Applicability to the Appalachian Region

Significant in the Green Wastewater Project is its actual location…the Left Fork watershed of the Mud River. The Left Fork is a very rural area in the southeastern part of Lincoln County, one of West Virginia's poorest. The Appalachian Regional Commission has designated Lincoln as a distressed county.

In 2000, the last year Census figures were broken down by zip codes, the median family income in the zip code area containing the Left Fork was $19,120. Lincoln County's was $28,297. The United States was $50,046. The area's high poverty rate increased the project's importance. **Could what happened in the Left Fork become a model for solving wastewater issues in other rural, low income Appalachian communities?** The answer to that question, like answers to most big-picture questions, is complex and multi-faceted.

A major piece of the answer has to do with **technology**, its applications, product research, manufacturer support, and the actual results. Another key involves the **realities of rural, low income life** and how these realities impact wastewater systems. Finally, there are **cost issues**.

Traditional home wastewater systems consist of a septic tank and a leach field. Waste from the home is broken down by naturally occurring "good" bacteria in the septic tank. Liquids from the tank move to the leach field and are drained into the soil where breakdown and decontamination continue. Nature has the ability to purify septic waste if soil conditions are right, water tables are deep enough, and there is enough land to handle the flow.

All the wastewater systems in the Project had additional components. These added extra levels of treatment in order further breakdown effluent. These extra features, however, increased the systems' complexities, their need for extra maintenance and surveillance, and the need for homeowner diligence in what is allowed to enter the systems.

The Project worked under the assumption that all the wastewater technologies used were NSF-40 approved. Like the Underwriters seal of approval for electrical products, NSF-40 approved systems have met certain parameters in field tests designed to make sure the systems work properly and satisfy government watchdog agencies that they perform as expected.

But there was a flaw in this testing when it came to the Left Fork. NFS tested systems using municipal water and municipal sewage. All of the homes in the Left Fork relied on well water. This meant that various homes had different kinds and amounts of minerals in their wells. Research does not seem to have been done on how well water impacts these high tech wastewater systems. This made it difficult to determine whether problems with Project systems were driven by well water composition.

The other issue for the Project related to NSF testing using municipal sewage. In a municipal plant, an individual's home wastes are diluted by everyone else's. In the Project when someone in the household was undergoing chemo therapy or following a regime of strong anti-bacterial drugs, those chemicals were not diluted down with thousands of gallons from other homes' wastewater. Often these drugs killed off the needed beneficial bacteria in the wastewater system, causing the system to stop functioning properly. Like the well water issue, this issue had not been researched enough to guide the Project.

More recent WV State laws set guidelines for inground wastewater systems (systems where the effluent ends up in the soil). Inground fields need to be placed away from creeks, have low water tables, and have significant land in order to be installed. The majority of homes in the Left Fork are located close to streams, on small flat pieces of land where water tables are high. Peoples' original wastewater systems, mainly constructed by homeowners in the 1970's and 1980's, were failing because of poor construction and inappropriate locations. The only legally acceptable replacement systems were direct discharge. This meant that the final effluent had to be clean enough to be discharged back into the creek. Over 90% of Green Wastewater Project systems

were direct discharge. Of these, 80% were peat systems, manufactured by Anua (formerly Bord na Mona).

The Anua peat direct discharge systems consisted of a two-compartment septic tank followed by a pump tank where liquid effluent was electrically pumped into a series of peat modules. The peat increased decontamination in the effluent. Finally, that effluent passed out of the peat modules and through an ultraviolet light for final decontamination before it entered a nearby tributary. An electrical transducer panel regulated the flow of the effluent from the pump tank to the peat modules and provided alarms to notify if there were problems with the pump, the effluent level, or the UV bulb. These wastewater systems were complex and sometimes temperamental. Another overlay was the fact that electrical power in the watershed was unreliable. Multiple power failures and lightning strikes impacted the systems and sometimes required replacing components.

However, the Anua systems initially had excellent results. Samples of the direct discharge effluent showed much, much lower-than-allowed bacterial counts entering the tributaries. As a result, bacterial levels in the tributaries, themselves, dropped significantly as more systems were installed, making the environment cleaner and probably improving human health as well. Yet after close to a decade of use, some systems began to show signs of problems, not functioning well, and in some cases had to be replaced. The reasons for this are not clear. Mineral content in wells? Use of pharmacologicals? Prescription drug abuse? Homeowner misuse of the system? Technology problems? It was difficult for the Project to research and test various hypotheses. Currently there does not seem to be research being done in any of these areas.

There were problems with some system components. Concrete tanks and adapter rings did not work as they were supposed to. This led to delays, replacements, and contentious relationships with manufacturers. In addition, not all installers were equally competent, knowledgeable, or diligent in their work. Some wastewater technologies did not live up to distributors' promises. Newly installed systems had to be replaced.

When the project began, most system manufacturers had field engineers who were willing to come into the watershed and help address issues and problems which arose. This insured systems functioned well and problems were caught early on. However, when the national economy slid downhill in 2008, those positions were eliminated, leaving a very limited number of regional salespeople as the source of help. Turnover in staff in the wastewater industry, and turnover and reduction of staff in regulatory agencies exacerbated the lack of on-the-ground help.

The reality of low income life also has impacted the Project. Like many rural, low income communities, the Left Fork has a growing number of aging, disabled, unemployed, and retired people. Though most people own their homes and land, many homes are worth less than the new wastewater systems. Peoples' original systems were more tolerant of grease, cigarette butts, bleach and other household cleaners. The Project's new, high tech systems demanded a much closer watch over what went down the drain. Changing peoples' habits and lifestyles was a challenge. The Project held over 160 community meetings at a local volunteer fire station in an effort to help educate people and get buy-in. Often though, peoples' attendance decreased once they got a new system.

A non-profit wastewater management association with a volunteer board was established in 2010 to help insure that systems were properly maintained and that homeowners could afford necessary upkeep. It continues to be difficult to get people to attend association meetings and participate in leadership. Equally difficult has been getting a small percentage of people to keep their association dues paid up. Yet, the local association continues to function with volunteer leadership and provide critical maintenance and homeowner support.

Currently, no public service district is willing to take over the wastewater management in the Left Fork, compounding the difficulties of insuring systems are properly maintained and monitored. As the Project's wastewater systems age, maintenance and replacement issues will only increase. Support from technology manufacturers, state agencies, and regional colleges and universities could have a critically positive impact on system viability. Yet, this will probably not happen without leadership from outside the community.

The average cost of a system was $23,445. Such high costs make this model a nearly prohibitive solution.

So… **Could the Green Wastewater Project become a model for solving wastewater issues in other rural, low income Appalachian communities?** The answer is probably no, given these systems' complex technologies and high costs, and the reality of low income lives.