Performance and Reliability of Decentralized Wastewater Infrastructure

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Status of small community wastewater infrastructure in the United States (using the State of Iowa as an example)

- 739 public treatment wastewater treatment systems (as of 2005)
- Population served by those systems: 76% (legacy of the Clean Water Act)
- Number of villages needing sewage treatment: 740
- Conclusion – Only half of the needed treatment systems have been built!

What do un-sewered communities in the US lack? (using the State of Indiana as an example)

- Small size: 78% are less than 100 homes, and 51% are less than 50 homes. (Small community problem)
- Financial situation: 90% of residents are "low to moderate income"; 48% are "low income). (Poor community problem)
- Self-governance: Small and poor communities typically have little experience in infrastructure management, so operating, maintaining and financially managing a wastewater system is new. (Lack of access to appropriate technical and financial skills)

Why does the US have this problem?

- Clean Water Act passed in 1972 (equivalent to EU Water Quality Framework Directive)
- Grant money allocated based on environmental impact (EPA Construction Grants Program)
- Environmental impact of large cities is the greatest
- Therefore the large cities got the money
- Then the US “ran out” of money for small communities (political, fiscal and social dimensions)
- Helping small communities is expensive; current government allocations address about 5% of the overall need

Two extremes of wastewater infrastructure

What triggers infrastructure change?

- Change in regulation or accountability standards (e.g. the old way does not work anymore)
- Access to capital financing (We have money to fix this problem)
- Belief that helping the village change is the right thing to do (leaving a positive legacy for the next generation) Economic, environmental (or both)
- A commitment that *being on the forefront* of these changes for my village/community helps ensure a place for my children in the future world (legacy and culture)

“Cascade of accountability” (within local regulatory frameworks)

Low

High

- Ignore the problem (no regulation or money available to help)
- “Disposable” systems (single-home systems with little or no regulation)
- Village systems that are “temporary” (interim solutions within a regulated environment awaiting regionalization)
- Permanent solutions meant to meet regulated outcomes (Can be centralized or de-centralized depending on the € available by the central government)

Wastewater Infrastructure Models

Population Density	Infrastructure Model	Technology Option	O&M Requirement
Lowest	Single Home	Onsite	No central management
	Small Village	Wetlands, Sand Filters, Willow, etc.	Regular (monthly)
	Large Village	Ponds	Periodic (semi-annual)
Highest	Regional	Mechanical treatment	Continuous

Which infrastructure model is best?

Depends on:

- Size
- Population density
- Land availability
- Climate
- Environmental regulations
- Management capacity of the community

Wastewater systems that seem to be the best suited for small communities

Ponds
(more land intensive)

Wetlands
(less land intensive)

What is the role of the community? (using the State of Minnesota as an example)

System Type	Number of Systems (2005)	Percentage in Compliance
City	State-wide	90%
Small Community (private management)	65	95%
Small Community (self-managed)	10	70%

What does the Minnesota data suggest?

- Small community-scale systems (such as ponds and wetlands) can be just as reliable as regional mechanical works, *provided that they are adequately cared for*
- Left to their own resources, small communities had less success in wastewater treatment (70% vs. 90%) compared to large mechanical works
- With adequate O&M support, small communities had greater success in wastewater treatment (95% vs. 90%) compared to large mechanical works

Policy Implications (getting the most benefit out of limited money)

- Choose mechanically simple systems such as ponds and wetlands (minimize O&M)
- Focusing on construction € only addresses part of the problem
- Any wastewater system will only function as well as the O&M needs of that technology is met
- Funding O&M (training, education and labor) is just as important as building appropriate treatment systems

Thank You!