

Government Financing for On-Site Wastewater Treatment Facilities in North Carolina

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In the kitchen, the laundry, and the bathroom, people use clean water, and it becomes wastewater. In urban areas, sewer systems carry the wastewater to centralized treatment facilities, but for millions of North Carolinians, treatment occurs in their own backyards. The private citizens who operate a majority of these backyard facilities often lack the knowledge and the experience to maintain them properly. When the facilities fail, they pose unique challenges to human and environmental health, not only on that property but also to the wider community.

This article presents data on the extent of “on-site” (decentralized) wastewater treatment facilities in North Carolina.¹ It outlines some of the challenges inherent in operating, managing, and funding on-site systems, and it examines several local and regional initiatives to expand funding options and implement management programs.

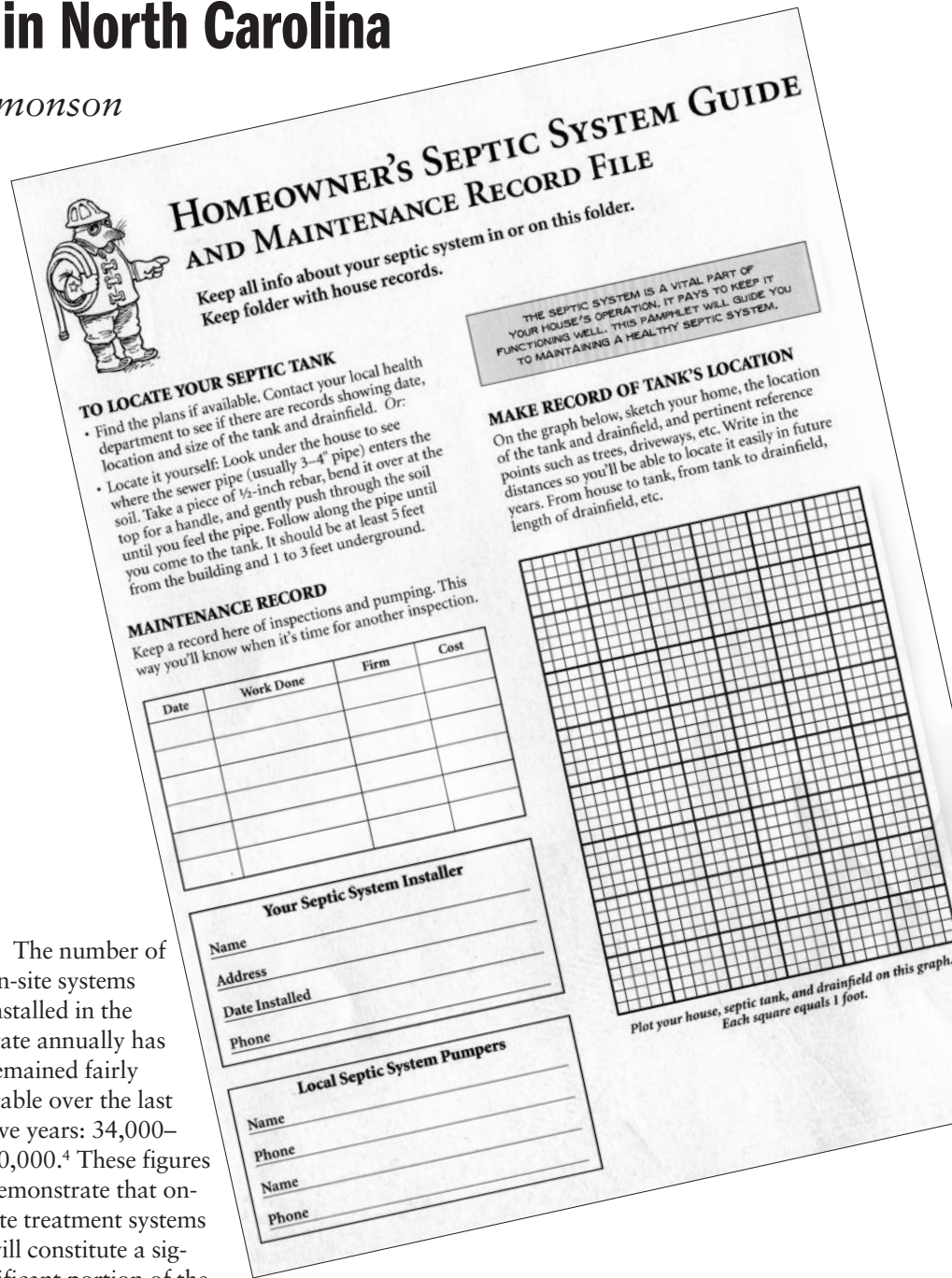
On-Site Systems in North Carolina

Calculating the number of existing on-site systems in North Carolina is a challenge. Current knowledge relies mostly on data from the 1990 Census that were self-reported. Those data indicate that about one-half of the North Carolina population uses on-site systems to treat wastewater, compared with an estimated one-fourth of the nation’s population.² Nationally, one-third of new housing uses on-site systems.³

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The number of on-site systems installed in the state annually has remained fairly stable over the last five years: 34,000–40,000.⁴ These figures demonstrate that on-site treatment systems will constitute a significant portion of the state’s wastewater infrastructure for the foreseeable future.

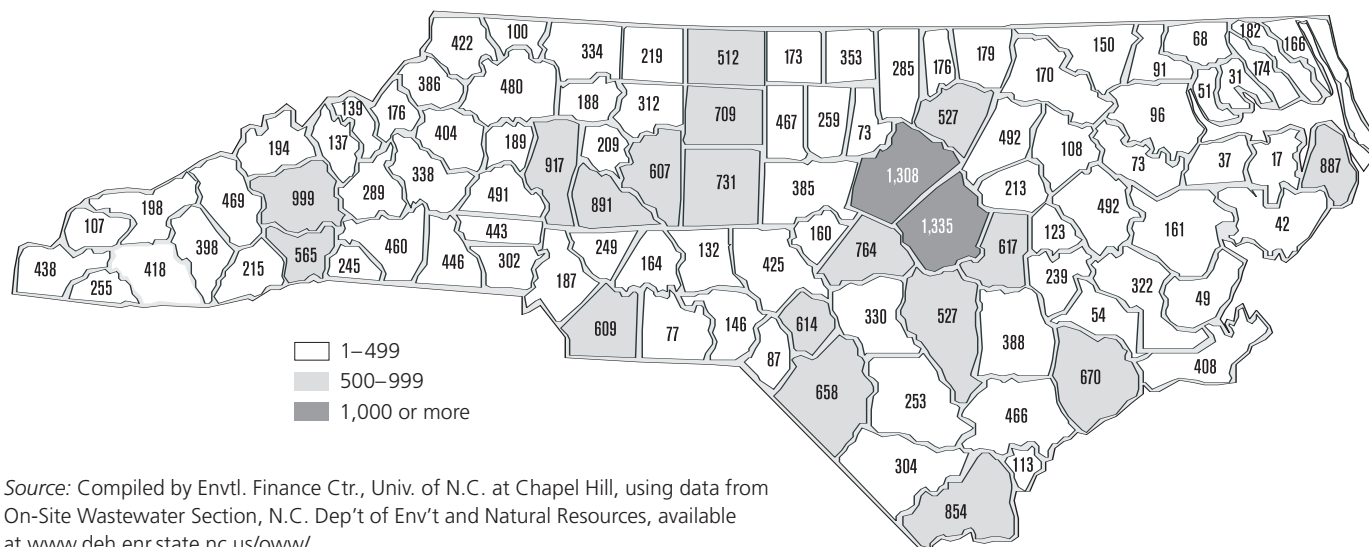
On-site systems are not limited to rural counties. For example, in 2003, Wake County, one of the state’s most urban counties, issued the second-highest number of permits for new systems (1,308), Johnston County issuing the highest number (1,335) (see Figure 1).⁵



Challenges of On-Site Systems

Although the design and the scale are very different, many of the sophisticated biological processes that occur in large centralized wastewater treatment facilities also occur in on-site systems.⁶ However, the procedures for operating,

Figure 1. **New Operating Permits Issued for On-Site Wastewater Systems in North Carolina, by County, 2003**



Source: Compiled by Env'tl. Finance Ctr., Univ. of N.C. at Chapel Hill, using data from On-Site Wastewater Section, N.C. Dep't of Env't and Natural Resources, available at www.deh.enr.state.nc.us/oww/.

inspecting, and funding centralized and on-site systems have notable differences. Centralized treatment facilities in North Carolina are maintained by certified professional wastewater operators, who must meet strict education and experience requirements.⁷ In stark contrast, most of North Carolina's on-site systems are the responsibility of doctors, schoolteachers, accountants, factory workers, or whoever else happens to own or live on the properties where the systems are located.

On-site systems are under scrutiny more than ever with regard to their contributions to public health problems and environmental degradation. Their out-of-sight, out-of-mind nature results in an estimated 10–30 percent of them failing annually. They “can release pathogens and nutrients into the environment that may . . . reach surface waters either through groundwater flow or overland if there is a surface failure.”⁸ Nationwide, a majority of them are more than thirty years old, and their failure is the second most frequently cited source of groundwater contamination.⁹ “The *National Water Quality Inventory 1996 Report to Congress* states that ‘improperly constructed and poorly maintained septic systems are believed to cause substantial and widespread nutrient and microbial contamination to ground water.’”¹⁰

Most on-site systems “are designed to operate indefinitely if properly maintained. However, because most house-

hold systems are not well maintained, the functioning life of septic systems is typically 20 years or less.”¹¹ In North Carolina, failure of on-site systems is most frequently attributable to age; poor soil conditions; tree roots; overloading; lack of maintenance; poor siting, design, or installation of the system; high water tables; seasonal soil wetness; and abuse, such as driving over the lines or using toxic household cleaners excessively.¹² These problems relate directly to lack of consumer information or interest regarding the maintenance needs and the life expectancies of systems.

Often, developers install the systems, and homeowners, who do not see them, never give them a thought until they fail. Homes may change hands before that happens, and the new homeowners may have even less information than the previous ones about age and capacity because on-site systems are rarely inspected at real estate closings. In North Carolina, as in most states, there is no law requiring inspection of on-site systems before property changes hands. Only three states have a statewide “inspection requirement that result[s] in the eventual inspection of all onsite systems through a ‘time of transfer’ mandatory inspection requirement.”¹³

There is a strong symbiotic relationship between programs for regulating on-site systems and programs for repairing or replacing them. North Carolina places the responsibility of regular

maintenance on any person who owns or controls an on-site system.¹⁴ Violations carry administrative, civil, and criminal penalties.¹⁵ Once an environmental health specialist has written a notice of violation because a system is failing, the homeowner has thirty days to repair or replace it (unless notified otherwise). If the system is not repairable, it may not be used, and it may be placed out of service to protect the health and the safety of the public.¹⁶ The homeowner may appeal both the interpretation and the enforcement of the rules.¹⁷ But if the homeowner does not appeal, or appeals and loses, local regulators may face the difficult choice of evicting the homeowner or allowing the public health problem to continue, unless a repair or replacement program is available.

Local governments throughout the state play a major role in organizing and coordinating funding for centralized sewer systems. Homeowners served by these systems pay for maintenance and repairs through their service rates and rely on the local government or utility to coordinate funding and repair. Thus, communities served by centralized systems pool the resources of residents and spread the costs more or less evenly among them over time. Also, improvements to centralized systems have long been considered to be a governmental responsibility and often are funded with long-term loans, which allow their costs to be spread over 20–30 years.

In contrast, homeowners served by on-site systems individually determine how to fund and coordinate management and repairs. Unfortunately, many cannot pay for needed repairs. They are unable to obtain a loan, or they have limited resources.

Basic State and County Health Department Responsibilities

Under the current state regulatory framework, the environmental health division of a county's health department makes most of the essential decisions about on-site wastewater systems.

Specialists from the local health department must inspect a site before installation or repair of a system.¹⁸ By law they must evaluate the soils and issue a permit before house construction can begin or a system can be installed. Also, they must approve the installation before electric service can be permanently connected to the house and the on-site system can be put into use.¹⁹

Environmental health programs have substantial responsibilities beyond wastewater regulation, including inspection of restaurants. According to many environmental health directors, their divisions are notoriously underfunded and have difficulty carrying out essential responsibilities, let alone initiating proactive programs. Monitoring and documentation of on-site wastewater systems, especially in excess of the state's minimum requirements, are limited.

Most counties continue to rely on a mixture of fees and general fund revenue, such as property and sales tax revenue, to support regulation of on-site systems. Many have made concerted efforts to ensure that the fees they charge for on-site inspections and permits cover as much of their costs as possible.

Some communities increase their monitoring services by shifting funding

burdens from general local tax revenue to dedicated revenue sources. For example, Chatham County's Environmental Health Program initiated a fee-based, self-supporting program that issues permits and monitors several types of on-site systems, at a cost of \$100,000 a year.²⁰

Government Management of On-Site Systems

On-site specialists have argued for years that local governments should expand their management role beyond the issuance of permits, given the potential

environmental and public health impact of improperly maintained on-site systems. Relatively little disagreement exists about the types of activities that are needed to reduce the possibility of on-site system failure. The Environmental Protection Agency and the National Small Flows Clearing House, an organization that provides wastewater assistance to small communities,

have long promoted new management models.²¹ The Environmental Protection Agency encourages local government management of on-site systems and has

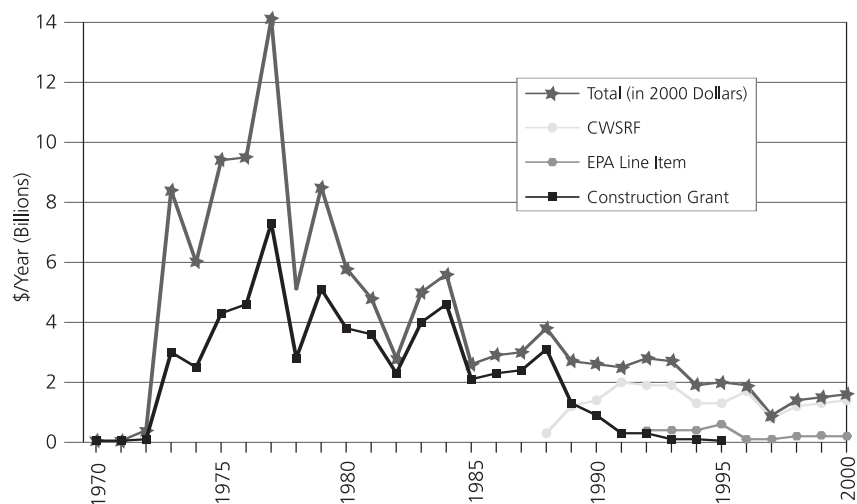
proposed voluntary national guidelines.²² The elements of centralized management that are currently missing in most areas include an inventory of all systems in the area, a record-keeping system, periodic inspections, monitoring of water quality, and issuance and periodic review and renewal of operating permits.

For at least thirty years, communities in North Carolina have been considering options for expanding the role of governments in managing and funding on-site systems. For example, Orange County has long recognized the inherent limitations of a completely decentralized management and funding framework for its on-site systems.²³ A 1981 survey indicated that about one-tenth of the systems in the county were failing and two-thirds of the septic tanks had never been pumped. These findings led to a detailed proposal for a countywide management system.²⁴ Yet almost twenty-five years later, the county still is considering options.

In many respects, Orange County's situation mirrors that of communities across the country. The number of guidebooks, proposals, and manuals describing models for centralized management of on-site systems most likely far exceeds the number of models actually in place. Many of the models appear sound on paper but never seem to overcome the hurdles of local implementation.

Most on-site systems "are designed to operate indefinitely if properly maintained. However, because most household systems are not well maintained, the functioning life of septic systems is typically 20 years or less."

Figure 2. Environmental Protection Agency Funding for Wastewater Facilities, 1970-2000



Source: Data from OFFICE OF WATER, ENVTL. PROT. AGENCY, REPORT TO CONGRESS: IMPACTS AND CONTROL OF CSOs AND SSOs, Table M.2 (Washington, D.C.: EPA, 2004), available at http://cfpub.epa.gov/npdes/cso/cpolicy_report2004.cfm (follow "Appendix M. Financial Information" hyperlink).

Funding of Repairs and Replacements

Funding of wastewater services in the United States changed dramatically from the 1970s to the 2000s. A sizable federal grant program that accompanied the passage of the 1972 Clean Water Act (see Figure 2) evolved into a more complex system delivering a smaller amount of money through grants and loans administered by a wide variety of federal and state agencies. Almost all the funding from 1970 to 1990 went to communities to construct or maintain centralized treatment systems. Such a focus was logical at the time, given the nation's concern about "point sources" of pollution (distinct sources discharging waste into rivers and streams) and their devastating ecological impacts.

The federal Construction Grant Program was phased out in the 1980s. Replacing it was the Clean Water State Revolving Fund (CWSRF), a loan program that can be used for large centralized facilities as well as for programs that reduce "non-point-sources" of pollution (diffuse sources, associated with failing on-site systems). Every year the Environmental Protection Agency allocates monies to a CWSRF in each state. The states use the monies as capital for a "revolving loan program" that makes low-interest loans available to communities and uses the loan payments to finance new loans. North Carolina's CWSRF has focused on assisting communities in constructing and maintaining centralized facilities. Under the right circumstances, the CWSRF may be used to support repair and replacement of on-site systems, but to date it has not been used this way in North Carolina.²⁵

Other federal programs, such as the Water and Waste Disposal Loans and Grants Program of the U.S. Department of Agriculture, and Community Development Block Grants, support small-scale funding initiatives that have resulted in federal and state money flowing to on-site systems through local governments.²⁶ The Appalachian Regional Commission, which funds water and wastewater projects in the western area of the state, has collaborated with other federal and state programs and local nonprofits to establish programs to address failing

on-site systems and eliminate "straight piping" (the practice of piping wastewater directly into the environment without any treatment) for a single county and for multiple counties. However, the commission has not been an ongoing source of funding for repair and replacement programs.²⁷

As its name suggests, the Unsewered Community Grant Program of the North Carolina Rural Economic Development Center provides state grant funding to communities for the purpose of providing sewers to households that have relied on on-site systems.

Between 2000 and 2004, the program distributed about \$75 million to about thirty communities.²⁸

The North Carolina Clean Water Management Trust Fund (CWMTF) supports programs to protect water resources. It has funded a number of initiatives to repair on-site systems (see examples below).

The On-Site Wastewater Section of the North Carolina Department of Environment and Natural Resources is responsible for regulating and overseeing the state's on-site wastewater systems. Historically its primary role has been regulatory. However, in 1996 the General Assembly created the Wastewater Discharge Elimination (WaDE) program under the On-Site Wastewater Section to identify and eliminate straight piping and failing on-site systems statewide.²⁹ To date, limited funding has restricted most of WaDE's efforts to western North Carolina. WaDE conducts door-to-door surveys in targeted watersheds in the western part of the state, identifies failing systems, and funds local health departments to issue repair permits and conduct final repair inspections.

Local and Regional Funding Program Examples

Programs that provide funding assistance to address failing on-site systems or other serious public health threats through repair and replacement have been surprisingly diverse in terms of the participating agencies, their roles and

responsibilities, their funding streams, and their eligibility requirements. The diversity of models highlights their experimental nature. Figuring out an efficient and transparent process of moving money from federal, state, and local funding sources to individual homeowners is a challenge. Staff time is required to meet with homeowners and assist them through the application process, confirm credit histories and income levels, cut checks and receive and track payments, write grant proposals and prepare reports, and deal with

delinquencies. Administering loan and grant programs requires expertise and experience not normally found in many county environmental health programs.

Two efforts show the progress and the challenges of funding programs to repair and replace straight piping and failing on-site systems: one in Madison County and another encompassing four counties in the western Piedmont. These programs exemplify concerns about administering grants and loans.

Madison County's Straight Pipe Elimination Revolving Loan and Grant Relief Program

In 1996 the newly created WaDE program reported that many homes on the Ivy River relied on outhouses and incomplete indoor facilities.³⁰ In 1997 the Madison County Straight Pipe Elimination Revolving Loan and Grant Relief Program evolved from a statewide initiative to eliminate straight piping and from the community's own need to terminate the practice. The project, led by the Land-of-Sky Regional Council (the region's council of governments) and the Madison County Health Department, involved a collaboration of community, regional, state, and federal partners. It included a door-to-door survey assessing wastewater conditions and household needs; community education; and the identification of installation and repair resources for households with straight piping or failing on-site systems.

In many ways, improving both the quality and the performance of on-site wastewater system management remains a chicken-or-egg puzzle.

The survey results indicated that 205 households had straight piping of “black water” (human waste from toilets); 243 households, straight piping of “gray water” (nontilet waste, such as bath water and laundry water); and 104, failing on-site systems. Also, 60 percent of the households relied on incomes of less than \$26,000 per year.

The project started with a \$750,000 grant from CWMTF. Additional funding from CWMTF provided \$51,000 per year for three years to cover administrative costs. A nonprofit banking institution, the Center for Community Self-Help, administered the funds and serviced the loans. Homeowners had to pay a \$100 application fee for access to the program. Loans required a \$100 origination fee as well as a monthly service fee.

The program initially met strong local resistance, for homeowners were extremely wary of local regulatory officials offering funding. Thus, not much was accomplished in the first five years and eight months. As the grant neared completion, \$550,000 had yet to be spent. Health Director Buck Wilson and the Madison County Board of Health, unwilling to lose funds for area homeowners and the local economy, met with and explained the program to county commissioners and community representatives, who in turn encouraged their friends, families, and neighbors to make use of it. This extensive public outreach made the difference. In the remaining four months, the balance was spent, and 446 systems were installed or repaired.

The CWMTF funding was depleted as of June 30, 2003. Since then, Madison County itself has provided a few loans directly to county homeowners. However, an estimated 300–400 homeowners still are in need, including 75 who now have enough faith in the program that they have actually put their names on a waiting list for future funding.

Unifour Failing Septic Repair Program

The Unifour Failing Septic Repair Program began as the result of a particularly high rate of failing on-site systems in the densely populated, unincorporated areas of Alexander, Burke,

Caldwell, and Catawaba counties, as well as concerns about bacteria in some of the region’s streams.³¹ The Western Piedmont Council of Governments submitted grant proposals to CWMTF for sewer system extensions in the region. Officials of CWMTF voiced concerns about the secondary impacts of extensions and instead recommended a program for repair of failing on-site systems. In 1998, CWMTF granted \$450,000 for the project but did not provide funds for administration of it. The downtown Hickory branch of the Bank of America agreed to provide a free checking account for the Unifour Septic Tank Repair Program but no administrative oversight.

The program targets “moderate-income” homeowners as defined by guidelines of the U.S. Department of Housing and Urban Development. Participants must own their own homes and reside in state-designated watershed regions, although exceptions are made for homeowners currently relying on gray- or black-water straight piping. Financing options include grants, deferred forgivable loans, and standard loans. The goal of the funding is to make each system function as designed.

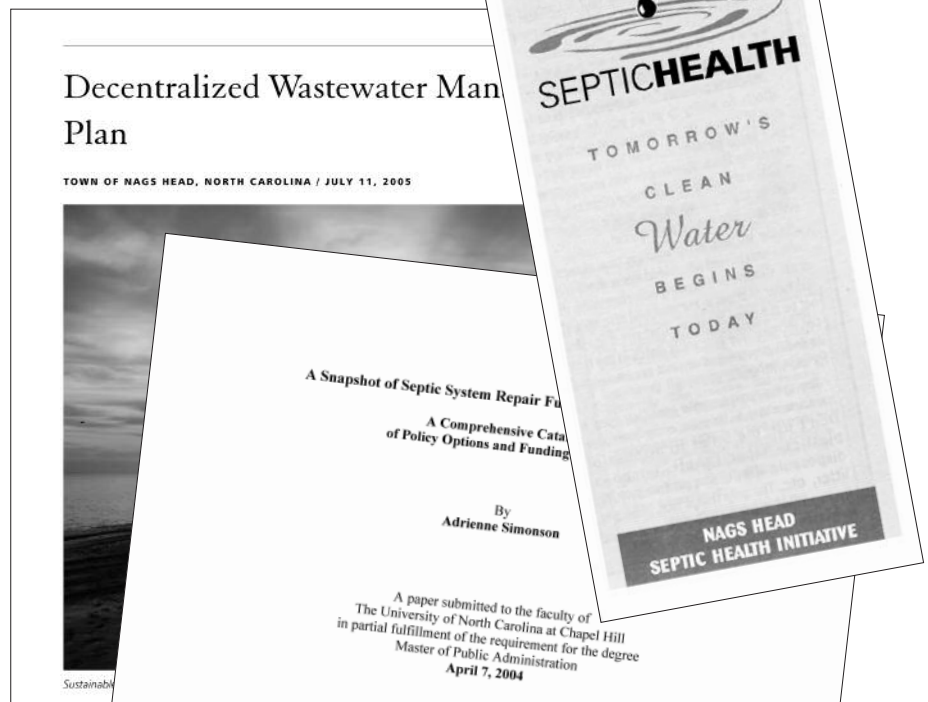
The Western Piedmont Council of Governments administers the program through just one staff member. He fields calls; meets with homeowners; assists

them in filling out forms; determines homeowner eligibility and the level of assistance needed; and verifies household income. In addition, he communicates with contractors, tracks results, pays the invoices submitted for completed repairs, furnishes grant reports, and serves as the program contact for CWMTF and other partners.

As of March 2004, 101 homeowners had participated, and \$260,000 had been spent. Of the systems repaired, 25–30 percent involved straight piping, and of those, 95 percent were gray water. Generally, four or five homeowners are at some stage of the process at any given time, and two to four new applications come in weekly. Homeowner loan payments are deposited into the account for reuse. However, half of the applicants use some form of grant, so the revolving loan feature will eventually run out.

Creation of Sustainable, Innovative Local Government Programs for On-Site Management

Although the funding programs described



in the previous section have helped individual households, questions remain about the long-term viability of repair programs that are founded almost entirely on outside grant assistance. During a special work session in October 2004, local government practitioners and funding agency representatives analyzed the programs offering grants for repair and replacement of on-site systems.³² At least one funding agency representative voiced frustration about the lack of consistency among the different local government funding models and the complicated flow of funds among funding agencies, local governments, other intermediaries, and households. Funding agency representatives complained that many of the repair and replacement programs lacked sustainability and that once the infusion of external capital was depleted, programs often came to a sudden end.

Not all local funding programs rely primarily on external grants. In fact, a program in Nags Head, North Carolina, that is funded primarily from local utility fees currently provides the widest range of on-site services. Another program that relies primarily on local revenue, the Albemarle Septic Management Entity, was created primarily to provide one-time approval services and recurring inspections. Each of these programs has had a steady source of revenue and relatively stable budgets. Yet these types of ongoing funding programs are extremely rare in North Carolina.

Nags Head's Septic Health Initiative

Nags Head, a tourist-centered town on a narrow barrier island, was experiencing a decrease in water quality as a result of faulty on-site systems. Many of the town's 4,400 homes are rental properties owned by absentee landlords, and visiting tourists often were unfamiliar with the peculiar requirements of on-site systems. Nags Head residents did not want to convert to a centralized wastewater system, however, because they feared that the town's character would change as a result of the intense development that often follows introduction of such a system.

So a group of local citizens formed the Septic Health Committee and spent

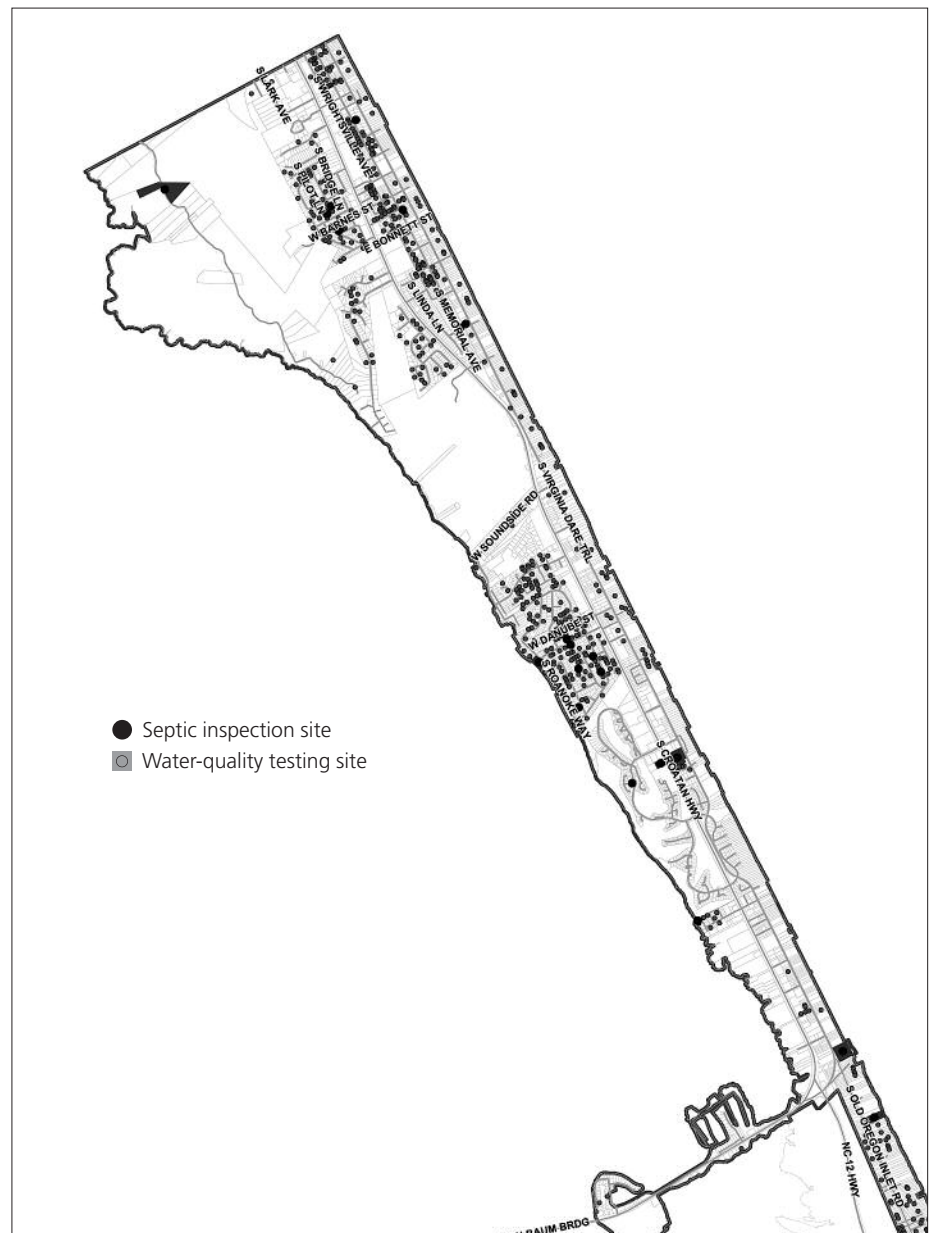
three years discussing a series of town-wide programs designed to improve the performance of on-site systems "while maintaining acceptable surface and ground water quality—as well as controlling the density of developed land by promoting the use of [on-site] systems."³³ The committee formed the Septic Health Initiative, a voluntary program to protect the town's water quality. It offers a set of complementary services aimed at educating citizens, improving documentation and maintenance of on-site systems, and repairing failing systems. The program also in-

cludes an extensive component to test water quality.

The Septic Health Initiative is funded as part of the town's water enterprise fund. According to Kim Kenny, Nags Head's finance director, the town views the program primarily as a component of the water utility, intended to protect the water resources, and funds the \$300,000 or so in annual operating costs out of water rate revenues.³⁴

Property owners may voluntarily request inspections to assess the condition of their systems. A town-approved independent contractor determines the level

Figure 3. Nags Head's Septic Health Initiative



Source: From Town of Nags Head, Water Quality Monitoring Program (last visited Nov. 13), available at http://nagshead.govoffice.com/index.asp?Type=B_BASIC&SEC=%7bC50FD321-F32E-44A0-96C3-C981BF915C86%7d (follow "North Map" hyperlink).



of solids in the septic tank, the condition of the tank, and the condition and the effectiveness of the drainage field. Property owners pay a negotiated rate of \$65 for the inspection. However, on receipt of the inspection report, the town issues a full reimbursement to them.

The inspection reports then are entered into a comprehensive on-site system database. As part of the program, the town also conducts routine water-quality testing at several strategic locations, in part to identify septic system failures as soon as possible. (For the sites of inspections and water-quality testing, see Figure 3.)

The town also has negotiated rates with local contractors for pumping out septic tanks. Property owners who hire an approved contractor pay the negotiated rate—\$200 for a tank of 1,000 gallons or less—and receive a voucher worth \$30 toward their next water bill, resulting in a net pumping cost of \$170.

For property owners facing costly repairs, the town offers a three-year, low-interest revolving-loan program.³⁵ Homeowners are eligible for loans as long as their property tax payments are current. The program can cut off water to a home for nonpayment of a loan but has never had to do so.

Nags Head takes education about septic system health seriously. The coordinator of the Septic Health Initiative, Todd Kraft, visits each fifth-grade class in the town's schools to discuss the do's and don'ts of septic system health.

Homeowners receive septic system owner's manuals, and realtors get education packets for use in rental cottages. These packets include door hangers, decals, and brochures explaining what not to flush. The program also is extensively publicized through the town newsletter, the government access channel, civic function signage, and mass mailings twice a year. In a survey of town residents, Nags Head officials discovered that 66 percent of program participants had gained an understanding of the basic functions of their septic systems, and 94 percent would sign up for program services again.³⁶

Albemarle Septic Management Entity

The Albemarle Septic Management Entity covers eleven counties in north-eastern North Carolina: Bertie, Camden, Chowan, Currituck, Gates, Hertford, Martin, Pasquotank, Perquimans, Tyrrell, and Washington. It offers some services similar to those of the Nags Head program, but its objectives and history are quite different. It is managed as a component of the Environmental Health Program of Albemarle Regional Health Services to facilitate the approval and monitoring of alternative wastewater systems. According to Environmental Health Director Ralph Hollowell, in many parts of the region, soils with extremely high clay content and a high water table make traditional septic tank

and gravity drainage fields unfeasible.³⁷

By including "management entity" in the name, Albemarle Regional Health Services reinforced its interest in having the utility fulfill the roles and the responsibilities assigned to such an entity in the state rules governing on-site systems.³⁸ The program operates as a joint management agency relying on Section 153A-274 of the North Carolina General Statutes for its public enterprise fee-setting authority.³⁹

The entity currently serves 3,500 property owners with innovative or alternative systems. Property owners wanting to install an innovative or alternative system pay \$300 in fees to cover the initial application and the operating permit.⁴⁰ Subsequently they pay \$50 a year for annual inspections. Special door hangers informing homeowners that the annual inspections have been completed, a recent program addition, remind residents of the services that they receive for their payments. If staff identify problems during inspections, they notify property owners and work with them to ensure appropriate follow-up. Program fees also support documentation and database efforts.

Environmental Health Director Hollowell reports that the percentage of failed systems at any given time has dropped significantly since the program was established.⁴¹ According to Hollowell, the program's success has turned largely on staff members' ability to work with county officials in the service area.

The Next Twenty-Five Years

Policy makers have long searched for the silver bullet that would open the way to more sustainable programs to manage on-site systems in North Carolina. Before 1979, North Carolina's public enterprise statutes provided no explicit authorization for funding and management of on-site systems as a local government public enterprise service. Many people believed that the lack of authorization was one of the main obstacles to the establishment of on-site wastewater utilities and management programs in the state. This perceived obstacle eventually led to legislation by the 1979 General Assembly that added on-site wastewater disposal to the list of services that may be managed as public enterprises.⁴²

Proponents of the legislation believed that it would open the door to a range of innovative options for public management of on-site systems. Existing water and sewer utilities could incorporate responsibility for management of such systems into their service areas. Counties could create new utilities, either at the county level or at the subcounty level, through the use of special districts. By managing on-site systems as utilities, local governments could pool funding resources and provide higher levels of inspection, maintenance, and repair in some cases.

Twenty-five years later, few counties go much farther than basic state requirements, and it would be difficult to declare that any have shown great flexibility in generating significant financial resources to support management activities. Meanwhile, almost one million additional on-site systems have been constructed in North Carolina, and the responsibility for inspecting, maintaining, and repairing them continues to rest almost exclusively with untrained individuals.

Even though the federal and state funding levels for centralized wastewater systems have fallen in recent years, they still far exceed the amount of federal and state funds devoted to on-site systems. As a result, many on-site specialists call for increased federal and state funding as a way of improving on-site systems. But federal and state

funds that have gone into the country's centralized wastewater infrastructure have been matched and leveraged with many more millions in locally generated revenues from user fees. In 2004 alone, local government water and sewer utilities in North Carolina collected more than \$1.4 billion in revenues from their customers.

Without revenues from on-site users, local governments are unlikely to be able to leverage external funds or expand their own role in improving on-site sanitation, as they have done for centralized wastewater systems. As noted earlier, representatives of several of the state funding agencies that have supported repair programs have expressed frustration that the programs ended once their funding stopped.⁴³

The success of the Nags Head and Albemarle programs shows the level of services that can be offered with a dedicated source of revenue or a well-designed fee structure.

New fee programs are typically unpopular, especially when they address an issue that for so long has literally been out of sight and out of mind to most North Carolina citizens and public officials. On the other hand, the financial challenges facing some North Carolina counties largely preclude their redirecting existing revenues to new programs.

In many ways, improving both the quality and the performance of on-site wastewater system management remains a chicken-or-egg puzzle. It is not a coincidence that many of the large federal programs to fund centralized systems came at a time when the country was increasing its regulation of public treatment facilities. Did the increased regulation lead to increased funding, or did increased funding give regulators the confidence to demand more? Many now pose a similar question regarding the regulation and the funding of on-site systems. The western North Carolina repair programs clearly demonstrate that once funding options are available, regulators can address straight piping more aggressively. Likewise, without regulatory pressure for improving facilities, the demand for better management programs will remain relatively academic, given the other priorities facing the state's communities.

Notes

1. On-site systems using septic tanks, often referred to as "septic systems," are by far the most common type of decentralized system in North Carolina.

2. N.C. Div. of Water Quality, Non Point Source Management Program: Onsite Wastewater Systems (last modified Feb. 10, 2002), available at http://h2o.enr.state.nc.us/nps/What_is_NPS/OWS.htm. As of 2002, that is about 1.85 million North Carolina homes. Census Bureau, State and County QuickFacts, available at <http://quickfacts.census.gov/qfd/states/37000.html>. "In large communities (those with more than 10,000 people) almost 93 percent of the housing units are connected to a public sewer . . . In contrast, about 61 percent of housing units in small communities use a septic tank or cesspool for wastewater disposal . . . [California has the highest number of housing units using outhouses or privies (67,865).] Other states with large numbers of small community housing units using outhouses or privies are Kentucky (55,764), Pennsylvania (47,902), Missouri (46,223), and North Carolina (45,461)." Env'tl. Prot. Agency, Small Communities: U.S. Census Data on Small Community Housing and Wastewater Disposal and Plumbing Practices (last modified June 28, 2002), available at www.epa.gov/OWM/mab/smcmm/factsheets/census/index.htm.

3. OFFICE OF WATER, ENVTL. PROT. AGENCY, *Executive Summary*, VOLUNTARY NATIONAL GUIDELINES FOR MANAGEMENT OF ONSITE AND CLUSTERED (DECENTRALIZED) WASTEWATER TREATMENT SYSTEMS (Washington, D.C.: Office of Water, EPA, Mar. 2003), available at www.epa.gov/owm/septic/pubs/septic_guidelines.pdf.

4. Data from On-Site Wastewater Section, N.C. Dept of Env't and Natural Resources, available at www.deh.enr.state.nc.us/oww (follow "Program Improvement Team" hyperlink).

5. *Id.*

6. The most common design for on-site systems is a septic tank connected to a sub-surface absorption or drainage field, serving an individual homeowner or business. However, in many areas of the state, soil and space limitations are unsuitable for this model. In such situations a variety of systems are used, employing features such as pressured pipes, pumps, disinfection processes, specially designed drainage basins, and spray irrigation fields (wastewater sprayed onto a surface rather than absorbed beneath the surface).

7. A small percentage of alternative and innovative on-site systems also require certified operators. New on-site systems tracked by the On-Site Wastewater Section of North Carolina's Department of Environment and Natural Resources fit into one of five classes, I-V. Class I, II, and III systems (accounting for 33,478 of the 34,176 on-site

systems receiving permits in 2003) do not require certified operators; Class IV and V systems do.

8. N.C. Div. of Water Quality, Non Point Source Management Program: Onsite Wastewater Systems (last modified Feb. 10, 2002), available at http://h2o.enr.state.nc.us/nps/What_is_NPS/OWS.htm.

9. OFFICE OF WATER, VOLUNTARY NATIONAL GUIDELINES.

10. *Id.* at 4.

11. OFFICE OF WATER, ENVTL. PROT. AGENCY, DECENTRALIZED SYSTEMS TECHNOLOGY FACT SHEET: SEPTIC TANK-SOIL ABSORPTION SYSTEMS (Washington, D.C.: Office of Water, EPA, Sept. 1999), available at www.epa.gov/owmitnet/mtb/septicfc.pdf. Facts about septic systems are available at www.soil.ncsu.edu/publications/Soilfacts/AG-439-13/ and www.bae.ncsu.edu/programs/extension/publicat/wqwm/wm1.html.

12. NATIONAL ONSITE WASTEWATER TREATMENT, SUMMARY OF ONSITE SYSTEMS IN THE UNITED STATES (Morgantown, W.Va.: Nat'l Small Flows Clearinghouse, 1993).

13. Lorene Lindsay and Michael Aiton, *NODP Update: Inspection of Onsite Systems*, SMALL FLOWS QUARTERLY, Fall 2002, available at www.nesc.wvu.edu/nsfc/sfq_fall02/pg12.html. However, “[l]ending institutions in a real estate transaction will often require an inspection of the onsite system. In areas where onsite systems are frequently used *and failure of these systems has become public knowledge*, the local lending institutions, the real estate community, or the buyer will often require an inspection” (emphasis added). *Id.*

14. Maintenance of Sewage Systems, 15A NCAC 18A .1961 (2002), available at www.deh.enr.state.nc.us/oww/Rulelaw/2002_Rules.htm (follow “Links to Individual Rules” hyperlink; then follow “15A NCAC 18A .1961” hyperlink).

15. Penalties, 15A NCAC 18A .1968 (2002), available at www.deh.enr.state.nc.us/oww/Rulelaw/2002_Rules.htm (follow “Links to Individual Rules” hyperlink; then follow “15A NCAC 18A .1968” hyperlink).

16. Maintenance of Sewage Systems, 15A NCAC 18A .1961(l) (2002), available at www.deh.enr.state.nc.us/oww/Rulelaw/2002_Rules.htm (follow “Links to Individual Rules” hyperlink; then follow “15A NCAC 18A .1961” hyperlink).

17. Appeals Procedure, 15A NCAC 18A.1965 (2002), available at www.deh.enr.state.nc.us/oww/Rulelaw/2002_Rules.htm (follow “Links to Individual Rules” hyperlink; then follow “15A NCAC 18A .1965” hyperlink).

18. N.C. Gen. Stat. §§ 130A-333 through -345 (hereinafter G.S.).

19. G.S. 130A-336; *see also* MICHAEL T. HOOVER, SOIL FACTS: SEPTIC SYSTEMS AND THEIR MAINTENANCE (Raleigh: N.C. Cooperative Extension Serv., Feb. 1994; updated online Dec. 1997), available at www.soil.ncsu.edu/publications/Soilfacts/AG-439-13/.

www.soil.ncsu.edu/publications/Soilfacts/AG-439-13/.

20. CHATHAM COUNTY, N.C., 2004-05 FY APPROVED ANNUAL BUDGET DOCUMENT (Pittsboro: 2004).

21. For relevant publications, *see* the general websites of the Environmental Protection Agency and the National Small Flows Clearing House, at www.epa.gov and www.nesc.wvu.edu/nsfc/nsfc_index.htm, respectively.

22. OFFICE OF WATER, VOLUNTARY NATIONAL GUIDELINES.

23. Memorandum from Adrienne Simonson to Ron Holdway, Director, Env'tl. Health Div., Orange County Health Dep't (May 17, 2004).

24. A Proposal to Establish an Operation and Maintenance Program for Sewerage Treatment and Disposal in Orange County, Submitted to Orange County Bd. of Health by Dan Reimer, Env'tl. Health Director, Orange County Health Dep't (Hillsborough, N.C.: 1989).

25. *See* CLEAN WATER STATE REVOLVING FUND, ENVIRONMENTAL PROTECTION AGENCY, ACTIVITY UPDATE: FUNDING DECENTRALIZED WASTEWATER SYSTEMS USING THE CLEAN WATER STATE REVOLVING FUND (Washington, D.C.: CWSRF, EPA, Jan. 2003), available at www.epa.gov/OWOWM.html/cwfinance/cwsrf/septic.pdf.

26. In North Carolina the Division of Community Assistance, in the Department of Commerce, administers federal CDBG funds. The proposed federal budget for fiscal year 2005-06 makes major changes in how these programs will be administered.

27. Telephone interview with Sara Stuckey, N.C. State Coordinator, Appalachian Regional Council (Apr. 7, 2004).

28. Analysis conducted by authors using data from N.C. Rural Econ. Dev. Ctr. (no longer available on website).

29. Nikki Stiles, *Flushing Out the Straight Pipes*, SMALL FLOWS QUARTERLY, Fall 2002, available at www.nesc.wvu.edu/nsfc/sfq_fall02/pg18.html.

30. The description that follows draws on a telephone interview with Buck Wilson, director, Madison County Health Department, in April 2004. More information about the project is contained in a local government case study prepared by the University of North Carolina Environmental Finance Center, available at www.efc.unc.edu/onsite/index.htm (follow “Madison County” hyperlink).

31. The description that follows draws on a telephone interview with Mike Struve, water quality administrator, Western Piedmont Council of Governments, in March 2004. More information about the project is contained in a local government case study prepared by the University of North Carolina Environmental Finance Center, available at www.efc.unc.edu/onsite/index.htm (follow “Western Piedmont” hyperlink). Section

303(d) of the Clean Water Act requires states to develop a list of waters that do not meet water quality standards or are impaired for certain uses (e.g., fishing or recreation). They must prioritize listed waters and develop a management strategy or a total maximum daily load (TMDL) for all listed waters.

N.C. Div. of Water Quality, Modeling and TMDL Unit: The 303b and 303d Report, available at http://h2o.enr.state.nc.us/tmdl/General_303d.htm. A TMDL is “a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant’s sources.” *See* The Total Maximum Daily Loads Program (last modified July 19, 2005), available at www.tmdls.net/basics/general.htm.

32. “Finance Strategies for Decentralized Wastewater Systems,” Workshop Sponsored by UNC Env'tl. Finance Ctr., in Cullowhee, N.C. (Oct. 26, 2004).

33. Town of Nags Head, Septic Health Initiative (last visited July 20, 2005), available at <http://nagshead.govoffice.com/index.asp?Type=NONE&SEC={F43EBE1E-2B2D-4F36-8182-0544F0BEEAD1}>.

34. The information in this section was obtained from the Nags Head website, at <http://nagshead.govoffice.com>, and from personal correspondence with Kim Kenny, Finance Director, Town of Nags Head (Mar. 31, 2005).

35. *Id.*

36. Todd Kraft, Septic Health Coordinator, Nags Head Septic Health Initiative, Presentation at the 2003 Onsite Conference, N.C. State Univ. (Oct. 21-23, 2003).

37. Telephone Interview with Ralph Hollowell, Environmental Health Director, Albemarle Regional Health Services (Apr. 1, 2005).

38. 15A NCAC 18A .1901 through .1968 (2002).

39. Telephone Interview with Hollowell.

40. Maintenance of Sewage Systems, 15A NCAC 18A .1961 (2002), available at www.deh.enr.state.nc.us/oww/Rulelaw/2002_Rules.htm (follow “Links to Individual Rules” hyperlink; then follow “15A NCAC 18A .1961” hyperlink).

41. NAT'L ONSITE DEMONSTRATION PROGRAM, NAT'L ENVTL. SERV. CTR., INSIGHTS INTO COMMUNITY ONSITE MANAGEMENT SYSTEMS: A NATIONAL OVERVIEW (Morgantown, W.Va.: the Center, 2002), available at www.nesc.wvu.edu/nsfc/NewReleases/nsfc_NR_5_19_03.htm.

42. 1979 N.C. Sess. Laws ch. 619, as cited in Warren J. Wicker, *Public Management of On-Site Wastewater Systems*, POPULAR GOVERNMENT, Fall 1980, at 20.

43. Finding from “Finance Strategies for Decentralized Wastewater Systems,” Workshop Sponsored by UNC Env'tl. Finance Ctr., in Cullowhee, N.C. (Oct. 26, 2004).