CHAPTER IX.
CONCLUSIONS AND PROSPECTS

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Chapter IX. Conclusions and Projects
CONCLUSIONS AND PROSPECTS

Importance of Adequate Sanitation

Clean water and adequate sanitation benefit not just individual utility customers but the larger community, as well as the state and the nation. Improved public health reduces the demand for health care services, decreases absenteeism at school and work, and increases productivity. Better water and sewer service broadens business opportunities. It improves the quality of life for residents. Given the existing institutional arrangements, taxpayers also benefit from improved operation and maintenance of local facilities, through decreased costs for facility repair and replacement.

Because adequate sanitation has such broad benefits, economists describe it as a “public good.” That perspective is reflected in Article VII, Section 4 of the Alaska Constitution, which requires the legislature to provide for the “promotion and protection of public health.” In addition to its general public health mission, the U.S. Public Health Service has a specific mandate to provide public health services to Alaska Natives, deriving from the Snyder Act. That law addresses the federal government’s continuing contractual and legal obligations to provide for the health and welfare of tribal members, in partial compensation for the lands surrendered by the indigenous nations.

Since 1989, the state and federal governments have spent an estimated $723 million constructing water and sanitation systems in rural Alaska. The push to “put the honey bucket in the museum” has accelerated: construction funding in FY 2000 was up approximately 40 percent, to $82 million. The state’s Village Safe Water program estimates that by 2003, 118 villages will provide in-home sanitation services to 90 percent or more of their households.

The current government policy is that once these systems are built, communities must operate and maintain them at their own expense. How well these new sanitation systems deliver services over time depends on the communities’ ability to finance their operation and maintenance. For most rural communities, financing these operation and maintenance activities is a major challenge.

Conclusions From Analyses

Rural water and sanitation revenues do not cover costs.

Across the board, the investigations in this volume show that rural water and sanitation systems operate in the red. In the 1999 RUBA survey described in Chapter II, 64 percent of the 134 small communities that reported charging for sanitation services said they did not collect enough revenue to cover their costs; 37 percent of these utilities reported losses in excess of $20,000. The total deficit across 94 small communities was roughly $2.7 million in 1999.

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1 42 Stat. 208; 90 Stat. 2233; 112 Stat. 1619
2 But in additional analysis, Wiita (Chapter II-A) observes that the survey question did not specify a time period for losses, so the data are not well defined and may not be consistent.
Table 9-1 summarizes financial data from this report for five rural water and sewer utilities with piped systems and five with closed-haul systems. Both expenditures and net income (or losses) per customer show wide variations across communities. But the table makes it clear that most of these utilities are operating in the red.

It’s important to keep in mind that we can’t make valid cost comparisons between those communities with piped systems and those with closed-haul systems in Table 9-1. Our data for the closed-haul systems do not include the costs of water production or of washeterias; the data for piped systems do includes such costs.

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3 There are also unexplained differences between analysts. Compare Campbell and WW&G, Woodlee and Colt. These estimates could be improved if we had more complete data.
Table 9-1 Expenditures and Net Income per Customer for Selected Rural Water and Sanitation Utilities

<table>
<thead>
<tr>
<th></th>
<th>Nulato (WW&amp;G)</th>
<th>Nulato (Campbell)</th>
<th>McGrath</th>
<th>Nenana</th>
<th>Huslia</th>
<th>Ft. Yukon</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>70</td>
<td>68</td>
<td>176</td>
<td>149</td>
<td>61</td>
<td>240</td>
<td>127</td>
</tr>
<tr>
<td>Total Expenditures</td>
<td>125,957</td>
<td>121,999</td>
<td>233,287</td>
<td>152,488</td>
<td>50,113</td>
<td>148,312</td>
<td>138,693</td>
</tr>
<tr>
<td>per customer</td>
<td>1,799</td>
<td>1,794</td>
<td>1,325</td>
<td>1,023</td>
<td>822</td>
<td>618</td>
<td>1,230</td>
</tr>
<tr>
<td>Net Income (Loss)</td>
<td>(8,698)</td>
<td>6,773</td>
<td>(17,992)</td>
<td>64,303</td>
<td>(11,503)</td>
<td>(25,923)</td>
<td>1,160</td>
</tr>
<tr>
<td>per customer</td>
<td>(124)</td>
<td>100</td>
<td>(102)</td>
<td>432</td>
<td>(189)</td>
<td>(108)</td>
<td>1</td>
</tr>
<tr>
<td>per customer per month</td>
<td>(10.35)</td>
<td>8.30</td>
<td>(8.52)</td>
<td>35.96</td>
<td>(15.71)</td>
<td>(9.00)</td>
<td>0.11</td>
</tr>
<tr>
<td>as % of expenses</td>
<td>-7%</td>
<td>6%</td>
<td>-8%</td>
<td>42%</td>
<td>-23%</td>
<td>-17%</td>
<td>1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Bucklan</th>
<th>Nunapitchuk</th>
<th>Tuntutuik</th>
<th>Mekoryuk</th>
<th>Quinhagak</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
<td>36</td>
<td>20</td>
<td>37</td>
<td>65</td>
<td>44</td>
<td>40</td>
</tr>
<tr>
<td>Total Expenditures*</td>
<td>36,239</td>
<td>15,362</td>
<td>24,626</td>
<td>35,872</td>
<td>22,338</td>
<td>26,887</td>
</tr>
<tr>
<td>per customer</td>
<td>1,007</td>
<td>768</td>
<td>666</td>
<td>552</td>
<td>508</td>
<td>700</td>
</tr>
<tr>
<td>Net Income (Loss)</td>
<td>-</td>
<td>-</td>
<td>(4,751)</td>
<td>(6,734)</td>
<td>(5,543)</td>
<td>(5,676)</td>
</tr>
<tr>
<td>per customer</td>
<td>-</td>
<td>-</td>
<td>(128)</td>
<td>(104)</td>
<td>(126)</td>
<td>(119)</td>
</tr>
<tr>
<td>per customer per month</td>
<td>-</td>
<td>-</td>
<td>(10.70)</td>
<td>(8.63)</td>
<td>(10.50)</td>
<td>(9.94)</td>
</tr>
<tr>
<td>as % of expenses</td>
<td>-</td>
<td>-</td>
<td>-19%</td>
<td>-19%</td>
<td>-25%</td>
<td>-21%</td>
</tr>
</tbody>
</table>

* Does not include the cost of water production or washeteria services.
None of the utilities calculate depreciation. No community has established a reserve to rebuild aging facilities: outside funding agencies are bearing the total costs of replacing and expanding systems. Some communities maintain an inventory of spare parts and reserve funds to pay for replacement parts, but many do not. Many communities short their preventive maintenance, resulting in emergency repairs and premature failure. The foregoing estimates of loss do not include the deferred costs and reduced levels of service in utilities that short their operations and maintenance.

**O&M costs for Arctic piped systems are high.**

Piped systems designed for Arctic conditions are more expensive to operate and maintain than are such systems in temperate regions. Harsh climate, permafrost, and flat terrain dictate engineering solutions that involve more specialized equipment—and that equipment is more complex to operate and maintain, both for operators and for users. Small scale and remoteness also increase per unit operating costs.

Rocky Wilson and others (Chapter III) found that labor is the most significant operating cost—making up almost half—followed by costs of fuel oil, electricity, and maintenance.

**Operating and maintaining closed-haul systems is no cheaper.**

While closed haul systems are much cheaper to build than piped systems, they are not cheaper to operate and maintain. (Note that the figures in Table 9.1, while they appear lower than for piped systems, do not include costs of water production or washeteria services.) And they provide a lower level of service: the closed-haul technologies used in villages do not support either bathing or laundry facilities in the home. They do have other advantages. They require more labor and less skilled labor to operate—a plus in village economies. And because they operate on a pay-per-haul basis, collection and enforcement are politically and administratively easier. Still, Charles Woodlee (Chapter V) found the three closed-haul systems he studied operate at a loss. These are new technologies in rural Alaska, and their design and operation are still being refined.

**Rural residents pay more for water and sewer.**

Village residents on average spend more of their cash income for water and sewer services than do Anchorage or other U.S. residents. Average U.S. water and sewer spending as a percentage of household income is less than half a percent. Anchorage residents pay about one percent. Across 81 small Alaska villages with piped water and sewer systems, residents paid an average of about 1.5 percent of their household income for sanitation services in 1999. The range of income residents spent for piped water and sewer services ranged from 0 percent (for the five utilities that reported not charging for service) to about 4.3 percent.

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4 Steve Colt's findings in Chapter VI support the conclusion that closed-haul systems do have lower life-cycle costs. His estimates of per household O&M costs were lower than he had anticipated, because customers conserved water and ordered fewer hauls; some customers apparently dispose of their graywater themselves, to keep costs down.

Fig. 9-1. Comparison of Household Spending for Piped Water and Sewer Service, U.S., Anchorage, and 81 Small Alaska Villages
(As Percentage of Household Income)

<table>
<thead>
<tr>
<th></th>
<th>U.S.</th>
<th>Anchorage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest</td>
<td>0.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Average</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Highest</td>
<td>1.5%</td>
<td></td>
</tr>
<tr>
<td>Village</td>
<td>4.3%</td>
<td></td>
</tr>
</tbody>
</table>

* Weighted by population.

**Fees and collections are insufficient to cover costs.**

The RUBA survey (Chapter II) cites several reasons why sanitation revenues in small rural communities (those with populations under 1,000) don’t cover costs:

- Twenty one percent (21%) of the surveyed utilities do not charge customers for services.
- Fifty three percent (53%) of the utilities that charge fees do not review or adjust fees to reflect costs. Many of them have never adjusted their fees since the utility was created.
- Forty two percent (42%) of those communities that charge customers do not attempt to collect past due accounts.
- Fifty-seven percent (57%) of the respondents had never cut off service for past due accounts.

The reasons communities cited for non-enforcement varied. Twenty six percent (26%) said that they are unable to shut off service (e.g., no shut-off valves, or inability to exclude non-payers from honey-bucket haul services). Other reasons included reluctance to cut off service to family and friends in small towns and worries about the detrimental effects cutting off service would have on community health and on elders and children.

Rocky Wilson and other with WWG consultants (Chapter III) found that utility fees generally reflect management philosophy—e.g. the council’s subjective impression about how much residents can and should pay—not costs. The greatest collection problems were in the communities with the lowest fees. The community with the highest fees experienced average collection rates.

**Poor economic conditions and other factors contribute to deficits.**

Nulato is a community with generally good administration and accounting (though short on staff), high fees ($115 per month), and collections enforcement. Steven Campbell’s fiscal analysis (Chapter IV) showed positive net income (not accounting for depreciation or reserves for parts replacement) in Nulato for two years, and a net loss in the third year; the trend was downward. As of May 1999, half the 69 customer accounts were overdue;

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6 This finding is reinforced by observations of Remote Maintenance Workers (RMWs) in Kodiak villages.
one third were more than 90 days overdue. Poor economic conditions were a factor; administrative failure to send timely bills and overdue notices also contributed. Labor and supply costs had increased almost 30 percent over the period.

Campbell also found a seasonal cash flow problem in Nulato. Collections are lowest during the winter quarter (January to March) when unemployment peaks; this is also when expenses for energy and emergency repairs are highest. The seasonal deficit is about 12 percent of annual revenues.

In Tanana, Campbell found that Too’gha would have operated at a significant loss throughout the study period without the one-time availability of grant funds. Collections were not the problem: the problem was start-up costs and the lag between operating expenses and customer revenue. During the multi-year transition to full piped service, the customer base was too small to carry the utility’s expanding operations.

Nulato and Tanana face the same dilemma but from opposite sides. Campbell concluded that Nulato’s utility would be financially viable if it could solve its collections problems, but it is not likely to resolve its billing and collections problems without hiring a part-time utility clerk or manager—the cost of which would put it back in deficit. And Too’gha can’t afford to keep the manager it already has.

**Communities subsidize water and sewer service.**

In the early 1980s, rural communities commonly paid for water and sewer O&M with state and federal pass-through funds. With the decline of state oil revenues, however, all state pass-through funds to Alaskan municipalities have declined over 80 percent since 1987. Black and Logan note in Chapter II:

> Each time the State Legislature reduced municipal revenue sharing programs, the city councils and municipal assemblies either adjusted their levels of services or found additional revenues. Today we see local governments that have eliminated or reduced local services, increased taxing efforts, or successfully increased non-tax revenue such as gaming and/or enterprise revenues. Most have done some combination of these.

Black and Logan report improved local revenue generation since 1992. In 1999, ninety-eight (98) cities levied sales taxes, compared with seventy-eight (78) cities in 1992. On average, these cities levy a 3.25 percent sales tax to help generate revenue. Average household fees have increased—22 percent for both water and sewer and 40 percent for sewer only. Most of the increases, however, were in communities with new systems. Also, average monthly wages for water operators increased, both absolutely and relative to those for some other village occupations.

Besides state or federal pass-through funds, sales taxes, and gaming receipts, communities also incur long-term debt to finance their water and sewer deficit. In the RUBA survey, 27 percent of communities said they have long-term debt for their utilities; 89 percent of this debt is for operations, not capital expenses.

John Fischer (a long-time RUBA who provided an addendum to Chapter IV) does not expect rural water and sewer utilities to break even. A utility may show a positive cash flow in some years, but he believes this is as much due to luck (e.g., mild weather and no
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freeze ups) as to good management. He found the same to be true for smaller urban municipal utilities.

I worked with the North Pole (urban) system for sixteen years and got it to [positive] cash flow (including a reserve account) but could not totally cover the capital depreciation. I worked with the Galena system for a year and was unsuccessful at that time in getting it to even cash flow.

He regards it as normal and appropriate that small communities subsidize water and sewer operations with other revenue sources.

In the early 1990s the LUMP demonstration project in villages in the Northwest Arctic Borough (Chapter VIII) found that incentive-based subsidies increased collections an average of 20 percent; reduced operator turnover 74 percent; improved water testing compliance from 64 percent to 100 percent; improved facility maintenance, with 100 percent of the villages maintaining critical parts lists, regular operator logs, and monthly reporting to the council; and increased attention to operator training.

The fiscal capacity of villages is limited.

In Chapter VII, Steve Colt and Alexandra Hill of ISER analyzed the fiscal capacity of 254 villages that are eligible for sanitation construction projects under the state’s Village Safe Water (VSW) program. They found the average per capita income in VSW-eligible communities is between 30 and 40 percent lower than the statewide average. Of the 118 communities that are both eligible for VSW grants and able (by virtue of being incorporated) to levy some sort of tax, 80 do collect local taxes. On average, however, VSW communities collect only about $313 per capita, or 27 percent of the per capita tax revenue collected by larger communities that are not eligible for the VSW program.

Communities that receive VSW funding do often contribute land and provide labor for facility construction at below-market rates. Colt and Hill report that force accounting (which increases local employment but at lower-than prevailing wage rates) contributes in-kind 3 to 20 percent of total project construction costs.

Community support and administrative capacity are critical.

John Fischer observed (in an addendum to Chapter IV) that community support and commitment are critical ingredients for a successful water and sanitation utility—just as important as delivering a valuable, affordable service in a financially and operationally viable manner. He believes that Nulato and Tanana will succeed where others fail because water and sewer service is their priority: the citizens will not let the utilities fail. Both communities also enjoy better than average leadership, city and tribal organization, and administrative capacity.

Many communities are not organized to effectively manage O&M costs and do not have accurate up-to-date records of sanitation revenues and expenditures. There are often too few trained people and too few funded hours to effectively carry out all O&M functions. Another hindrance to effective O&M management is the prevalent “who’s in charge” dilemma. Without clear leadership and strategy from within a community, not even basic tasks such as bill collection can be accomplished efficiently and effectively.

The Local Utility Match Program evaluators (Chapter VIII) found:
[T]he importance of accounting systems in the villages is a critical part of their daily operations. Having properly trained bookkeepers and/or accountants in these villages is critical yet sometimes unattainable due to the lack of properly trained personnel and low wages.

For the eleven communities they surveyed (Chapter III), Rocky Wilson and other reported that:

All of the communities display a significant amount of pride in their utilities and appreciate having piped water and sewer. All without exception are concerned about needed repairs, the necessity to keep the system in operating condition and, if the system is aging, how they ultimately will deal with the situation.

**Prospects for the Future**

In most communities there is ample room for improvement in financial management, specifically in levying and collecting fees for service. At the same time, evidence in this report suggests that even with higher fees, effective collections and good management, some small rural utilities will not be self-supporting. Even if user fees can cover the day-to-day costs of operations, these utilities will not be able to build up the cash reserves required for routine repair and replacement of equipment. The shortfall is currently covered by a combination of poor service, local general funds, federal, state and regional assistance programs, and premature repair or replacement of facilities—paid for by VSW and ANTHC. The premise for the analysis below is that this defacto public policy is inefficient. With thoughtful policy attention and research, we can craft a better solution.

**Policy Analysis**

O&M finance is not just a local concern. Given the larger public interest in adequate local sanitation services, adequate funding for operations, maintenance, and management is a concern for state and federal agencies as well. Strategies for lowering costs and increasing revenues might include: improved operating efficiency of existing systems; lower cost technologies; lower cost administrative arrangements; increased collections from households; or subsidies to utilities. The larger objective of improving sanitation O&M also requires community support and agency collaboration.

*Efficient operations.* Just as the state’s weatherization program in the 1970s performed energy audits and upgraded the energy efficiency of homes, a systematic assessment of each utility’s operations would find many opportunities to improve operating efficiency and cut O&M costs. For example, Noorvik used an O&M grant from the Alaska Native Health Board to replace old toilet units, which both reduced repair costs and improved the vacuum efficiency of the entire sewer system—thereby prolonging the life of the pumps. Sleetmute saved an estimated $200 per month in winter energy costs by insulating the wellhead and pipe to the pump house. Nondalton and Hydaburg used grant money to replace leaking water lines and dramatically reduced the number of gallons the utility had to produce. Systematic improvements in preventive maintenance planning, implementation, and critical parts inventories should also increase operating efficiency.

**Lower cost systems.** O&M costs need to be a major consideration in the system planning and design phase. Improvements might be made in three areas: (1) development and dissemination of alternative technologies with low O&M costs, as well as labor and other inputs appropriate to village conditions; (2) development and effective presentation of O&M cost information on alternatives, in support of community-based planning and decision making; and (3) strong community involvement in the planning process and effective communication between community people and agency personnel, to ensure that communities fully understand the financial obligations of each alternative and that agency planners understand and consider village concerns and priorities.

Nulato’s city treasurer has pointed out that “what people want does not always coincide with what people can afford.” A first step to bringing the villages closer to determining and obtaining what they can afford might be to organize and update communities’ financial record keeping and data entry procedures.

**Lower cost administrative arrangements.** Currently, most village water and sanitation systems are operated by municipal or tribal governments and share overhead (office space, management and accounting personnel) with other governmental functions. This is an important cost saving arrangement. The tradeoff is that the focus and expertise required for efficient utility management is diluted. There are currently two demonstration projects—proposed or in the initial stages—that explore alternative arrangements, looking for greater cost savings with fewer tradeoffs. One would contract out billing and collection functions to the Alaska Village Electric Cooperative based in Anchorage.\footnote{For further information, contact Mike Black, Rural Utility Business Advisor Program, (907)269-4564.} The other would create a regional utility, consolidating billing and collections, personnel, purchasing, technical assistance, and possibly policy and planning functions at a regional hub.\footnote{For further information, contact Steve Weaver, Alaska Native Tribal Health Consortium, (907)729-1900.} Both of these would be important demonstrations.

A third idea would be a regional purchasing cooperative. This might offer several advantages: bulk buying reduces unit costs; a single purchasing agent develops more expertise and relationships with suppliers; a common warehouse at a transportation hub might reduce the stock needed for some critical spare parts; a level monthly payment to the coop might help utilities with financial planning and management of cash reserves for replacing parts and equipment; and a coop could provide some risk pooling or “insurance” type service for unanticipated major expenses.
Another dimension that warrants thoughtful attention is risk pooling. Small utility operations in Arctic environments are subject to large expenses associated with unpredictable events such as freeze ups, equipment failures, or transportation delays for parts and technical assistance. Small operations lack the cash flow and reserves needed to absorb these financial emergencies.

**Increased Collections.** Increasing collections is the current policy focus. The Rural Utility Business Advisor program provides training and technical assistance to client communities on the full range of utility management functions. The largest part of the RUBAs’ time is devoted to billing and collections, accounting, and financial management. This program could be expanded to provide services to more communities. A valuable supplement to the RUBA program might be regional conferences where community representatives could share their experiences in peer-led workshops. Communities participating in ISER’s evaluation of the ANHB operation and maintenance demonstration grant program frequently commented that this sort of information exchange is very valuable to them. This format is likely to elicit practical ideas that work in village conditions and foster changes in perspective as well as build networks. A third program approach might be to support community education campaigns on why maintaining the sanitation system is important, why fees must be levied and paid, and what the money goes for. Ambler, Mekoryuk and New Stuyahok piloted this kind of education campaign using Alaska Native Health Board demonstration grant funds.

The potential for higher fees and increased collections is of course limited by household incomes. Assessing potential additions to income through opportunities for wage employment, dividends, or transfer payments is beyond the scope of this paper. We can, however, consider subsidies to households for water and sewer services. Some urban utilities have “lifeline” rates for low-income households, subsidized by other consumers. This model will not work in communities where low income households are a high proportion of total customers. Lifeline utility rates in rural communities would likely require state funding.

**Subsidies to utilities.** Local governments currently subsidize water and sewer utilities from a wide range of other funds, including sales taxes and state revenue sharing. While these are good mechanisms, given the many unincorporated communities, limited tax base, dramatically reduced revenue sharing, and many competing local service needs, these sources are inadequate. A broad approach to the local fiscal squeeze would be to increase revenue sharing. A more focused approach would be a need-based O&M subsidy factoring per capita cost, per capita income, and local effort. The Local Utilities Matching Program demonstration project reported in Chapter VIII successfully piloted an incentive-based approach. Extending this model to small communities statewide might cost on the order of $10 million per year—about two thirds of the PCE subsidy for small electric utilities.

Another approach would be a wage supplement for certified operators. This pay increase would not only provide a positive incentive for certification, it would improve operator

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10 Examples include raffling one month of free service among paid-up customers; and publicizing the names of delinquent customers on the local cable scanner.

retention and help the state meet new EPA regulations for small water systems (and avoid financial penalties). A $4 per hour increase in wages for certified operators would cost on the order of $2 million per year.

Community support. Community support is critical to the success of community sanitation systems. Community involvement and customer education are basic to building community commitment to supporting the water and sewer utility. But the question goes deeper than that: the sanitation system must be an integral part of the community’s values and lifestyle. The values-based strategic planning process for small communities, developed by the U.S. Department of Agriculture’s Rural Development Office is a step in this direction. There also needs to be institutional support and encouragement of community innovation, looking for ways to customize the operation, maintenance and administrative systems to better match local resources and preferences.

Agency collaboration. Small communities cannot solve their long-term O&M finance problems without agency collaboration. Federal, state, and regional personnel provide needed information and institutional resources. The foregoing policy discussion has mentioned many programmatic ways that state and federal agencies can support and promote local learning and problem solving. In addition to these, continuing education for agency personnel might enhance their effectiveness at working with the full spectrum of rural communities, each one unique in its resources and circumstances. Even more important, effective collaborative relations are time intensive: line personnel must be afforded the time and travel to support this style of work. The policy regarding agency-community relations must be set at the highest agency level, and reinforced through the hiring, evaluation and promotion process.

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Further Research

To more clearly focus and assess the policy options, we need more information. An agenda for further research might include:

- **Cost analysis.** Identification of the actual cost of operations in each village would serve multiple purposes: communities would use the information in rate setting and long-term financial planning, and agencies and researchers would use the data from many places to compare system costs and evaluate policy options. Since many communities lack good financial record keeping, generating cost data requires a substantial investment in fieldwork.

- **Financial analysis.** Once good cost data is at hand, the scope of the analysis could be expanded to collect and analyze revenue data and estimate depreciation. Such data would be used to analyze seasonal and annual variance in costs and revenues, and estimate reserve requirements for cash management, as well as risk management parts replacement, and training. The data would also support first estimates of the size of the total O&M deficit, or how large the public subsidy would have to be to bring O&M up to par.

- **Flush haul analysis.** Additional data would further our understanding of the use and economics of flush-haul systems. Of interest would be the actual employment patterns of flush-haul operators; customer satisfaction with service levels; actual patterns of household water supply and consumption, (including self-haul from traditional sources); actual patterns of household gray water and septic disposal (including gray water dumping, use of public facilities, and reversion to honey buckets); and analysis of elasticity of demand, comparing usage under pay-per-haul versus flat-rate pricing.

- **Household budgets I.** Data available on household income, sources of income, and expenditures is limited, especially for small rural communities, whose data is lost in aggregation even with regional hubs such as Barrow, Bethel and Kotzebue. Decennial census data (which covers 1999 for income) should be available within the next two years and represents one of the few sources of community data for Alaska’s small rural communities. These data should be analyzed while they are still relatively recent.

- **Household budgets II.** The Survey of Living Conditions in the Arctic (SLiCA) will provide additional information on household cost of living. The SLiCA, however, will cover only the North Slope, Northwest and Bering Straits regions. This data could be extended with a household survey in other rural Alaska regions, using the household economy section of the SLiCA questionnaire.

- **Alternative collections and enforcement mechanisms.** Cutting off water and sewer service is not always feasible, and often is not a desirable means for collections enforcement. There is great need for creative thinking about and piloting of alternative billing and collection mechanisms, incentives and enforcement strategies that will be practical and effective in rural communities.
Community ability to pay. The ability of rural communities to pay the costs of water and sewer services has likely declined in the last decade due to decreased state support and stagnant growth in real income. Further research on both halves of this topic—fiscal capacity of governments and the practical ability of potential rate payers—is necessary. The two are intertwined, as local government's ability to raise local revenues rests on the personal income of community members. In addition, it is important to assess local governments' ability to raise continuing revenues from state or federal grants to meet ongoing O&M costs as well as capital costs, and to combine this with the assessment of feasible local revenues.

Comparisons to electricity. Casual observation suggests that, by and large, village electric systems have fewer (or perhaps different) difficulties than sanitation systems. The most obvious reason for this is the Power Cost Equalization (PCE) program, which provides a $15 million+ annual subsidy to electric utilities. A rigorous analysis focused directly on the differences between electric and sanitation utilities in rural Alaska has never been attempted and might produce valuable new insights.

Demonstration programs. Any of the previously mentioned program initiatives could be usefully piloted and evaluated.

Other jurisdictions. Rural Alaska isn’t the only region with challenging water and sewer finance problems. All the circumpolar Arctic regions have high costs associated with harsh climate, poor soils, small scale, and remote locations. And even major metropolitan areas such as Atlanta and Chicago have collections problems exceeding [twenty] percent. Research into comparative institutional responses to these challenges would provide a broader perspective for policy.

Public goods analysis. Estimates of the collective benefits from adequate sanitation systems in small communities might help us decide how much to collectively invest in O&M. Analysis would include the public health outcomes measured by school attendance and the costs of deferred maintenance. Analysis of the consumer and public health benefits of piped service relative to closed haul—i.e. in-home showers and laundry—would help us decide what level of service merits our collective support.

The development of long-term operations and maintenance financing solutions will require teamwork among communities, agencies, researchers, and policy makers. It is an exercise in collective learning and institutional innovation in which we all have a role to play and contribution to make.