Accountability: Issues of Compliance with Decentralized Wastewater Management Goals

Prepared for the Waquoit Bay National Estuarine Research Reserve
Under the direction of the ad hoc Task Force
for Decentralized Wastewater Management

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Citation: Nelson, V. I. and F. C. Shephard. 1998. Accountability: Issues of Compliance with Decentralized Wastewater Management Goals. Waquoit Bay National Estuarine Research Reserve and *ad hoc* Task Force for Decentralized Wastewater Management. Waquoit, Massachusetts. 122 pp.

August, 1998

The ad hoc Task Force for Decentralized Wastewater Management is a group of non-governmental organizations, municipalities, regional planning agencies, state and federal government representatives, academics and engineers working together to help municipalities achieve real cost and performance benefits from wastewater technologies through education and implementation of basic wastewater planning and management programs.

ad hoc Task Force for Decentralized Wastewater Management Steering Committee members:

- Town of Barnstable
- Massachusetts Department of Environmental Protection
- Cape Cod Commission
- U.S. Environmental Protection Agency - Region 1
- City of Gloucester, MA
- University of Rhode Island On-Site Wastewater Training Program
- Coalition for Alternative Wastewater Treatment
- Waquoit Bay National Estuarine Research Reserve
- Marine Studies Consortium
- Massachusetts Department of Environmental Management
- Massachusetts Bays Program

Acknowledgements

Many people from a variety of organizations contributed their time and knowledge to the production of this document. Special thanks go to the members of the ad hoc Task Force for Decentralized Wastewater Management, who gave so generously of their time to provide information and review various drafts. Reviewers also included James Kreissl of the U.S. Environmental Protection Agency, Kevin Sherman of the Florida Department of Health, Patricia Miller of the Virginia Department of Health, Jennifer Sullivan of the Scituate Board of Health, and Jerry Stonebridge of Stonebridge Construction. Thanks also to Maggie Geist of the Waquoit Bay Reserve for review and editorial assistance.

Support for the preparation of this document was provided by the Island Foundation, Massachusetts Bays Program, the Switzer Foundation, and the United States Environmental Protection Agency's Environmental Technologies Initiative Program and US EPA’s Small Flows Clearinghouse's National On-site Demonstration Project.

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Preface

There has been increased interest in Massachusetts in improving on-site wastewater technologies and practices to address the problem of nitrogen removal. This interest provided the impetus for a February 1992 conference sponsored by the Waquoit Bay National Estuarine Research Reserve (WBNERR). The conference focused on problems of eutrophication of coastal embayments, on-site wastewater technologies and their effectiveness at removing nitrogen, and management and institutional structures required for advanced on-site systems.

Following this conference, the ad hoc Task Force for Decentralized Wastewater Management was formed to explore these issues further. The Task Force included representatives from several towns, the Massachusetts Department of Environmental Protection (DEP), the Cape Cod Commission, the Waquoit Bay National Estuarine Research Reserve/Massachusetts Department of Environmental Management, the Massachusetts Bays Program, the Coalition for Alternative Wastewater Treatment, and the Marine Studies Consortium. Today, the ad hoc Task Force includes representatives from all of New England.

In 1994, on behalf of the ad hoc Task Force for Decentralized Wastewater Management, WBNERR submitted a grant proposal entitled “Remedial On-Site Wastewater Treatment Districts” to the U.S. Environmental Protection Agency's Environmental Technology Initiative (ETI) program. EPA stated in the grant announcement that environmental regulations had “locked-in” expensive technologies over time. To address this problem, the agency was making funds available to explore specific cases and remedies. In responding, the Task Force suggested that EPA's NPDES point-source permit approach had locked in the technology of central sewering, and the Task Force proposed to develop a regulatory framework for a new concept of community-wide remedial on-site wastewater treatment districts. Funds were awarded to this project in 1995.

With EPA Environmental Technology Initiative funding in place, the Task Force sought support to broaden its agenda, and received funding from the Island Foundation, Massachusetts Bays Program, the Switzer Foundation, the Massachusetts Environmental Trust, and EPA's Small Flows Clearinghouse's National On-site Demonstration Project. The initial foci were on how to adapt a recommended EPA/DEP facilities planning process, which was oriented toward centralized sewer planning, to decentralized wastewater planning, and on how to design and implement centralized management structures for decentralized wastewater treatment. In December 1995 the Task Force held a conference entitled Managing Small-scale, Alternative and On-site Wastewater Systems: Opportunities, Problems and Responsibilities.

Several guidance documents were eventually produced:

A Massachusetts Guide to Needs Assessment and Evaluation of Decentralized Wastewater Treatment Alternatives, 1995, by A. L. Arenovski and F. C. Shephard (a planning document).

Managing Wastewater: Prospects in Massachusetts for a Decentralized Approach, 1996, by F. C. Shephard (a management document).

A Framework for Site Evaluation, Design, and Engineering of On-Site Technologies within a Management Context, 1997, by M. Hoover (a site evaluation, design, and engineering document).

In 1997 a series of workshops for municipal officials, engineers, planners, and health agents was held to further explain the guidance documents. A summary of the workshops, "New Tools for Community Wastewater Management: Balancing Cost, Development and Resource Protection" is available in the report:

Decentralized Community Wastewater Treatment: New Concepts and Methods in Water Quality Protection, 1997, by V. I. Nelson (a summary document).

Finally, this document, Accountability: Issues of Compliance with Decentralized Wastewater Management Goals returns full circle to the central motivating themes and questions of the initial EPA Environmental Technology Initiative grant.

A fundamental reason that EPA favored central sewering was its clear accountability. Federal and state regulators had one point source—effluent from the treatment plant—to monitor, and one legal entity—the municipality—to hold accountable and fund. Can accountability be achieved in the decentralized field with hundreds or thousands of sources of pollutants and homeowners in each community? This document is an analysis of the accountability issues in decentralized wastewater treatment for federal, state, and local regulators and officials, as well as for the academic and professional community concerned about reform in goals and practices.

Executive Summary

Decentralized wastewater treatment is a fairly recent term that encompasses conventional on-site septic tank/drainfield systems, newer pre-treatment and alternative disposal technologies, and more recently, small neighborhood cluster systems. Decentralized wastewater treatment serves about 25% of American homes, primarily in rural areas of the country, but also in low-density suburbs of major cities and in higher-density small town centers. The remaining 75% of homes connects to sewers and central treatment plants.[1]

Accountability for the performance of conventional on-site systems has traditionally been restricted to the initial design and siting requirements of uniform, prescriptive codes established by states or counties. These codes vary across the country, based on different climate and soil conditions. In recent years many areas have established stricter rules for some siting considerations, such as separation from groundwater and soil profile requirements. Long-term functioning of these systems, once installed, has been considered the responsibility of the individual homeowner. Homeowner maintenance of the on-site septic system generally consisted of suggested routine pump-out of the septic tank. Failures were presumed to be minimal because design and siting codes were conservative. Over time, as problems developed or as density increased, central sewers were expected to replace on-site septic systems.

This structure of prescriptive codes coupled to homeowner maintenance had certain strengths of equity: the same requirements for every homeowner; simplicity and clarity for the installer; and low cost. In addition the codes proscribed development on lands with poor or shallow soils that could not accommodate such systems.

In recent years there have been increasing calls for new regulations and accountability structures in the field, in particular for measures that would mandate periodic inspection and maintenance, and that would shift responsibility for performance away from the homeowner and on to qualified professionals. There also have been discussions about the merits of replacing the existing uniform prescriptive codes with "performance" codes, which set specific standards for treatment at various sites based on needs to protect the environment and on soil and site conditions. Performance codes would give designers flexibility to use advanced pretreatment technologies and designs such as sand or other media filters and shallow, pressure-dosed drainfields. These technologies would either be used to compensate for poor soil or other adverse site conditions or to improve effluent quality, or both.

The calls for regulatory reform have arisen from a variety of sources. Technology companies with innovative pre-treatment or disposal units have pushed to be permitted under state or county codes. Academics and professionals who understand the potential of these systems have also sought to raise the standards of treatment. However, most state and county health departments and legislatures have resisted widespread permitting of newer technologies and a shift to performance codes for several reasons. Alternative systems pose greater risks of mechanical failure than passive, conventional systems. There are few trained professionals for the more demanding designs, installations, and maintenance needs of these new systems. The public is not comfortable with the increased cost and intrusiveness of inspections and maintenance required by these technologies. Government bureaucracies are not equipped for increased oversight roles. Finally, in many jurisdictions, growth control proponents have successfully argued that advanced technologies will open up new areas for development.

There are several overriding public interest considerations for reforming the structure of the traditional prescriptive code with homeowner maintenance, at least in some key sections of the country. First, it is increasingly apparent that existing conventional on-site systems fail to remove enough nutrients, primarily nitrogen, to protect nearby drinking water sources or sensitive coastal estuaries, lakes or ponds. Second there is growing concern about pathogen contamination of drinking water sources and recreational waters. Third, the cost of sewering existing, older neighborhoods near sensitive ecosystems or with high-density development on poor soils is prohibitive for many communities.

Advanced on-site treatment and disinfection technologies can address human and aquatic ecosystem health concerns, provided that system oversight and maintenance are mandatory components of decentralized treatment plans. Combinations of advanced on-site technologies, conventional septic systems, and cluster systems all operating under a central management structure may be a cost-effective alternative to sewering. It may also be less expensive to decrease nitrogen or phosphorous levels by installing advanced on-site systems in certain neighborhoods or buffer zones in the watershed, rather than to upgrade treatment levels at a wastewater treatment plant.

Another advantage of decentralized systems is the local replenishment of groundwater and surface water from individual systems. Central sewering and treatment plants often transfer large amounts from one watershed to another or convey water via outfall pipes to the ocean.

This document is an extended discussion about accountability, including a set of recommendations about the shape and form that accountability structures might take in the decentralized wastewater field in the future. Options range from a federal mandate and set of uniform national standards for design and oversight of on-site and cluster systems, to state or county initiatives to permit advanced technologies under private maintenance contracts by each homeowner, to the creation of decentralized system management districts operating under a single permit.

This document summarizes some of the key lessons from a national literature on regulatory structures and reform. Tight, uniform regulations, designed and implemented to protect public health and the environment, have resulted in several adverse effects. These include a resistance to technological and practical innovation, an inevitable tendency of standard one-size-fits-all systems that either over-protect or under-protect the environment depending on local circumstances, and a growing public opposition to top-down government mandates and enforcement. In general, these concerns have led to greater flexibility in the imposition of regulations and an increasing reliance on non-regulatory incentives and on citizen involvement in framing the solutions at the local level.

The history of regulations and other accountability and compliance structures in the on-site field are also reviewed in some detail. Although each state is different, there have been several phases of reform in the last forty or fifty years. In the 1960s and 1970s many states imposed stricter on-site system design and siting requirements in response to U.S. Public Health Service recommendations, but maintenance was still the homeowner's responsibility and advanced treatment systems were not allowed. In the 1970s, wastewater professionals and the Environmental Protection Agency urged states to authorize and encourage on-site wastewater management districts with simple maintenance and inspection functions performed by district staff rather than the homeowner, but few such districts were created. More recently, some state and county codes have permitted a few of the newer on-site technologies and some have required long-term inspection and maintenance contracts between the homeowner and the installer or company.

For the last several years, the ad hoc Task Force for Decentralized Wastewater Management in Massachusetts has explored an expanded concept of centralized management of decentralized systems that goes beyond previous concepts of wastewater management districts. The Task Force proposes that districts perform inspection and maintenance functions as recommended earlier, but also that communities adopt a risk-management framework to assess soils and sensitive and critical environmental conditions, and utilize advanced technologies where needed to minimize risk to public health and the environment. The Task Force further expands management services beyond traditional municipal staffing to include the possibility of utility or private company contracts. Finally, under the Task Force's concept, the public would participate in the initial wastewater, land use, and other infrastructure planning that establishes the purposes and functions of the decentralized district. The state or county would issue a single permit to the managing entity, and this entity would have a certain amount of flexibility or waivers from the uniform code in the use of technologies or siting criteria.

Six case studies of community decentralized wastewater treatment districts are analyzed in this document. In general, such districts have been highly successful models of enhanced accountability. The primary recommendation of this document is for federal, state, and local government to cooperate in exploring and developing examples or demonstrations of such districts throughout the country, and in particular where sensitive environmental ecosystems or drinking water sources are threatened. The term "charter" districts is used here, because, like charter schools with regulatory flexibility, districts can function as laboratories for innovation and reform in technology and practice, and lessons learned can be broadly disseminated.

The final section of this document summarizes the findings and lessons in a comprehensive list of suggested federal, state and local regulatory and non-regulatory actions. No one blueprint is appropriate for all areas, but in general the Task Force recommends that the federal government apply pressure on states to maintain or improve water quality and that the government substantially increase the federal resources for research, training, technology verification, and demonstration projects.

States and counties should retain regulatory authority for decentralized systems. Regulatory programs should make use of new technologies and include mandated inspection and maintenance in cases where protecting public health and the environment warrant the additional expenses and intrusiveness. States also need to work with and support the efforts of local communities to develop innovative technology, planning, and management structures under a community decentralized wastewater treatment district framework. Increased regulatory flexibility for innovative designs, technologies, and management structures should be allowed in return for legally binding assurances and monitoring programs to guarantee results.

Recommendations for local communities vary with the particular site conditions and commitments of local citizens and staff. The ad hoc Task Force has laid out a complex risk management and participatory planning structure for decentralized districts that worked in the case studies reviewed, and in other communities. However, many of the practices and technologies involved are currently neither mandated nor permitted by state and county codes, and implementation of this approach requires the flexibility and support of regulators.

The community must be prepared to seek out qualified engineers and inspectors to minimize the risks that this new approach entails. Federal and state financial support should be sought to help absorb these risks. New utility and privatization approaches may be suitable in some communities. As these “charter” reform districts become successful and grow in number, the risk of the approach will decline dramatically and the costs of new technologies and of qualified designers and other personnel will decrease as well.

Wastewater management districts are not the answer for all communities. In many instances, communities may decide that performance codes and inspection programs are not warranted by the local site conditions, and that a uniform code/homeowner maintenance system is sufficiently protective of public health and the environment. This decision is likely in areas where soil conditions are good, groundwater contamination is improbable, and density is low. Many other communities may determine that sewer collection systems and a central treatment plant are more desirable and cost-effective.

I. Introduction

Background

In the years following passage of the 1972 Clean Water Act, the EPA and the States regulated wastewater treatment via a permit system that established pollutant removal standards for "point source" discharges. For municipalities, this meant construction of a treatment plant or its upgrade from primary to secondary or tertiary levels and extensions of sewer lines into unsewered areas. Most costs were borne fairly comfortably with the available 75–90% federal–state grant subsidies.

In many respects and for many years, this approach worked well. Federal and state regulators had one point source to monitor, effluent from the treatment plant, and one legal entity, the municipality or sewer utility, to hold accountable and fund. At the same time, federally funded research improved treatment technologies; large engineering firms became well versed in the design of plants and sewers; and universities' engineering curricula thoroughly covered centralized treatment and collection systems. Over time, major improvements were made in the water quality of rivers and streams and of harbors and coastal waters.

In recent years, problems and limitations of the centralized treatment approach have surfaced, not the least of which is its high cost. With the replacement of the federal and state grants program by a federally seeded state revolving loan fund, local communities bear the burden of mandated projects. For example, in 1994 two towns on Martha's Vineyard, Massachusetts, faced a requirement to build a new treatment plant and sewer system that was projected to cost each homeowner $30,000.

Other adverse side effects have emerged as well, including the transport of water by sewer pipes out of watersheds and the resulting depletion of groundwater levels, the intrusion of saltwater in coastal areas, and the overloading of coastal waters with excessive nitrogen from treatment plant effluent. In retrospect, implementation of the Clean Water Act was geared to the protection of public health, while understanding the effects of water pollution on the natural environment has surfaced only recently.[2]

There are alternatives to centralized collection and treatment of wastewater. For many areas these alternatives are less destructive to the environment and less expensive for the community. These options include:

- targeted upgrades of failing on-site treatment systems;
- innovative, high-performance technologies for pre-treatment on lots with shallow soils or other adverse site conditions;
- small satellite treatment plants or leaching fields in high-density areas;
- detailed watershed planning and risk management to specify precise system performance standards for sensitive vs. non-sensitive zones; and
- maintenance, inspection and monitoring programs to detect failures.

Interest in these methods challenges a conventional premise of wastewater treatment engineering—that on-site treatment is a temporary solution on the way to permanent sewers. Broad acceptance of alternative approaches will require continued refinement and performance testing of innovative on-site technologies and the retraining of engineers and contractors in small-system design and construction. It also will require a renewed emphasis on monitoring and assessment technology and practice, and increased eligibility for federal and state financing.

A critical impediment to the advancement of these alternatives is the lack of a consensus that a comparable level of "accountability" can be achieved in the on-site field as is found in central sewering. The task appears daunting, particularly from a federal perspective. Rather than one point-source effluent to monitor, there may be hundreds or thousands of individual on-site systems. Rather than one municipality or utility to hold accountable, there may be hundreds or thousands of homeowners, as well as designers and contractor/installers of on-site systems. In theory, EPA and state regulators could extend their enforcement activities to individual homes by considering effluent from on-site systems as a point source requiring an NPDES permit. But enforcement actions against hundreds or thousands of citizens within a single community alone would be a legal and administrative nightmare.

In general, state or county codes have specified and regulated on-site designs, but have not required long-term monitoring of installed systems. In addition, local health departments have often been reluctant to enforce costly upgrades or repairs of on-site systems, in part for lack of funds or staffing, and in part for lack of authority or political backing to routinely enter private property to inspect the performance of septic systems. Finally, real estate and citizens' groups across the country have typically opposed more stringent inspection programs or enforcement.

A New Regulatory Paradigm: Decentralized Districts

A centrally managed decentralized wastewater district is a potential solution to the problem of accountability in the on-site field. Under this model, the state would grant the district, with its multiple on-site and cluster systems, a single permit (possibly labeled as a decentralized or non-point source discharge permit). A municipality or public utility would manage the district and be the one legal entity responsible for meeting water quality standards. The managing entity would reach agreement with the state concerning goals, timetables, and methods of treatment, including systematic repair of older systems.

While such a district is conceptually not difficult to envision few of its details had been analyzed or agreed upon when the ad hoc Task Force began its work. For example, although some states have revised on-site codes to allow for innovative technologies, these revisions have applied to single sites and not to a community. In the 1970s a number of states authorized and enabled the formation of on-site inspection and maintenance districts, but few were ever established. The ad hoc Task Force recommends a much more comprehensive planning and risk management approach to on-site management districts than these previous endeavors.

The three other documents of the Task Force have explored the major aspects of a comprehensive decentralized district:

- the facilities planning process, including a needs assessment and engineering evaluation of the full range of centralized and decentralized treatment modes[3];
- site evaluation, engineering and design factors in a risk management approach that targets advanced technologies in critical areas of concern[4]; and
- a full range of options and requirements for central management of decentralized treatment facilities.[5]

This document provides recommendations to federal, state or county, and local levels concerning the "accountability" aspects of decentralized wastewater treatment, and, in particular, the potential role and advantages of a new decentralized wastewater district approach. The proposed districts incorporate the facilities planning, site evaluation, design and engineering, and management principles identified in the earlier documents.

The summary document of the work of the Task Force, Community Decentralized Wastewater Treatment: New Concepts and Methods in Water Quality Protection outlines the range of recommended activities and approaches of a comprehensive district, including:

- community participation,
- comprehensive infrastructure and land use planning,
- development of a community and watershed profile,
- identification of critical areas of concern,
- assessment of engineering alternatives,
- risk assessment and risk management analysis,
- formation of a district and its long-term management.[6]

Issues to Consider

This recommendation for new decentralized wastewater treatment districts comes at a time when there are widespread concerns about regulatory approaches and numerous efforts at regulatory reform or reinvention. It would be a mistake to forge ahead with a traditional impulse to regulate and permit these activities, when many concerned parties are seeking revisions and alternatives to regulation. This document, therefore, looks to find answers and provide guidance for the decentralized wastewater field first by reviewing the literature and recent initiatives in environmental regulation in the United States. What is the history of environmental regulation? What factors have led to this new era of regulatory reform and devolution? What are the strengths and weaknesses of command-and-control regulations and permitting, and what non-regulatory alternatives are there to achieve the same or better goals? What factors are behind the pressure to shift accountability down to the local level and to stakeholders? Chapter 2 describes the critiques and suggested remedies of command-and-control environmental regulation.

Second, what are the history and current status of regulation in decentralized wastewater treatment? Chapter 3 discusses the evolving state and county regulatory code structures. Chapter 4 covers a host of new non-regulatory efforts to increase compliance with good practices, including education campaigns, funding incentives, and others.

Third, six case studies of on-site districts have been conducted for this document. This research describes communities in North America that have opted to solve their wastewater problems through a district-type model of centrally managed on-site systems. What lessons can be learned from these examples, and has a high level of accountability and compliance been achieved? A summary of the case studies is provided in Chapter 5, with complete studies in the Appendix.

Finally, what guidance can be provided to local, state and federal policy makers and others about an appropriate mix of regulatory and non-regulatory approaches to increase accountability in the decentralized wastewater treatment field? Chapters 6 and 7 summarize the findings and conclusions of the prior Chapters.

Aspects of Accountability

The term "accountability" will be interpreted very broadly in this document. Webster's Dictionary defines accountable as "answerable" and provides a synonym "responsible." Not just government, or regulated entities, are considered accountable for environmental protection today. All participants in decentralized wastewater treatment are responsible for the success or failure of treatment modes and practices implemented to protect public health and the environment. These participants include government regulators, policy makers and managers, private companies, consultants, contractors, utilities, health department agents, legislators, environmental organization representatives, academic researchers, educators, and homeowners.[7]

A broad framework is significant for this analysis, because the workload of government regulators can be much reduced if non-governmental entities take on greater responsibilities for the success of decentralized wastewater treatment. Compliance with decentralized wastewater goals and practices does not mean just regulated and enforced compliance according to government-set standards and by government staff. Many trade associations, research consortia, and other private sector entities are seeking to upgrade methods and practices in this field. The questions here are the proper balance of public and private responsibilities, and the types of frameworks and partnerships that should be established.

Accountability will refer to broad aspects and technical details alike. Three major dimensions of accountability are important.[8] First, how well do regulatory and non-regulatory frameworks protect public health and the environment? All parties are answerable or responsible for the success or failure of the decentralized sector in cleaning up lakes and streams, protecting coastal waters from eutrophication, keeping pathogens and nitrogen out of drinking water sources, and preventing septic tank effluent from surfacing on lawns, etc.

Second, how responsive are regulatory and non-regulatory frameworks to the totality of community and citizens' needs. Are the benefits of protection commensurate with the costs? Are the costs of protection equitably distributed? Has the public been involved in setting a vision for the community, and have they chosen to accept new charges, inspections on private property, etc.? Are there unintended and adverse consequences on land use and available open space that have been disregarded?

A third dimension of accountability concerns technical questions of practicality and feasibility. Will communities accept the responsibilities of decentralized wastewater system management? Do we know enough about transport of on-site system effluent through the ecosystem to determine appropriate treatment levels at each site? Can agreements be structured that give communities flexibility in treatment approaches, but at the same time provide firm measures of outcome? If expected outcomes are not achieved, will the state have the power or the enforcement ability to demand additional treatment measures?

II. Environmental Regulation: Critiques and Remedies

Background

Prior to 1972, the federal government had played a relatively minor role of encouraging the states to establish standards for water quality. Left to themselves, the states moved very slowly to implement water pollution control. However, the burning of the Cuyahoga River in Ohio led to a movement to clean-up lakes and rivers and eventually resulted in passage in 1972 of the Federal Water Pollution Control Act, or Clean Water Act as it is called. Its key features were the establishment of national water quality standards for various types of water bodies (fishable, swimmable, etc.), a system of permits for municipal and industrial point-sources (NPDES permits), and substantial funding in the form of federal construction grants for municipal sewers and treatment plants. The Environmental Protection Agency itself was established in 1970. Similar national initiatives were the Clean Air Act of l970 and other major presumptions of federal authority such as Superfund legislation, the Endangered Species Act, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act.

Most analysts of these laws and their impacts would begin by applauding the major improvements in public health and environmental conditions that have been achieved. Certainly the combination of national standards, subsidies, and enforcement was largely responsible for the observed improvements in water quality of many lakes and streams and harbors since the early 1970s. During that time, over $60 billion in federal appropriations were funneled to municipalities that undertook major sewer construction projects and upgrades of treatment plants. For those communities that did not act, enforcement actions by EPA or by EPA-delegated states led to consent decrees with binding commitments for remedial activities. Factories and power plants were subject to permitting and enforcement actions as well.

During the last decade, extensive analyses of the effects of these environmental regulations have resulted in revisions to legislation, including the hallmark Clean Water Act and its later Amendments. One identified problem was that the federal permitting system seemed to deter innovation in methods and technologies. A second concern was the economic inefficiency of one-size-fits-all regulations that led to costly over-protection in some instances and under-protection or missed opportunities in others. A third criticism was that federal regulatory structures had lost touch with citizens—increasingly, initiatives were characterized as mandates rather than aids or assistance to local goals. Further criticism followed the 1987 Clean Water Act Amendments that replaced outright federal grants with loan programs that placed the burden of water pollution control on state and local governments.

Finally, in both air and water policy discussions, there was growing recognition that the remaining pollution was to a large extent from nonpoint sources not covered by point-source regulation. In the case of air pollution, millions of automobiles, lawn mowers, oil furnaces, and the like would be included. In the case of water pollution, non-point sources included farms, lawn fertilizers, septic systems, storm water and urban runoff. To what extent could a point-source command-and-control regulatory framework be extended to millions of nonpoint sources? Was this extension logistically viable, and would farmers and citizens accept this control from above?

These aspects and critiques of federal environmental regulation are discussed below, followed by a description of recent initiatives to reform or restructure policy, in particular at the federal level. While almost all policy and regulation of on-site systems occur at the state and county level, the findings and lessons about how higher, centralized authorities regulate or otherwise relate to local communities or individual citizens are directly applicable.

Areas of Critical Concern

Barriers to Innovation in Technology and Practice

A series of EPA-sponsored reports in the late 1980s focused on the unintended effect of federal command-and-control regulation of discouraging technological innovation. Two key analyses were the Bush-Administration report, Permitting and Compliance Policy: Barriers to U.S. Environmental Technology Innovation (a Report and Recommendations of the Technology Innovation Committee),[9] the Clinton-Administration report, Technology for a Sustainable Future: A Framework for Action,[10] and a report by the Office of Technology Assessment (OTA) to the U.S. Congress, Industry, Technology, and the Environment: Competitive Challenges and Business Opportunities.[11] These and other reports culminated in the EPA Environmental Technology Initiative (ETI). (The ETI funded the project that resulted in this document, others in this series and numerous other projects nationwide.)

According to the above reports, federal regulations and funding programs were largely prescriptive, that is, they explicitly prescribed or were based on the specific technologies or designs available to meet the requirements of the permit. The guidance documents and technical manuals were sometimes dogmatic and detailed only certain technologies as solutions. At any given point in time, the understanding was that these requirements would be grounded in “best available technology” (BAT) at reasonable cost to the regulated entity, whether industry or municipal. However, there was no premium to a company or utility for exceeding the required standards. Without technology development and productivity advances, the EPA reports declared, pollution control would lag behind other sectors in the economy and become relatively more expensive and burdensome to society. Several specific problems resulting from the prescriptive approach were identified.

First, the regulatory structure inhibited technology innovation by what the reports characterized as double jeopardy. A regulated company or municipal treatment plant might propose an innovative, less costly technology, but if it was installed and failed to meet EPA standards, the entity would pay twice—once for the failed approach and a second time for the standard, prescribed technology. According to the OTA report, "the risk to individual companies in proceeding alone with the needed R & D may be too great, given technical uncertainties and questions about the acceptability of new technologies in the regulatory system."[12]

Few companies or communities were willing to take this risk. EPA and other federal agencies witnessed and documented a low rate of capital investment in environmental technology development and commercialization. As the Clinton-Administration report stated, " Many venture capitalists cite uncertainty about the regulatory process as a central reason for reluctance to invest in the environmental industry. Uncertainty about whether a particular technology will be approved or endorsed by regulators adds a significant and difficult-to-analyze dimension to the riskiness of investment projects."[13] Government-sponsored research might help, but as the Bush-Administration report stated, "the government role as gatekeeper and overseer transcends its role as investor in technology innovation."[14]

An earlier attempt to overcome this technology lock-in was the Innovative and Alternative (I&A) provision of the Clean Water Act's construction grants program. Until 1990, I&A projects received an additional subsidy of approximately 15% and the federal government covered the cost of replacement if an innovative system failed. Under this program, numerous on-site, cluster and constructed wetlands systems were funded. However, oversight and quality control were insufficient and failures resulted, in part due to the employment of inexperienced local engineers and operators and in part to the lack of risk to the community because of the replacement provision. The 1989 EPA Report to Congress on the Effectiveness of the Innovative and Alternative Wastewater Treatment Technology Program cited for example "lack of knowledge and proper guidance when the system was designed" as the cause of failures in community mound systems in New York, North Dakota and Illinois.[15] Many decentralized wastewater treatment professionals believe that these failures set back the field for quite some time, because they created the impression that these systems would not work. Future efforts to fund demonstration projects should include strong provisions for the use of qualified engineers.

Second, beyond the "double jeopardy" problems of risk from investing in lower-cost approaches, municipalities and companies also lacked strong incentives to invest in higher-quality, higher-cost pollution control devices or in pollution prevention earlier in the production process. In a typical consumer market, a company might increase profits by producing higher-quality, higher-cost, goods or services, because the consumer is willing to pay the price for the better product. But pollution is an externality to production, and most consumers are unwilling to pay the higher costs of enhanced pollution control unless required by law to do so. For example, in the case of water quality consumers are willing to spend more for bottled water for drinking, but do not want to spend more to clean up their wastewater.

Finally, a further problem stems from the circular relationship between setting water quality standards and setting technology standards to achieve water quality standards. The EPA has stated, “EPA typically bases pollution control standards on the achievable limits of available well-demonstrated technologies.”[16] Thus, the regulations stipulate that best available technology is used, and the regulations utilize standards for effluent quality that are based on that existing technology. This circularity dissuades interest in developing innovative technologies that would improve water quality and freezes best available technologies in place for long periods of time.

If environmental conditions deteriorate considerably, new laws and regulations will raise standards. However, acceptance of new regulations is a lengthy and controversial process because municipalities and companies will oppose the larger burden imposed upon them if technology that will achieve these higher standards is not available at reasonable cost. According to EPA, “...the nation has fewer technologies to choose from as it moves to the next generation of environmental protection goals.”[17]

Once higher standards are set, technology entrepreneurs respond to the opening of new markets, and typically develop new pollution control devices at substantially lower costs than had been predicted. In the interim, however, BAT prevails for long periods and acts as a drag on the ability of regulators to impose the higher standards that would promote innovation in the first place.

Economic Inefficiencies in Environmental Regulation

Critical analysis from the field of economics has provided the foundation for revisions to regulations in recent years. The economist, John J. Boland, headed the Committee on Wastewater Management for Coastal Urban Areas of the National Research Council in its mid-1990s landmark study, Managing Wastewater in Coastal Urban Areas.[18] Stephen Breyer, now a U.S. Supreme Court Justice, also used an economics framework in his influential book, Breaking the Vicious Circle: Toward Effective Risk Regulation.[19]

Essentially, the studies blamed the rigidity and one-size-fits-all character of the federal regulations for massive waste and inefficiency in water pollution control and in other environmental sectors. For example, because federal legislation did not include economic considerations or tradeoffs, cleaning up pollution was always a requirement, regardless of cost to the community or company. Regulations and policies included no mechanisms for prioritizing projects or varying standards of treatment to achieve the maximum environmental clean up at the minimum cost. Breyer argued that a large fraction of environmental resources was used to clean up the last few percentages of pollution.

The Boland Committee's critique was similarly far-reaching, noting that federal water quality standards and permit requirements took insufficient account of the wide-ranging variations in ecosystems and receiving waters across the country. In some cases, such as coastal embayments, federal standards were insufficient to protect the waters from excessive nutrients. In other cases, such as San Diego, where the City was close to a steep continental shelf and strong currents, requirements for secondary treatment were arguably of minimal value.

Similarly, for air pollution, the 1989 annual report of the President's Council of Economic Advisors concluded that "EPA's rigid regulatory strategy has clearly wasted a substantial portion of the Nation's investment aimed at improving air quality...more cost effective pollution control strategies could have achieved the same degree of environmental quality for billions less."[20]

Regardless of the actual amount of money that might have been misallocated on environmental protection, the arguments achieved a political saliency as local governments and industry, which felt victimized by one-size-fits-all regulations, called for reform. Ultimately, the need to consider benefit-cost analysis and market mechanisms achieved fairly widespread acceptance. A number of initiatives incorporating these ideas are discussed in later sections of this document.

Declining Citizen Involvement and Support

An additional problem in the regulatory structure was that enforcement and permitting bureaucracies increasingly lost touch with citizens' concerns, and especially with the cessation of federal grants, were characterized by adversarial, uncooperative, relationships. Over time, anti-Washington backlash was probably inevitable, as evidenced in such movements as the opposition to unfunded mandates that constrained new federal legislation after 1995.

Fortunately, the majority of Americans continues to support environmental protection programs, and when they are involved in setting visions and priorities at the local level, are as likely to want more rather than less environmental protection. Recognizing that attitude, Dewitt John from the National Academy of Public Administration stated that "Support for traditional ways of protecting the environment has been eroding for some time. ... The crisis of confidence is not one of whether to protect the environment but of how to do it."[21] John recommended that the path to resolution of many environmental controversies was through informal, local cooperative efforts rather than federal regulation, because regulation tends to produce highly adversarial politics.

Nonpoint Source Pollution

The criticisms about water pollution control regulations emerged simultaneously with the realization that progress on point-source control had been achieved to a large degree. A much larger fraction of the remaining air and water pollution originated from a diverse and dispersed set of nonpoint sources. Agriculture and urban runoff contributed 65% to the total water pollution according to a 1998 estimate.[22] Stubborn air quality problems were also caused to a fair degree by diverse and dispersed sources.

The wide range of jurisdictions and authorities involved in nonpoint source pollution control further complicated regulatory efforts. Nonpoint source activities include farming, fertilizing lawns, keeping pets, septic system use, timber harvesting, land development, road construction activities, etc. Different bureaucracies or departments, at distinct levels of federal, state or local government, control or influence each regulated activity. To create a coherent, inclusive regulatory program would require an unprecedented level of coordination among these entities. In particular, many of the determinants of water quality relate to land use. Local governments, with jurisdiction over zoning and other land use measures, have been unwilling to cede this traditional control to upper levels of government.

The shift toward nonpoint source abatements paralleled efforts to encourage states to focus on watersheds. In the 1970s states had been encouraged to analyze "area units of water quality," but in the rush to get quick results, the emphasis was on getting the dollars out the door rather than on monitoring the impacts of the projects on the ecosystems. Projects that addressed stream segments, lakes or coastal zones focused predominantly on the water body itself, rather than on the contributing watershed.

Questions of how to regulate millions of individual nonpoint sources, therefore, were blended with widespread critiques of prior regulatory structures. A plethora of new proposals and initiatives emerged from commissions and advisory panels and ultimately from EPA and the Congress. The themes of innovation, economic efficiency, citizen involvement and a nonpoint source focus overlapped in a number of initiatives, many with the same ideas but with slightly different rhetoric. In 1995, the Clinton Reinventing Environmental Regulation initiative of the National Performance Review, alluded specifically to the critiques described above:

"But as we achieved these successes, we learned a great deal about the limitations of command-and-control. Prescriptive regulations can be inflexible, resulting in costly actions that defy common sense by requiring greater costs for smaller returns. This approach can discourage technological innovation that can lower the costs of regulation or achieve environmental benefits beyond compliance. Prescriptive regulation is often less effective in addressing some of the more diffuse sources of pollution that we will face in the years ahead."[23]

Remedies and Reform

Regulatory Flexibility

After much analysis of command-and-control approaches, the EPA responded with several recommendations and initiatives to loosen rigid regulations and to facilitate a more productive enforcement relationship between the regulator and the regulated.[24] These included Project XL, a program to encourage companies or municipalities to initiate innovative approaches. Under this program, departures from prescriptive technological requirements would be allowed if more pollution prevention or reduction could be achieved. The EPA also approved a reduction in reporting requirements and offered other incentives or rewards for companies or communities that showed good performance. Another recommendation was to allow more time before enforcement against regulated entities that proposed to use innovative technologies. The EPA also initiated permit teams to work with and support innovative companies or communities. Finally the government offered other forms of technical assistance to local communities.

Alternatives to Regulation

Economics-based and other critiques of regulatory structures also led analysts to search for non-regulatory mechanisms to achieve the same goals of environmental protection at less cost and with more public support. EPA was encouraged to explore a range of additional measures, including:

- Voluntary compliance, by which cities, companies, or communities could be encouraged to clean up or prevent pollution through education and public information campaigns.

- Incentives, that utilize a range of market-like inducements to change behavior instead of mandates and control. (These include pollution taxes or fees to discourage pollution and subsidies to encourage clean up. The most radical suggestion in this area was for the creation of markets in pollution rights or tradeable permits that allowed trading in sulfur emissions permits among companies. Instituted first in the 1989 reauthorization of the Clean Air Act, the same principles have been explored in watershed projects, notably in North Carolina.)

- Research and development, technology verification, technical assistance, training, and extension services, which would demonstrate a commitment to environmental research much like the federal government commitment to large scale defense and energy research.

- The establishment of a National Institute for the Environment, modeled on the National Institutes for Health.[25] (The Office of Technology Assessment also has recommended consideration of an "institute for environmental cooperation" for industry, environmental organizations, and regulators to collaborate on technology development projects.[26] Some projects have been proposed and funded for technical assistance, particularly to small communities, and for information campaigns to homeowners and farmers.)

All of these initiatives are designed to bring economic rationality to the sector and to encourage voluntary compliance rather than resistance to mandated compliance. Pollution taxes create a financial incentive for companies to go beyond regulations to identify and utilize pollution-prevention and cost-effective clean up methods. Tradeable permits encourage reductions in pollution in the most cost-effective manner—companies with costly clean up alternatives can pay for pollution rights for companies that can use cheap technologies.

Economists argue that research and development, demonstration projects, technical assistance, information dissemination, and training are not a normal part of a private market system, but are a necessary public or non-profit sector expense. The reason is that the benefits of such programs are wide and diffuse, and cannot reasonably be captured by individual investors or local communities. Historically, this has been the argument for federal funding of land-grant universities to provide for research, education, and outreach. Indeed, from an economics standpoint, supporting basic and applied research is one of the most fundamental and productive roles of the federal government.

These broad suggestions to explore non-regulatory alternatives in the federal role have been integrated into both the Coastal Zone Management Acts and Nonpoint Source Control programs under the Clean Water Act. Guidance documents, for example, support such alternative management measures as tax credits or deductions, cost-share programs or loans, and trading of pollution control requirements, all of which are economic incentives to remediate pollution; and taxes, fees, or pricing structures, which are economic disincentives to creating pollution in the first place. However, states must still ensure that enforcement authority backs these voluntary measures.[27]

A more recent suggestion by the Presidential Commission on Risk Assessment and Risk Management is that EPA examine the public health model, which traditionally relied on "management actions at the community level to reducing exposures with the biggest impacts in terms of the number of people affected and severity of effect," rather than on command-and-control regulations. The tools of public health protection are "epidemiology, exposure assessment, surveillance, nutrition, genetics, and behavior change," not just regulation.[28]

The Commission's Framework for Environmental Health Risk Management published in 1997 presented risk management methods including education/information, incentives, monitoring, surveillance, and research. The Commission also critiqued the rigid compartmentalization of EPA and recommended an integration of risks across the various media of air, water, etc.[29]

Community-based, Stakeholder Involvement

Beginning with the Bush Administration and accelerating under the Clinton Administration, EPA has invested in a number of initiatives to encourage greater involvement by citizens in formulation of plans and in setting of priorities at the local level. Community-Based Environmental Protection (CBEP) projects, in which EPA provides technical assistance to small communities, are a prime example.[30] In addition, EPA's Comparative Risk Project has helped communities across the country analyze the risks from pollution, and, combined with other public health and environmental risk factors, to agree on plans of action.[31]

These efforts build on the ideal of democratic self-control, and local level involvement to determine priorities for the future. In large part, however, these efforts are necessary to build the level of local political support that allows new and complex environmental initiatives to proceed. Citizens may tend to resist new regulatory requirements or constraints on behavior, unless they are able to see the choices and benefits they have and to participate in making those choices.

A further aspect of citizen-based programs is education to raise the level of voluntary compliance with environmental programs. These efforts have been the mainstay of public health projects to discourage drug or alcohol abuse and tobacco smoking, and to encourage childhood immunizations, etc. They may be increasingly important in environmental programs in the future, since the mood of the public has coalesced against the seemingly arbitrary imposition of unfunded environmental mandates that result in higher local tax burdens.

Accountable Devolution

A 1995 National Academy of Public Administration (NAPA) publication, Setting Priorities Getting Results, has recommended the most radical restructuring of the EPA role yet seen under the framework of accountable devolution.[32] This recommendation also happens to be the most relevant or applicable to discussions about decentralized wastewater treatment districts appearing in the next chapters of this document. Essentially, NAPA has blended the critiques of stifled innovation, economic inefficiency, loss of citizen confidence, and the new realities of nonpoint-source pollution into a fundamental restructuring of authority and responsibility downward to state and local levels. The report calls for a new mission statement for EPA:

"The mission of the Environmental Protection Agency is to provide national leadership in setting goals and priorities for environmental protection. The agency sets national standards for environmental protection and undertakes a variety of activities to ensure that the standards are met. To that end, EPA builds knowledge about opportunities to reduce risks to human health and the environment, enforces some standards and oversees state enforcement of national standards, and assists states and communities in designing and implementing their environmental protection strategies."[33]

This proposed mission statement reinforces the concept that key federal roles are in research, monitoring, and technical assistance. The federal government would also retain, however, the role of setting national standards for water quality, air quality, etc. The primary responsibility for meeting these standards would fall, then, on state and local governments, with a fair degree of autonomy in how they met those standards. As the report states, "In return for flexibility, state and local governments must take responsibility."[34]

In 1998, eighteen governors of Western States reached a similar agreement on principles to resolve disputes that polarize environmentalists and industry or communities. " We're not rejecting federal environmental standards and goals" said Governor John Kitzhaber of Oregon, "But the problems we're facing now require sustained efforts by private individuals and local communities as well, and that means giving them ownership of the solutions."[35] Some of the governors' principles include:

- set national standards but leave flexibility for neighborhood solutions;
- reward results and don't get hung up on compliance with specific program requirements; and,
- markets are preferable to mandates when it comes to achieving your goals.

Caution and Caveats

Federal command-and-control regulations have been an easy target for critics. But a balanced review must admit that alternative strategies and non-regulatory alternatives may not always produce results commensurate with their idealized promise. For example, EPA Headquarters expressed concern when the Region I Office of EPA implemented more voluntary reports and compliance by companies.[36] A Boston Globe editorial was a reminder that government must still be vigilant and recommended, "Don't expect, inspect."[37] Similarly, reviews of the 104th Congress' radical Clean Water Act proposals from the U.S. House of Representatives showed that a number of provisions that were couched in benefit-cost and flexibility arguments essentially provided an escape from many environmental clean-up requirements.[38] As the Clinton Administration Regulatory Reinvention initiative pointed out, the appropriate strategy is "Reinvention Yes, Rollback No."

"Our effort to reinvent environmental regulation does not imply compromise on the public health and environmental protection goals to be achieved. While increased flexibility is a central principle of our reinvention effort, flexibility is not a codeword for loophole. Those who abuse this new flexibility will find the traditional tools still at hand to enforce the law."[39]

III. Evolving Regulatory Structures in Decentralized Wastewater Treatment

Background

Regulatory structures for accountability of on-site and decentralized wastewater treatment vary from state to state. However, during the past half-century, the states have tended to proceed through four general phases.

1. Development of septic system design codes or strengthening of existing codes. In this stage, accountability rests primarily in the conservative nature of the code itself and in a minimal expectation of homeowner maintenance of a system.

2. Authorization of a simple local public management structure. In this phase, a local management entity is responsible for implementation of code requirements and inspection, system monitoring, and maintenance programs.

3. Modification of codes to include permitting of advanced technologies, inspection and maintenance requirements, and higher standards for performance in critical zones. This structure requires greater involvement and higher levels of skill from design and installation professionals under contracts with the homeowner. But the success or failure of on-site treatment still rests primarily in the details or adequacy of the code.

4. Decentralized wastewater treatment districts: accountability shifts to the local level. Districts are given a substantial degree of flexibility in implementing code requirements in return for assuming responsibility for the outcomes of the system in the environment.

Each of these phases mirrors in some fashion the trends and pressures for reform seen in the larger regulatory and policy arena at the national level—an initial strengthening of regulations at a higher, centralized level; attempts to transfer management down to lower levels of government; followed by pressures for increased regulatory flexibility and attention to areas of critical concern; and finally, calls for serious devolution of authority to local levels. Most states have completed the first phase of strengthening or initiating an on-site code and have implemented or are exploring the third phase of permitting advanced systems. Curiously, the second phase of simple management districts has been authorized in enabling legislation in many states, but rarely implemented. Some decentralized wastewater professionals believe communities will essentially leapfrog over a simple management approach to a more comprehensive district model.

This chapter describes these transitions in the on-site field and seeks to identify the strengths and weaknesses in the several approaches. Because regulations vary from state to state, a number of statements will be over-generalizations. Nevertheless, the four stripped-down models and frameworks are useful in the analysis of accountability and compliance in the on-site field.

Development of Septic System Design Codes or Strengthening of Existing Codes: Accountability Rests in the Code

Historically on-site wastewater treatment regulations have been the responsibility of state and, in most instances, county governments and have been exempt from federal NPDES or groundwater discharge permits. Until the end of World War II, regulations were fairly lax, presumably because on-site systems were considered a temporary solution. Thus the regulations focused on disposal of wastewater effluent below ground rather than on treatment of the effluent.[40] However, as development increased in unsewered areas and expanded onto poorer and shallower soils, the need for stricter regulations became apparent. States revised and tightened standards and most adopted a U.S. Public Health System model code in the mid-1970s. Recent Title 5 revisions in Massachusetts can be characterized in part as a greater strengthening of standards in the code.

Essentially this command-and-control model of regulation established accountability in the state or county code itself. A uniform set of design and technology standards was laid out with the presumption that protection would be achieved if these standards were met. If on-site systems were not adequate, the understanding was that the code should be tightened.

Conformance with code requirements was largely a health department responsibility at the county or local level. An initial permit was issued for construction of the system, but generally maintenance and inspection were not requirements because of the conservative nature of the code. Health department agents did have the power to force remedial upgrades or replacements of failing systems.

A perceived strength in the code was that uniform technology and design requirements were simple and relatively maintenance-free. The small community wastewater manual published by EPA in 1992 included criteria and suggestions for design and operation of individual on-site, cluster and small community systems. The manual included the requirement that small community systems be simple to operate, reliable, and economical to construct and operate.[41] In particular, the manual noted, “The simplest of all systems is the individual on-site septic system, and its simplicity is a reason for its attractiveness as a wastewater management option.”[42] Favoring simple technologies that local people could maintain, the report explained, “Large subsurface, sand filter, and wetland-based systems are examples of larger systems that are simpler to operate. Members from the local farming, electrical contracting, plumbing/contracting, and excavating/contracting communities collectively have the skills necessary to construct and operate these systems.”[43] At an isolated hydropower station in northern Quebec, for example, simple mound systems were chosen over mechanical treatment plants because minimal maintenance was required.[44]

Kevin White, a professor of civil engineering at the University of South Alabama, also stressed that on-site technologies have relatively low maintenance requirements, and "they need to remain that way." He also recommends wetlands and sand filter systems because they are "low maintenance and reliable."[45]

According to Homer C. Emery, a regulatory compliance planner from Texas: "The major purpose of rules and regulations related to the on-site industry (pumping, installation, maintenance) is to protect public health and prevent environmental pollution problems. When on-site rules are clearly written and fairly enforced, both the industry and public will benefit. No one benefits when regulatory definitions and terms are fuzzy and enforcement of the rules varies from county to county. The majority of state and local environmental agencies strive to enact and apply on-site rules that are technically correct, clearly written and equally applied across the state."[46]

The success of the stricter, uniform standards is evident in various studies that have shown that failing on-site systems tend to be concentrated among those built prior to the major code revisions of the 1950s and 1960s. In a recent National Small Flows Clearinghouse survey of health department agents, system age and non-conformance with code and current site requirements were identified as causes for failure of on-site systems.[47]

The strengths and enduring value of a uniform code approach to dispersed nonpoint-source pollution regulation can also be seen in the recent adoption of new storm water regulations in Massachusetts.[48] Key features of essentially a stronger command-and-control framework are prohibitions of development under certain circumstances (adjacent to rivers); permitting at the local level; best available technology requirements; and, minimal expectation of follow-up maintenance or monitoring. Requirements are clear and uniform, reliability is fairly high, and there should be an enhanced degree of environmental protection in new development along rivers and coastal water.

There are still areas where a continued strengthening or tightening of codes is desirable. A key example is a requirement for septic tanks to be watertight. While there has been an extended discussion in the Small Flows newsletter of the advantages and cost-effectiveness of watertight tanks, there appears to be a growing consensus that watertight design requirements built-in to the code generally would lead to a substantial improvement in performance of systems.[49]

During the 1970s increasing concerns were voiced about the inadequacy of traditional regulations that relied on prescriptive codes for design and technology to achieve accountability, and left operation and maintenance responsibilities to homeowners. In 1979 Elmer Staats, then Comptroller General of the United States, stated that septic system failures were due not only to inadequate technology and design but also to "poor operation and maintenance."[50] He attributed malfunctioning septic systems and ineffective management to:

- lack of board of health resources;
- poorly qualified and inadequately trained sanitarians;

- dependence on the integrity and ability of soil testers and contractors to evaluate sites, design and install systems;
- and pressure on local officials to approve systems on poor or marginal sites.[51]

Staat's concerns and proposed solutions echoed those of others, notably at the University of Wisconsin and the U.S. EPA. Their suggestions for local public management of septic systems are described in the next section.

Table 1. On-Site Wastewater System Regulation. Phase 1. Development of Septic System Design Codes or Strengthening of Existing Codes after World War II.

Accountability:
Septic system design and installation requirements are regulated in the state or county code. Accountability rests in the details and adequacy of the prescriptive codes that establish design and technology requirements for lots. Installers and designers need only a fairly low level of skills for the uniform septic system requirements. Generally, local or county boards of health issue construction permits. Homeowners are responsible for maintenance of the system.

Strengths of this Approach:
The stricter codes upgraded performance of new systems and eliminated development on lots that could not properly be served by conventional septic systems. The codes were clear and not arbitrary among homeowners. Septic systems were relatively inexpensive. The key strength of this approach is that of low maintenance—the systems were over-designed, so that even without periodic inspection or pumping they were likely to function.

Weaknesses of this Approach:
There were no requirements for systems built prior to the code to be upgraded. Failures were not necessarily detected or corrected. Systems did not adequately protect public health and the environment in sensitive areas. Advanced systems with innovative technological designs that could address public health and environmental concerns were not permitted.

The failure to permit advanced systems led to the default position of installing expensive sewers in neighborhoods and communities where only a fraction of homes were the source of the problem.

Authorization of a Simple Local Public Management Structure: Accountability Divided between Homeowner and Local Entity

During the 1970s, the concept of local public management of on-site septic systems surfaced and a number of states passed "district" or "zone" enabling legislation. Under these programs, new districts were authorized to carry out inspection and maintenance of septic systems, or existing municipalities or utilities were authorized to assume these new powers and duties. In some cases, the powers included outright public ownership of on-site and cluster systems on private property. These districts could be formed by counties, townships, municipalities, electric cooperatives, or special districts and could be funded by inspection fees and other charges. Because the types of entities capable of managing decentralized wastewater treatment vary among the states, determining the best type for a particular area requires detailed analyses of constitutions, statutes and administrative rules and regulations in each state.[52]

Local district proposals were specifically an attempt to increase accountability in the on-site field by turning over system inspection and maintenance to the public sector or by requiring the homeowner to show evidence of a private contract. Accountability would shift to trained professionals, within the context of design code requirements.

A number of states drafted and passed enabling legislation authorizing public management. California was a key state passing such a law in 1977,[53] and Illinois adopted its basic framework and detailed language in 1978. Ohio, Washington, Iowa, and New York were among a number of other states that authorized similar programs.[54]

The California law outlined the following new powers for existing entities to adopt in new, special on-site wastewater disposal zones:

(a) "To collect, treat, reclaim, or dispose of waste water without the use of sanitary sewers or community sewage systems and without degrading water quality within or outside the zone.
(b) To acquire, design, own, construct, install, operate, monitor, inspect, and maintain on-site wastewater disposal systems ... within the zone in a manner which will promote water quality, prevent the pollution, waste, and contamination of water, and abate nuisances.
(c) To conduct investigations, make analyses, and monitor conditions with regard to water quality within the zone.
(d) To adopt and enforce reasonable rules and regulations necessary to implement the purposes of the zone. Such rules and regulations may be adopted only after the board conducts a public hearing. ..."[55]

Other state laws were quite similar, although they did not necessarily provide the authority for public ownership of on-site systems.

While a few districts resulted from state enabling legislation and the urging of the professional community in the on-site field, there has not been a stampede to establish districts or zones. In fact, in Washington, Rhode Island, and Massachusetts voters in a referendum, or public officials on their own, have rejected the formation of such districts. The state of New Jersey actually rescinded its legislation authorizing management districts.

There are several reasons for the lack of support for local management of on-site systems, including a lack of public confidence or conviction that new regulatory programs are necessary or offer sufficient benefits to offset the costs. Also, many homeowners would prefer to hire their own private inspector/maintenance contractor than allow a government inspector on their property. Even more, homeowners have rejected the idea of government ownership of an on-site system on their lot.

In a 1996 article in Small Flows, A Private Market Approach to Onsite Wastewater Treatment System Maintenance, John Herring reviewed some of the same case studies included in this document and others. He concluded that management districts had been formed rarely and only when one of the following conditions had been met:

"there is a serious threat to health or property values that a district might reduce at less expense than central sewers;

there is a widespread perception of a threat to public health or the environment and a perception that central sewers would be more expensive, or,

the area is undergoing significant new development, so that district formation is part of an overall development package."[56]

In Herring's view, widespread expansion of inspection and maintenance districts for on-site systems was unlikely, given that "the immense cost associated with such an expansion would require a significant increase in public funds."[57]

Over time a privatized ministerial model, as it is being called in Florida, of a local government recording and overseeing permits showing inspection and maintenance contracts between homeowners and private contractors has gained some support. In the new Title 5 regulations in Massachusetts, for example, a required inspection of on-site systems at time of real estate property transfer is to be met by the homeowner hiring a certified inspector trained by the state. An earlier proposal, that local municipalities each develop inspection and maintenance requirements for their communities, based on a phased inspection of all properties with on-site systems, had been rejected after much opposition in public hearings.

EPA, in its landmark 1997 Response to Congress On Use of Decentralized Wastewater Treatment Systems, has reiterated its support for local public management programs and the state enabling legislation required to support such programs. "The incentives for establishing proactive management programs for decentralized wastewater systems include better on-site system performance and environmental protection, extended life of the system, significant cost savings, planning flexibility, assistance for individual homeowners and developers in meeting requirements, and economic benefits accruing from the use of local contractors."[58]

Table 2. On-Site Wastewater System Regulation. Phase II Authorization of a Local Public Management Structure.

<u>Accountability:</u>
Accountability is divided between the local management structure and the homeowner. Local districts or zones are authorized by state enabling legislation to assume powers of periodic inspection and maintenance of systems in addition to traditional design and installation oversight, and in some instances to own systems. Prescriptive state codes continue to define design and technology requirements for lots.

<u>Strengths of this Approach:</u>
Regular, periodic inspection and maintenance of on-site systems can increase their overall system life and performance. Required inspections can make a difference in compliance with code requirements. An inspection program can identify cesspools and other on-site systems built before tighter code requirements were instituted and can result in mandated upgrades to code.

<u>Weaknesses in this Approach:</u>
Homeowners and public officials have tended to resist such new government regulatory authorities and imposition of fees. The local public management programs have not permitted advanced systems and have inhibited innovation in technology. Systems have not adequately protected public health and the environment in sensitive areas. Neighborhoods and communities have been required to install expensive sewers because advanced systems that might have been used to remediate problems on the few non-conforming lots were not allowed.

Modification of Codes to Include Permitting of Advanced Technologies, Inspection and Maintenance Requirements, and Higher Standards for Performance in Critical Zones: Accountability Rests Largely in the Code

While the strengthened on-site codes overviewed in Table 1 led to improvements in environmental and public health protection, the basic structure of the regulations raised concerns similar to those highlighted in the chapter on federal regulatory reform. The most potent criticism from on-site academics and technology developers has been the immense barriers to use of innovative technologies and practices built into these regulatory structures.[59] On-site codes are basically prescriptive codes that dictate design and technology requirements. Permitting of newer technologies has been limited. Without markets, there has been minimal incentive for entrepreneurs to invest in basic research and development or in technology development.

Indeed, the Clinton-Administration Office of Science and Technology-sponsored report, Technology for a Sustainable Future recognized that most of the significant environmental challenges in water pollution control are in improving the performance and increasing the cost-effectiveness of small systems. The report cites the following on-site areas in particular need of new technology development: nutrient removal; low-tech treatment systems such as constructed wetlands; membrane technologies; recycling and reuse of household wastewater; and cost-effective, advanced on-site residential treatment and/or recovery of sanitary and other water and nutrients.[60]

Most state and county regulators have been skeptical of permitting advanced systems for several legitimate reasons. Advanced systems with mechanical parts require maintenance, but because of public opposition, laws permitting advanced systems may not include requirements for inspection and maintenance by professionals.[61] For example, several hundred sand-lined trench systems were installed in eastern counties of North Carolina. North Carolina State University (NCSU) researchers documented failure rates of 25% when they monitored the systems several years later.[62] In their opinion, the high rate of failure was largely the result of insufficient homeowner oversight and maintenance. In a separate study by NCSU researchers, failure rates for other types of alternative systems were found to be 30-60%.[63] Beginning in the 1950s the State of Ohio permitted large numbers of home aeration on-site systems that had been marketed as virtually maintenance free. When these systems were inspected in 1994, in response to a disease outbreak in Hamilton County, the inspectors found that 34% of the systems had failed. In contrast, inspection of conventional systems in 1996-1997 revealed a failure rate of 8%.[64] Regulators also have voiced concerns about unscrupulous companies marketing so-called advanced on-site systems. Some companies promised good results that did not materialize.

Another critique of on-site regulations mirrored the arguments in the 1993 Boland report that one-size-fits-all code requirements both underprotect and over-protect public health and the environment, depending on the site.[65] For example, Kent Seitzinger, a legal specialist who wrote a column for Small Flows for many years, argued that standard codes were over designed by 900% and that regulators have never been able to justify the requirements that they had imposed on the homeowner.[66]

The newer regulations also did not go far enough to protect public health and the environment. The revised Title 5 requirements in Massachusetts for “maximum feasible upgrade” of older systems were acknowledged at a Marine Studies Consortium conference in Boston to be under-protective for fecal coliform and other contaminants if located close to shellfish beds.[67] One example presented at the conference came from the Town of Weymouth. The Town decided to construct a small cluster system away from the edge of the water, because the on-site upgrades allowed for several lots would not have adequately protected the adjacent shellfish beds.[68] Similarly, the Barnstable County, Massachusetts, Department of Health and the Environment has warned “the most common misapplication of alternative septic system technology…is the situation where a Board of Health allows the installation of alternative on-site systems to compensate for the inability of a proponent to meet a setback requirement of 100 feet from a water course. In these instances we have seen denitrifying technologies allowed to compensate for a setback that was predicated on pathogen (specifically virus) concerns.[69]

A more widespread critique among regulators was that the conventional septic system did not remove nitrogen, thereby threatening the safety of drinking water and leading to eutrophication and degradation of coastal waters.

These critiques and others led to a fairly consistent set of proposals among on-site professionals and researchers to protect public health and the environment.

- permit new, advanced technologies;
- require inspection, system monitoring, and maintenance programs, usually through a contract between the homeowner and a certified on-site system professional; and

- establish zones requiring advanced treatment standards to be met, in particular for nitrogen-removal near drinking water supplies, sensitive embayments and estuaries.

Some states (notably North Carolina, Florida, and Massachusetts) have modified on-site codes to incorporate these suggestions, shifting accountability somewhat from the homeowner to the on-site system contractor and maintenance personnel. These initiatives were intertwined and interdependent, at least in the view of on-site professionals. Complex, advanced technologies could not be expected to perform without mandated inspection, system monitoring, and maintenance and conversely, inspection and maintenance programs would open the door for a more complex array of technologies. Similarly, the demand for permitting of advanced systems was driven in part by recognition of the need to deal with critical areas of concern. Unfortunately, not all states that have permitted advanced, mechanical systems have instituted strong oversight programs.[70]

In 1994, Richard Otis and Damann Anderson of Ayres Associates presented a significant paper on individual and small community sewage system, Meeting Public Health and Environmental Goals: Performance Standards for On-Site Wastewater Treatment Systems, at the American Society of Agricultural Engineers conference. They urged a shift away from a prescriptive code of one-size-fits-all designs and technologies to performance standards based on the needs of each site.[71] The National Onsite Wastewater Recycling Association has taken a lead, with Otis's help, in drafting the underlying elements for such a performance code. [72]

In addition, the 1994 Otis and Anderson framework strengthens accountability through requirements for clear and specific performance guidelines; technical guidelines for site evaluation, design, construction and operation; regular compliance monitoring; licensing or certification of all service providers, and; effective enforcement measures.[73] As Otis and Anderson state, "Regulatory programs for on-site treatment systems based on performance standards place greater responsibilities on the regulating agency, site evaluator and design professional, construction contractor, system operator, and system owner."[74] In essence, there is less margin for error in the revised code, and practices must be more tightly monitored. On-site management districts may usefully coordinate these activities.

Essentially, however, the above are modifications, and not a radical restructuring of the codes. As more work has been done on performance codes, it has been recognized that they are really just a broadening of technologies allowed under what are still fundamentally prescriptive codes. Engineers remain limited in the particular technologies they may utilize and in the standards they must meet at any given site. The code is not uniform or limited to only one technology, but is still prescriptive, and the Otis and Anderson framework fits under the same general category of code modifications at the state or county level that were discussed above.[75]

Table 3. On-Site Wastewater System Regulation. Phase III. Permitting of Advanced On-site Technologies, Inspection and Maintenance Requirements, and Higher Standards for Performance in Critical Zones

Accountability:
Accountability rests primarily in the code and in the delineation of sensitive areas by state officials. The code may have additional elements, including permitting of some advanced technologies and designs; establishment of critical zones for advanced treatment; and requirements for routine inspection and maintenance in renewable permits, particularly for advanced systems. On-site professionals are expected to have a high level of skills in design and technology. Less responsibility for maintenance rests with the homeowner and more with system professionals if maintenance contracts are required.

Strengths of this Approach:
These modifications in state or county codes lead to both improved public health and environmental protection. Advanced systems will better protect the environment in sensitive areas. The public will benefit from advanced technologies that may be more cost-effective, and remedial upgrades on difficult lots will be more effective with advanced, pre-treatment. With the permitting of advanced systems, landowners will be able to develop housing on lots previously not allowed (see below).

Weaknesses in this Approach:
Public opposition to requirements for inspection and maintenance may lead to permitting of advanced systems without the necessary maintenance requirements and thus result in high failure rates. Further innovation in technology and design is inhibited, unless the code includes favorable provisions for experimental permits. Net degradation of surface and groundwater and of quality of life in the community may result from development of previously unbuildable land.

Decentralized Wastewater Treatment Districts: Accountable Devolution, a New On-Site Paradigm:

The ad hoc Task Force proposes a more radical shift of accountability and responsibility to the local level. In return for flexibility in the implementation of state or county on-site codes, local entities would be responsible for the success of their programs. This approach shifts the permitting process in a fundamental way. Traditionally, a permit process is characterized as a command-and-control process because the regulator prescribes technologies and designs for pollutant-removal and has legal powers to force compliance. The regulated entity is permitted to discharge air or water, etc. into the environment if those precise requirements are met. The strengths of the permitting approach are several. Precise, prescribed standards are clear and uniform. They do not discriminate between firms or individuals. Because the terms of the permit are precise, violations are clear. With appropriate monitoring, violators can be identified and forced into compliance. Sufficient resources of the permitting agency to detect and enforce compliance are assumed.

The proposed approach to permitting focuses on outcomes in surrounding waters and a flexible set of measures to reach those outcomes. The regulated entity would have the responsibility to meet those outcomes. If, for example, monitoring showed that water quality improvements had not been made, additional steps would have to be taken. State or county regulators would have authorities and powers to enforce district compliance.

In the on-site field, a permit would be issued by the state to a local entity, whether it is a municipality or specially formed district. The agreement would specify the public health and water quality problems to be corrected or prevented, the engineering plans to be followed, the financing and management structures to be put in place, and the system and environmental monitoring program to be implemented. (The specific elements of district operation are described in the other guidance documents of the Task Force.)

A critical element of the agreement, however, is the acceptable flexibility from the on-site code that the local entity will be permitted to undertake. First, advanced technologies that were not previously permitted under the state code would be allowed. Second, soil or site requirements of the code would be loosened. [76, 77] Third, other precise standards, such as inspection schedules, pump-out schedules, etc. might be altered. For example, a statewide time-of-transfer (sale of home) inspection of on-site systems could be waived if alternative inspection schedules are in place.

In return for more flexibility in optimizing wastewater treatment, the local entity would be responsible for results. Innovative technologies must demonstrate their performance by meeting specified effluent standards at point of discharge. Second, those lots where soil or site requirements have been waived must be subject to periodic monitoring both at point of discharge and other defined points such as groundwater, property line, etc. Finally, and most important, receiving surface and ground water must be monitored for changes and improvements. Ecosystem, habitat and other monitoring may also be required. The local entity would be required to undertake additional remedial measures if expected improvements were not met.

This permitting approach should accelerate the pace of innovation in technologies and management and allow for a substantially more cost-effective set of solutions, since the problem identified by the Boland National Research Council Committee of under- or over-protection would be addressed.[78] More expensive treatment modes might be utilized in sensitive areas, while less expensive treatment modes would be allowed in areas that could handle the discharges. Because of assured management and monitoring, maintenance-intensive technologies would be allowed that on balance could be less expensive for a community than conventional sewers.

The technology and site combinations allowed in the district would not be permitted outside the district, because homeowners outside the district would not be able to guarantee the level of assessment and planning, maintenance, and monitoring that the district would be able to provide. Over time, however, advanced technologies or other practices introduced into a state through one district might be more broadly allowed under well-defined circumstances. In this way, districts can also serve as demonstration programs, or “charter districts” for new technologies and practices.

Actual experiences with six comprehensive districts around the U.S. and Nova Scotia are overviewed in Chapter 5 and presented in the Appendix.

Table 4. On-Site Wastewater System Regulation. Phase IV. Decentralized Wastewater Treatment Districts: Accountable Devolution, A New On-Site Paradigm:

Accountability:
State governments and local municipalities or specially formed districts share responsibility for water quality protection. The state issues a permit to the local entity. In return for greater flexibility, the local district becomes accountable for the outcomes of remedial efforts. Designers, contractors and managers also have greater autonomy and responsibility for the performance of their systems.

The permit is an agreement between the state or county and the local managing entity or district to focus on outcomes that protect public health and water quality. This local district has flexibility in the use of technology and in siting criteria and practices beyond what is allowed in the state code. A comprehensive plan is developed that includes wastewater treatment measures, land use criteria, and other factors. Water quality protection may be achieved by innovative methods. Surface and groundwater monitoring is required to demonstrate improvements. The state has enforcement powers if the local entity fails to meet agreed-upon outcomes in water quality protection and public health.

Strengths of the Approach:
There are strong incentives for technology and design innovation and development as well as for research and development in monitoring and in ecological assessment. The risk of new systems will be absorbed by the larger management entity and by the community at large. There will be cost-savings from flexibility in use of technology and design. Environmental and public health protection is enhanced from the carefully targeted delineation of critical areas of concern. Land-use possibilities are more flexible.

Weaknesses of the approach:
Citizens may resist innovative and risky approaches. A higher level of skills is required to install, design and maintain the complex systems. Monitoring to insure proper system performance may be expensive. There are potentially higher capital costs if initial systems do not work. Communities may try to abuse the flexibility of the permit.

IV. Non-Regulatory Supports for Accountability in Decentralized Wastewater Treatment

Much of the literature discussed in Chapter 2 on regulatory reform concerned the need to shift from a regulatory approach to a non-regulatory approach. Recommendations included citizen involvement and education, market and incentive approaches, research and development, and technical assistance. Parallel themes have emerged in the decentralized wastewater field and are described in this chapter. Non-regulatory measures can be used in place of or to support regulatory structures. The absence of non-regulatory supports can deter the use of decentralized wastewater systems.[79] In EPA's 1997 Response to Congress on Use of Decentralized Wastewater Systems, the agency identifies a lack of knowledge and public misperception, lack of management programs, financial barriers, and regulatory impediments as significant barriers to the use of decentralized wastewater treatment.

Citizen Participation and Voluntary Compliance

In the decentralized wastewater treatment field, citizen-based decision making and voluntary compliance have been important new initiatives. Education and outreach programs can be vital to voluntary compliance in maintenance of on-site systems and in repairs and upgrades within the uniform code framework. For example, extension faculty at many land-grant universities have become involved in programs such as Home*A*Syst, which provides information to homeowners about the care of on-site systems.[80] A Massachusetts Audubon Society initiative has combined site visits with information programs to encourage maintenance and repairs of on-site systems in homes, farms, and businesses.

Education and citizen involvement are also essential to the development of community plans for decentralized wastewater treatment. Open planning is necessary to achieve consensus not only about the growth and infrastructure choices but also about the costs and benefits of proposed wastewater treatment plans. For example, homeowners near sensitive environments may need to upgrade their on-site systems to advanced treatment standards.

Ad hoc Task Force members who have worked with citizens' advisory commissions on decentralized wastewater planning in Massachusetts, Vermont and Rhode Island have several recommendations for successful planning. These include:

- include all land development and other impacts that citizens consider important for the long-term vision of the community,
- keep the process open and public to build trust and achieve consensus,
- work closely with consultants to ensure they consider new options and technologies, and

- limit the citizens' advisory committee membership to 10–12 participants, but provide for public hearings, surveys and other outreach efforts.

A number of EPA's Community-Based Environmental Protection projects in small communities have followed similar approaches. It has not been uncommon for citizens to choose cost-effective decentralized wastewater options over central sewers, when they have been involved from the beginning in an open planning process.[81]

The experiences of Benzie County planners in Michigan are also instructive. Phosphorus contamination in Crystal Lake led to an initial plan for a local public management district for on-site systems. Residents voted down the formation of a new district because they did not want government in their backyards. In its place, a local citizens' association voluntarily created a new, strengthened county code that required all systems around the lake to meet standards in a five-year phased program. Inspection and maintenance were provided by private contractors, but under health department guidance. Benzie County has also now become a National Onsite Demonstration Project (NODP) site, where several new phosphorous-removing systems were installed under Small Flows Clearinghouse, Michigan State University, and University of Waterloo guidance. In Benzie County, citizens were able to define problems, structure solutions and achieve progress in water quality protection[82]

Economic Incentives for Compliance

A number of economic incentives have been developed for voluntary installation and repair of decentralized wastewater systems. An early example of a subsidy approach was the Innovative and Alternative (I & A) wastewater technology program described earlier, which offered a 15% bonus subsidy for wastewater construction projects that used I & A technologies.

Government programs are available to subsidize on-site system repair and upgrades. The Section 319 nonpoint source program of the federal Clean Water Act funds on-site projects. The much larger State Revolving Loan Fund (SRF), which provides low-interest loans to communities, is in the process of being expanded to include on-site system upgrades and other pollution control projects.[83]

Delaware, Washington, Pennsylvania, Minnesota, and Rhode Island have created special SRF-seeded on-site system loan programs for homeowners. Massachusetts has created a similar pool, along with tax credits for on-site system repair.[84] These programs encourage voluntary repairs, while decreasing citizen opposition to new regulations or requirements. In addition, they put decentralized wastewater treatment approaches on an equal footing for funding with central sewering remediation.

Grants or loan programs to homeowners needing expensive remedial upgrades encourage acceptance of community-wide remedial projects. An interesting incentive program in the Florida Keys promotes remedial upgrades in areas where transportation-related growth controls severely limit development to only a small number of building permits each year. There, permit applications receive points; an application that includes a commitment to bring someone else's on-site system up to advanced treatment standards receives more points.[85] This approach has resulted in remedial upgrades that otherwise would not have occurred.

Stephen Dix, a professional in the on-site wastewater field, proposes ranking on-site systems based on the capacities and level of treatment of the system.[86] The ranking level would be one factor utilized by potential buyers and lending institutions when assessing the value of the property. This proposal creates an incentive for owners to invest in high-quality on-site systems, similar to investments in other features of the home, such as furnaces that also may increase the value of the property. The absence of government involvement in this approach appeals to many homeowners. When the Commonwealth of Massachusetts passed Title 5 time-of-transfer inspection requirements, it was the banks that would not finance mortgages without proof of Title 5 compliance.

Pollution taxes and tradeable permits utilized in centralized wastewater treatment have less relevance for the on-site field. It would be logistically impossible to monitor and charge for the pollutant discharged from an individual homeowner lot. It is also impossible to imagine how homeowners could trade among themselves for a right to pollute from an on-site system. However, tradeable permits between point-source discharges and decentralized wastewater districts are an interesting possibility. Municipal wastewater plants are under pressure to upgrade effluent quality and to remediate combined sewer overflow problems. Municipal utilities and their serviced industries are therefore looking to nonpoint-sources such as farming or on-site systems as a potentially cheaper target to meet watershed clean-up goals. While individual homeowners could not trade with a municipal plant or industry, a management district could undertake such trading. The plant could avoid costly upgrades, and homeowners could receive a subsidy for repair and upgrade of their systems.

A good example of crossing jurisdictions and technologies to find the cheapest overall solution is a project in New York City. The city has been allowed to delay construction of a water filtration plant in exchange for subsidizing agricultural and on-site system repairs in its source water watersheds. Similarly, the Massachusetts Water Resources Authority is repairing failing septic systems in the Wachusett Reservoir watershed to prevent contamination of the groundwater sources, rather than constructing a more expensive water filtration plant.

Research and Development, Demonstrations, Technology Verification, Technical Assistance and Training

A number of states have supported capacity-development efforts in research and development, demonstration projects, technical assistance, and training for the on-site field. Florida and Texas created funds for on-site system research in the 1980s. Seven states (North Carolina, Rhode Island, Washington, Arizona, Texas, Missouri, and Wisconsin) now have extensive on-site training programs for installers, designers, boards of health, and homeowners. Numerous other states are in the early stages of building comprehensive training center programs.

Since the Clean Water Act was authorized in 1972, the federal government has invested only a modest amount to advance the on-site field. In early years, funding was available for research and technical assistance in technology development and in management improvements. By the mid-1980s, however, funding for a research program in wastewater was eliminated. Presumably, the minimal funding resulted from the assumption that septic systems were a temporary and low-tech solution; the relative lack of interest by mainstream engineers; and the absence of a federal regulatory role in on-site systems.

Since 1979 the EPA, however, has funded the Small Flows Clearinghouse at West Virginia University to collect and disseminate information on decentralized, on-site, alternative collection, and small treatment technologies. [87] WVU also receives funds for the National Environmental Training Center for Small Communities, which develops and disseminates training curricula and programs to "train the trainers." The Small Flows Clearinghouse also manages the National Onsite Demonstration Project, which has supported advanced on-site technical installations, community education, technology transfer and other related programs in a number of communities.

EPA also is redrafting the Design Manual for Onsite Systems (also known as the "purple manual") and the Design Manual for Constructed Wetlands Wastewater Treatment Systems. EPA also has initiated an Environmental Technology Verification (ETV) project for small community wastewater technology testing. Under the ETV program, testing centers are built where proprietary technologies submitted by interested manufacturers are installed and monitored. This project is considered a public service because the claims of manufacturers are subject to independent verification. An additional testing center is under construction on Cape Cod, Massachusetts.

A number of non-governmental organizations have formed in the last few years to advance the decentralized wastewater field. The National Onsite Wastewater Recycling Association (NOWRA) involves industry, regulators, and academics in leading-edge discussions on performance codes and other technical matters.[88] Attendance at NOWRA annual conferences has quadrupled in the last five years. Affiliated on-site associations have also been formed in about a dozen states, and these organizations often provide a forum for creative leadership within the states for regulatory reform and other initiatives in the on-site field.

The Consortium of Institutes for Decentralized Wastewater Treatment is an affiliation of universities and colleges whose goals are to advance decentralized wastewater treatment research, education, and training and to coordinate dialogue and debate and information transfer across the country.[89] Seventeen universities are currently members of the Consortium. A third collaboration is the National Decentralized Water Resources Capacity Development Project, which includes the Consortium, the Electric Power Research Institute (EPRI), the National Rural Electric Cooperative Association

(NRECA), the Water Environment Research Foundation (WERF), NOWRA, and the Coalition for Alternative Wastewater Treatment (CAWT).[90]

The US Congress has recently directed federal appropriations to the Capacity Development Project to undertake training, research and development projects in coordination with EPA. A $250,000 project to identify and prioritize decentralized wastewater treatment research needs in a risk management framework has begun. A second $5 million project will be directed to projects that overcome the EPA-identified barriers to effective use of decentralized wastewater treatment, including support of training centers and educational/engineering curriculum development, regulatory reform and model code development, and a wide variety of management, planning, and demonstration projects. Finally, the Capacity Development Project has been identifying and recommending federal funding for community decentralized wastewater treatment projects across the country and will provide technical assistance to these projects as they evolve.

The Electric Power Research Institute and the National Rural Electric Cooperative Association are, independently of the above effort, supporting planning, technology and management demonstrations involving a number of electric utilities across the country.[91] Utilities, particularly in rural areas, may be good candidates for taking over comprehensive planning and management functions. Utilities have substantial resources to finance upgrades, have experience in dealing with new technology developments, already have billing and service agreements with homeowners, and may be able to avoid the kind of public backlash that frequently accompanies programs that involve government intrusion on private property. In the future, EPRI may also focus on a "commercialization" project to develop and standardize an on-site system that could be used by utilities across the country.

Technical Assistance: New Technologies in Remote Sensing and Monitoring

Technological breakthroughs in remote sensing and monitoring could markedly improve prospects for accountability in decentralized wastewater treatment. A number of companies are exploring the application of "supervisory control and data acquisition" (SCADA) systems in the on-site arena.[92] Advanced on-site systems typically utilize control boxes that turn electric pumps on and off, monitor tank levels, and sound an alarm in the house if a problem develops. If the alarm sounds, the homeowner must call in a report. Remote sensing can take the homeowner out of this loop, because the control system can send a signal indicating system failure over telephone wires to a central office. Other information transferred may be about pressure in pressure-dosed leachfield lines. In more complex systems, the communication is interactive. Pump-out frequencies can be changed, for example, by a command from program staff. Computer software packages are under development to manage these communications.

These leading-edge technologies can dramatically increase the level of oversight of on-site system performance. Information transfer can be continuous, rather than based on quarterly or annual physical inspections. This technology keeps inspectors off of private property, unless there is a problem, and lifts the burden of oversight responsibility from the homeowner and on to professionals. This option may make advanced on-site systems much more acceptable to homeowners and to regulators alike.

V. Summary of Research on Six Decentralized Wastewater Treatment Districts

The Task Force has conducted six case studies of decentralized wastewater management districts in the United States and Canada in order to investigate diverse examples of districts and to determine if the devolution of authority to the local level has increased accountability. The districts were evaluated with respect to their success in meeting the measures of accountability identified in Chapter one: protection of public health and the environment; acceptability in terms of costs, equity, public involvement and other factors; and practicality or feasibility of implementation. The case studies are overviewed in this chapter and presented in detail in the Appendix.

Perhaps the dominant conclusion of the case study research is the potential of decentralized wastewater districts to achieve accountability using innovative technologies and management practices that are then accepted into the mainstream of on-site practice for the entire state. An analogy to "charter schools" is a helpful one. The goal of charter schools is to permit a small number of schools to experiment with new practices, organizational structures, and technologies. Charter schools are held accountable for their efforts, and the work to develop performance goals and standards for student achievement has been essential to the success of the programs. Lessons learned in charter schools are disseminated throughout the school system. Our case studies of decentralized community wastewater districts show them to function in a parallel fashion. Indeed, these case studies may be described as charter districts. Thus, the states and the federal government should promote, fund, and otherwise assist the development of "charter" decentralized wastewater districts, with the understanding that the lessons learned from the planning, technology, and management approaches undertaken by charter districts will be disseminated throughout the states and nation.

Another important finding is that there is no one detailed formula for charter district operation, or for attaining accountability. History, tradition, and the particulars of legal structures vary among the states. A blueprint of a district structure for one state may be largely irrelevant in another state, where authorities and responsibilities rest in different agencies. Beyond that, the problems of soils, climates, sensitive environments, or development patterns may be different.

The Task Force analysis underscores the importance of comprehensive planning, community input, identification of critical areas of concern, risk management, environmental monitoring, and ongoing inspection, monitoring, and maintenance to the success of the district. The districts evaluated here typically go far beyond the simple local management structures first envisioned in the 1970s. The districts are explicitly responsive to concerns about technology innovation, cost-effectiveness and citizen input, and also integrate both regulatory and non-regulatory elements.

Six Case Studies

The ad hoc Task Force examined six communities in the United States and Canada that initiated decentralized wastewater treatment districts in the past 25 years. Beyond their basic structure, we were interested in difficulties that they encountered in order to assess the practicality and feasibility of district management. We also wanted to know how the state ensured compliance with agreed upon goals, whether in a permit process or by other means. Did districts function as centers of innovation and reform? Were non-regulatory functions of education, funding assistance, etc. integrated into district operation, and were they a key to success? Was the public successfully involved in planning and implementation? Did "accountable devolution" ultimately work, in the sense that flexibility was granted to local authorities in return for an assumption of responsibility on their part to meet performance goals and measures? The answers are generally yes.

Thurston County, Washington State

Thurston County Operational Certificate Program

The Thurston County Board of Health initiated a permit-based inspection program for on-site systems in the mid-1970s in response to increased development of houses serviced by on-site systems and to concerns about the observed degradation of shellfish beds and water supplies. This program, the first of its kind in the state, was expanded over time to include design review, inspection, professional training and certification, public education, and water quality monitoring. State grants for monitoring and for on-site system repair have been critical supporting elements.

Among the more significant aspects of the Thurston County program are the prioritization and targeting of inspections of on-site systems, starting with: new, large, or alternative systems; systems serving restaurants; systems undergoing transfer of ownership; and systems located in areas of special concern. The areas of special concern were identified either by the health department, as "geologically sensitive" or by the planning department as critical areas with water frontage, unstable slopes, or areas susceptible to flooding. The designation of such areas was subject to public hearings and other meetings. This targeted approach is, from an economic standpoint, a major improvement over uniform inspection programs.

The Thurston County effort currently covers about 10,500 on-site systems of the approximately 40,000 in the county and has appeared to halt the further degradation of shellfish beds. It is hoped that with increased water-quality monitoring and remedial upgrades, shellfish beds will be reopened, and drinking water quality maintained.

The district has not taken the lead in experimentation in the use of new, alternative technologies. Currently all systems used must have approval by the state Board of Health's Technical Review Committee. However, there is a National Onsite Demonstration Project site to demonstrate alternative, advanced systems in nearby Pierce County, and there is the Washington Onsite Wastewater Training Center in Puyallup.

Research into the effectiveness of new technologies is an ongoing concern of the network of on-site professionals in the state.

Two lawsuits challenging the phased implementation of the program and the imposition of new water quality monitoring fees raised concerns about the practicality and public acceptance of the approach. The County has now won both cases.

Guysborough, Nova Scotia

Guysborough Waste Water Management District

A 1982 amendment to the Nova Scotia Municipal and Town Act authorized communities to create wastewater management districts that are then held responsible by the Province for overall planning, upgrades, design, construction, inspection, operation, and maintenance of any type of system. Districts could cover neighborhoods or be noncontiguous in that they include dispersed systems requiring special management for environmental or health reasons. The concept behind the law was to expand public wastewater services to homeowners beyond sewer options to include public ownership and maintenance of on-site or cluster systems on private property. Once implemented, all homeowners would pay the same fee, regardless of the system they utilized.

In response to finding that more than 90% of on-site systems were failing, Guysborough established a wastewater management district in 1989. Eventually a small, conventional treatment plant for 130 buildings, an aerated lagoon system for 90 buildings, and 25 independent on-site systems were constructed or repaired, all with the same charge to the homeowner.

The Guysborough district has demonstrated the practicality and feasibility of a provincial delegation of management authority to the local level. The district follows protocols and passes bylaws that include explicit requirements for comprehensive planning studies, public hearings and a vote, as well as for detailed designs, management structures, and fees. The Province's Department of Environment is responsible for providing water resources monitoring, research, training, and certification, and approval of alternative systems.

Nine Counties in North Carolina

Pasquotank-Perquimans-Camden-Chowan Management Entity

Unlike many other places, alternative septic systems have been used in North Carolina for a long time to address problem areas where conventional on-site septic systems were unsuitable. As development pressures increased in many of these areas, so has the use of alternative systems. The College of Agriculture and Life Sciences at the North Carolina State University (NCSU) has an active research and extension program focusing on alternative wastewater treatment. It was NCSU surveys in the late 1980s and early 1990s that revealed that local alternative septic systems experienced high rate of failures, presumably due to lack of maintenance.

These studies provided major input to the 1992 state code revisions that strengthened requirements for all, but particularly innovative or experimental, on-site systems. The new code requires mandatory surveillance, at least by a homeowner, and mandatory surveillance and maintenance by a management entity for more complex or risky on-site systems. Approved management entities include governmental agencies, public utilities, or private certified operators.

In the northeastern area of the state that drains into Albemarle Sound, four counties formed the Pasquotank-Perquimans-Camden-Chowman (PPCC) management entity. Five other counties have since joined. The local management entity oversees inspection and maintenance of alternative systems and of conventional systems that depend on perimeter drainage. There are about 1000 systems in the district.

Under this management entity, the property owner retains ownership of the system and maintains the system according to conditions attached to an operating permit issued by the district. The owner agrees to allow access to the system for annual inspection. Owners are responsible for any mandated repairs.

Accountability for the PPCC on-site management district is a direct concern of the PPCC health department, which receives reports from and reviews the activities of the district. However, if enforcement actions are needed against individual property owners, state authorities are notified. There is also a separation of function between the health department, which determines the suitability of a site for development and the management entity, which takes over inspection and maintenance functions of alternative systems. Management entities are not specifically charged with environmental monitoring, although NCSU is conducting limited water quality monitoring in connection with ongoing studies of the on-site program in the PPCC District

In 1996, NCSU reassessed performance and found that failure rates of sand-lined trench systems had fallen from 25% to about 5%, in part because of district oversight and management. However, additional problems of subsurface ponding in trenches and poor drainage maintenance were identified. The PPCC on-site management district example shows that problems and deficits can be identified by continuous research, and that corrections can be made in siting, design, and management criteria.

Georgetown Divide, California

Auburn Lake Trails Wastewater Management Zone

The Auburn Lake Trails Wastewater Management Zone of the Georgetown Divide Public Utility District is an early example of a decentralized district that expanded the limits of existing county law and practices—in effect acting as a “charter district.” The district implementation also included a specific permit process, with monitoring and reporting requirements granted to the district much like a NPDES permit. While there have been problems along the way, the county and the Regional Water Quality Control Board have been able to keep the district focused on water quality improvements, while at the same time providing flexibility to Georgetown Divide in how it meets those requirements.

The on-site management district was established in 1971 for the new Auburn Trails development, where thin, poor soils and steep slopes posed wastewater management problems that threatened water quality in the American River. The developer's consultant, J. T. Winneberger, was a major advocate in the on-site field of shifting the emphasis from identifying new on-site technologies to concentrating on adequate system monitoring and maintenance. The initial agreement with the Regional Board and County was that a central sewer would be deterred or delayed if the district assumed responsibility for the performance of on-site systems. This precedent was one of several that led the State of California in 1978 to pass an on-site wastewater disposal zone law that enabled 17 types of institutions already authorized to construct and manage central treatment plants and sewers to extend their management to on-site systems under a permit structure.

When numerous septic systems, including innovative systems in the Auburn Hills development, were found to be failing, the Regional Board was able to impose a moratorium on further development until problems were solved. A reorganized district in 1985 extended its activities to include a rigorous program of environmental monitoring and alternative systems research. The district has completely mapped the hydrology and soil geology and divided the Auburn Trails subdivision into 5 different zones of varying design and maintenance requirements. Mound system leachfield discharges, groundwater, and seven streams are regularly sampled. About 1,000 on-site systems are regularly inspected on a maintenance and monitoring schedule matched to the type of system.

Stinson Beach, California

Stinson Beach Onsite Wastewater Management Program

As a coastal community of about 700 homes, the Stinson Beach area included a sensitive coastal pond surrounded by a narrow spit of sand with homes and difficult sites on steep hills. The perceived need for on-site management at Stinson Beach predated and helped to propel passage of the 1978 California law (discussed in the case study of the Auburn Trails Development) that enabled various authorities to establish on-site wastewater management zones.

Stinson Beach was selected as a case study not only because of its innovative, pathbreaking approach to decentralized wastewater treatment, but also because of problems the district experienced with agreed-upon inspection and maintenance programs. The key question was if higher authorities would discover this non-compliance and have the means to enforce compliance with prior agreements. This is clearly an important consideration for federal and state authorities because there must be effective means to monitor compliance and to hold local entities accountable. The Stinson Beach case is a positive example of successful oversight through a NPDES-type permit structure.

Voters had rejected ten separate proposals for a central sewer project at Stinson Beach. A federally funded study of alternatives suggested that on-site remedial upgrades and management might be the preferred, cost-effective solution. Approval was then sought from the Regional Water Quality Control Board. Regulators agreed to permit the district as a 3-year trial effort and imposed stiff reporting requirements. EPA funded initial costs of the program.

Key elements of the Stinson Beach program are district approval of system design and district inspections of systems, quarterly to once every three years depending on the technology used at the site. A pamphlet, Homeowners' and Users' Guide for Onsite Wastewater Disposal Systems, prepared for Stinson Beach residents, has been subsequently adopted by other California programs. A revolving loan fund capitalized by the state has also been made available to low-income residents. The record-keeping computer programs, loan programs, and other elements that Stinson Beach developed can benefit other communities.

A comprehensive surface and groundwater-monitoring program has been critical to the success of the Stinson Beach program. With standards for pollutants set by state and regional boards, a sampling program was initially designed for seven surface water and six groundwater stations. Over time, as more knowledge about the area has been gathered and as conditions have improved, the monitoring program has been somewhat relaxed. Similarly, general reporting requirements to the state have been relaxed. Regional Water Quality Control Board staff also meets with program staff about once a year to discuss progress.

There have been problems of implementation, corrected with state and regional oversight. Delays in the early years were due to the workload of initiating all the new procedures of a complex program. More serious problems in 1987 and in 1992, however, resulted in a building moratorium by the Regional Water Quality Control Board until the problems were solved. In the first instance, conventional systems adjacent to the Bolinas Lagoon proved to be inadequate; sand filter systems are now required in that area. In the second instance, inadequate tracking and follow-up for compliance and the use of uncertified staff to approve plans led to the passage of new ordinances for approval and tracking procedures and the development of a more adequate staffing and fee structure.

Keuka Lake, New York

Keuka Watershed Improvement Cooperative (KWIC)

The Keuka Watershed Improvement Cooperative is a successful example of civic environmentalism. The formation of a decentralized wastewater district was a direct result of the action of local citizens who identified water quality of Keuka Lake as a priority and who took it upon themselves to form the necessary new inter-governmental organizations. It is also an important example of how a new district can stimulate research into new on-site system technologies and become a demonstration project for systems not yet allowed in the state code.

A Keuka Lake Association survey showing that water quality was a critical concern led to the formation in 1991 of the Keuka Lake Watershed Project. Members were concerned about failing septic systems potentially impacting the lake and about maintaining drinking water quality. The Watershed Project undertook projects to survey conditions, to educate the public, and to build cooperation among agencies, including several at the state level and the eight municipalities surrounding the lake. Numerous public meetings were held in each of the towns and villages.

In 1992, the Keuka Watershed Improvement Cooperative was formed with representatives from each of the municipalities. Their goal was to develop a model watershed law and the administrative structure to support it. Eventually, they decided upon a home rule petition to the state to establish an intermunicipal agreement, and they developed a uniform wastewater law that was eventually approved by each of the eight municipalities.

Regulations govern permitting, design standards, permitted technologies, inspection, and enforcement. Decisions about design standards and allowable technologies were reached via a cooperative effort among the watershed manager, a representative from the district office of the state health department, and a consulting engineer. A grant from the Keuka Lake Foundation was used to evaluate practices and technologies used in other areas.

Research and monitoring continue to be an important part of the program. The Keuka Lake Association continues a comprehensive water quality monitoring program, while the Cooperative's computerized database is used to evaluate the performance of various technologies and approaches. The results of this research are expected to be relevant for the entire Finger Lakes area of New York. Many of the activities of the Cooperative are guided by a Technical Review Committee composed of watershed inspectors and sanitarians, consulting engineers, state health department officials, and university cooperative extension agents.

Lessons from the Case Studies

As these case studies show, decentralized wastewater treatment districts hold great promise for communities for many reasons. The sophisticated and complex array of planning tools and technologies necessary to district success can be managed at the local level far better than at the state or county level. In addition, a local effort can more easily and credibly involve the community in decision-making. Districts also can be the engines of reform and innovation within a state. Finally, targeting advanced technologies in sensitive environments can lower the overall cost and raise the performance level of treatment. The case studies also highlight:

- the importance of focussing on environmental and public health goals at the community level, instead of at each site;
- the necessity of building in enforcement powers, whether by conditions of a permit, fines, building moratoria, etc.;
- the value of educating the public about the importance of the district;

- the importance of involving the public in the design of the particular solutions and tools;
- the potential of collaboration with and support from state and federal governments in funding planning studies, research on technology, training, etc.;
- the contribution of risk management approaches that concentrate resources and attention on critical areas of concern and on priority remedial upgrades.

VI. Recommendations for Federal, State or County Governments

Summary of Findings

In recent years, there has been a growing consensus about the need for stronger accountability measures in the decentralized wastewater field. The simple approach of using a uniform code for design of conventional septic systems, with long-term maintenance by the homeowner is breaking down in key respects. Many rural areas are experiencing explosive growth and do not have enough land with adequate soils for conventional septic systems. Degraded water quality threatens public health and the environment. In many areas, even properly functioning conventional systems do not remove enough nitrogen. In the absence of federal grants, communities find that they can no longer turn to sewers as a relatively inexpensive solution when on-site systems fail.

Simple, straightforward ideas for increasing accountability in the decentralized wastewater field, such as professional inspection and maintenance or more widespread use of advanced systems, have been suggested but have often failed due to political, economic and technical realities. Many communities have rejected inspection and maintenance programs due to their cost and the need for site visits. Also, advanced onsite and cluster system technologies are still evolving; for example, in the Florida Keys, advanced systems have not consistently met the advanced treatment standards originally set. There also is a lack of agreement among decentralized wastewater experts throughout the country concerning appropriate treatment standards or goals, and how they might vary with different soil or hydrogeologic conditions.[93] Local engineers and installers typically do not possess the experience to design and construct the relatively delicate new systems. And, from a broader land use policy perspective, widespread permitting of advanced systems would open up wide areas of land for new development.

Finally, where there has been movement to allow the use of new technologies, accountability in the form of required professional maintenance has not always followed. Many states now permit advanced or alternative on-site technologies (in response to pressures from equipment manufacturers in particular) but without required professional maintenance. In other cases states or counties require inspections and maintenance but only for the first two years after construction. Still other states and counties have maintenance requirements on the books, but do little to enforce these requirements.[94]

This confusion has led many in the wastewater field to argue for the status quo of uniform codes for conventional septic systems.[95] The risk to public health and the environment from a few failed systems is less than the risk of failure from unmanaged advanced systems. A counter-argument to this conservative approach is that the tight uniform code regulatory structure has stymied innovation in technologies, methods and practices that might have led to a high-quality, high technology, low-cost, decentralized system approach. It is a bit of a Catch-22. Without quality products and skilled professionals, regulators will not depart from the code. But if regulators do not provide some flexibility, the field cannot mature.

Throughout the country, the conservative, uniform code approach seems to be responding to pressures for reform from legislators, property owners and equipment manufacturers. The danger is that new technologies will be allowed without the proper accountability controls in place. This chapter discusses various aspects of accountability for federal and state or county governments and the final chapter provides guidance to local municipalities. Recommendations follow from the more general analysis of regulations provided in Chapter 2, the recent history of regulatory and non-regulatory projects in decentralized wastewater treatment presented in Chapters 3 and 4, and the case studies summarized in Chapter 5 and presented in full in the Appendix.

Recommendations for the Federal Government

Because on-site system regulation historically was the responsibility of state or county governments, the federal government has only been minimally engaged in the field. In the 1970s the new Environmental Protection Agency devoted some resources to on-site system research and demonstration projects and also urged the creation of on-site management districts. However, in the heyday of massive sewer construction, these programs were underfunded. The Small Flows Clearinghouse at the University of West Virginia remains the principal focus of EPA's on-site efforts.

More recently there has been a slight resurgence of interest in the on-site field by the federal government as a result of growing concerns about nonpoint sources of pollution. In 1993, the Coastal Zone Management Act guidance measures for states included new system standards to protect surface and groundwater; inspection schedules; protective setbacks; and permitting and utilization of advanced systems where needed to reduce nitrogen-loadings by fifty percent.[96]

For a brief time, there appears to have been consideration of federal involvement in on-site system regulation. In 1994, Water Quality 2000, a Water Environment Federation-sponsored initiative with widespread participation of environmental organizations, government, and the wastewater industry, issued a report, A National Water Agenda for the 21st Century, and a set of recommendations, one of which was for national on-site system standards and enforcement:

"Congress should amend the Clean Water Act to require EPA to set minimum design and performance standards for all septic systems, which must be adopted and enforced by states. The amendment also should include EPA enforcement powers. National minimum standards are easier and faster to promulgate than amending 50 state laws. Current state standards for septic system design and installation vary widely, and many are inadequate."[97]

The report also recommended research to develop affordable alternative on-site systems for those areas unsuitable for traditional systems. Finally, programs for proper maintenance and periodic inspection of on-site systems were recommended to states.

While there is continued, sporadic discussion of a greater role for the federal government in decentralized wastewater regulation,[98] there are three fundamental arguments against it. First, natural variability in soils, climates, and environmental conditions is so great that a national, uniform code would be highly problematic. Second, the political backlash by states and counties, homeowners, and the industry would be intense, and in all likelihood, insurmountable, as was the case when EPA tried to mandate more stringent auto inspection programs in the early 1990s. Finally, to the extent that states and counties are exploring different approaches, the "laboratories of democracy" argument for not federalizing the regulations is valid. Eventually, the best innovative methods and practices should emerge from the fray. This "new federalism" model presumes that states, counties, and municipalities act responsibly and include accountability. If they do not adequately protect public health and the environment, the federal government can step in. High national standards for effluent quality or equipment performance would also create very large incentives for entrepreneurial development of high-quality and low-cost technologies.

There are existing federal pressures and supports for greater accountability. EPA drinking water and surface water quality standards and enforcement will continue to place healthy pressure on states and communities to respond with on-site system improvements. Similarly, the move to watershed-based planning and assessment is highly productive because it focuses attention on septic systems where they actually are a problem. EPA's involvement in Chesapeake Bay clean up is an example of these effects.[99] The federal government identified septic systems as one of the causes of water quality degradation, but has not yet mandated any specific responses by the states of Maryland or Virginia. Nevertheless, the federal pressure and presence prompt the states to invest in nonpoint-source pollution projects and research, and to explore and evaluate new on-site system standards, management options, and decentralized district demonstrations. However, the states are able to develop new approaches, within the context of their particular pollution problems and their history and traditions with respect to different agency roles. A similar process is occurring in the Puget Sound area of Washington State, where EPA is pushing for water quality improvements, but not dictating specific on-site regulations or practices. Emerging concerns about such pollution-related problems as "red tides," Pfisteria blooms, endocrine disrupters, and the bleaching of coral reefs, will increase the pressure for water quality improvements in a risk management framework.[100]

There are many non-regulatory measures government can take to encourage compliance with goals and practices. The federal government can significantly increase subsidies for on-site system remedial upgrades. Section 319 funds have been available for nonpoint-source pollution projects for a number of years, but recent efforts by EPA to extend State Revolving Fund financing to public on-site management entities that include easements to privately-owned systems will help as well. As watershed-wide studies identify on-site systems as priorities for remediation, these subsidies will increasingly provide incentives for prompt repairs or upgrades.

There is also federal support for non-regulatory measures, such as the Small Flows Clearinghouse information dissemination projects; the National On-site Demonstration Project for new technology installations; the Environmental Technology Initiative to establish an on-site technology verification project through the National Sanitation Foundation; and the Electric Power Research Institute-sponsored training, research, and development initiative. Unfortunately, the recent EPA Response to Congress on Use of Decentralized Wastewater Technology describes only a $5-10 million per year commitment to these kinds of activities.[101] The federal commitment should be substantially increased, because the potential benefits in improved performance and accountability to the nation are so great. Other organizations in the broader wastewater field have recommended that a portion of the SRF loan subsidy for construction be diverted to these types of capacity-development programs, and these funds would assist decentralized system improvements as well.[102]

In general, these projects will focus on advanced treatment standards and technologies and on tools for risk-management. Because the on-site field historically has been simply framed by a uniform code, a conventional septic system technology, and a presumption of sewering if problems developed or density increased, there has been little need to investigate community-wide impacts, pollutant transport models, or relative risks from nitrogen, viruses, or other contaminants. Now that the decentralized wastewater field is developing into a permanent, community-wide, and advanced system framework, the gaps in understanding and practice are evident. Many of the tools necessary for district design and operation are simply not available in any standard or agreed-upon format.

It is generally recognized that treatment processes in natural soils or filter media are not fully understood, and as a result, that design protocols are still built more on experience than on science. The cumulative impacts of conventional or advanced systems on local ecosystems are poorly understood. And, finally, the relative costs and effectiveness of various management approaches or technologies are unclear. The Capacity Development Project sponsored by the Electric Power Research Institute is analyzing and prioritizing the needs for education, training, research, management and regulatory reform in this regard.[103]

Federal financial support for innovative, decentralized community wastewater districts is of immediate necessity for three important reasons. The first is the risk that new technologies and practices may later require expensive modifications or that state regulators may not approve widespread use of new systems. Many federal reports have identified this risk as a major barrier to reform. Federal cost sharing or insurance could make a major difference in the willingness of local communities to develop innovative programs. Second, the federal Innovative and Alternative Program, which provided subsidies to communities interested in alternative on-site systems, encountered difficulties when projects were designed by local engineers unfamiliar with I & A technologies. In contrast, federal aid for designated demonstration projects can include the costs of procuring the services of nationally experienced experts and professionals. Finally, the rigidity of conventional septic system regulations in the on-site field has stifled technology innovation by restricting the market for new approaches. Charter districts can create a market niche for new ideas, and ultimately an opening into the entire on-site market. A federally funded design competition would attract academics and technology developers to submit on-site system applications.

The response to Florida's imposition of advanced on-site treatment standards in the Florida Keys is a good example of how entrepreneurs respond to local market openings. Sears and Roebuck has selected a treatment unit and a dispersal system from the half-dozen technologies being tested at the Big Pine Key demonstration site. This combined unit will be for sale under a Sears and Roebuck guarantee and Sears has arranged for several local companies to install and maintain these systems.[104] For the technology developers involved, this represents a major increase in business.

Summary of Recommendations for Federal Initiatives

Recommendations for federal decentralized wastewater treatment projects in coming years can be summarized as:

- Avoid using national standards or permit structures for on-site septic systems, because environmental, climate and soil conditions vary across the country.
- Continue to pressure states to improve drinking and surface water quality; this pressure will prod states to address on-site system problems.
- Increase federal support for non-regulatory functions of government, including funding, research and development, training, demonstrations, technology verification, and in particular, charter districts in decentralized wastewater treatment.

Recommendations for State or County Actions:

Preceding chapters have focused much discussion on the current and possible activities of state and county regulators and policymakers. These government bodies have traditionally taken the lead in accountability for on-site system performance and permitting, and they will continue in that role. However, pressures from the federal government to reform on-site practices to safeguard drinking water, watersheds and coastal waters will only increase over time, as seen in the Florida Keys, Puget Sound and the Chesapeake Bay regions.

From a regulatory standpoint, states and counties have two choices to open the field to advanced technologies, practices, and management. They may retain authority over the kinds of systems permitted and the maintenance and inspection required, and continue to deal more or less directly (e.g. through a local permitting process) with each homeowner. Or they may devolve a measure of flexibility over the implementation of regulations and inspections and maintenance programs to local municipalities, albeit with binding agreements about the resulting protection of public health and the environment or lack of it.

Herein, counties are discussed in the role of the regulatory agency in its relationship to cities and towns that may initiate decentralized wastewater districts under their purview. Counties may also decide to develop decentralized districts with their own staff, but this role is described in the final chapter about local municipalities.

In each of these approaches, there are dangers that accountability for the performance of advanced technologies will be compromised. The fact that some states have allowed new technologies without adequate research on their design, performance or maintenance requirements is troubling.[105] When a system such as a sand filter fails, for example, the homeowner may be told it was for lack of proper homeowner maintenance and that the county is not responsible for the failure. But that may not be true, if, for example, the management entity permitted an inadequate design. Ultimately, the state and the county are responsible for their failure to research the performance of systems over time and to require professional maintenance that would protect the homeowner from the development of problems. Professionals in the field have a responsibility to urge states and counties to research advanced technologies and to require maintenance and monitoring of their performance.

The best opportunity to diminish or eliminate industry, homeowner, or municipal resistance to accountability structures is when the initial agreements or permitting procedures are put in place. Requirements for maintenance, upgrades or monitoring of water quality must be established as a precondition for use of advanced systems and approaches. These requirements are part of the price of allowing homeowners or communities to build homes or solve their wastewater problems at lower cost. It is much more difficult to mandate inspections and upgrades after the fact.

These accountability structures are particularly important when technologies and the community-wide planning and monitoring approaches are new. A condition of technology exploration must be extensive oversight. Once the reliability of an approach has been demonstrated, requirements may be reduced. A number of states have developed specific frameworks for the introduction of limited numbers of new technologies under an experimental program with extensive monitoring, followed by general use permitting with fewer requirements for monitoring. A similar process will probably evolve as the experiences of charter districts are documented and the outcomes of new methods and practices are better known.

North Carolina has increased the requirements of homeowners to maintain their systems, partly as a result of the high failure rates of some of the newly permitted systems. The state has implemented a six-tier, increasingly rigorous set of categories for required maintenance, ranging from the conventional system with homeowner maintenance through more advanced systems with increasing frequencies of inspection by professionals.[106]

The case study communities examined in this document employed different methods to implement state or county approval and oversight of community wastewater management districts. For example, in California, the NPDES permit structure was adapted to cover agreement on a decentralized approach. In Nova Scotia, authorizing legislation established the parameters for municipal action. In Massachusetts, innovative projects seem to be evolving through consent decree agreements. In Rhode Island, the state assented to leadership of local communities without written agreements or permits in place.[107]

This document does not recommend specific details of an agreement for accountable devolution of on-site regulations and practice to the local level because laws and traditions vary across the states and counties, and because communities should explore a variety of approaches, in effect as charter or demonstration projects. Many state or county regulators will acknowledge that decentralized districts could work in the abstract, but are not confident that proper planning and management will occur at the local level. It is time that states and counties relax the requirements enough to allow communities to explore these new approaches, even if mistakes are occasionally made.

The state, in particular, should lend assistance to these innovative communities through financial assistance and technical advice. States have sometimes taken the position that it is up to the community to develop a comprehensive decentralized wastewater district approach, and then see if it meets with state approval. But, local engineering firms and citizens' groups are typically unqualified to deal with the intricacies of emerging technologies and research that are appearing nationwide.[108]

In a number of states, for example, several municipalities have struggled with new proposals for decentralized districts, but have been largely unaware of existing districts in other parts of the country. In some cases, advanced system designers brought in to speak have experience only within the state. State officials may be well versed in what is happening elsewhere, but are hesitant to lend a hand. Much time and energy are wasted in these explorations and some ill will is generated in the process.

One barrier to a more active state/local partnership seems to be the tradition of local control with state approval that has been part of the sewer facilities planning process. States are wary of telling the community what to do, but do retain permitting and funding approval powers. This approach is non-productive when it comes to demonstration projects.

States described in the case studies, including California, New York, and Washington in particular, have discovered the value of a partnership approach with innovative local efforts. Rhode Island, Vermont, and Oregon are also exploring partnerships with local communities to facilitate decentralized demonstration or charter districts. If federal financial support is forthcoming, additional states are likely to follow.

Current proposals for federal funding of community decentralized districts require that the state be an active partner in assisting and facilitating new approaches; that nationally-recognized experts and on-site training centers be involved in the project; and that citizens and other stakeholders are actively involved in the decision to go forward with a demonstration project.[109]

Non-Regulatory State and County Actions:

States and counties should financially support these non-regulatory activities, like the development of training centers that can coordinate interrelated efforts and build a strong base of expertise and outreach in the state. Other possible initiatives to upgrade the field include certification of designers and installers, and conferences and networking with other states with particular attention to exchanging testing and field evaluation methods for new technologies and approaches.

Summary of Recommendations for State or County Initiatives

- Continue to modify on-site regulatory codes to include managed advanced technologies, inspection and monitoring programs, and additional treatment standards in critical areas of concern.
- Build training, certification, and monitoring capacities and other non-regulatory support structures in decentralized treatment within the state.
- Work with a manageable number of local initiatives to develop and demonstrate "district" permits and agreements that give communities flexibility in return for responsibility for outcomes.
- Support "charter districts" with financial and technical assistance.
- Incorporate stiff, but fair, penalties and enforcement options into district agreements.
- As experience is gained with districts, implement lessons learned, including knowledge about innovative systems, monitoring and planning, and about strengths and weaknesses of permits and enforcement mechanisms.

VII. Guidance to Municipalities on Options for Wastewater Management

Small towns, rural counties, and fringe areas of larger metropolitan centers are beginning to consider measures to assume greater levels of responsibility for performance of on-site and other decentralized wastewater treatment systems. The increased interest is due to drinking water and other water quality problems associated with on-site septic system failures and the loss in recent decades of federal grant support for central treatment plant and sewer construction.

Traditionally, municipalities have had two options for managing wastewater:

1. a reliance on a uniform state or county code that dictates septic system site and design standards and relies on the homeowner for system maintenance, with little involvement by the municipality for accountability for overall performance.
2. a central sewer collection system and treatment plant infrastructure operated by the municipality or group of municipalities under a common utility or district.

Recently two additional options have emerged in which municipalities assume greater responsibility for on-site and cluster systems:

3. a shift of accountability for inspection and maintenance responsibilities from the homeowner to the municipality, which manages a community-wide inspection and maintenance program;

4. an assumption by the municipality or utility district of overall responsibility for design and operation of conventional and advanced on-site and cluster systems to achieve public health and water quality protection.

Communities may find that combinations or hybrids of these approaches make the most sense, as for example sewering of a dense, central area and continued reliance on conventional on-site systems in less-dense outlying areas.

In Chapter One of this document, three areas of accountability were described:

- protection of public health and the environment;
- minimization of monetary costs and other public concerns, and
- practicality and feasibility of implementation.

In this chapter, these areas are discussed as they apply to the above wastewater management options, followed by some summary conclusions and guidance for municipalities.

Protection of Public Health and the Environment

Protection of public health, and increasingly, of the environment are the primary objectives of wastewater management. How accountable are the four community wastewater choices outlined above to this objective? From a public health standpoint, reliance on the broader state and county code and homeowner maintenance is a reasonably stable and appropriate solution, if soil conditions are reasonably good. Properly sited conventional septic systems function well as disposal systems, keeping wastewater below the surface and away from exposure to humans, except through groundwater transmission to drinking water sources.

Ideally, under this plan, any failures causing surface ponding or back-ups to the home are obvious to the homeowner and neighbors and a high fraction of these failures are corrected by the homeowner. To increase compliance, Harry Nurse, the founder of the National Onsite Wastewater Recycling Association, proposes the installation of filters in the septic tank. With a filter in place, malfunctions will result in back-ups in the home before there are visible failures in the leachfield.[110]

A broader oversight role for maintenance and inspection of on-site systems by the municipality would presumably lead to faster and more thorough detection of failures and to more frequent pump-outs (which can help prolong the life of the system). No benefit–cost studies of these relationships have been made. However, the more difficult the soil conditions in the community, the more valuable will such preventative maintenance be.

Conventional septic systems do not remove enough nitrogen to protect surface water resources in many areas. The use of advanced denitrifying on-site systems to better protect water quality can be part of any municipal solution to wastewater treatment, but these systems with their electrical parts and pumps require more oversight. If the state or county code does not require long-term maintenance contracts for a homeowner using an advanced system, municipalities may have the right by law to impose the necessary stricter standards for advanced on-site system permitting. Municipalities also may choose not to permit systems in which they lack confidence.

Traditionally, the need for accountability for protection of public health and the environment has led communities to construct sewers and central treatment plants. Sewers have the advantage of removing wastewater from homes, out of soils and groundwater, and to a central treatment plant. However, sewers and central treatment plants are not without problems. Leaks in sewer pipes can lead to major contamination problems. Failures at the treatment plant are also large-scale environmental pollution events, as untreated effluent is released into the environment. Rainfall or storm events can overwhelm a central system and lead to a major pollution event. Moving large quantities of water from one recharge area to another or transferring water offshore may disrupt watershed hydrology; in coastal areas, the result may be saltwater intrusion into a sole-source aquifer. Discharge points for treated effluent may be difficult to find in sensitive coastal areas. Sewer construction itself can destroy critical resource areas.

The comprehensive decentralized wastewater approach can do better than sewers in these key respects. A system failure may be limited to a single home at a time. Water is kept as a resource in the community. On-site systems disperse effluent throughout a community, rather than at one point. Advanced on-site and cluster systems can compensate for difficult site conditions and achieve higher effluent quality in sensitive, critical resource areas. New technologies and combinations of technologies are capable of meeting increasingly high effluent standards. For example, there are possibilities, barely explored, to rebuild streams, irrigate parks, etc., and to view on-site septic system effluent as a recycled resource. (These systems and the planning approach for their utilization are described more fully in the Task Force's Risk Management document.[111])

Because few, if any, states or counties permit all of the major types of new disposal systems, a key requirement for many municipalities to utilize decentralized approaches is the ability to explore non-permitted technologies on an experimental or demonstration basis. This need is one of the major dimensions of accountability that the municipality assumes when implementing a district approach. Within the boundaries of the community, a range of new technologies can be utilized, if monitoring shows that public health and the environment are adequately protected.

One of the primary differences between the traditional sewering approach and the decentralized districts reviewed in this document is that most of the districts were required by higher authorities to conduct ongoing monitoring programs of drinking water wells, groundwater, streams, estuaries, shellfish beds, and the like. Programs to evaluate system effectiveness after central treatment plant installation have generally been lacking. (In some cases where there have been monitoring programs after central treatment plant installation, results have shown that on-site septic systems were not the problem after all.[112])

Accountability for water quality protection in the decentralized management approach requires the implementation of additional measures if problems emerge. Municipalities are responsible for replacement of failing technologies and, most important, for upgrades of treatment standards if water quality deteriorates further, or if expected and needed improvements in water quality do not occur. A typical concern may be elevated nitrate levels in groundwater; in such cases, nitrogen-removing technologies may be necessary add-ons to some systems in the community. The assumption of risk that future corrective actions may need to be taken by the municipality is a necessary part of the accountable devolution involved in district operation, and a price to be paid for the flexibility in design and technology use that make cost-effective solutions possible. Ideally, over time, the risks of new technologies and approaches will fall as more knowledge is gained about successes and failures. For the time being, however, any municipality deciding to undertake decentralized wastewater management is still breaking new ground and operating as a demonstration community.

Minimization of Monetary and other Costs or Disruptions to the Public

Economic Considerations

From a cost perspective, the choice among wastewater management options will depend on the relative costs of the initial planning and construction of sewer systems, on-site or cluster systems, and on the later costs of ongoing maintenance and management. The initial construction costs will vary depending on such factors as density of housing, terrain, amount of ledge or rock, and available soils for subsurface disposal. If soil conditions are compromised at individual sites, effluent could be transported off-site to a nearby small cluster system or further to a central treatment plant. But, if conventional gravity pipe installation costs are high, (e.g., because of ledge or low-density housing patterns), then on-site treatment may be more cost effective. Maintenance costs for the infrastructure will depend on the extent of mechanical or electrical parts, reliability of the parts, failure rates of on-site system non-electrical treatment materials, etc.

Although it may appear that initial costs will be higher for central treatment plants, and that long-term maintenance requirements will be higher for on-site systems, this may not be the case. For example, treatment plants require extensive staffing and some sewer systems use pumping stations that require daily checks. Only a detailed engineering study of the particular community will provide the necessary comparisons. In general, the less dense the housing units, the more sewer line construction will cost for each house, and the more cost-effective will be an on-site approach. The EPA Response to Congress contains examples of this type of analysis.[113]

Costs will also vary with the quality of soils, depth to bedrock or groundwater, and the nature of critical resources. The more appropriate the soil conditions are for conventional septic system disposal, and the less critical or sensitive the water quality resources are, the more viable is a reliance on the uniform state or county code and on homeowner maintenance.

If on-site failures or pollution problems develop, and as the percentage of house lots with significant soil or drainage problems rises, then an increasing oversight role by the municipality may be a cost-effective alternative to construction of an expensive sewer. In general, relatively few communities have chosen to implement inspection and maintenance programs. Part of the reason may be that the benefits have not been adequately demonstrated compared to the costs.

At some point as conditions become more challenging, total construction and long-term management costs of the decentralized approach will exceed the costs of a sewer system. However, as the cost of on-site and cluster treatment technologies and practices fall over time, the point when central treatment is obligatory will be delayed, and the opportunity for decentralized wastewater treatment and management will increase.

A better cost-effectiveness argument for increased municipal oversight can be made for the more complex decentralized district approach explored by the ad hoc Task Force. The costs of an expensive sewer collection/treatment plant system may be avoided if the community absorbs additional planning, design, oversight, and environmental monitoring functions for the on-site and cluster systems. Because there are so few existing examples of districts, the costs of these activities are not well established, and are higher than they will be as more experience is gained in district design and implementation. In general, however, these planning and support costs will be significantly less than the physical infrastructure construction costs of the collector, on-site or cluster systems. From a purely cost perspective, the optimal wastewater management solution for a municipality will continue to be based primarily on the engineering estimates of actual system costs rather than the planning costs.

Public Concerns: Equity, Private Property Rights, and Growth of Bureaucracy

As a municipality considers the options for decentralized or centralized treatment, officials are accountable to the public for developing a solution that is responsive to local preferences. Experience shows that failure to take account of these issues can lead to a rejection of proposals, or if a solution is implemented over the wishes of the public, to an unhealthy residue of resentment and public disaffection from the program and against local government officials more generally.

There are three major dimensions of public concern to evaluate when developing a plan. The first of these is equity, the second is private property rights, and the third is the implications for an expanded government role and proliferation of bureaucracy.

Under the traditional reliance on the state or county code with homeowner maintenance, equity is achieved because citizens believe it is fair for individual homeowners to bear the cost of treating their own wastewater, even if those costs vary from house to house. It is also acceptable from a private property standpoint, because the homeowner owns the system, and government officials do not enter private property or mandate pump-outs or upgrades. Finally, private contractors, rather than government offices, carry out needed functions.

For these same reasons, sewering has been an acceptable solution as well. Homeowners pay the same or almost the same betterment fees for installation of the sewer in the street and then incur differential hook-up costs for the pipe from the house to the street. Once installed, the house is connected to a community-wide system, but sewer department staff will not typically enter private property because maintenance occurs at the street, at pump stations, or at the treatment plant. Property values may increase following connection to a public sewer. Indeed, the laws surrounding betterment charges for sewer construction were based on the principle that the charges would reflect the extent to which properties were “bettered” by the sewer. Finally, while a sewer system requires an expansion of the size of government, either with municipal staff or with private contracts, this particular public service has become a traditional and valued service.

Both a simple inspection and maintenance option and a comprehensive decentralized wastewater district upset these traditional relationships. The inspection program may be equitable across homeowners, but it disrupts notions of private property rights and values. Homeowners are not comfortable with inspectors on their private property, and such intrusions by "potty police" as they are sometimes called, will be fiercely resisted in some places.[114] In fact, some communities have found that homeowners reject offers of free on-site system upgrades. Homeowners fear that government inspectors may discover other problems of non-compliance with regulations. And it is true that when HUD low-income grants are provided for septic system upgrades, any violations of other codes must be reported and eventually repaired.

A comprehensive decentralized wastewater district is an even more radical challenge to public values and traditions. Equity questions become paramount. A central feature of the district concept is that expensive advanced on-site or cluster systems will be required in order to protect public health and the environment in a community with threatened resources and failing systems. This may mean that some homeowners will bear a greater burden than others will for water quality protection efforts. Arguments are made from both sides. Those with acceptable systems argue that it is only fair for those who are polluting to pay for remediation of their systems and they will oppose options that equalize the costs across the district. Those who are being asked to pay more for advanced treatment argue that they are being unfairly targeted to absorb the costs of a public project that has environmental benefits for the entire community.

In the past, these conflicts would have been resolved by installing sewer lines and a central treatment plant. For example, if a minority of houses and businesses in a dense downtown area along a river or harbor were the source of a problem, a sewer would have been built and would have included many more houses than actually needed. The resulting costs would have been spread across this larger number of residents. The burden to homeowners with functioning on-site systems, who must nevertheless hook-up to the sewer, would have been mitigated by the perception that the sewer was a betterment to their property.

The comprehensive district will also entail official site visits for a number of reasons. Planning will require appointments to research and map existing soil conditions, failure rates, and drainage conditions, as well as to assess the viability of a range of possible on-site or cluster systems. Borings or percolation tests may be required with staff and equipment in the yard. Once systems are installed, permanent easements will be required for inspections by municipal or homeowner-contracted staff.

Cluster or shared systems may be the most cost-effective solution for dense neighborhoods or homes near sensitive resources. The need for intrusive inspections should also be less frequent. But cluster systems require a level of cooperation among neighbors that is unfamiliar in established communities. A homeowner who is asked to sell land or an easement to his land may resist such overtures. The perception of risk from sharing a common leaching field may deter interest. For example, a particular homeowner may abuse the system. How do people deal with such violations by their neighbors?[115]

Finally, management of a comprehensive district operation is a series of complex tasks of planning, monitoring, maintenance, and the like. If citizens distrust or are wary of local government, they may believe that local staff is not up to the challenges and that staffing levels and costs, paid for by taxes or new fees, will increase over time.[116]

Resolution of these difficulties will only occur through active involvement by the citizens in the design of the overall approach.[117] Grants and loans can be provided for homeowners who are burdened with the most expensive system upgrades. It is particularly helpful if these subsidies come from state or federal funding sources outside the community. Use of private subcontracting or utility management rather than municipal staffing may alleviate concerns about intrusions on private property or about bloated bureaucracies. Remote sensing technologies, sending continuous monitoring data on system status to a central office, can decrease the number of potentially intrusive site visits.

These issues may be more readily resolved in new construction projects than in remedial upgrades of existing systems. People seem more willing to purchase homes with existing advanced on-site and cluster systems and to then accept inspections on their property.[118] Further, the cost of the system will be a small part of the purchase price. A homebuyer may be more able to absorb the cost than the homeowner facing an expensive remedial upgrade. Finally, if developers perceive that the installation of advanced on-site and cluster systems is the only option available to them, they will accept these requirements.

Land Use Issues

Wastewater infrastructure solutions are inseparable from considerations of growth and development within a community.[119] The interrelationships of wastewater infrastructure with water supply systems, roads, schools and other city services are important, along with impacts on open space, congestion, and community character.

Continued reliance on the traditional state or county code with homeowner maintenance limits overall growth and development, but encourages sprawl. The on-site code functions powerfully as a brake on development and as a means to preserve open space in areas where the land cannot accommodate conventional or permitted advanced systems. The community also keeps the costs of servicing new homes with roads and schools low and manageable, because services to each new home generally cost more than is returned in property taxes. However, the traditional code requires large lot sizes for leaching fields and thus encourages low-density neighborhoods and community sprawl.

Central sewers typically transform a community, by allowing higher-density development and infilling of previously unbuildable lots. Indeed, these possibilities may be one of the primary motivating factors for building sewers and a treatment plant. Downtown business districts may be able to expand as wastewater-related limits on restaurants, hotels or other businesses are lifted. Real estate developers may be able to build new subdivisions in areas of poor or shallow soils. The effects on city services and community development patterns may be large because zoning and other land-use policies may not be sufficient to control and guide growth.

The option to implement an inspection and maintenance program may have a minimal impact on patterns of development if there are only a few advanced on-site systems and they are allowed only for remedial upgrades of existing homes. However, if a community permits large numbers of advanced systems for existing or new construction, previously unbuildable lots may become buildable. The resulting potential impact on community character and services is a major reason that some states and counties resist widespread permitting of advanced onsite systems.[120] Communities may also choose not to develop management programs because of the fear of over-development.[121]

Some decentralized wastewater professionals have argued that a comprehensive wastewater district can have almost the same impact on community development patterns as central treatment and sewers. However, the decentralized wastewater district may give the community the greatest ability to plan for and guide its future. New cluster systems for a dense downtown area can forestall the construction of a standard treatment plant, while the traditional on-site code remains in place in other areas of the town. And, if growth is desirable, cluster wastewater systems can be used for cluster developments. This option avoids the wastewater-related encouragement of sprawl.

Practicality and Feasibility:

The ad hoc Task Force has described a range of issues concerning the implementation of the various approaches in this document and others. One can present new solutions in the abstract. But, how practical are they in the real world of laws and traditions, skill levels, knowledge base, etc.? The answers will vary so much across the states, in terms of authorizing legislation, public attitudes and other factors that it is not possible to make precise statements in this regard. However, there are some general conclusions from the experiences of various communities.

Managing wastewater through reliance on on-site systems under the uniform code or through reliance on sewers and a treatment plant are the traditional options that are well established in law and practice. The creation of a comprehensive decentralized district is the most radical and therefore the most problematic of the four alternatives described in this document. Successful creation of a district also requires comprehensive and simultaneous planning and consensus building among all participants. Any single difficulty can threaten the whole process and lead either to no action or to central sewers as a remedial project with established practices.

Essential Elements of a Comprehensive Wastewater District

The following practices or projects are essential elements for a successful comprehensive decentralized district approach:

- identification of water quality problems in the community (failing septic systems, contaminated private water wells, or public water supplies, degraded surface water quality);
- articulation of the contributions that current or proposed onsite or cluster systems have or would have to these water quality problems;
- development of a consensus in the community for the major outlines of the wastewater solution and how wastewater infrastructure planning interacts with other public service and land use planning;
- determination of the particular technologies and approaches that will be utilized and a securing agreement from state and county regulators that these systems can be used on a “charter” or demonstration basis;
- design of a monitoring program for water quality resources that is capable of identifying water quality problems as they develop, along with the specific systems failures that cause them.

The six case studies demonstrate that these elements can be achieved, at least for the environmental conditions and communities described. In general, however, the following aspects of the district approach are still problematic:

- a precise delineation of sources of pollution and their impacts are still expensive and difficult tasks. Other sources of pollution, such as road runoff, from waste, or pets, must also be distinguished from septic system pollution. However, progress is being made in the development of GIS mapping and other techniques;
- decisions about treatment standards for individual homes depend on precision in understanding drainage, transport of pollutants in the area, etc. This can be extremely expensive to establish, through dye tests, monitoring wells, etc.;
- securing the assent and participation of homeowners in granting easements and allowing staff on their property for inspections and maintenance is difficult;
- the ability to monitor water quality conditions at reasonable cost is a major technological challenge;
- finding qualified staff to implement and manage the program is difficult since wastewater engineering curricula and training programs have been oriented almost exclusively around sewers. The skills required include an understanding of water quality resources, soils, engineering and management;
- securing the assent of the public at large and individual homeowners particularly affected by an expensive, and what may be perceived as a risky, program, and resolving the issues of equity, intrusion on private property, etc. requires hours and hours of education and debate;
- returning to homeowners for add-ons or to rebuild systems if water quality problems continue is frustrating to the public;

- locating contractors who will carry out construction of advanced onsite and cluster systems at reasonable cost is initially very difficult. Typically, construction costs fall by 50% over the first year or two of experience with these systems in the area.

The above hurdles can be overcome. The impetus to resolve them is greatest when water quality, particularly drinking water quality, is clearly threatened and when a sewering alternative is very expensive or has adverse environmental impacts; when implementation of the district approach is for new home construction, not remediation; and when growth pressures are high. Essential to facilitating the district approach and avoiding potential roadblocks are:

- citizen involvement in the planning process,
- education campaigns,
- the availability of outside financial resources,
- securing of professional consultants who are knowledgeable about new developments in the field throughout the country,
- and an early partnership with a cooperative state or county policy and regulatory staff.

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[43] Ibid.
[44] Dix, S., 1992.
[45] Information from a presentation by K. White, 1998. Navigating the Regulatory Obstacle Course. Neighborhood Wastewater Management Seminar. Joe Wheeler Electric Cooperative, Decatur, Alabama.
[46] Emery, H. C., 1998.
[47] Angoli, P., et al., 1996.
[48] DEP, 1997.
[49] See, for example, discussion in National Small Flows Clearinghouse Hotline A & A, 1996.
[50] Staats, E., 1979, p. 90
[51] Ibid.
[52] Ibid, p. 91
[53] California Senate, 1977.
[54] Washington State, 1976; Ohio General Assembly, 1980; Illinois General Assembly, 1978; and New York Senate and Assembly.
[55] California Senate, 1977.
[56] Herring, J., 1996, p. 18.
[57] Ibid.
[58] EPA, 1997, Response to Congress..., p. 22.
[59] See, for example, U.S. General Accounting Office, 1994.
[60] National Science and Technology Council, 1993, p. 133-135.
[61] May, R., 1997.
[62] See Nine Counties in North Carolina, in Appendix to this document.
[63] Water Resources Research Institute News, 1992. p. 3.
[64] Ingram, T. et al., 1994.
[65] Boland, J. J. et al., 1993.
[66] Seitzinger, K., 1996.
[67] Information from a presentation by J. Grady and P. Goodwin, 1996. Innovative Wastewater Treatment, at the Tenth Massachusetts Marine Environment Symposium, Boston, MA.
[68] Ibid.
[69] Heufelder, G. and S. Rask, 1997.
[70] Nelson, V. I. et al., 1999.
[71] Otis, R. J. and D. L. Anderson, 1994.
[72] National Onsite Wastewater Recycling Association, 1996; and Miller, P., 1997.
[73] Otis, R. J., pp. 2-3.
[74] Ibid, p. 3.
[75] Ibid.
[76] In Alabama, for example, a draft on-site code includes new elements for performance-based technology installations that require secondary treatment in sensitive areas. According to Jim Coles of the Alabama Department of Health, with a reporting and tracking system, “the regulator won’t feel so hesitant to provide more flexibility. The

managing entity will not have to check every dotted "i" or crossed "t" and the pre-treatment technology will be left to the engineer." The trade-off is "more flexibility for developers vs. more information for regulators. Information from a presentation by J. Coles, Navigating the Regulatory Obstacle Course: Neighborhood Wastewater Management Seminar. 1998. Joe Wheeler Electric Cooperative, Decaturo, Alabama.

[77] For example, in a review of alternative approaches for the towns of Oak Bluffs and Tisbury, Massachusetts, Mike Parker recognized that variances from the state Title V code would be required for on-site disposal systems to be used. His recommendation was that these variances not be granted on an individual basis, but rather for the whole area at once, and that the state Department of Environmental Protection be involved in setting standards for these variances. Parker, M. 1996.

[78] Boland, J. J. et al., 1993.

[79] See for example, US General Accounting Office, 1992, for a discussion of cost, information and institutional bias barriers to use of alternative systems.

[80] Galbraith, L., 1995.

[81] Conversation with James Kreissl, U.S. EPA, National Risk Management Research Laboratory, Cincinnati, Ohio.

[82] Conversation with Stephen Dix, Infiltrator Systems, Inc., Old Saybrook, Connecticut.

[83] EPA, 1993, State Revolving Fund...; EPA, 1995, Current Policy on SRF Eligibilities; EPA. 1996, The Clean Water State Revolving Fund ...; and Singelis, N., 1996.

[84] Nelson, V. I. et al., 1999.

[85] Conversation with Kevin Sherman, Florida Department of Health, Tallahassee, Florida.

[86] Dix, S., 1998.

[87] Information from The Small Flows Clearinghouse at West Virginia University, Morgantown, West Virginia.

[88] Information from the National Onsite Wastewater Recycling Association, Northbrook, Illinois.

[89] Information from the Consortium of Institutes for Decentralized Wastewater Treatment, Chairman George Loomis, University of Rhode Island, Kingston, Rhode Island.

[90] Information from Tom Yeager, Consultant to Electric Power Institute, Palo Also, California.

[91] Cagle, W., 1998.

[92] See, for example, Hoover, M. et al., 1998.

[93] Nelson, V. et al., 1998.

[94] May, R., 1997.

[95] EPA, 1993, Guidance Specifying Management...

[96] Water Quality 2000, 1992, p. 96.

[97] Ibid.

[98] The Clinton Administration's 1998 Clean Water Action Plan includes provisions for development of voluntary national standards for on-site management programs. EPA and US Dep't of Agriculture, 1998.

[99] Conversation with Patricia Miller, Virginia State Department of Health, Richmond, Virginia

[100] Broad, W. J. 1996; Saltons, R., 1998; Cone, M., 1998; and Anderson, D. M., 1994.

[101] EPA, 1997, Response to Congress.
[102] Kirk, K. et al., 1993.
[103] For further information on the Capacity Development Project, contact Valerie Nelson, Coalition of Alternative Wastewater Treatment, Gloucester, Massachusetts.
[104] Conversation with Kevin Sherman, Florida Department of Health, Tallahassee, Florida.
[105] See Nelson, V. et al., 1998.
[106] See the Risk Management document of the Task Force by Mike Hoover of North Carolina State University for suggestions on inspection and maintenance protocols for various types of systems in different management zones.
[107] Nelson, V. et al., 1999.
[108] Kevin White of the University of South Alabama also stresses the need for communities to work with experts, “It doesn’t work without good people.” Information from a presentation by K. White, 1998. Navigating the Regulatory Obstacle Course. Neighborhood Wastewater Management Seminar. Joe Wheeler Electric Cooperative, Decatur, Alabama.
[109] For further information, contact V. Nelson, Coalition for Alternative Wastewater Treatment, Gloucester, Massachusetts.
[110] Nurse, H., 1997, National Environmental Health Association presentation, Crystal City, Virginia.
[111] Hoover, M., 1997.
[112] Conversation with George Tchobanoglous, University of California at Davis.
[113] EPA, 1997, Response to Congress...
[114] Fehr, S. C. and P. Pae, 1997.
[115] Uhren, D.J., 1991, p. 12.
[116] For example, in a 1995 survey of 1792 Wayland, Massachusetts residents, 1425 opposed “the Town of Wayland assuming the responsibility for scheduled pumping of residential and business wastewater disposal systems using revenues from user fees.” Wayland Wastewater Management Committee. 1995; See also Ingram, T. et al., 1998.
[117] See for example, Caudhill, J. R., 1998, for a discussion of the importance of education and outreach. “…effective education followed by regulatory enforcement can lead to homeowner acceptance of their role as a wastewater treatment system operator...”
[118] In Alabama, for example, the Joe Wheeler Electric Cooperative is developing a pilot constructed wetlands cluster system for a new subdivision, and the developer is marketing the homes as “sewered.” A presentation by S. Odin, 1998. Maximizing Your Co-op's Business Potential. Neighborhood Wastewater Management Seminar. Joe Wheeler Electric Cooperative, Decaturo, Alabama.
[119] See, for example, Haynes, J., 1998.
[120] Burks, B. D. and M. M. Minnis, 1994, pp. 215-224; and Heufelder, G. and S. Rask, 1997, p. 2.
[121] In Essex, Massachusetts, for example, town boards are not supporting a town-wide wastewater district commission “because they have concerns about the extent of the system and its impact on development.” Lewis, S. 1998.