Understanding Wastewater Treatment Systems

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First!

The Law of “Conservation of Mass”:

“Matter is neither created or destroyed”

Always remember: when you flush, it doesn’t disappear!
To Centralize or Decentralize? That is the question!

Centralized Treatment System

Wastewater Treatment Plant
Decentralized Treatment Systems

On-Site Wastewater Treatment (Septic Systems)

Large Community Systems
Centralized vs. Decentralized

- Discharge system
- Capital intensive
- Personnel intensive, but labor efficient
- Provides higher degree of treatment

- Non-discharge system
- Less capital
- Less labor, but still needs maintenance (Who maintains?)
- Uses plant /soil soil system for treatment
Centralized System Treatment

- Large Debris: screened and sent to a landfilled
- Grit Removal: collected and sent to a landfill
- Biological Treatment: microbes use organic matter to grow
- Clarifiers: remove floating oil & grease and biosolids
- Biosolids: Treated and stabilized sludge containing microbe cells
Centralized Wastestreams

Treated Wastewater

Sludge or Biosolids
Decentralized Wastestreams

Effluent

Sludge
Septic Tanks
# What Are We Talking About?

## Septic Tank Performance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration (mg/L)</th>
<th>Percent Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD&lt;sub&gt;5&lt;/sub&gt;</td>
<td>200 - 290</td>
<td>40 - 50 %</td>
</tr>
<tr>
<td>TSS</td>
<td>200 - 290</td>
<td>50 - 70 %</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>35 - 100</td>
<td>20 - 30 %</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>18 - 30</td>
<td>30 %</td>
</tr>
<tr>
<td>Fecal coliforms (#/L)</td>
<td>10&lt;sup&gt;8&lt;/sup&gt; - 10&lt;sup&gt;10&lt;/sup&gt;</td>
<td>?</td>
</tr>
</tbody>
</table>

BOD<sub>5</sub> - Biochemical Oxygen Demand; TSS - Total Suspended Solids
Natural Wastewater Disposal Systems

• Uses natural plant/soil processes to clean up wastewater.
• Recycling!
Plant/Soil System

- Soil organisms and plants – absorb nutrients, breakdown organics
- Soil chemical characteristics – hold metals
- Removing aboveground plants - removes nutrients
What Makes It All Work

- Protozoa
- Actinomycetes
- Mites
- Mycorhizzae
- Roots
What Makes It All Work!

Plants!

Annual Rye

Bermudagrass

Forests
What Makes It All Work!

Soil!

- Habitat (mixture of solid, water, and air
- Holds minerals and metals
- Acts as filter

Adapted from Tisdale et al, 1993
Soils
Natural systems affected by the environment

- Weather
- Insect pests
- Stresses
  - too much water,
  - not enough of certain nutrients
Effluent or Wastewater
Slow Rate Irrigation

Irrigation onto land to support vegetative growth, with *no direct discharge* to surface water
Spray Irrigation

Municipal, commercial, or cluster residential

Forest or crops (Bermudagrass/rye)

Forest less management, more land

How NOT to do it!
Spray Irrigation

With filtering and disinfection can be used to irrigate parks or golf courses.
Drip Irrigation

- Commercial or cluster residential
- Some surface drip lines, mostly buried 8-12 in.
- Have to have good filters for particulates
- Usually septic tank then ATU package plant
Drip Irrigation

- Anecdotal evidence:
  - Larger systems >10 acres tend to experience more problems
  - Shopping center systems tend to have more problems
Drainfields

Commercial, cluster residential, single residential

2,000 - 150,000 gpd

Septic tank and trenches
Overland Flow

Discharge system in which wastewater is treated as it flows down grass-covered slopes. Soils must have low permeability to minimize percolation.
Discharge system where wastewater treated by plant/soil system then discharged to stream.

Non-discharge system where treated water infiltrates or evaporates.
Constructed Wetlands

- Municipal, commercial, cluster residential, or single residential
- Septic tank or other treatment, then wetland
- Free water surface and vegetated submerged bed.
Choosing the Right System

**Site Characteristics**
- Waste strength
- Flows
- Soils
- Hydrology
- Geology
- Topography
- Sensitive areas

**Capital Costs**
- Land
- Equipment
- Construction
- Operating Costs
- Electricity
- Maintenance
- Periodic Cleaning
Who Maintains?

County?

Homeowners association?

Third party?

Need long-term planning.

May need long-term bonding for failures.
Who Maintains?

- **County** - Set up public utility & charge sewer fees
- **Third party utility** - Private entity set up as utility, Electric Membership Cooperative (EMC) provide this service in some areas
- **Homeowners Assoc.** - Harder to maintain
Public Education

Everyone should know the type of treatment systems they are on

AND things that create problems
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