Innovations in Rural Wastewater Management - Decentralized Approach

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Graham Knowles oversees the New Mexico Environment Department's (NMED), Community Services Group (CSG). The group's primary focus is on assisting communities to fund the development of sustainable water, wastewater and solid waste infrastructure solutions. For more than a decade, he worked with the U.S. Environmental Protection Agency directing decentralized wastewater infrastructure demonstration projects nationwide. Subsequently, he directed both the National Environmental Training Center for Small Communities and the National Small Flows Clearinghouse at the EPA sponsored National Environmental Services Center. Graham attended Plymouth College in the UK and holds a bachelor's degree from the University of South Africa. He also has graduate degrees in public administration and political science from West Virginia University. Graham is also a certified ISO 14000 Environmental Management Systems international lead auditor.

Good afternoon, I want to set the stage about innovations in rural decentralized wastewater management by looking back in order to move forward (Fig. 1). In the early 1990s, the United States Environmental Protection Agency (EPA) initiated a demonstration program to encourage the utilization of alternative, decentralized wastewater treatment technologies in an effort to better protect public health and the environment in small and rural communities. In 1996, Congress charged the EPA with developing a report focusing on three core concerns.

1. The ability of onsite/decentralized systems to make more efficient use of the limited funding available for wastewater infrastructure;
2. Whether or not these systems were appropriate alternatives to centralized treatment, and if so;
3. What actions EPA would take to implement the alternatives.

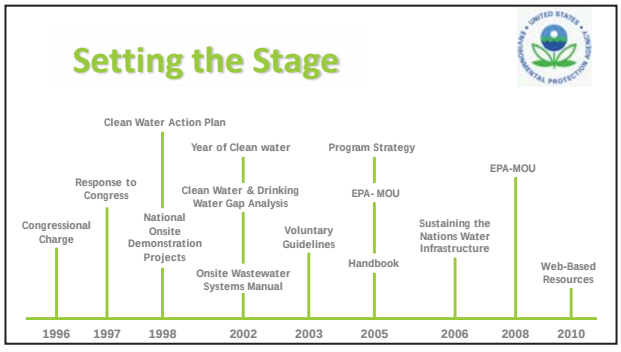

Figure 1. Federal timeline for wastewater management since 1996

A year later in its Response to Congress (1997), EPA concluded that onsite/decentralized systems could protect public health and the environment and that such systems typically tend to have lower capital and maintenance costs for rural communities. The report also noted that onsite/decentralized systems are appropriate for varying site conditions and are suitable for ecologically sensitive areas when adequately managed. However, EPA identified several barriers to the improved performance of onsite/decentralized systems. These included the lack of awareness about system maintenance requirements along with public misperception regarding system performance and capability. Other concerns centered on regulatory and legal constraints along with the lack of management and liability fears coupled with financial constraints. In conclusion, EPA observed that until significant progress toward eliminating these major concerns was made, it was likely that onsite/decentralized systems would continue to cause health and environmental problems, and would not be recognized as a key component of the nation's long-term wastewater infrastructure.

In 1998, states and tribes reported in their Clean Water Act section 303(d) reports that designated uses (e.g., drinking water, aquatic habitat) were not being met for more than five thousand water-bodies as a result of pathogens. It was also reported that almost five thousand water-bodies were impaired by nutrients. State and tribal reports clearly indicated that onsite systems

were a significant contributor of pathogens and nutrients to surface and groundwaters. Onsite wastewater systems were also contributing to an overabundance of nutrients in ponds, lakes, and coastal estuaries, leading to overgrowth of algae and other nuisance aquatic plants.

These threats to both the public health and water resources clearly underscored the importance of enabling onsite/decentralized wastewater management programs with both the authority and necessary resources to oversee the full range of onsite system activities—planning, siting, design, installation, operation, monitoring, and maintenance. This along with the Clean Water Action Plan was in harmony with an evolving decentralized wastewater infrastructure agenda in terms of the Clean Water Act (CWA) goals. In fact, throughout the 1990s this emerging research program saw several initiatives gathering data and conducting analytical studies focusing on onsite/decentralized wastewater issues.

In 2000, EPA published a draft version of its Guidelines for Management of Onsite/Decentralized Wastewater Systems as a practical reference for tribes, states, local governments, and community groups to strengthen their existing onsite/decentralized programs. These guidelines included a set of recommended program elements, activities, and model approaches that program managers could refer to in evaluating their management program.

Within two years EPA published a revised Onsite Wastewater Treatment Systems Manual (2002) to both complement as well as update the design manual published two decades earlier. The publication provided information for wastewater treatment professionals in both the public and private sectors and further explored developments in treatment technologies, system design, and long-term system management. In addition, the growing national emphasis on management programs that establish performance requirements rather than prescriptive codes for the design, siting, installation, operation, and maintenance of onsite systems underscored the importance of revising the manual to address these emerging issues in public health and water resource protection. In 2003, EPA published the Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems bringing to the forefront that the performance of onsite and clustered (decentralized) wastewater treatment systems was indeed a national issue of great concern. Finally, it seemed EPA was acknowledging that onsite and clustered (decentralized) systems were a permanent component of the country's wastewater infrastructure.

During this period, EPA also clarified what was meant by decentralized wastewater treatment systems and defined them as managed individual onsite or clustered wastewater systems (commonly referred to as septic systems, private sewage systems, individual sewage treatment systems, onsite sewage disposal systems, or "package" plants) used to collect, treat, and disperse or reclaim wastewater from individual dwellings, businesses, or small communities or service areas. That said, EPA indicated that many of the systems in use were improperly managed and did not provide the level of treatment necessary to adequately protect public health and surface and groundwater quality. Noting that proper management of decentralized systems involves implementation of a comprehensive, life-cycle series of elements and activities that address public education and participation, planning, performance, site evaluation, design, construction, operation and maintenance, residuals management, training and certification/licensing, inspections and monitoring, corrective actions, recordkeeping, inventorying, reporting, and financial assistance and funding.

In a nutshell, the underpinning premise of the guidelines was simply that, adequately managed decentralized systems that protect the environment and public health can provide an alternative to centralized wastewater treatment systems. Noting that against this backdrop, EPA supported the most sustainable approach to implementing protective water pollution control solutions whether centralized or decentralized. The guidelines were simply a framework within which state, tribal, and local authorities along with other applicable federal requirements, may better meet water quality and public health goals as an integrated component of a comprehensive watershed approach at the state, tribal, or local government level.

EPA noted that the benefits of an adequate management program include: protection of water quality and public health; protection of consumers' investment in home and business ownership; increased onsite system service life and replacement cost savings; avoidance of transfers of water away from the source by conserving groundwater; and negates the need to use a community's tax base

to finance sewers. As a result, EPA continued to strongly encourage communities to consider the voluntary guidelines as a template to strengthen an existing management program or implement a new program. Along with these efforts, in 2005 EPA developed a specific program strategy through its Office of Water.

Evidently, the Agency wanted to improve the performance of these systems in terms of the EPA strategic plan and wanted to move forward by integrating appropriate and affordable technologies with sustainable management strategies to bring about viable community solutions. Unfortunately, more than a decade after the initial congressional mandate there seems to be a continuing lack of awareness, and that is really where we are today in terms of diffusing the innovation of rural infrastructure management. Public misperceptions continue concerning the systems and their capabilities, as well as other legal and regulatory constraints in terms of responsible management entities and oversight.

In 2007, EPA's Office of Water came out with a collaborative approach to sustainable water, which was something new to a bifurcated and fractured set of government agencies and the internal politics among divisions within agencies. The approach advocated sharing information, developing best practices, and introducing inventive new technologies. A research and development agenda was set forth.

The approach was underpinned by four pillars: 1) better management, 2) full cost pricing, 3) water efficiency, and 4) a watershed approach. I've selected these today to put into context the evolving agenda, and how ultimately the watershed approach is connected to decentralized wastewater infrastructure management. Simply stated, decentralized wastewater infrastructure management is a subset of the watershed approach, and is one of the four pillars, which when they work together in an integrated and holistic fashion results in sustainable community outcomes.

When we look at management we view it as a continuum. In Figure 2, we look at personal accountability, individual responsibility, regulatory compliance, and system integrity. At one end, it means that individual users are responsible, while at the other end, a management entity takes full turn-key responsibility.

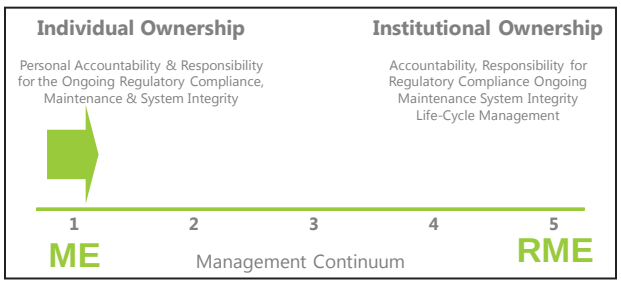

Figure 2. Management continuum

I want to briefly look at three community initiatives in New Mexico (Fig. 3). The figure shows a parallel path that I want you to follow. Peña Blanca a small community north of Albuquerque began their effort in 1990, predating EPA's congressional mandate to examine this institutional option by six years. By 1996, Estranosa Water & Wastewater Cooperative also took action independently. Three years later Willard became an EPA demonstration project. Let's look at these community initiatives briefly.

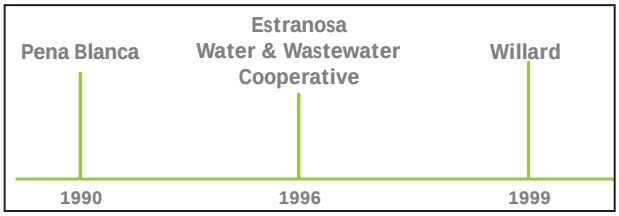

Figure 3. Community initiatives in New Mexico

The basic driving forces in Peña Blanca were failing systems. The systems were malfunctioning, dysfunctional, or nonexistent; they were noncompliant with regulatory requirements. The net result was potential public health challenges; we had multiple residents who were served by overloaded and overburdened systems. In other words, we had too many people too active in too small of a space. The systems had also affected high groundwater, and inadequate leech fields served these overburdened systems. The recommendations were for a small diameter pressure collection system with an estimated cost of over $3 million. The connection cost was $16,800 to $18,300 per 1,000 gallons of waste treated. We had to utilize these systems because we weren't going to get a big pipe. We installed appropriate systems to get the right kind of disposal and dispersal in place. We could protect public health and enhance water quality by putting in onsite systems at a total cost of less than $1 million. That was a significant savings over the earlier recommendations. The

Water and Sanitation District that was designated as the lead agency became responsible for maintaining the systems to ensure proper operation and management for the life cycle of the systems. Outcomes included biannual pumping services for a monthly fee of $10.64 for a 1,000 gallon tank and sampling of private wells in the area found nitrate nitrogen levels below 1 mg/l.

Estranosa is another case study and the driving force was pretty simple: protect the groundwater and put a management program in place. The recommendation was to initiate a septic tank management program. Actions included efforts to provide an operation and maintenance certification programs, instituting a voluntary program to provide discounted septic tank pumping at a three-year interval, and revising bylaws to make the program mandatory for all new and transfer memberships. The outcomes: first membership organization to institute a septic tank maintenance program in New Mexico and it provides service to an area approximately 20 miles east of the City of Albuquerque, known as the East Mountain Area. Initially, there were seventy members signed up for the voluntary program at a cost of $5.00 per month. By 2005, over 1,100 households were served by the septic tank pumping program and the rate increased to $5.50 per month.

Willard is another example of driving forces, actions, and outcomes. The driving forces were the lack of adequate septic tanks and surface contamination with rising levels of nitrates in the village communal well. The recommendations were to demonstrate the viability of the centralized management of affordable, decentralized wastewater systems within New Mexico. Our actions included providing higher levels of treatment by linking conventional septic tanks to re-circulating textile media filters. The village also took legal and administrative steps to operate the system, including holding a Wednesday night meeting in a little town hall where we were able to get some resolution to move forward. The outcome is that today, Willard has a centralized management of decentralized systems.

So what do we take away from all of this? Fifty-two percent of all housing units in New Mexico are served by decentralized systems. We continue to have growth and some new homes will not be served by the big pipe systems. Today there is increasingly less funding available for the big pipe infrastructure solutions because we are busy retrofitting the existing aging infrastructure. The reality is that we know that we need to manage decentralized systems properly. One institutional consideration that you might take back to your communities today is this: there are mechanisms in place, there are institutional options that you can consider, and it behooves us all to consider those alternatives and options. Consider cost efficient, economically viable institutional options for alternative onsite technology management, so that we can protect the scarce water resources of our beloved New Mexico. Move forward knowing that decentralized wastewater infrastructure solutions have been done and are being done in New Mexico. Building on these early efforts coupled with federal guidance documents and resources along with the experience of others, this approach continues to gain momentum. We are now looking to move that groundswell forward to a more elevated level and to continue the momentum.

Good work has been done in the state by forward thinking well-intentioned innovative community leaders. Management approaches tailored to meet local needs are in place, they are working and based on experience are increasingly becoming more efficient and effective in meeting the needs of communities in New Mexico.

Thank you for your time.