

Eradicating Straight Pipes and Failed Systems in Kentucky

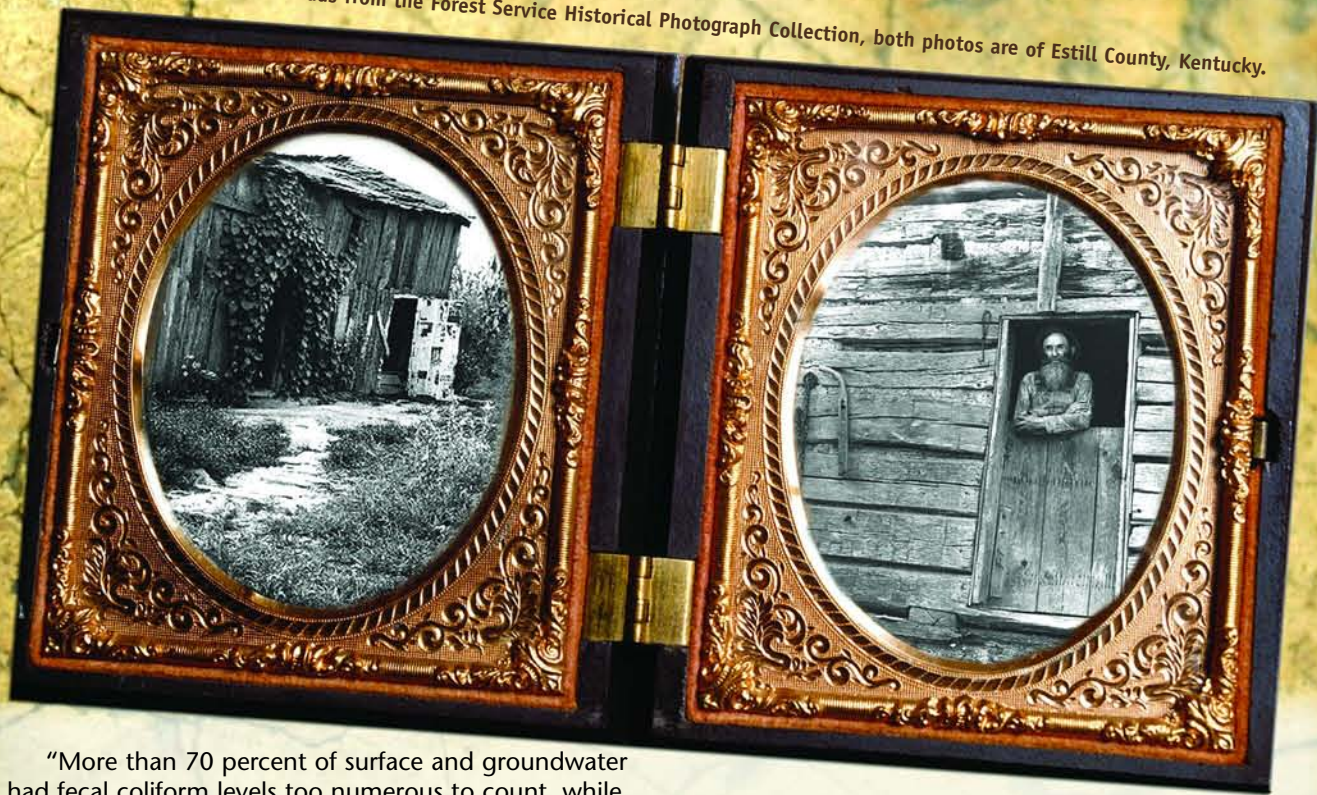
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At the beginning of the 20th century, finding raw sewage on the ground and in streams around most U.S. rural communities was commonplace. Unfortunately, at the beginning of the 21st century, it still is in many parts of the country.

In 1995, more than 80 percent of the 242 households in southeastern Kentucky's Wagersville/Barnes Mountain community, located in Estill County, had failing septic systems or straight pipes that emptied raw sewage directly into fields, woods, and streams. Water samples taken from watershed streams showed dangerously high levels of fecal coliform.



Photo Source: Homesteads from the Forest Service Historical Photograph Collection, both photos are of Estill County, Kentucky.



“More than 70 percent of surface and groundwater had fecal coliform levels too numerous to count, while others had fecal coliform levels between 1,250 to 1,300 colonies per 100 millimeters,” said Kenny Cole, environmentalist, Estill County Health Department.

These polluted watershed streams flowed directly into the Kentucky River, located upstream from the public water intake for Estill County. Medical professionals believed the increased health problems in the area were a result of contaminated drinking water.

Extending Water Lines Highlights Wastewater Problem

“For years, the people in this community relied upon springs, wells, and cisterns for their drinking water,” Cole said. “When Estill County was awarded a 2.1 million dollar federal Rural Development grant in October 1994 to extend water lines into the Wagersville/Barnes Mountain area, the county health department pointed out that it would be inappropriate for residents to hook onto the new water lines unless they had adequate sewage disposal. We had to find a way to help the people in this low-income area find a low-cost or no-cost solution to their wastewater problem.”

Funding Homeowner Septic Systems

Using information derived from water studies, Cole; Chuck White, Estill County conservationist; and Rodney Hendrickson, Cumberland Valley Resource Conservation and Development Council coordinator, co-authored a proposal for a 319(h) grant from the U.S. Environmental Protection Agency (EPA) and the Kentucky Division of Water to eradicate straight pipes and failed septic systems in two of its watersheds.

In March 1997, two years after the grant was written, EPA approved a 319(h) grant for \$219,030. Total funding for the project was \$418,750:

- **\$219,030**—EPA 319(h) grant.
- **\$55,000**—Eastern Kentucky PRIDE grant (Personal Responsibility in a Desirable Environment).
- **\$27,000**—Estill Fiscal Court, spread over three years.
- **\$109,000**—In-kind contributions from community organizations and from homeowners who received new systems. This included community education sponsored by area organizations, and homeowners raking, seeding, fertilizing, and mulching. “I am certain we exceeded the \$109,000 we were required to meet,” Hendrickson said.
- **\$8,700**—Homeowner Contributions. Each homeowner paid \$100 for septic system maintenance education. “We felt pretty strongly that recipients of new systems should come up with some investment of their own so that they would have ownership in their systems,” Hendrickson said.

Partnering

“One of the things I am most proud of with this project is that so many people and organizations took ownership. I was concerned that Chuck [White] and I were going to have to do most of the work ourselves,” Hendrickson said. Project partners included:

- Estill County Conservation District;
- Estill County Health Department;
- Cumberland Valley RC&D Council;

In Estill County, priorities for funding included the illimination of straight pipes, (below) and failed septic systems (right).



Photo source: Clemson University Public Service

- Estill County Fiscal Court;
- Estill County Cooperative Extension;
- Estill County Schools;
- University of Kentucky;
- Kentucky Division of Water;
- PRIDE;
- Rural Community Assistance Program;
- U.S. Department of Agriculture, Natural Resources Conservation Service;
- U.S. EPA; and
- Wagersville/Barnes Mountain Citizens Group.

The project was coordinated through an advisory committee composed of representatives from each of the project partners. Funding issues, however, were deferred to the Natural Resources Conservation Service, since they had initiated the grant and were familiar with its requirements.

Setting Priorities for Installing Systems

During the two-year lapse between writing the grant and receiving the 319(h) funds, costs for installing the systems had increased. "We could find only two or three contractors to bid on the project because small operators were unable to post the required bond," White said. "When you are doing 25 or 30 systems in a compressed time period, even those contractors who have plenty of manpower can be strained."

Higher costs meant installing fewer systems, reducing the number from 242 systems to 98. PRIDE money could be used to install an additional 12 to 14 systems.

With limited funds, it was important to begin with homeowners who were making the greatest impact on water quality. The Advisory Committee defined priorities based on the following descriptions.

- **Priority 1:** straight pipes that emptied directly into a water source.
- **Priority 2:** straight pipes that emptied into wooded areas.

- **Priority 3:** failing septic systems coming to the top of the ground.
- **Priority 4:** working septic systems over 10 years old.

Homeowner Involvement

Homeowner participation in the septic system demonstration project was voluntary. With the exception of the \$100 education cost, the septic system was given to the homeowner free of charge. "Those who didn't take advantage of the project will fall under the enforcement policies of the local health department and the Division of Water," Hendrickson said.

"When we had our first public meetings, I told residents that if they were honest with us about having straight pipes or a failing system, the health department would not cite them," Cole said. "We were able to build a level of trust."

Some members of the advisory committee were community residents who were chosen by their peers to represent them. "In a rural community like this, sometimes people trust their neighbor more than they do government," Hendrickson said. "When their neighbor tells them the project is on the up-and-up, that they need to take advantage of it, and that there is no catch to it, it really helps gain support."

"One of the ladies on the advisory committee was 100 percent blind, and she was very active in the project. She had her sister take her door to door to promote it."

Throughout the project, members of the Advisory Committee, Estill County Conservation, and the Estill County Health Department visited with residents in their homes to keep them informed.

Best Management Practice (BMP) Implementation

Cole, the Project Advisory Committee, and the homeowner worked together to find the best system for a particular site. Criteria for selecting BMPs included soil characteristics, cost, frequency of required maintenance, land availability, educational value, and BMP demonstration value. Cole used this information to design a system that best met the homeowner's needs.

Site Obstacles

Limiting site conditions, such as shallow soils, steep slopes, high water tables, and small lot sizes made many locations unsuitable for a conventional septic system. "We had to balance our need to be innovative with some of the installations with our need to ensure the safety of the installer," Cole said. Some of the alternative systems installed include overflow wetland cells, lagoons, leaching chambers, and low-pressure systems.

"Some areas had homes so close together that there wasn't enough land to physically hold an onsite system; for instance, the back walls of some homes were almost vertical with the creek bank," White said. "On the other side of the homes were wells. Based on any rule or regulation, there was nothing we could do. If we had more time and more money, maybe we could have installed a package system on a downstream property."

A few of the newly installed systems did not operate as expected. "One system was surfacing because of underground wet weather springs on the hillside that caused the system to be overloaded to overflow into the yard," White said. "The installers placed some upstream curtain drains to intercept the water before it reached the system, and that solved the problem."

"But we have been very successful in getting these systems installed, and we always kept the homeowner informed about any problems we encountered. There were certain sites where we were unable to put in a system because the health department was unable to design a system that would work."

Monitoring Water Quality

"We monitored the streams before we installed the systems, during installation, and after installation, so that we could document improvement in water quality," Hendrickson said.

The bottles used to collect samples were sterile, plastic bottles, each containing a sodium thiosulfate tablet. Stream bacteria samples were collected using the surface-grab technique. One hand grasped the bottle and plunged it mouth down 6 to 12 inches below the surface of the water, with the mouth positioned upstream into the current. Each bottle was filled to approximately 75 percent capacity and was free of debris, surface scum, and bottom sediment.

After the sample was collected, the bottle was tagged with information about the sample. This information was then entered onto the chain-of-custody form and was initialed by the sampler. Samples were placed immediately into small, ice-filled containers and were sent to the lab for analysis within one hour of the time they were collected.

Water Quality Test Results

The results of the water quality monitoring tests are given in **Tables 1** and **2** (on page 26.)

"There are so many variable factors in the water testing that some of the results look as though we might not have accomplished our goal," said Sonja Estes, administrative secretary, Estill County Conservation District.

"Testing is done to show the presence of fecal coliform in test sites, and we cannot explain why some tests showed unusual amounts of bacteria after systems were installed," Estes said. "We have talked with our health

environmentalist about this, and he can't explain it. Our conclusion is that water becomes contaminated from warm-blooded animals other than humans, like deer, bear, and raccoons, and that runoff after heavy rains causes a rise in the presence of bacteria in the streams.

"With the exception of October 2002, when samples were taken after a period of heavy rain, test results in 2002 and 2003 were better than earlier results."

Initially, water quality monitoring sites were chosen in areas where it was believed systems would be installed so that any subsequent water quality improvements might be documented. "As it turned out, one of the monitoring sites (Jones Branch) did not have any upstream system replacements, and thus can be used as a comparison to the other sites," said Julie Smoak, technical advisor, Kentucky Division of Water. "The limited data did not allow for statistical analysis or definitive conclusion about water quality; however, we believe that a positive direction was evident in the limited sampling. A comparison of the ratio of exceedances (400 or more colony-forming units) was made prior to and after installation of systems. For all sites except Jones Branch, a trend toward lower incidence of exceedance was revealed."

Operations and Management (O&M)

Ongoing operations and management (O&M) of BMPs was not required with 319(h) grants before 1998. Since then, BMPs require O&M.

Estill County Board of Health has not passed, nor is it considering, a mandatory operations and management component to onsite systems, according to Cole. Although septic tank systems are not periodically inspected after installation, alternative systems are checked. "This is one of the reasons we educated homeowners, so they would know the kind of system they were getting and how to take care of it," Cole said. However, homeowner education was not a requirement for PRIDE systems.

"Even though we don't have an O&M component, if a homeowner has a problem with a system after it has been installed, Kenny Cole, the environmentalist, will be happy to work with them one on one," Hendrickson said.

Estill County Becomes a Model for Future Projects

"Subsequent 319(h) onsite projects in Kentucky have benefited greatly from Estill County's trail-blazing



Water quality monitoring. Photo supplied by National Resources Conservation Service (NRCS).

TABLE 1 - Wagersville-Barnes Mountain EPA #139 Nonpoint Source Water Test Results

SITES	10/98	12/98	2/99	4/99	6/99	8/99	10/99	12/99
1. Doe Creek (Upper Reach)	TNTC*	TNTC	60**	TNTC	216	TNTC	TNTC	1,000
2. Doe Creek (Upper Reach)	TNTC	150	3	40	36	TNTC	TNTC	123
3. Buck Creek	TNTC	2,620	693	560	36	TNTC	TNTC	150
4. Little Doe Creek	TNTC	800	640	780	2,320	TNTC	TNTC	TNTC
5. Jones Branch	200	2,400	107	400	600	TNTC	1740	72
6. Jakes Heavenly Highway	TNTC	TNTC	TNTC	400	310	TNTC	TNTC	TNTC
Water Flow Rates	750 CFS***	12,000 CFS	5,800 CFS	4,100 CFS	390 CFS	85 CFS	750 CFS	4,100 CFS
NOTES:	Pre-BMP	Pre-BMP	Pre-BMP	Pre-BMP	3 sites implemented	6 sites Drought	13 sites Extreme Drought	16 sites

*too numerous to count (TNTC), **colonies/100mL, ***cubic feet per second

Beginning in October 1998, pre-BMP water samples were taken from six designated sites bimonthly until a total of 24 samples were tested. After a total of 16 BMPs had been implemented, the Division of Water decided that testing should cease until approximately 70 to 75 BMPs had been installed. It was thought that delaying testing until more BMPs were installed would give a more accurate picture of septic system impact on the bacteria content in the watershed streams. Water flow rates for the streams and river in Estill County for the date testing took place are also shown.

TABLE 2 - Wagersville-Barnes Mountain EPA #139 Nonpoint Source Water Test Results (continued)

SITES	6/02	8/02	10/02*	11/02	7/03	9/03	10/03	11/03
1. Doe Creek (Upper Reach)	<4**	<4	TNTC***	TNTC	27	253	500	257
2. Doe Creek (Upper Reach)	<4	<4	TNTC	130	67	TNTC	30	130
3. Buck Creek	<4	60	TNTC	27	143	437	27	27
4. Little Doe Creek	<4	63	TNTC	<4	257	157	224	<4
5. Jones Branch	16	27	TNTC	77	TNTC	900	17	77
6. Jakes Heavenly Highway	TNTC	10	TNTC	30	73	470	116	30
Water Flow Rates****	3,200 CFS*****	320 CFS						

* samples taken after a period of heavy rain--water was extremely murky, ** less than four colonies in 100 mL (<4),

*** too numerous to count (TNTC), ****flow rates were unavailable after August, 2002, ***** cubic feet per second (CFS)

Seventy systems had been installed in spring 2002, but rains and flooding delayed the water tests until June. An early fall with unusually heavy rains moved Estill County Health Environmentalist Kenny Cole to ask that installations and water tests cease until drier weather in the spring of 2003. Heavy rains and floods in spring 2003 further delayed installations and water tests. At an advisory meeting at the Estill County Conservation District office on June 8, 2003, Cole advised that testing should resume. Present at the meeting were Ms. Julie Smoak and Joel Murphy, NPS Grant Administrator. The Division of Water gave the district permission to complete the required water testing with four additional tests, which were performed in August, September, October, and November 2003.

effort," Smoak said. "The concepts of homeowner investment in the system and identifying trusted local leaders to assist with recruitment are being implemented in projects currently underway or just now starting up. The emphasis on O&M for more recently developed projects will hopefully help us recruit responsible management entities to oversee decentralized systems beyond the scope of 319-funded projects."

In 2001, the Estill County Conservation District received the Governor's Environmental Excellence Award for Community Environmental Leadership. "The people wanted this

project to be successful, and I think that is why everyone pulled together," Cole said.

The Septic System Demonstration Project has proven so successful in Estill County that three other eastern Kentucky counties have applied for and received their own EPA 319(h) grants for septic system installation projects. In addition, PRIDE has awarded eastern Kentucky \$9 million to repeat the Estill County project over an 18-county area.

For more information, contact Cole at (606) 723-5181, Hendrickson at (606) 864-2172, White at (606) 723-5104, Smoak at (502) 564-3410, and Estes at (606) 723-5104.