An Assessment of the Performance and Management of Advanced Onsite Systems in Florida

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Onsite sewage systems in Florida

There are approximately 2.6 million onsite sewage systems in Florida
Florida Department of Health

Statewide rule implemented by 67 county offices
“Advanced Systems”

- Aerobic Treatment Units (ATUs)
- Performance-based Treatment Systems (PBTS)
- Innovative Systems
Management Levels

1. Homeowner Awareness
2. Maintenance Contracts
3. Operating Permits
4. Responsible Management Entity (RME) Operation and Maintenance
5. RME Ownership
How are these systems working?

- What are the options?
- How effective are they?
- How are systems working day-to-day?
- How are these systems perceived?
EPA Nonpoint Source Pollution program funding - Section 319(h)
Project Objectives

1. Inventory system number, types, and locations
2. Assess operational status of systems
3. Quantify reduced loading of contaminants from systems
4. Survey perceptions of user groups
5. Determine consistent assessment of systems
6. Identify best management practices
Project Objectives

1. Inventory system number, types, and locations
2. Assess operational status of systems
3. Quantify reduced loading of contaminants from systems
4. Survey perceptions of user groups
5. Determine consolidation or removal of systems
6. Identify best management practices
Where are the advanced systems?

There are approximately 12,000 advanced systems in Florida.
Review advanced system files

Select pure random sample from all systems
900 systems

Select additional systems as needed
14 systems

Determine subcategories to represent within the following categories:
- Extended aeration (88%)
- Combined media (7%)
- Fixed media (3%)
- Other (2%)

100 systems

Finalize sample population
629 systems random
86 treatment technology
Treatment technology manufacturers

- Consolidated: 27%
- Aqua-Klear: 15%
- Hoot: 11%
- Norweco: 11%
- Clearstream: 10%
- Delta: 9%
- Bio-Microbics: 4%
- H.E. McGrew: 4%
- Other (Combined Total of 14 Manufacturers with Total Under 100): 2%
- Acquired Wastewater Technologies: 2%
- American Wastewater: 2%
- Ecological Tanks, Inc.: 1%
- Jet: 1%
- Earthtek: 1%
- Other: 1%
Construction information

- Most for new homes
- 300 gallons per day (gpd) flow / 500 gpd treatment capacity
- 65% have drainfield sidewalls extending above natural grade

- Mineral aggregate, 28%
- Chamber systems, 24%
- Drip irrigation systems, 15%
- Multi-pipe rockless systems, 15%
- Other, 18%
Project Objectives

2. Assess operational status of systems
Sampling protocol

Three groups of measurements:

1. Initial system assessment
2. System operation evaluation
3. Sample analysis
Sampling team

- 50 systems visited
- 71 systems visited
- 120 systems visited
- 140 systems visited
- 166 systems visited
Initial system evaluation

- Power is on
- No sewage on the ground
- Aeration occurring
- Alarms are off
- Changes to site conditions
The exception!
## Vacancy and system operation
(all randomly selected visited systems)

<table>
<thead>
<tr>
<th>Occupancy Status</th>
<th>Switched off</th>
<th>Power indicator off</th>
<th>Aeration off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacant (n=89)</td>
<td>54%</td>
<td>54%</td>
<td>59%</td>
</tr>
<tr>
<td>Non-Vacant (n=445)</td>
<td>6%</td>
<td>17%</td>
<td>14%</td>
</tr>
</tbody>
</table>
## Issues for non-vacant systems

n=454 non-vacant systems based on permit review  
# of non-operational systems = 127 (28%)

<table>
<thead>
<tr>
<th>Reason for non-operational status</th>
<th>Number</th>
<th>Percent of total non-operational systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power switched off</td>
<td>54</td>
<td>43%</td>
</tr>
<tr>
<td>Power indicator off</td>
<td>79</td>
<td>62%</td>
</tr>
<tr>
<td>Aeration not working</td>
<td>73</td>
<td>57%</td>
</tr>
<tr>
<td>Sanitary nuisance</td>
<td>20</td>
<td>16%</td>
</tr>
<tr>
<td>Alarm issue</td>
<td>19</td>
<td>15%</td>
</tr>
</tbody>
</table>
Project Objectives

3. Quantify reduced loading of contaminants from systems
Sampling
# Sampling results

<table>
<thead>
<tr>
<th>Median</th>
<th>cBOD$_5$ (mg/L)</th>
<th>TSS (mg/L)</th>
<th>TN (mg/L)</th>
<th>TP (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influent (n=42)</td>
<td>95</td>
<td>66</td>
<td>45</td>
<td>7.9</td>
</tr>
<tr>
<td>Effluent (n=301)</td>
<td>5.5</td>
<td>19</td>
<td>30</td>
<td>7.5</td>
</tr>
<tr>
<td>% Removal</td>
<td>94%</td>
<td>72%</td>
<td>33%</td>
<td>6%</td>
</tr>
</tbody>
</table>
## Effluent standards

<table>
<thead>
<tr>
<th>Permitting Level</th>
<th>cBOD₅ mg/L</th>
<th>TSS mg/L</th>
<th>TN mg/L</th>
<th>TP mg/L</th>
<th>Fecal cfu/100 mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>120-240</td>
<td>65-176</td>
<td>36-45</td>
<td>6-10</td>
<td>NA</td>
</tr>
<tr>
<td>ATU</td>
<td>≤ 25</td>
<td>≤ 30</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Secondary</td>
<td>≤ 20</td>
<td>≤ 20</td>
<td>NA</td>
<td>NA</td>
<td>≤ 200</td>
</tr>
<tr>
<td>Advanced Secondary</td>
<td>≤ 10</td>
<td>≤ 10</td>
<td>≤ 20</td>
<td>≤ 10</td>
<td>≤ 200</td>
</tr>
<tr>
<td>Advanced Wastewater</td>
<td>≤ 5</td>
<td>≤ 5</td>
<td>≤ 3</td>
<td>≤ 1</td>
<td>Below Detection</td>
</tr>
</tbody>
</table>
## Treatment standard exceedances

<table>
<thead>
<tr>
<th>System Type</th>
<th>cBOD\textsubscript{5}</th>
<th>TSS</th>
<th>TN</th>
<th>TP</th>
<th>Fecal</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBTS (random)</td>
<td>37% (n=30)</td>
<td>50%  (n=30)</td>
<td>70%  (n=23)</td>
<td>28%  (n=18)</td>
<td>50% (n=4)</td>
</tr>
<tr>
<td>PBTS (other)</td>
<td>36% (n=22)</td>
<td>50%  (n=22)</td>
<td>93%  (n=14)</td>
<td>42%  (n=12)</td>
<td>88% (n=8)</td>
</tr>
<tr>
<td>ATU (random)</td>
<td>22% (n=267)</td>
<td>36%  (n=275)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>ATU (other)</td>
<td>14% (n=7)</td>
<td>25%  (n=8)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
Comparison of results aerating and non-aerating systems

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent n=42</th>
<th>Aerating n=237</th>
<th>Non-Aerating n=42</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Result</td>
<td>% Removal</td>
<td>Result</td>
</tr>
<tr>
<td>cBOD₅ (mg/L)</td>
<td>95</td>
<td>4.6</td>
<td>95%</td>
</tr>
<tr>
<td>TSS (mg/L)</td>
<td>66</td>
<td>18</td>
<td>73%</td>
</tr>
<tr>
<td>TN (mg/L)</td>
<td>45</td>
<td>29</td>
<td>36%</td>
</tr>
<tr>
<td>TKN (mg/L)</td>
<td>45</td>
<td>4.9</td>
<td>89%</td>
</tr>
<tr>
<td>TP (mg/L)</td>
<td>7.9</td>
<td>7.3</td>
<td>7%</td>
</tr>
</tbody>
</table>
Field screening of samples

• Option to perform in situ sample screening
• Saves expense of sample analysis
• Results were favorable for:
  • Apparent color & turbidity (cBOD$_5$ & TSS)
  • Nitrate (nitrate+nitrite)
  • Ammonia (TKN)
Variability of performance

- Repeat visits to sites
- Influent and effluent results stay within a factor of two
- Variations in loading influence both influent and effluent
- Variability does not affect treatment effectiveness estimates
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Survey of stakeholders

- Homeowners
  - 3,800 surveys sent
  - 660 completed surveys (17%)
  - Most from full-time residents with the system
  - Most systems served less than 4 people
- Maintenance entities, installers, engineers, manufacturers
- Florida Department of Health at County Offices
Homeowner reported problems

Most were mechanical:

- Pump failures
- Electrical problems
- Faulty alarms
- Bad motors
Homeowner satisfaction

How would you describe your overall satisfaction with your advanced onsite sewage system (septic system)?

- 38% Very satisfied
- 41% Satisfied
- 10% Dissatisfied
- 11% Very dissatisfied

Florida HEALTH
Overall perception of treatment performance

No Basis to Judge
- Engineers
- Maintenance Entities
- Installers
- Regulators

Poor
- Engineers
- Maintenance Entities
- Installers
- Regulators

Fair
- Engineers
- Maintenance Entities
- Installers
- Regulators

Good
- Engineers
- Maintenance Entities
- Installers
- Regulators

Excellent
- Engineers
- Maintenance Entities
- Installers
- Regulators
Project Objectives

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Permitting violations requiring enforcement (n=262)

- Expired Maintenance Agreement: 47%
- Expired Operating Permit: 39%
- System Not Working Properly: 9%
- Failure to Conduct Inspections: 3%
- Sampling Not Performed: 1%
- Other: 1%
Current paperwork +

Regular inspections =

Satisfactory system operation =

Sample results meet standards
Monitoring protocol

• Up-to-date paperwork
• Field evaluation to check:
  • Power/on
  • No alarms on
  • Aeration on – bubbles and mixing
  • No sewage on the ground
• Good as-built drawing: show sample location
• Easy access to treatment units
• Clear and consistent sampling requirements
• Regular inspections
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What is a “best” management practice?

1. Complete, accurate, and current documentation
2. System operating conditions
3. System sampling results
4. User group recommendations
Major categories of BMPs

1. Recordkeeping practices
2. System maintenance practices
3. Enforcement practices
4. Fiscal practices
5. Communication practices
Recordkeeping practices

1. Central data location
2. Complete and accurate system file
3. Recording sample/performance information
4. Synchronization between data sources
5. Online billing system
System maintenance practices

1. Increased homeowner awareness/education

2. Statewide standardized form with maintenance and inspection requirements

3. Quality maintenance inspections performed routinely

4. Access to system interior and monitoring locations
System maintenance practices (continued)

5. Access to appropriate equipment for inspections
6. Sufficient access to resources
7. Clear monitoring/sampling requirements
8. Notification of system malfunctions
9. Consistency between regulator and maintenance entity
10. Keep track of vacant properties
Enforcement practices

1. Effective, standardized, and consistently applied enforcement procedure
2. Document systems in property records
3. Consistent pre-notification for payments
4. Standard timeframe for non-compliance letters
5. Build relationships between regulators and local government
6. Simplify the current rule
Fiscal practices

1. Ensure adequate staffing
2. Reduce cost of systems
3. Adjust payment schedules
   • installment billing
   • automatic payments
Communication practices

1. Training and education for all user groups
2. Open communications between user groups
Recommendations

1. Continue analyzing data

2. Implement database and website enhancements

3. Develop statewide standardized form

4. Evaluate low cost and effective nutrient reduction technologies
Recommendations (continued)

5. Develop a homeowner awareness and education campaign

6. Select a pilot county to implement the best management practices

7. Standardize enforcement procedures

8. Conduct workshops to discuss BMPs
What’s next?

Florida Department of Health Research Review and Advisory Committee
Florida Onsite Sewage Nitrogen Reduction Strategies Study

Study cost-effective ways to reduce nitrogen from onsite wastewater treatment systems

Original image source:
http://www.bgs.ac.uk/science/landUseAndDevelopment/images/urban_geoscience/suds/soakaway.jpg
Thank you!
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http://www.floridahealth.gov/healthy-environments/onsite-sewage/research

Division of Disease Control & Health Protection

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