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IMPROVING RURAL NEW YORK'S WATER SYSTEMS*

by Clifford Rossi

Many rural New York communities face considerable problems with deteriorating water supply facilities. The State Health Commissioner places the rehabilitation price tag at \$7 billion, with approximately \$1-2 billion needed to refurbish systems serving 50,000 people or fewer. A study of community water systems in the Adirondack region of upstate New York found that two-thirds of the municipal systems sampled had average concentration levels for coliform bacteria (associated with gastro-intestinal illnesses) between 1977 and 1982 exceeding Federal water quality standards. Moreover, two-fifths of these systems experienced breakdowns that caused a loss of service to customers.

The effects of system deterioration range from merely inconvenient to hazardous. Pipe fractures and leaks permit contaminants to infiltrate water supplies. Less of a hazard, but a problem nevertheless, are interruptions in service due to malfunctions. Widespread evidence of deteriorating facilities has stimulated some public awareness. But, the slow pace of deterioration helps forestall public perception of immediate rehabilitation needs, despite the potential harm to public safety and health.

This article is based on a 1985 survey of 75 rural New York communities and water systems and 35 county/district health inspection offices that monitored their water supply operations (see Description of the Survey for more information). The survey provides the basis for an evaluation of officials' perceptions of water system conditions and the physical characteristics of these systems.

No single factor is responsible for promoting deterioration or deferring rehabilitation activities. Rather, a complex interaction among physical, financial, institutional, and other factors contributes to a unique set of deterioration problems for

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each system. Despite the complexity of causes and the big price tag required to fix the problem, most rural communities have the resource base to keep their water quality at levels consistent with Federal and State standards.

What is Happening to Rural Water Systems in New York?

Public water system deterioration is most severe in the Northeast where many systems have been in operation for over 100 years. In New York alone, 453 public water systems, nearly a third of the State total, require rehabilitation of critical system components (table 1).

Common problems affecting water quality and service relate to system age. The average system surveyed was 52 years old in 1985, and had 17 miles of distribution lines. System components most susceptible to deterioration are underground. Weather, particularly temperature fluctuations, causes pipes to break. Internal corrosion of pipes and tuberculation (a buildup of plaque-like deposits inside a pipe) are leading causes of declining water pressure in distribution lines. Pipe stress from overlying pavement and overburden increases the probability of breaks. Some components do not deteriorate per se, but storage tanks, pumps, hydrants, valves, and meters may wear out prematurely because of improper maintenance.

Deterioration develops slowly over decades with few visible manifestations to the nonexpert until it is almost too late. Low visibility of decay along with limited technical expertise encourages delayed recognition of the problems. Constraints on technical resources also impede the adoption of programs of routine maintenance that could arrest the increasing rate of deterioration.

Rural Communities Are Slow to Respond to Water System Deterioration

Recognizing the problem of system deterioration is only the first step to rehabilitation. Responding to the problem depends upon local officials' leadership, perceptions, and commitment to the system's needs.

The primary decisionmakers for the sampled communities are the village mayor or town supervisor and their boards. Day-to-day decisions are left to hired operators. Mayors and supervisors were given the questionnaire and asked to describe their perceptions of the conditions in their community's system. A similar question was directed to health inspection officials for sample systems operating in their jurisdiction.

In general, the appraisals of system conditions by health inspection officials in the sample were fair to good (table 2)

Table 1 - Rehabilitation needs for rural New York water systems

Improvement needed	Systems
	Number
Treatment facility rehabilitation	80
Intake pipe replacement or repair	5
New storage	39
New transmission	16
Repair or replace pump	8
Distribution rehabilitation	46
New chlorinator	9
New source development	60
New reservoir cover	12
Total	275

The number of improvements noted in the table refers to 155 systems where water quality did not meet State standards (that is, contaminant levels exceeded State maximums).

Table 2 - Local officials are more optimistic about system condition than technical experts

Components	Community officials' evaluation			Inspection officials' evaluation			Total responses	Total responses
	Good	Fair	Poor	Good	Fair	Poor		
	% of respondents			% of respondents			Number	Number
Pumping	84.4	15.6	0	54.3	42.9	2.8	64	35
Source	53.1	42.2	4.7	48.4	38.7	12.9	64	31
Storage	44.3	44.3	11.7	58.8	26.5	14.7	70	34
Treatment	72.1	27.9	0	50.0	38.5	11.5	61	26
Transmission	52.3	36.9	10.8	61.3	35.5	3.2	65	31
Lines	50.0	39.7	10.3	37.1	54.3	8.6	68	35

and approximate the assessments of local government officials. These officials do, however, seem to have a slightly more optimistic evaluation than the inspection officials with the exception of the ratings for distribution and transmission lines. Problems associated with water mains are perhaps more noticeable to local officials in the form of lower water pressures and rust-tainted tap water. Local officials may overrate actual operational performance of other components because of a lack of information and personal bias based on past experience with the systems. If it worked well in the past and there are no visible problems, it must be fine now. Local appraisals of system condition form the basis of decisions on resource commitment to water supply and set the tone for public awareness of system problems.

Most local officials said they reacted to component breakdowns rather than pursuing a program of preventive maintenance. When asked, most officials indicated that service interruptions and customer complaints most frequently prompted repairs to the water systems (figure 1). Few communities performed maintenance and those that did were likely to do it in a patchwork, haphazard fashion, encouraging maintenance to be deferred. This approach to maintenance can be attributed in part to constraints on resources committed to water system infrastructure.

Limited manpower resources and technical expertise at the local level are significant constraints on system maintenance and rehabilitation activities. These limits contribute to misinformation regarding system needs and, hence, promote inefficient decisionmaking for system investment. Over 90 percent of municipal officials surveyed served part-time. Accordingly, an average of 27.8 hours per week are devoted to operations and maintenance by system operators.

Few operators keep system logs that document repairs, breakdowns, location of lines and equipment, and the dates of scheduled maintenance. Recordkeeping is largely anecdotal. Such practices may be blamed in part on demands on the operator's time from other public duties such as road repairs and waste disposal. Improved management skills would help operators establish priorities, schedule maintenance projects, and document activities.

State and local governments have historically underinvested in infrastructure which must compete with local services. One reason for this may be that public officials serve relatively short terms and, hence, make budget policies and project plans that maximize short-term benefits. Shortsighted policy decisions restricting the allocation of resources to infrastructure allow a community to benefit in the short run from reduced taxes and user fees at the expense of later generations.

In the surveyed communities the financial commitment to water service was estimated to be inadequate to meet system needs. Surveyed officials estimated an average of \$75,000 to bring their systems to acceptable standards compared with an actual average

Figure 1 - Preventive maintenance seldom prompts water system repairs in rural New York

	<u>Customer Complaints</u>	<u>System Breakdowns</u>	<u>Preventive Maintenance</u>
% responding often	19	18	3
% responding sometimes	69	67	19
% responding infrequent	12	15	78

Total responses = 75

capital investment of about \$400 per year. Capital improvement financing has been constrained in part because of recent reductions in Federal and State appropriations to rural areas and access to financial markets.

Since 1983, when Federal appropriations for water and sewer grant/loan programs were reduced to half the 1980 levels, rural communities have had to become more financially self-sufficient. Less than 1 percent of all rural systems in New York receive Federal aid; yet these funds, featuring subsidized loans, spark widespread interest at the local level. Limitations on these sources of aid and increasing pressure for fiscal austerity in recent years have profoundly influenced financial management in rural areas.

The survey asked local officials their views on financial strategies they would prefer if they were forced to make reductions in their municipal budget (table 3). Leaders did not favor reducing the level of public services as a method for relieving financial pressures. Local decisionmakers were also reluctant to increase tax revenues. They showed interest in raising water user fees and charges. The preference toward increasing water fees is somewhat surprising since 79 percent of the sample reported real increases in user fees over the last 5 years and 63 percent reported increases within the last 3 years.

User fee assessments are the basic source of revenues supporting water service. In the sample, 78 percent of water revenues were derived from fees. The average water fee was estimated at \$53 per year for each service connection, 55 percent less than the national average. Such low charges may explain why rural officials have increased rates in recent years. Local officials could be trying to catch up with water revenues and expenditures that more than match earlier deficiencies.

A better indication of financial resources committed to infrastructure rehabilitation is a comparison of actual operating costs to estimated costs to provide a level of reliability that meets Federal and State water quality standards. This evaluation is based on actual operating costs for the sampled systems and a set of derived ideal costs for systems of various sizes. More than half of the systems' costs fell short of estimated costs for routine maintenance. Such underspending for operations and maintenance provides evidence of a need for larger and earlier capital investments than would otherwise be required.

Local officials were asked to identify and estimate the cost of projects they would undertake in the near term if they had funds available. The responses to this question provide a measure of a community's capacity to finance system investments. Even if each community had to finance the project in full over a 20-year repayment period at 10-percent interest, nearly four-fifths of the sampled local governments could afford to pay for the projects under the guidelines used by the Environmental Pro-

Table 3 - Community officials prefer increased user charges to higher taxes or more debt

Category	Ranking*			Total responding
	1	2	3	
	<i>-Percent of respondents-</i>			<i>Number</i>
Increase water fees and charges	50.0	25.0	25.0	20
Seek new local revenue sources	38.1	19.1	42.8	21
Increase property taxes	15.0	30.0	55.0	20
Increase shortrun borrowing	15.8	47.4	36.8	19
Reduce services	14.3	38.1	47.6	21
Reduce capital expenditures	25.0	45.0	30.0	20
Reduce new construction	15.8	36.8	47.3	19

* 1 = most likely to adopt strategy to improve community financial management;
 3 = most unlikely to adopt a strategy.

tection Agency (EPA) in its water/sewer loan/grant program. Financial capacity is not a binding constraint.

Developing a Policy Blueprint for Rural Water System Rehabilitation

Most systems have no routine maintenance programs, according to the New York sample. Systems are fixed only when visible problems occur. In the few systems with regular maintenance programs, maintenance generally lags behind the rate of decay of the facility. Local decisionmakers are ill-equipped to evaluate financial and technical alternatives supporting capital improvement projects and maintenance programs. Because of diminished outside aid and an aversion to raising taxes or taking on more debt, rural communities must choose between developing small, manageable approaches to support improvements or limping along with systems that can compromise health and service. The infrastructure problem can be resolved by a combination of changes in the planning, management, and financing of public capital investments.

Federal infrastructure aid programs may have overemphasized capital financing of large rehabilitation projects relative to technical assistance programs and regularly scheduled maintenance. And these programs have only reached a few systems. An alternative approach would be to adopt less expensive technical assistance programs that reach a large number of communities. Rather than offering an attractive financial incentive for local governments to undertake projects, such programs would concentrate on self-improvement and development of skills enabling a community to use existing resources more effectively. The key issue is interesting local officials in such programs.

A large proportion of sampled officials expressed interest in receiving technical assistance to make better decisions. Forty-eight percent claimed they could use assistance in planning and fiscal management. Recognizing certain limitations on technical expertise relating to physical operations, 63 percent expressed interest in obtaining help in leak detection and other preventive maintenance activities.

Two New York technical assistance programs targeted at helping rural officials improve water system operations exemplify the type of programs required. The Rural Water Association (RWA) employs a trained system operator who visits rural systems at no charge. These visits often involve troubleshooting, including leak detection. RWA also offers operators a series of seminars on improving techniques for routine maintenance. The Rensselaerville Institute recently began programs of self-help for rural communities to improve problem identification, system management, and financial planning for rehabilitation projects. These programs, now reaching only a small proportion of rural systems, could be expanded to include most communities for a smaller outlay than is allocated through the Federal programs.

Water system costs per unit can be reduced by taking advantage of economies of size in water production. However, development of subregional and regional cooperative arrangements for supplying water to rural areas is inhibited by a lack of direction and sometimes parochial attitudes at the local level. New York State has considerable experience in formulating regional water development plans and identifying sharing arrangements between systems. These efforts could be expanded to define more efficient system operations that combine resources from two or more communities and possibly include some equipment and system sharing in order to reduce overall cost and avoid unnecessary duplication. The Southern Cayuga Lake Intermunicipal Water Commission is an extraordinary example demonstrating the advantages of cooperative institutional arrangements (see page 12). State agency resources could be used to facilitate such arrangements.

Infrastructure policy has traditionally emphasized the financing of large capital intensive projects for a small number of systems. The data presented here suggest that there should be more emphasis on options that improve the use of existing local resources. The resources are there to initiate rehabilitation projects, yet they often lie underused and underdeveloped. Committing State and Federal resources to technical assistance programs to better use local resources would be a significant contribution to a viable regional and national infrastructure policy.

For Additional Reading. . .

Advisory Commission on Intergovernmental Relations, "Financing Public Physical Infrastructure," Washington, DC, 1984.

Cornell University, "National Statistical Assessment of Rural Water Conditions," Volume 2, Ithaca, NY, 1981.

Joe D. Francis and Wendy F. Graham, "Community Water Supply Organization and Performance in the Adirondacks," Cornell University, Ithaca, NY, 1983.

Description of the Survey

This article presents information based on a 1985 mail questionnaire to 75 officials in rural New York communities that operated public water systems. The survey asked about financial, operating, and physical characteristics of these systems and the communities supporting them.

A random sample of communities geographically distributed throughout the State was selected and stratified by three system characteristics: size, ownership, and source.

- * Size. Six categories ranging from 25 to 10,000 customers.
- * Ownership. Public or private. Privately owned systems were excluded because response rates from operating officials were poor.
- * Source of water. Ground water, surface water, or purchased water. This factor was believed to affect system operation costs.

The survey questions required both subjective responses and factual data. For instance, a question regarding local officials' perception of the systems' condition and fiscal management techniques relied upon a subjective ranking by respondents. Alternatively, these officials had to provide information on past and projected revenues, expenditures, and capital investment requirements for water systems.

I sent a companion survey to 35 county and district health inspection officials with jurisdiction over the 75 community systems. This questionnaire paralleled the community survey on a number of issues relating to system operations, thereby providing a comparison between rural officials' responses and those of technical experts.

A Model Arrangement for Water Service Planning: The Southern Cayuga Lake Intermunicipal Water Commission

The Southern Cayuga Lake Intermunicipal Water Commission (SCLIWC), a cooperative organization in Tompkins County, pools local government resources to keep up with scheduled maintenance and to finance rural water systems.

Created in part because members realized they could provide better service as a group than as individual systems, the SCLIWC features a five-member community consortium of three towns and two villages. Each municipality appoints two commissioners to a board of directors. Each community has two votes, regardless of how much the community contributes to the system.

Preventive maintenance practices in the SCLIWC are a result of comprehensive planning and cooperation among members. Policy planning is performed over a 5-year period assessing needs and contingencies. The commission employs a circuit-riding crew to assist in repairs and troubleshooting for each municipality's water system. The communities also share some equipment, thereby reducing expensive duplication. The town engineer in one community can be called upon by member system operators for advice, which helps defray expensive consulting costs for the smaller municipalities.

The commission yields revenues adequate to support scheduled capital improvement projects and establishes a consolidated rate schedule for the entire system. Each municipality may collect revenues in addition to the consolidated rate. The commission has a financial advantage over individual communities by being able to sell bonds jointly for water service, thereby reducing the interest charged on debt. Moreover, risk is distributed among all participants, reducing the chance for default. If one member defaults, the other principals in the arrangement must back that debt. The SCLIWC enjoys an Aa bond rating (Moody's second highest rating) as a result.

By providing a network for sharing ideas and resources, the SCLIWC is a model for innovative water service management. Experience from this arrangement could well be applied to other rural systems.