25- 30% of tank capacity
- If necessary note on inspection



Checking the Sludge Levels

- Should be three distinct layers if functioning properly
- Heavy accumulation means excess inputs
- One uniform layer ~ excess chemical inputs?

Effluent Screen Cleaning

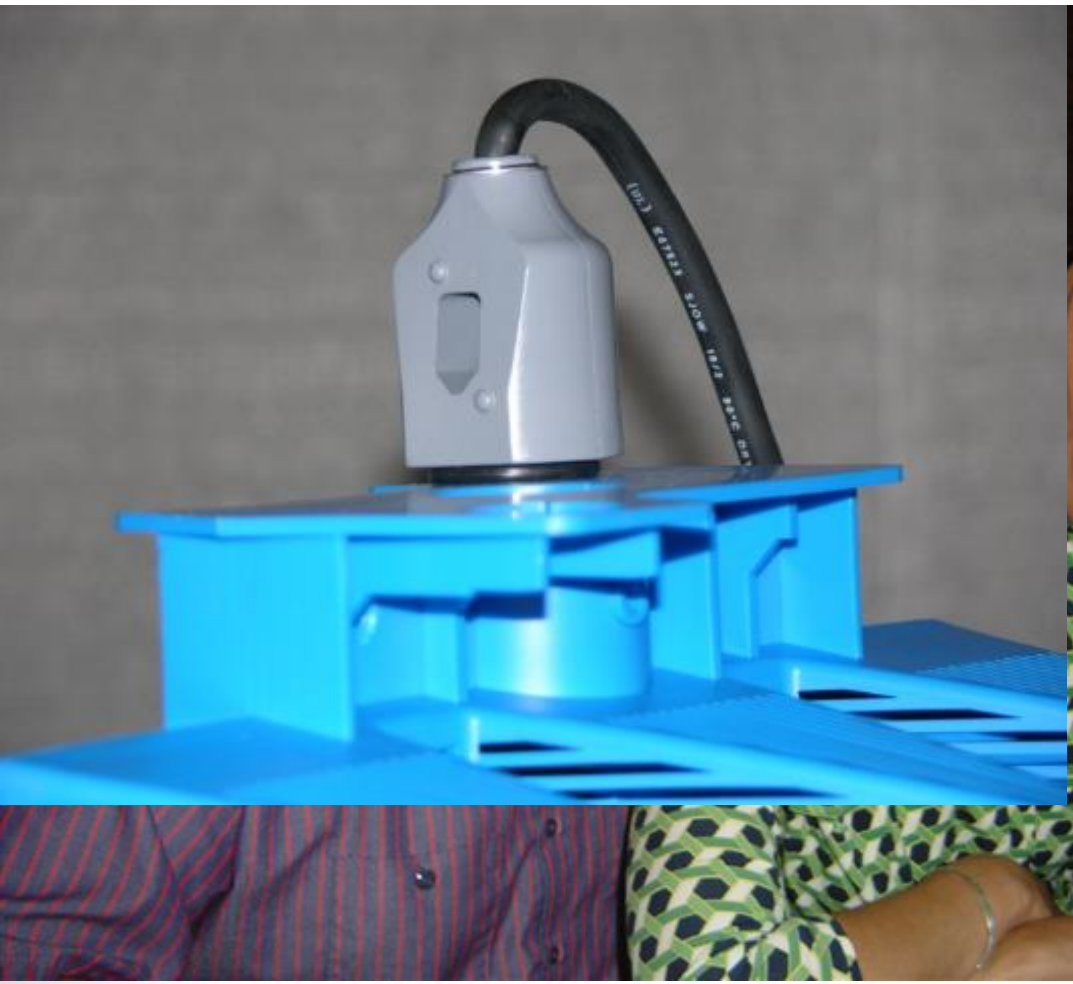
- Screen is washed off directly into the septic tank
- This is being done at the inlet end of the tank to protect against cleanings going directly out the outlet
- Some units have protection against outflow or an extra screen that that operates during cleaning.

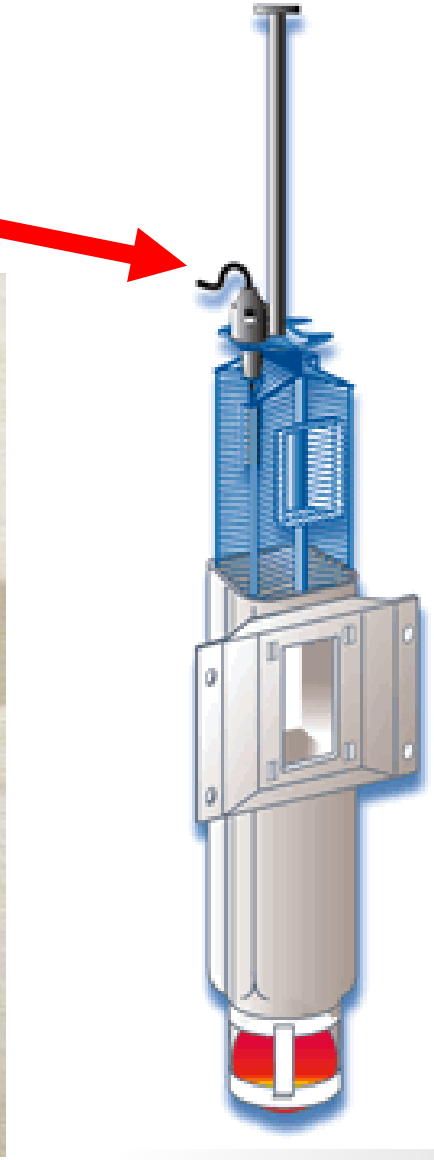
Effluent Screen Cleaning

- Often, a tool is needed to remove the screen for cleaning and then to replace it into the housing
- Note that riser opening allows easy access to filter

Alarm on Screen Present and working?

Alarm





Dissolved Oxygen (DO)

- Check in center or end of septic tank
- Value should be < 1 mg/L
- If > 1 mg/L
  - Check source water DO
  - Leaks into system
    - Home
    - Ground or surface water

Checking DO

How to Test DO

- Kit
- Probe

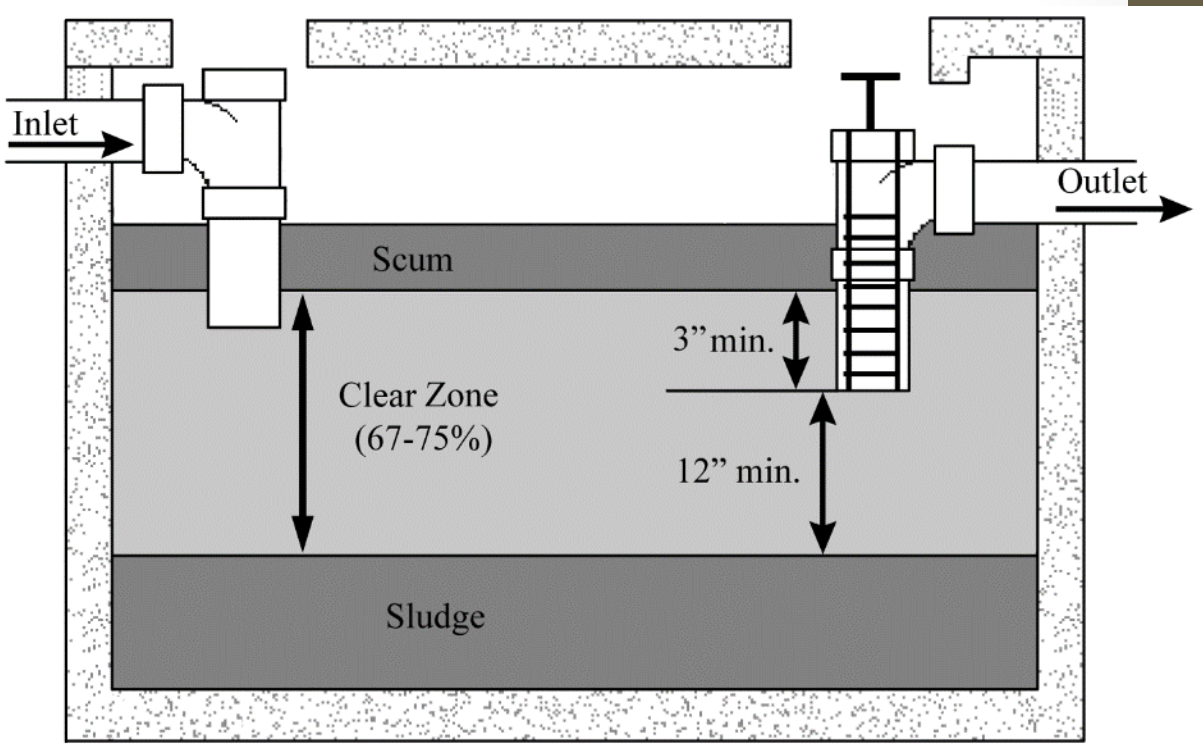
Operation Test

- Flush all toilets once and run all fixtures to determine that they flow into treatment tank
- Introduce water into the system at the rate of 3-4 gpm (this is the flow of one spigot fully opened) for 20-30 minutes
- Observe level of water in Tank

Water meter

Maintenance - When to Pump the Tank?

- 25 – 33 % of working volume of tank
- High risk pump more often



Sludge Levels

- Use sampling probe (Sludge Judge or Dip Stick)
- Indicates amount of settling in tank
- Heavy accumulation means excess inputs (garbage disposal?)
- Color should be black = anaerobic
- Yellow or brown can indicated chemical usage

Scum in Tank

- Heavy accumulation could be from:
  - Fat, oils and grease
  - excessive paper product usage
- Color should be noted

Sludge Measurements

The Dipstick

True Core

1 ¼” Sludge Judge

¾” Sludge Judge

Pump Through the Manhole

- Tanks shall ONLY be pumped from/through the manhole/access port of each tank or tank compartment

Observe

- Lid
- Walls
- Listen for running water
  - Inlet
  - Outlet
  - Sides

Current operating condition

Tank Structural Condition

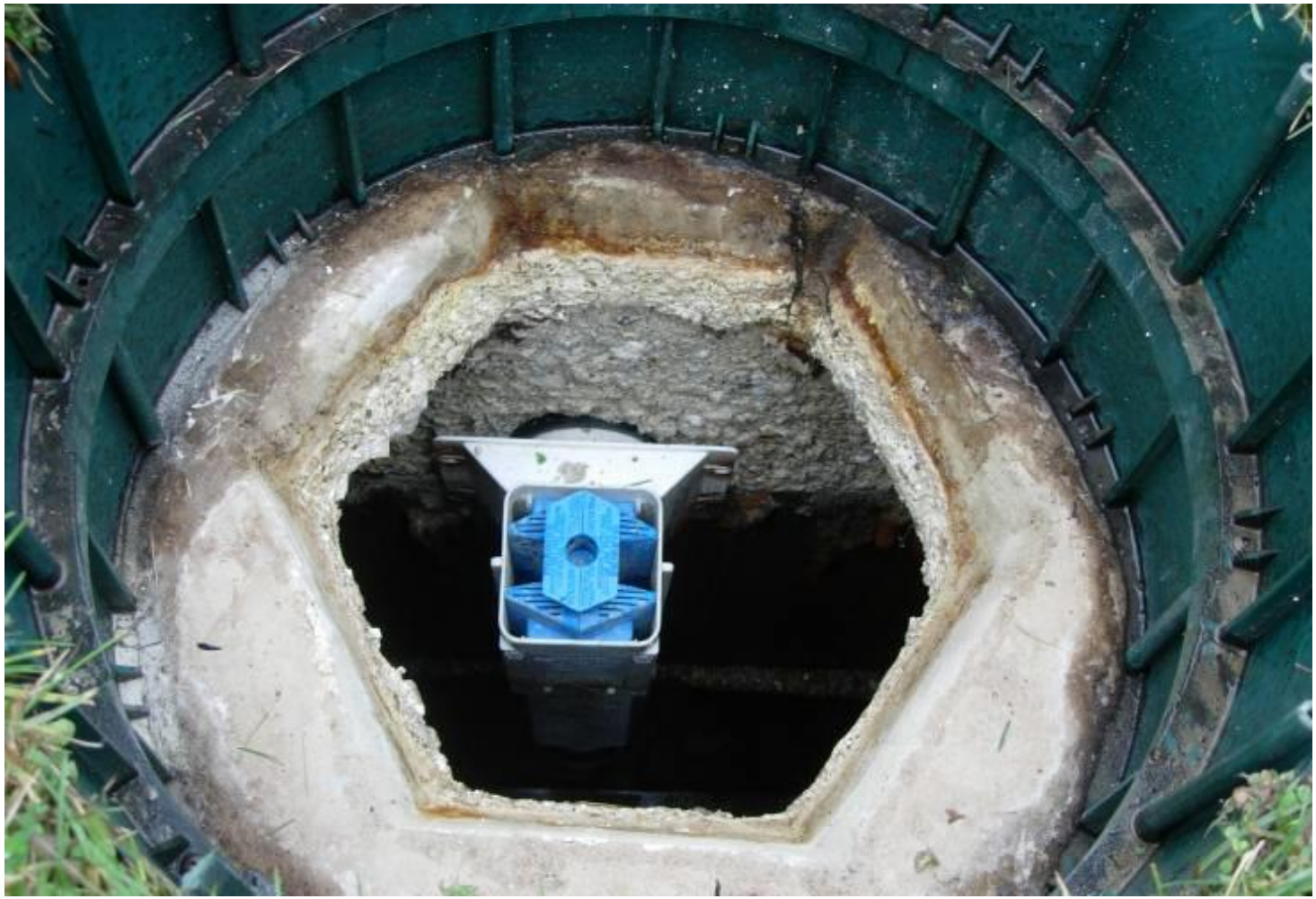
- Check for:
  - Rebar exposed
  - Corrosion
  - Spaulling

Problems - Roots

- Structural
- Back-up
- Leaks

Cracks, Deterioration, Damage?

Structural Issues?



Leak at Mid-Seam

Problem “Tanks” Seepage Pit, Leaching Pit, Drywell

Surface Water

- Down spots
- Storm water
- Elevation
- Slopes/settling
- Note issues on inspection

TROUBLESHOOTING

Process of Troubleshooting Tanks

- Identify that septic tank does not look normal
  - Off look or smell to tank?
  - Tank not have three distinct layers?
  - Sludge or scum too think
  - Effluent filter plugging up routinely?
- Interview owner/user of system
  - Use issues
  - Homeowner/troubleshooting survey
    - Antibacterials
    - Medicines
    - Cleaners

Troubleshooting Septic Tank

- Determine last date of tank pumping
- Determine mount of sludge and scum
  - Get profile of tank layers
- Get lab analysis to determine how “sick” the tank is
  - BOD and TSS
  - FOG only if commercial or a lot of FOG visible

Factors That Influence Anaerobic Digestion

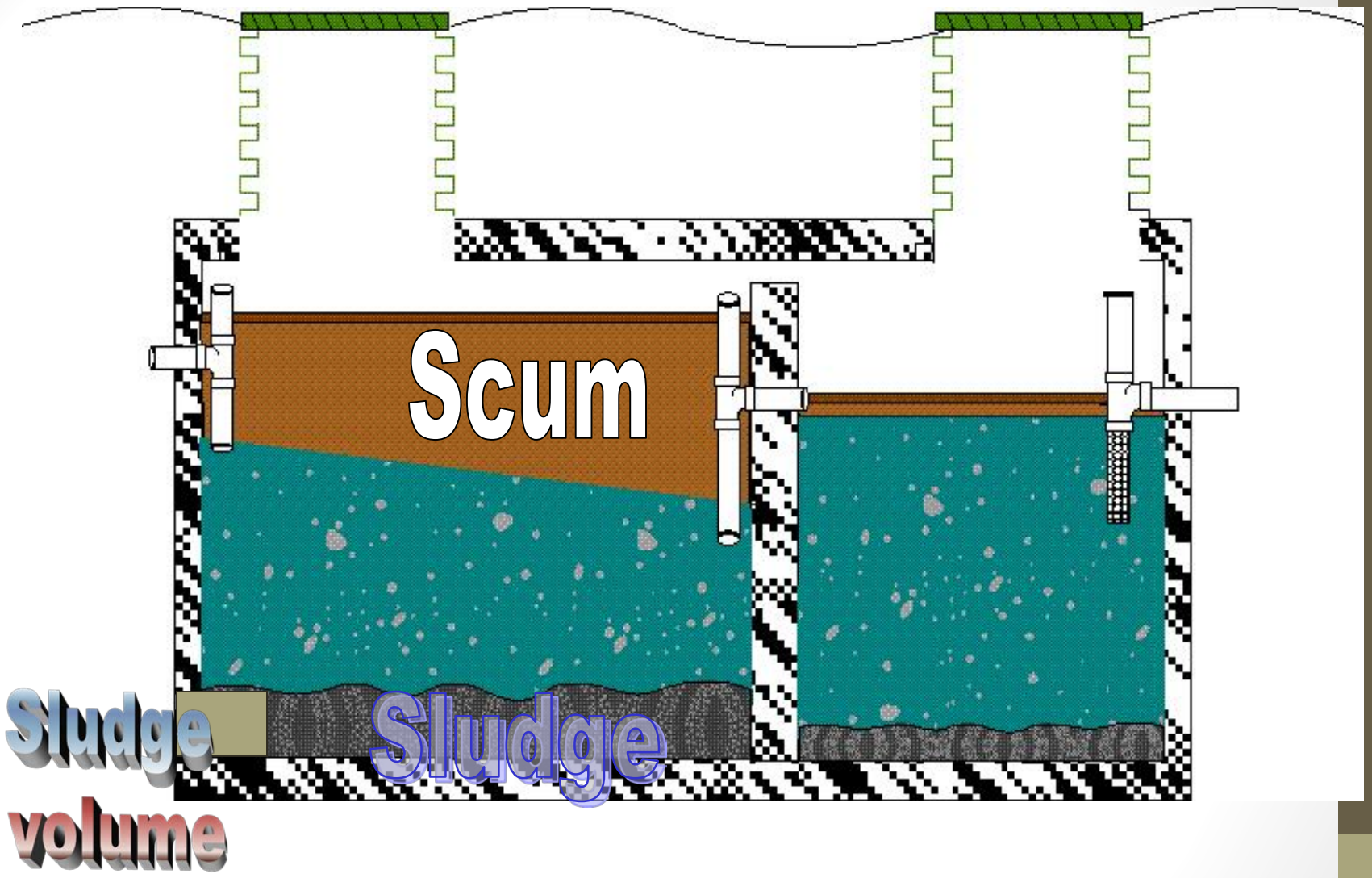
- Microbe health
- Detention time:
  - High velocity into tank
  - Highly variable flow patterns
    - High or low
  - Lack of tank maintenance
  - Process wastewaters from water treatment devices

Environmental Effects on Microbes

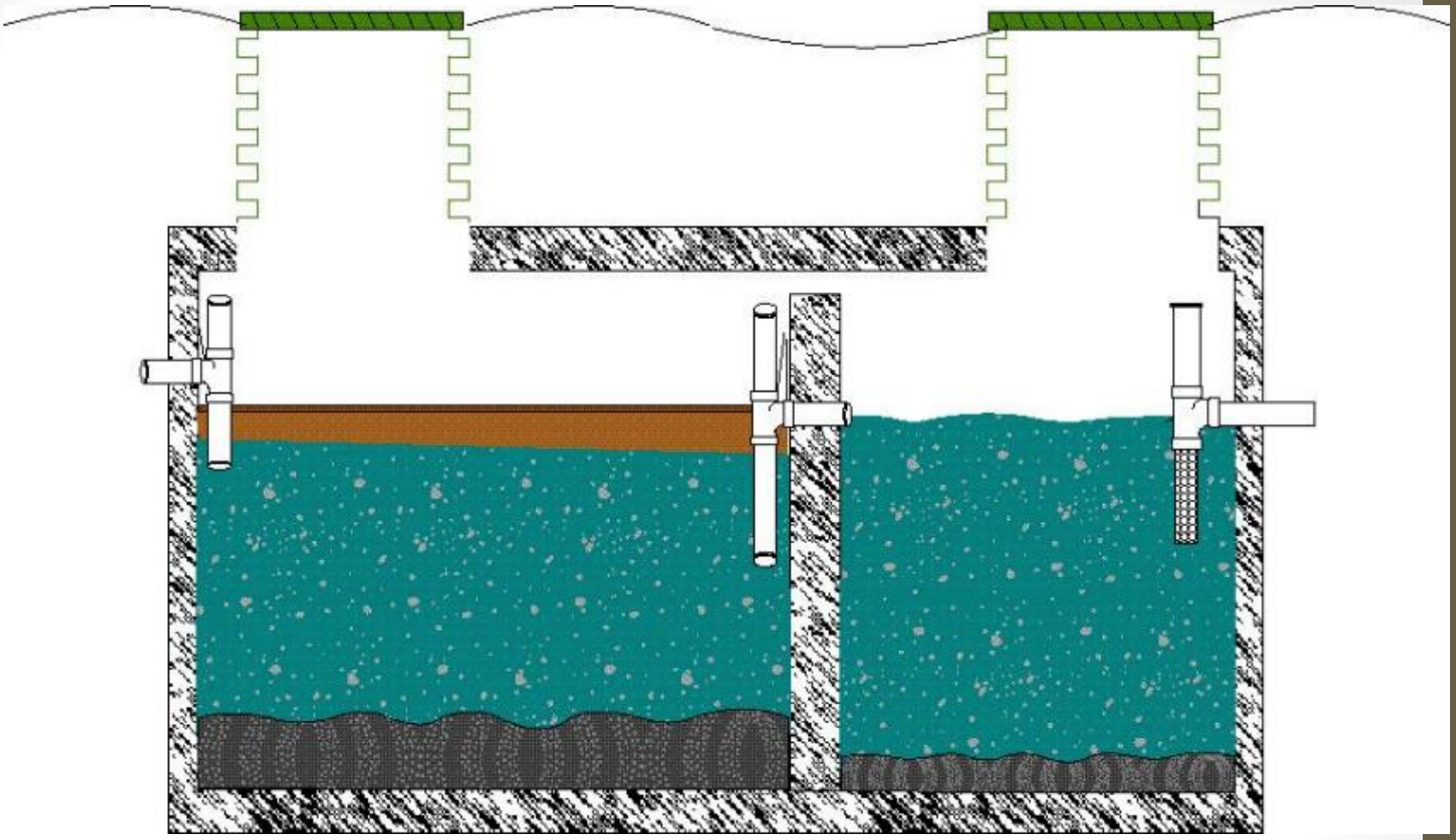
- Microbes need
  - Temperature must be life-sustaining
  - Steady supply of food to maintain stable microbial population
  - pH needs to be controlled
  - Limited biocides

Problematic Effluent Screens

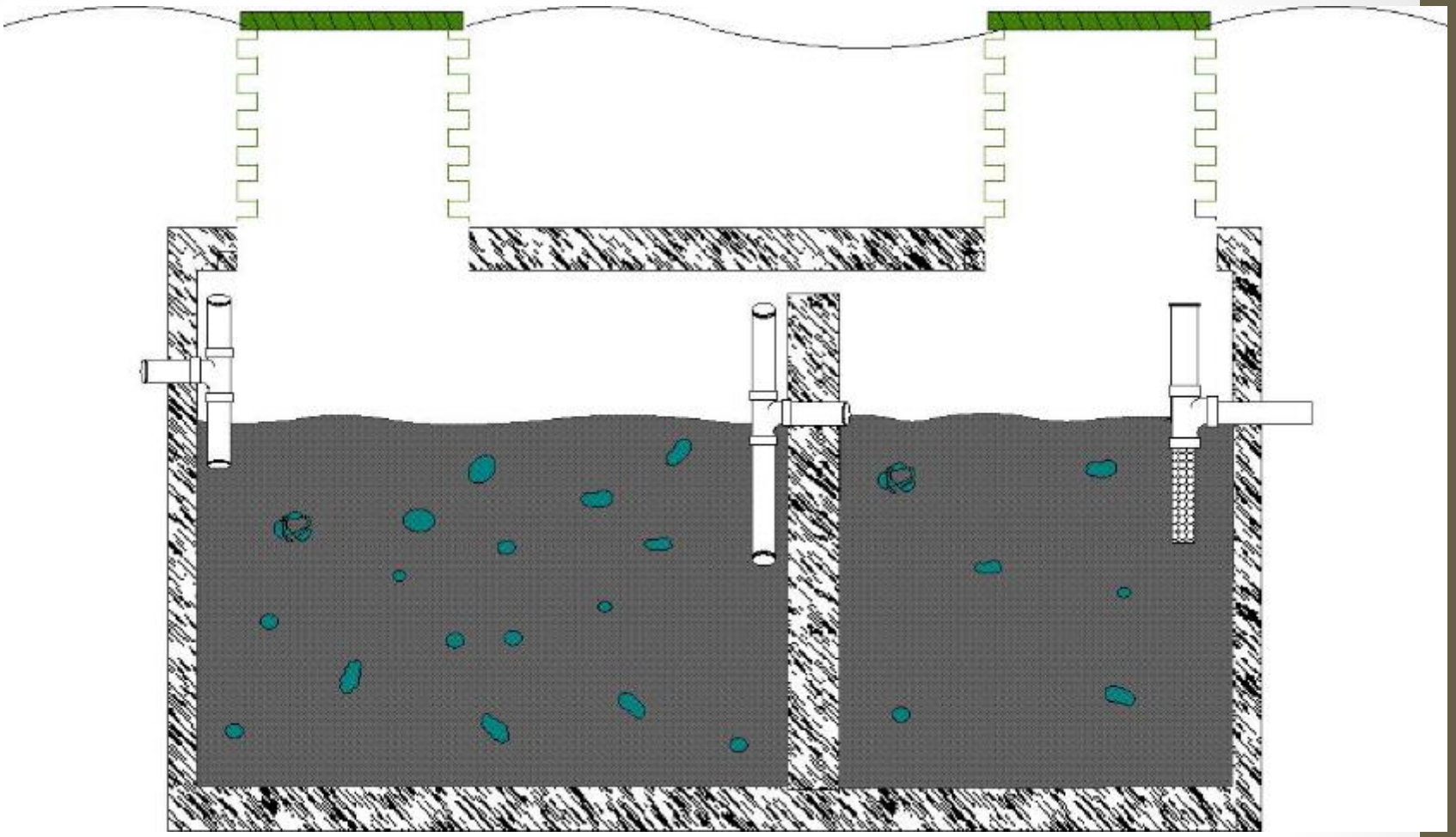
- The need for frequent cleaning is an indication of:
  - Hydraulic overloading
  - Organic over loading
  - Toxic loading



Healthy septic tank—before chemicals



Chemical reaction is starting



Bulking due to chemicals

Extra Water and Waste Producers

- Garbage disposal including many dishwashers
  - More food
  - More water
  - Slower to breakdown
  - Slower to settle
- Grinder pumps in the basement
- In home hobby/business

Solids

- Fats, oils and grease
- Toilet paper
- Non-biodigradables

Reasons for Low Flow

- Starving of bacteria
  - Vacation
  - Over designed
  - Under built
- Solutions
  - Zone system for low flow times
  - Seed system or feed?

Water Saving Devices

- Decrease the flow rate
- No effect on the overall organic load

Reasons for High Flows - Leaks

- Leaks
  - In home
    - Drips
    - A ½ gallon per minute leak results in 700 gpd!
  - In system
    - Leaks into tank/risers

Extra Water Sources

- Clean Water
  - Footing drains
    - Sump pumps
  - Roof leaders
  - De-humidifier
  - Ice maker
- Not Sewage
  - Condensate
  - Treated water
    - Pools
    - Hot tubs
    - Jacuzzis
  - Water treatment devices
    - Water softener
    - Iron filter
    - Reverse osmosis

Tanks Must be Watertight

- Exfiltration could release untreated sewage deep in the soil
- Infiltration may occur
  - Disrupt settling
  - Overload drainfield or downstream components

Possible Points of Leakage

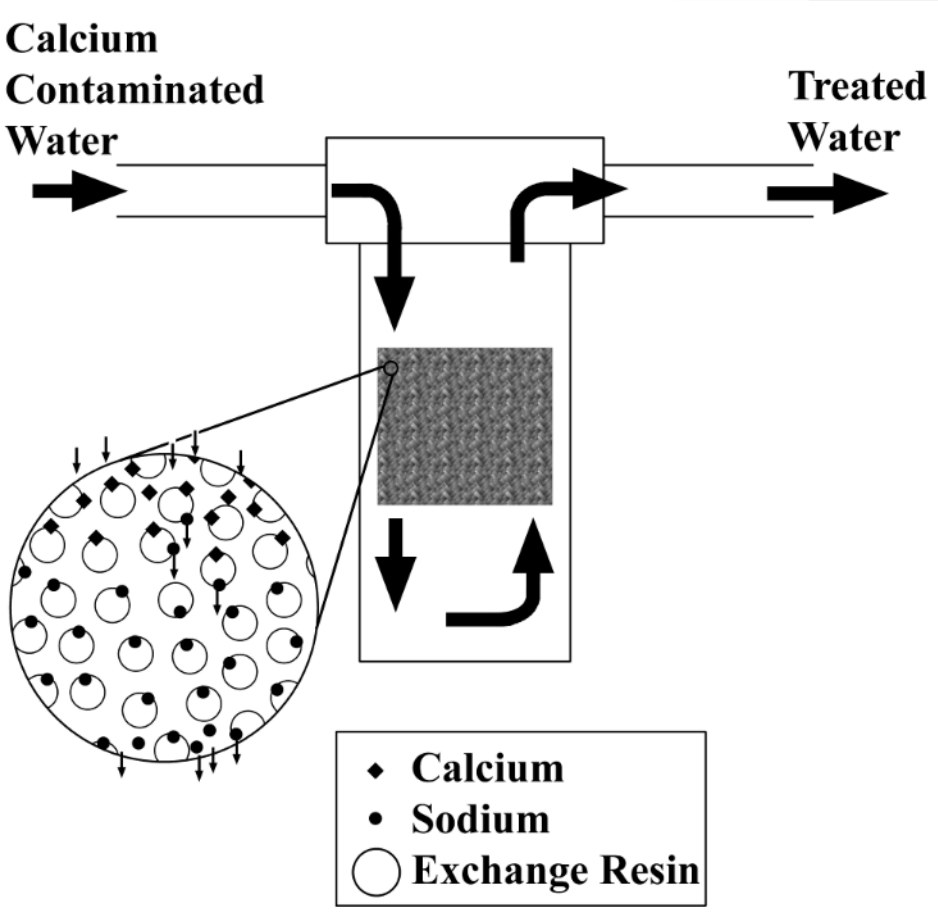
- Weep holes at the base of the tank
- Mid-seam joint
- Inlet/outlet pipe penetrations
- Top-seam joint
- Tank top/access riser joint
- Access riser/lid joint
- Any damaged, improperly-formed location or area where material is too thin.

Water Treatment Devices

- Water Softener
  - Salt- Concrete
  - Scum- Separation
  - Additional water
    - On demand regeneration better
  - Softener misuse and malfunctions
- Iron Filters
  - Change iron from dissolved to solid
  - Results in iron accumulation in tank
  - More pumping needed
  - Unknown impacts to system
  - Large amount of back

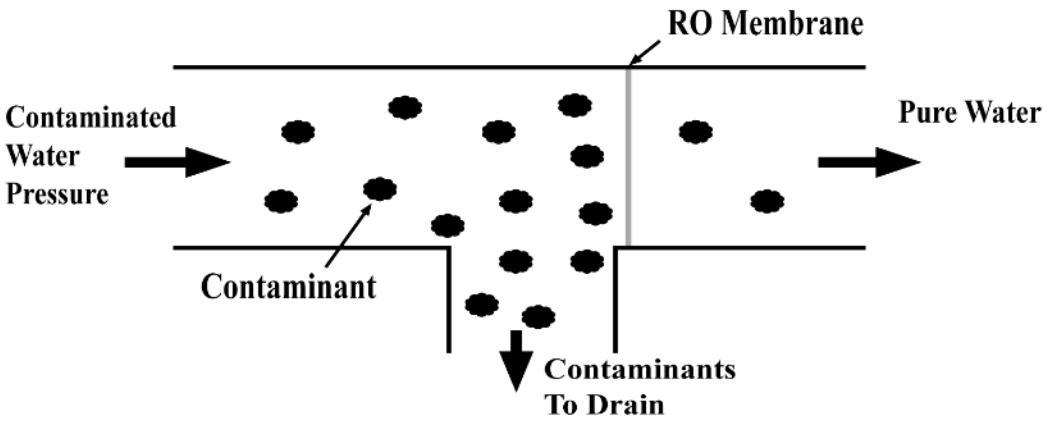
Water Softeners

- Ion exchange device using a resin
- Ions in raw water exchanged with regenerant ion

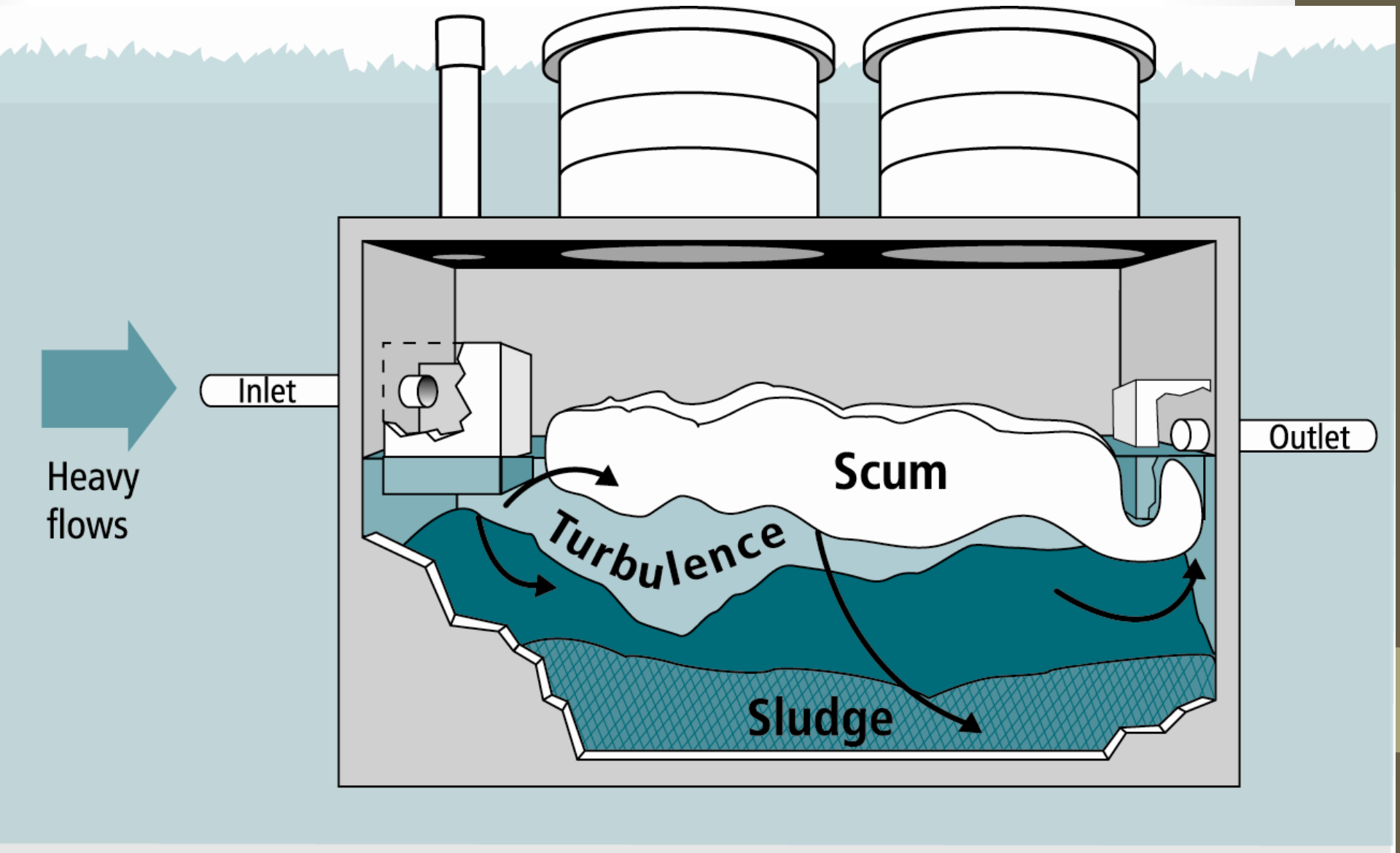


Reverse Osmosis

- Point of Use
  - Under the sink
  - Lower volume
- Point of Entry
  - Whole house system
  - Greater volume
- Ranges from 2-4 gallons wasted per 1 gallon purified



TURBULENCE FROM HEAVY USAGE



High Flows – Mixing of Tank

- Reasons
  - Leaks/clean water
  - Peak use
  - Pumping to tank
  - Elevation difference
    - Upstairs laundry or large bath tub

Mitigating High Flows

- Solutions
  - Control usage
  - Time dosing
    - Controlling loading
    - Timer control
  - Increased tank capacity
  - Effluent filter

Tank Start-up with New Systems

- Toxic tank
- Cleaning Chemicals
- Construction Chemicals
- Other Outcomes
  - First time on septic- Education on use
  - Understanding the need for maintenance

Baffles

- Plugging of baffles indicates use issues or construction problems
- Designed to only let water in clear zone to pass
- Indicates system upsets
- Three distinct zones in septic tank should be present

Effluent Screens

- Placed in outlet of septic tank for additional filtration
- Remove solids
- Requires periodic cleaning
- The need for frequent cleaning is an indication of overloading

Odors

- Can get caught under roof over hangs
- Wind patterns can limit odor traveling away from home
  - Valleys, forested areas, low areas, etc
- Vent can be extended
- Carbon filters can be added on end
  - Be careful of winter use
  - Last 1-5 years

Outdoor Odor Problems

- Odors near septic tank
  - Manholes and riser secure?
    - Cover with soil or mulch
    - Seal with weather stripping
  - Sick septic tank?
    - Excessive chemical use in tank or lack of maintenance can effect odor
    - Pump tanks, reduce chemical usage

Odors Continued

- Odors near pump tank
  - Tank lid secure
  - Electrical conduit sealed?
- Odors near soil treatment units
  - Surfacing effluent
  - Vent pipe open

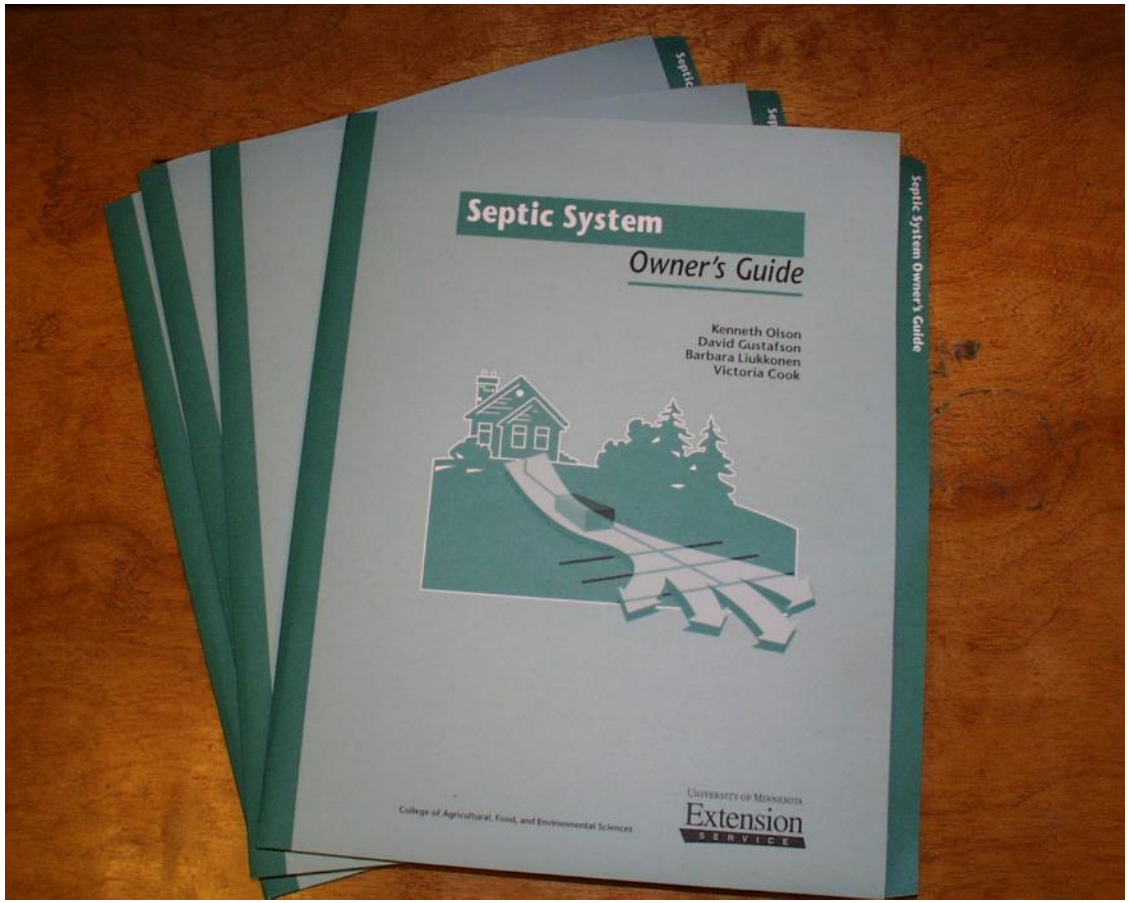
Venting

- Vents by septic tanks may be required
  - No adequate way to vent back through plumbing stack
  - Release hydrogen sulfide and methane naturally produced in septic tank

Odors in House?

- Dry traps
- Bad seal on grinder/ejector pump in home
- Blocked plumbing stack
- Improper venting
- Sewage back-ups

Educational Materials



Questions