# Installation Considerations in Field Repairs

FIRST DISTRICT HEALTH UNIT
Regional Public Health Agency

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## So you get the call…

- 3 major sources of problems
  - Use-related
  - Construction/materials-related
  - Soils-related
- Compile existing site information before visiting site
  - Existing permit file
  - Soil survey

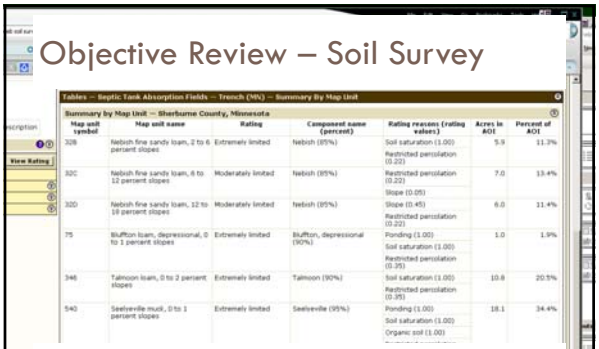
## Design/permit Complete?

- Review the permit file for completeness
  - Soil boring log form
  - Soil texture and structure match soil sizing factor
  - Separation from limiting condition(s)
  - Downsizing
  - Timing of field work
  - Percolation tests
  - Match soil survey report

## Does anything on the permit not make sense?

- Any discrepancy
- Potential for problem with system
- Conduct field investigation to explain
  - Complete soil boring log form
  - Percolation tests may also be necessary

## Objective Review – Soil Survey



- Official record copy soil survey is online
- websoilsurvey.nrcs.usda.gov

## What is the problem?

- System backing up into home
  - Excessive Ponding in media
  - Surfacing/ponding over system
- Mound bleeding at toe

## Excessive Ponding in Media

Soil properties to investigate:

- Construction materials
  - Rock
  - Topsoil cover
    - Too fine limits air diffusion
    - Organic-rich too much infiltration
  - Sand
- Vertical separation to limiting condition
- Fill soil
- Soil textures below system

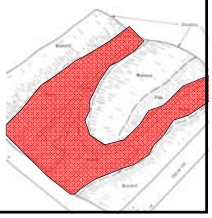
## Surfacing/ponding over system

Soil properties to investigate:

- Surface drainage
  - Downspouts
  - Concave areas, Swales
- Thickness of topsoil cover
- Texture of topsoil cover
- Texture below media
- Vertical separation to limiting condition
- Construction materials
  - Clean/durable rock
  - Trafficking/compaction

## Mound Bleeding at Toe

- Fill soil
- Compacted original soil surface
  - Percolation tests
- Smearing during scarification
- Soil texture of original soil
- Vertical separation to any limiting condition
- Landscape position - concave
- Washed sand
  - Jar test
- Loamy cover
  - Thickness
  - Loamy textured
  - Crowned



## Need for Soils Work

- Any system issue can be soils-related
- If you want to completely solve the problem, a soil investigation needs to be conducted

## No Obvious Soil Issues

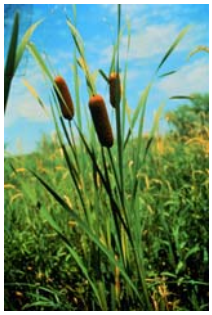
- Be sure that a soil boring log has been completed, including landscape description
  - Any soil/site property can to (or be part of) a system failure
  - Compaction or fill?
- Soils are only 1 aspect of a failure, but are likely easier to diagnose
- How the system is used (monitor, questioning, event counters, fixtures, habits, etc.)
- Materials and construction practices (reconstruct site conditions, climatic conditions, materials, site sensitivity, etc.)

## Evaluate Surface Water

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

## Vegetation

- Wetland
  - Broken
  - Missed in design?
- Lush?
  - Change or Different
  - NOT Greener



## Surfacing Effluent

- This level of ponding is *NOT* acceptable
- Indicates a drainfield failure
- Is a direct public and environmental health threat
- Needs prompt corrective actions

This lateral begs to be broken off

## Inspection of Drainfield Base

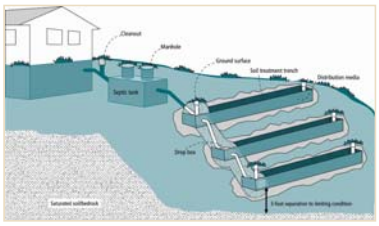
- Before you do any other component work on the site – look at drainfield base
- Avoid transferring a larger than normal load of effluent to the drainfield
- Inspect and comment on the current condition of drainfield base
- Is odor or biomat present ?

## Use

- Checking for ponding
- Check order of ponding [1-2-3….]
- % of System used

## Gravity

- Sequential
  - Drop boxes
- Parallel
  - Distribution boxes



## Open Distribution or Drop Boxes

- Even
  - Level
- Material in the Box
  - Solids?

## Things to Check

- Right direction
  - Downhill
- Pumping by-pass
  - Operate pump to see flow
    - 15-45 GPM
- Trench loading depth
  - Use the Whole thing

## Troubleshooting Mounds

- Correct size
  - Square footage
  - Amount of sand
  - For use – hydraulic and organic
- Smeared or compacted
- Clean material
- Even distribution
- Proper cover material

## Toe Failure

- Incorrect soils call and design
- Construction problems
- Hydraulic overload and drainage

## *Troubleshooting*

- *Disaster*


## Surfacing Effluent Out of the Top

- Ponding in the Rock Bed
  - Too much water
  - Too much BOD
  - Dirty materials
    - Sand
    - Rock
- Distribution plugging

## Disaster

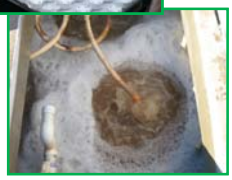
## Browning of Mounds


## COVER

- 12" min.
- Mounded
- Grow Something
- Spring protection

## Problem STAs Technology Applications

- Reduce organic levels
  - Cleaner effluent may be easier for soil to accept
- Residual oxygen in effluent
  - Can help reduce biomat
- Time dosing with some units to spread out loads



## Problem STAs

- Rest the system
  - Zone off a section of the soil treatment area
  - Pump the tank and system (i.e. operate as a holding tank)
- Add compressed air and 'beads' to open up the soil
- Re-build and replace the distribution media in the system
  - Typically a mound or sand fileter

Removing Contaminated Sludge

## Soil Treatment System Problems

- Biomat too thick?
- System is struggling to accept effluent
  - Surfacing
  - Excessive ponding

## Options

- Shock load
  - One time addition
  - Wait and see if it comes back or clean out and start over
- Short-term usage (<1 year)
  - Monitor tank
  - Holding tank if very upset
  - Manage
- Long term usage
  - Monitor
  - More maintenance needed?
  - Remediation?
  - Design in advanced treatment?

## Myths and Additives

- Tanks typically do not require additives
  - No need to "start" a tank with a dead chicken
  - Adding yeast, while harmless, is not needed
  - Commercial additives are normally not needed
- Beware of any additive that suggests it will reduce pumping frequency
  - Normal function means some accumulation
    - Nonbiodegradables – e.g. synthetic fabric lint
  - Solids may be washed out to next downstream treatment component
  - Independent research shows no benefit

## What is Remediation?

- A maintenance activity used to increase the acceptance of effluent to soil treatment systems must:
  1. Not be used on a system failing without separation to seasonal saturation
  2. Not cause preferential flow through the bottom of soil treatment systems
  3. Be conducted by an appropriately licensed business

## Why? Remediation Performance Standards

- Restores or improve the infiltration rate into and through the soil below the infiltrative surface
  - Bottom of trench or bed
  - Ground surface of at-grade
  - Media/sand interface in mound
- Does not result in harm to the system

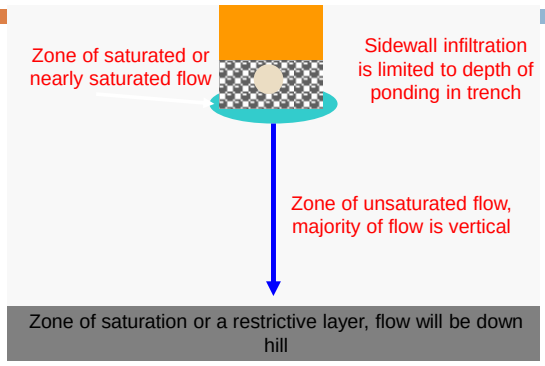
## When Can it Be Applied?

- Biomat too thick?
- System is struggling to accept effluent
  - Surfacing
  - Excessive ponding

## Biomat Review

- Effluent from septic tank is fairly strong
- Will cause a clogging mat to form
  - Suspended solids
  - Organic material (food for bacteria)
    - Bacteria growth
    - Bacteria by-products
  - Organic material (recalcitrant)
  - Chemical precipitates

## Flow From an Infiltrative Surface



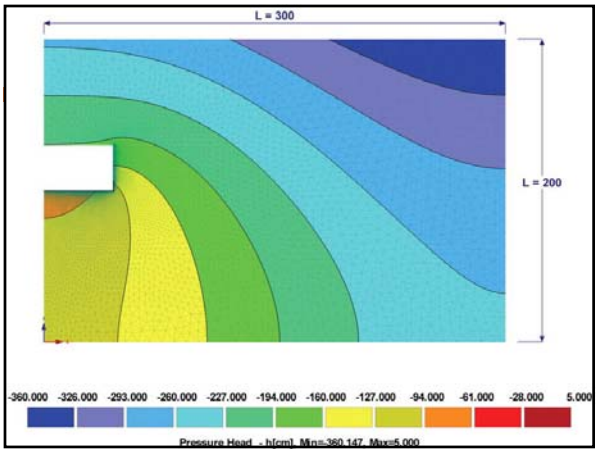

## Biomat Influences

- System: Food
  - Hydraulic loading
  - Organic loading
- Site: Oxygen
  - Soil type
    - Texture
    - Structure
  - Separation
  - Depth
  - Resting
    - Pressurization
  - Geometry [Width]



## Recent Research Findings

- Biomat restricted the flow by 10 to 1,000 times
- Heavier loading = more restrictive biomat
- Ponding in clay loam resulted in 30% of flow over the “lip” of the sidewall biomat




## Biomat composition

- 70% was humic substances (more resistant to breakdown – material found in stable topsoil)
- 30% was polysaccharides (more easily broken down)
- If had just a little bit of oxygen at/near biomat the organic matter increased by 4 to 8 times over total anaerobic conditions


## Evaluate - Depth Of Biomat

- Determines if the system is recoverable
- Determines the length of time for recovery
- Determines the degree of recovery

## Why Does a Biomat Get Too Thick?

1. Physical processes:
   - Solids in wastewater
   - Fines in backfill or drainfield rock are trapped
   - Surface soil can be compacted during construction

## Why Too Thick?

2. Biological processes:
   - Masses of microorganisms collect at the infiltrative surface

## Why Too Thick?

3. Chemical processes:
   - Waste products of microbiological metabolism accumulate

## When? Identifying the Problems & Solutions

- Determine factors that contributed to failure
- Need to check them all
- Need to fix them all
- Be careful
- Troubleshooting checklist on our website

**FAILURE ANALYSIS**

## Failure Analysis **Checklist**

- Number of occupants
  - Adults, teenagers, children
- Medical conditions and medicine use
- Use of cleaners, chemicals and other antimicrobials
- In-home businesses
- Clean water additions

## Failure Analysis Checklist

- Age of system
  - 1 to 2 years
  - 6 years
  - $15^{+}$ years

- Management
  - Long term and date of last pumping
- Effluent screen present and if so cleaning interval

## Failure Analysis Procedure

1. Review of:
   - The permit - system design, system component settings, and system component locations
   - Monitoring and maintenance the system has received (or not received) throughout its life
2. Determine actual wastewater flow:
   - Comparison to the design values
   - Hydraulic loading rate
   - Organic loading rates

## **Measuring Actual Flows**

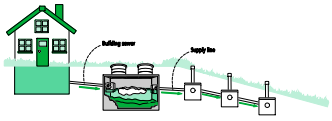
- Measuring on pump
  - Elapsed time meter
  - Cycle counter
  - Best way
- Water meter
  - Subject to source water challenges & reading by owner
- Number of people living in home
  - 75 gallons per person
  - Not always accurate

## Procedure Cont'd

3. Inspect and verify performance of all system components
4. Review of the soils to confirm that the soil descriptions in the design are accurate and system is sized appropriately
5. Determine of the factor(s) that contributed to the failure

## Factor Analysis

- Hydraulic overload
- Organic overload
- Improper design
  - Soils identification – texture and limiting condition
- Poor workmanship



## Hydraulic Overload

- User
- System
  - Components
  - Surface water

## Organic Overload- High Strength Waste (HSW)

- National glossary definition of HSW

Effluent from a septic tank or other pretreatment component that has:

- $BOD_5$ > 170 mg/L,
- and/or TSS > 60 mg/L,
- and/or (FOG) > 25 mg/L and is applied to an infiltrative surface

## Soils Issues - What Can Be Wrong?

- Sizing
  - Texture/structure
- Separation:
  - Limiting Condition
    - Bedrock
    - Redox features
- Construction techniques

## Poor Workmanship

- Materials
  - Dirty rock
  - Dirty sand
- Watertightness
- Smearing/compaction

## Rock and Sand

- Typically must be washed to free of fines (silts and clays)
- Rock should have <1% by weight
- Sand should have < 5% by weight
- More then that causes plugging of pores

## Watertightness

- Critical access points:
  - Inlets/outlets
  - Seams
  - Risers
- Methods:
  - Cast in place boots and risers
  - Proper application of mastic and other sealants

## Who?

- Property owner?
- Professional with necessary knowledge and skills to provide a diagnosis of factors that may have contributed to system malfunction

## How? Remediation Plan

- Assessment – results of failure analysis
- Action - including site-specific mitigation measures for containing and/or decontaminating sewage surfacing areas

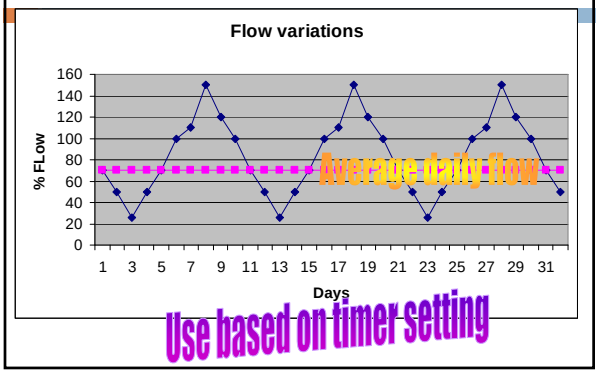
## Solutions: Lowering Hydraulic Loading

- Reduce usage
  - System owner uses less water, eliminate water softener, iron filter, add low flow fixtures and appliances, fix leaky toilets and faucets, etc.
- Time dosing with surge storage
- Holding tank for peak events

## Flow Equalization Systems

- Makes the flow introduced to the treatment system more consistent.
- Flow equalization is important if
  - The average flow is ≥ 70% of the design capacity
  - Water use habits or facility operations are variable- Example church only open on Sun.
  - Frequent peaks exceed system capacity
    - Wash day: cleaning service

## Effects of Flow Equalization

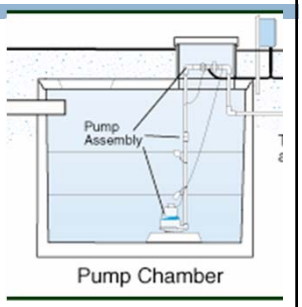



## Benefits of a Flow Equalization System

- Monitoring of flows from the surge tank may help detect
  - major changes in flow patterns
  - leaking effluent
  - clogging orifices
- Provide storage and spread out water delivery after a power outage.
- Regular feeding the hungry population of microbes that are used for treatment.
- Regular resting

## Hold & Dose

- Some chemical products must be contained in a separate tank and introduced into the system in small doses




Time dosed to treatment train

## Solutions - Lowering Organic Loading

- BOD
  - Recoverable
  - Eliminate garbage disposal or other v equipment or activities
  - Use composting toilets to provide hydraulic and organic discharge reductions
  - Add a treatment product to reduce organic loading

## Lowering Organic Loading

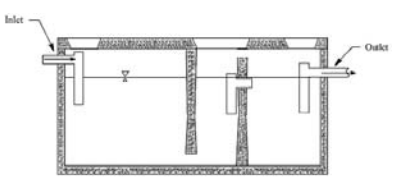
- TSS
  - Organic – recoverable
  - In-organic
    - Difficult to recover
    - Lint, soil, others
  - Plugging of soil pores
  - Terra-lifting?

## Lowering Organic Loading

- FOG
  - Slow to fix
  - Fat and oil only
  - Grease is toxic
  - Requires a lot of $O_2$
  - Future Eliminate
    - Capture in tanks
- Commercial kitchens
- Evaluate
  - Detention time
  - Flow pattern
  - Temperature
  - Degreasers
- Add grease traps

## Grease Trap

- Collects fats, oils, and grease
- Baffles extend lower into tank than septic tank
- Temperature is a key factor




## Grease Trap

- Design
  - Minimum of 24 hours (1 day) of hydraulic retention time is recommended, but can be up 4 days or more
  - Estimate 70% of total design flow if actual kitchen flows are unavailable
  - Outlet baffle should extended to 50 - 70% of liquid depth
- Needs frequent pumping
  - Evaluated quarterly at a minimum to determine if cleaning/pumping is needed

## Technology Applications

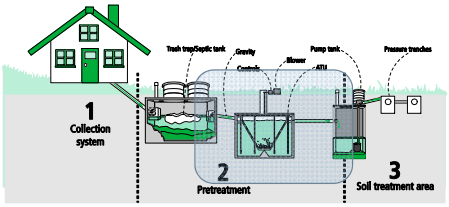
- Reduce organic levels
  - Cleaner effluent may be easier for soil to accept
- Residual oxygen in effluent
  - Can help reduce biomat
- Time dosing with some units to spread out loads

## Advanced System Purpose

- "Pretreat" wastewater so downstream component(s) can function more reliably for longer terms
- Move much of the treatment from the natural soil conditions – can not forget about dispersal
- Generally provide high quality effluent ~ secondary treatment or better

## System Type/Classification?

- Many solutions change system type
- Permitting issues?

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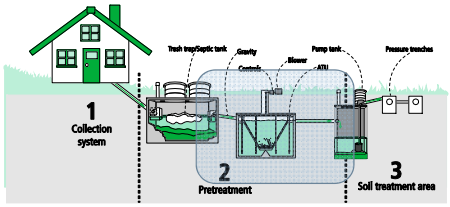


## Other Potential Solutions

- Rest the system
  - Zone off a section of the soil treatment area
  - Pump the tank and system (i.e. operate as a holding tank)
- Add compressed air and 'beads' to open up the soil
- Re-build and replace the distribution media in the system
  - Typically a mound or sand filter

Removing Contaminated Sludge

## Management Plan

- For a MINIMUM of one year the system should be monitored to determine if the malfunction is resolved
- Measurements to make and record include:
  1. Whether the symptom of malfunction (surfacing or backing up) stops
  2. Depth of effluent ponding in the monitoring ports
  3. Wastewater flow

## Is a Permit Required?

- Yes, most of the time
  - Repair
  - Adding a treatment component
- Either way this is a GOOD Idea
  - Tracking systems
  - Tracking fixes
  - Informing owners

## Operating Permit

- How long practice going to occur and how often monitored
- Who is responsible for doing the monitoring
- Who is responsible for reporting to local unit of government
- Documentation of an agreement between the Maintainer/Service Provider and system owner

## What if It Doesn't Work?

- Owner of the system must notify local permitting authority
- Actions include:
  - Discontinue the use of the remediation practice
  - Potential interim use of another remediation practice
  - Temporarily pump and haul
  - Replace the system

## Questions

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