# AFFORDABILITY AND SUSTAINABILITY OF MUNICIPAL WATER SUPPLY AND SANITATION FOR HOUSEHOLDS IN RURAL NEW YORK

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## Executive Summary: Rural Water Affordability

Traditionally, due to government subsidies and the cost structure of water utilities, community water supply has been available to the public at far below full cost, which has led to an undervaluation of an important set of public services. Consumers are accustomed to low prices and expect to continue to receive water and sewer services at these undervalued and unsustainable prices. Imperfect information on the part of consumers has created a market failure with respect water and wastewater infrastructure.

Policy makers, public administrators and water utilities must find ways to change consumer perceptions and behaviors in order to avert potential financial crises from deferred infrastructure maintenance costs. Those costs can be met, and service provision improved and expanded, through affordable rate increases. This report addresses issues of cost, value, quality, perception and pricing of water supply and sanitation services, and attempts to offer possible schemes to address and ameliorate the present dilemma.

***Key Findings:***

There are various actions that can be undertaken to resolve the growing financial and political pressures created by decreased federal subsidization and public apprehension over potential price increases. Working together, municipalities, consumers and policy makers can all take important and necessary steps to alleviate pressures on the water infrastructure. Municipalities can implement different management approaches to reduce costs and provide the public with information explaining and justifying rate increases. Consumers can change their behavior to reduce household water usage and lessen pressures on the water infrastructure (hence decreasing

per unit costs). Legislators and policy makers can implement programs and approaches similar to those used for other public utilities to provide funding for service provision specifically targeted at low-income individuals in rural communities.

## Introduction

The United States Department of Agriculture Rural Utilities Service has a long and distinguished history of offering support in the form of financial and technical assistance to rural communities for a variety of public utility services (e.g., electricity, water, and telecommunications). Due to recent and foreseeable budgetary constraints at the federal level, USDA allocations for financial assistance for rural municipal water supply and sanitation (WSS) will increasingly come in the form of low-interest loans rather than grants.

Thus, while USDA will continue to help communities leverage the large initial capital costs necessary for WSS infrastructure financing, these costs will progressively be borne by the communities themselves rather than covered through federal subsidies. In other words, costs that have historically been externalized to the federal government are gradually being internalized by the very rural communities that will be benefiting from investments toward infrastructure improvement. Residential consumers will invariably be faced with some measure of rate increases.

Although rate increases are always unpopular, they are likely to be more palatable to consumers if properly contextualized. Public education efforts must focus on changing widely-held perceptions regarding the quality and value of community water and sewer services vis-à-vis those of private wells and septic systems. A well-informed public will

better understand the costs that contribute to water prices, consider municipal water prices in the context of other water sources as well as other consumer expenditures, and appreciate the tremendous value provided by public ownership of WSS.

Even if it is a departure from precedent, the transfer of costs associated with infrastructure investments to those communities and persons who will be directly receiving the benefits is fair, sensible public policy. Some assistance will still need to be provided to those low-income individuals least capable of bearing higher rates. However, if x% of a community's residents are incapable of a paying increased prices, it does not make sense to subsidize 100% of the community, as has historically taken place. Instead, what is necessary, efficient and equitable is to offer targeted assistance to the x% of individuals with highest need.

## Cost, Price and Value: Municipal Water Supply and Sanitation in Context

As a commodity, water is relatively low-valued, especially in places such as the state of New York, where water is not considered scarce. Yet, since the costs associated with delivering clean water from its original source and state to the end user in an appropriately processed form "tend to be high relative to economic value at the point of use,"[1] the "price signals which … are successfully used to guide investments and resource allocations in the private sector are usually absent or distorted for water."[2]

The total costs of delivering clean water are often hidden to consumers, since the large capital costs of municipal water supply and sanitation (WSS) infrastructure have usually been borne either by previous generations or through government subsidies, so water "is priced on the basis of its historic cost, which is generally far below its current replacement cost."[3] In other words, consumers only pay present-day operating costs,

which are "historic" costs in the sense that the fixed costs of infrastructure have already been paid in the past. Current replacement costs, however, would necessarily need to encompass the costs of infrastructure investment.

Since capital costs have been outsourced to a third party (usually at some point in the hazy past), the price paid by the end user is artificially depressed and does not cover the total costs of supply. As a result, where municipal WSS is already in place, "costs may be lower than they should be to adequately maintain facilities and equipment," due to deferred maintenance costs, because "budgets [of water utilities] were never sufficient to cover the needed expenses."[4]

Even though municipal WSS infrastructure may be underdeveloped or altogether absent, it is difficult to mobilize the necessary capital for such projects. Especially in relation to its weight, transport costs for water are very high, so its undervaluation has led to the unfortunate fact that "the transportation infrastructure for water is far less extensive than that for more valuable liquids such as petroleum."[5] Recouping infrastructure costs would entail charging at a rate that is equivalent to average costs (inclusive of fixed costs) rather than marginal costs (exclusive of fixed costs). But, water prices tend to reflect only the latter.

The crux of the dilemma surrounding the state of water infrastructure in this country is that the historic cost (i.e., the current, undervalued price) of water echoes the long-lived nature of the water industry's physical capital. Thus, the price of water reflects the relatively low marginal operating costs of its provision, while the total costs of water delivery emerge largely from substantial fixed costs. This fact is further exacerbated and obscured by the fact that consumers are considerably shielded from the

total costs of WSS, since operating costs for efficient water utilities in the US are only 10% of total costs, as opposed to 32% for gas utilities and 57% for electric utilities.[6]

American consumers are unaccustomed to paying for the full cost of municipally-supplied clean water, since historic costs reflect marginal costs rather than the average costs of WSS. Moreover, water being a necessity for human life, in the public imagination clean water is widely considered in a separate category from other utilities and household commodities. Viewed as a social good that ought to be publicly available and accessible, raising rates for WSS can be very politically challenging: "in the US, for example, it is notoriously difficult for publicly owned water utilities to obtain political approval for even trivial rate increases while other household utilities such as cable television rates raise their rates with impunity."[7]

The political challenge of raising rates has led to a situation such that "about half of the [municipal water] utilities raised their user rates infrequently – once, twice, or not at all – from 1992 to 2001."[8] As a result, the Government Accountability Office (GAO) reports:

> *…a significant percentage of the utilities – 29 percent of the drinking water utilities and 41 percent of the wastewater utilities – were not generating enough revenue from user rates and other local sources to cover their full cost of service. Furthermore, roughly one-third of the utilities … deferred maintenance because of insufficient funding, [and] had 20 percent or more of their pipelines nearing the end of their useful life…*[9]

On a national scale, the costs and consequences of this "out of sight, out of mind" approach are enormous.

A 2002 EPA report notes that "$138 billion will be needed to maintain and replace existing drinking water systems over the next 20 years," with and estimated $77 billion of that amount "repairing and rehabilitating pipelines."[10] Another report,

published by the Water Infrastructure Network, a coalition of elected figures, public health officials and WSS providers, projects the amount needed at $2 trillion over the next 20 years for municipalities to build new drinking and wastewater facilities as well as to operate and maintain existing facilities.[11]

In the US, users do not pay for water per se, since water is publicly owned "and the right to use it is given away for free."[12] Rather than paying a price based on the "scarcity value" of water, users pay for its "physical supply cost."[13] Hence, improvements to infrastructure (i.e., "current replacement cost") must necessarily be reflected in rate increases, especially at a time when increasing budgetary constraints are eliminating federal subsidies. For rate increases to be feasible, consumers must be educated as to the value of infrastructure investments.

Consumers are only vaguely cognizant of the fact that their household water "is a 'value added' commodity – water utilities are in the business of adding value to a natural resource through treatment to improve its quality and conveyance."[14] Furthermore, they often fail to recognize and appreciate the costs (discussed above) and quality (discussed below) of treatment. It is fundamentally important for consumers to understand that increased prices do not so much suggest a commoditization of water ("scarcity value") as they do a commoditization of water quality ("physical supply cost").

***Perception, Reality and the Quality of Drinking Water***

There is considerable research to suggest that consumers do place great value on water quality, and that American consumers are willing to pay higher prices for clean drinking water when these prices are properly contextualized and consumers feel confident about the quality of their water. Yet, while people's tastes and preferences do

reveal a willingness to pay more for water that they perceive to be of higher quality, the problem for policy makers is in public perception of the comparative cost and quality of municipal tap water. Perception may be even more important than reality, but reality can be used to shape and change public perceptions, and the facts favor the champions of community water supply.

Franz Foltz identifies the taste and "status symbol" of bottled water as driving forces behind its popularity and cost in the US.[15] Although bottled water does not taste of chlorine, this preference "comes from the misnomer of relating taste to quality," as the safety of water cannot be determined by casual observation through sight, smell or taste.[16] In truth, there is "no real difference in the water quality" of tap, bottled and home purified water, and a quarter of the bottled water sold in the United States is actually nothing more than processed tap water – municipal water from which chlorine has been removed.[17]

The popularity of such water is unsurprising, given the power of perception. Consider the case of "bogus [home] purification systems on the market":

> *In one such incident, a manufacturer produced a black-boxed device that was nothing more than a black box with a hose from the input to the output connection. When the government forced a manufacturer to refund consumers' money, many consumers did not want their money back. They said that the apparatus "worked just fine" and that they were certain that it improved the quality of their water.*[18]

In the end, perception not only matters more than reality, but perception is reality.

Catherine Ferrier, in report commissioned by the World Wildlife Fund, taking a tack similar to that of Foltz, explains that consumers believe bottled water is "safer and of better quality" simply because it "tastes better than tap water (no chlorine taste)."[19] Like Foltz, Ferrier also emphasizes that much bottled water is not "natural mineral water"

(water from a protected underground source containing >250 ppm of naturally occurring minerals and trace elements in relatively constant proportions) or "spring water" (water flowing naturally to the surface from a protected underground source), but falls instead under the category of "purified water." Ferrier writes that "there is little difference between purified water and municipal tap water, except in the distribution method and retail price."[20] Coca-Cola's Dasani and PepsiCo's Aquafina are but two leading examples such purified water products.

As one might suspect from the presence of these large corporate players in the bottled water industry and the industry's rapid growth in recent years, public perception does not come from nowhere. Indeed, advertising costs comprise 10% to 15% of bottled water's price.[21] In the words of one bottled water industry consultant, "bottlers are selling a *market perception* that [their] water is 'pure and good for you,'" a perception which is achieved by contrasting the supposed purity of bottled water against the alleged inconsistency and unpredictability of tap water.[22] In reality, however, it is tap water that is more consistently low in bacterial and chemical counts, and bottled water that is highly variable and unpredictable in quality.

In a study published in *Archives of Family Medicine*, the authors compare water samples from 4 water processing plants in Cleveland, Ohio, to 57 varieties of store-bought bottled water available in the area, finding that "while two thirds of the bottled water samples had lower bacterial counts than the tap water samples, *one quarter of the bottled water samples contained bacterial counts more than 10 times higher than those of the tap water samples.*"[23] Also cited in the article is an investigative report by *Time* magazine that uncovered similar results, with a third of bottled water brands violating

even "the industry's own guidelines for purity."[24] The authors conclude that, at least in Cleveland, "one can be assured of tap water with very low bacterial counts [0.2 to 2.7 CFUs/mL], while the quality of bottled water may vary greatly, with bacterial counts ranging from less than 0.01 to almost 5000 CFUs/mL."[25]

The variation in bottled water quality is unsurprising given the fact that, as pointed out in a Physicians for Social Responsibility (PSR) publication, "60-70% of bottled water escapes FDA oversight because it is bottled and sold in the same state, and many states do not have a bottled water regulatory program."[26] Moreover, even tested brands "do not have to undergo the same number and frequency of tests that public water purveyors must perform."[27] Despite the comparatively rigorous testing of public water supplies, though, consumers often feel they are in the dark about their tap water. A 1999 National Environmental Education & Training Foundation / Roper study reveals that "Four in 10 Americans are dissatisfied with the information they currently receive about the quality and safety of their tap water. (Most of the information they receive comes from TV, radio, and news media)."[28]

The fact that so many citizens want to know more about their drinking water opens a window of opportunity for government officials. Municipal water supply and sanitation is generally of relatively high quality and low cost in the United States. Unfortunately, the public tends to be uninformed or, worse, misinformed as to the quality and cost. Consequently, citizens place a high value on bottled water and a high degree of faith in private well water – in other words, they fail to sufficiently value and trust public water supplies. An extensive education initiative must encompass not only an effort to provide much needed and sought after data reassuring the public of the high quality and

low cost of municipal water, but also an attempt to raise public awareness of the high prices of other utilities and the potentially low quality of other water sources.

Just as the successful campaigns of political candidates often demand some measure of negative campaigning, a campaign to educate the public on the safety and benefits of tap water may likewise require raising some doubts about the (un)reliability of other sources. The public must also be made aware, critical and cynical of deceptive marketing practices on the part of bottled water manufacturers, with exposure to cases such as the one where the bottle's "label reads 'spring water,' but the water actually comes from a well (known to have been periodically contaminated) in an industrial facility's parking lot near a waste dump."[29]

In fact, regarding well water, CDC figures reveal that, for 1997-98, almost three quarters of all reported outbreaks of waterborne disease are attributable to the consumption of contaminated well water.[30] More recent CDC figures, for the years between 2000 and 2002, indicate a similar ratio [see Appendix 1]. Moreover, a 1998 USGS study indicates that "over 54% of of samples from wells and springs" were contaminated with pesticides.[31] Nevertheless, given the media's interest in problems with public water supplies and concordant lack of interest in the troubles experienced by individual well owners, the perception persists that well water is a cheaper, safer and preferable alternative to tap water.

***Willingness and Ability to Pay: The Bargain of Municipal WSS***

Public education efforts must be aimed at better informing the public of both what they are paying for (breakdown of costs) and what they are getting (assurance of water quality as well as secondary benefits from being connected to a community water

supply). The public does value – and certainly is willing to pay for – clean drinking water. A survey sponsored by the American Water Works Association (AWWA) Research Foundation found that 74% of respondents were willing to pay higher rates for increased quality, while a follow-up survey suggested that consumers place pricing fourth in importance, behind water quality & safety, physical characteristics, and continuous supply & availability, when judging drinking water.[32]

It is also likely that consumers would be willing to pay more for municipal water were they more cognizant of its costs vis-à-vis other household expenses. The table below indicates that, on average, consumers not only spend on WSS just a fraction of what they pay for other public utilities (such as electricity and telephone services), but it also turns out that they even tend to spend less on municipal water and sewer services than they do on nonalcoholic or alcoholic beverages on a yearly basis. Thus, properly contextualized, even a substantial rate increase for water certainly seems comprehensible, bearable and feasible for most consumers.

Table 1: Comparative Consumer Expenditure Data [for more detail, see Appendix II]

| **Category** | $30,000 to $39,999 [Northeastern region] | Rural [National] |
|---|---|---|
| **Income before taxes** | $34,422 | $40,140 |
| **Natural gas** | $516 | $194 |
| **Electricity** | $835 | $1,126 |
| **Fuel oil and other fuels** | $265 | $233 |
| **Telephone services** | $899 | $875 |
| ***Water and other public services*** | *$205* | *$225* |
| **Gasoline and motor oil** | $1,042 | $1,587 |
| **Nonalcoholic beverages** | $264 | $296 |
| **Alcoholic beverages** | $446 | $292 |
| **Tobacco products and supplies** | $344 | $372 |

[source: Bureau of Labor Statistics, 2003 Consumer Expenditure Survey]

While the BLS data above can be criticized for depressing some expenditure statistics by averaging all consumers surveyed (i.e., the water figure, just like the figures

for fuel oil, alcohol and tobacco, includes those who do not expend any money for those items), more nuanced numbers, based on Census Bureau Public Use Microdata Areas (PUMA), offer a snapshot of typical water rates that is not a large departure from BLS numbers.

Figures calculated on the basis of PUMA data average only the amount paid for water and wastewater by those paying directly for such services (as opposed the Bureau of Labor Statistics' aggregate average which, in the case of water, is depressed by the inclusion of private well and septic system owners paying "$0" for public water and sewer services). According to PUMA data, reflecting regions of approximately 400,000 persons and derived from responses to data collected in 1999 for Census 2000: "The average household [nationally], among those paying for W/WW, spent 1.5% of its income for W/WW."[33] This is in comparison to a figure of 0.9% calculated on the basis of BLS data [see Appendix II]. For New York, beyond the New York City metropolitan region, the average water and wastewater bill in different PUMA regions ranges from $255 to $432 annually [see Appendix III].

Contrary to complaints commonly heard about the cost of water, residents in communities across the United States are receive municipal WSS at bargain rates when compared to the total costs of owning and operating a private well and septic system. Extrapolating from cost figures provided by the Environmental Finance Center (EFC) at Syracuse University, one of nine university-based centers that comprise the EPA's national EFC network, we find that the costs of private well and septic system ownership are considerably greater than the costs of publicly-provided WSS. And, even at rates considerably higher than those currently being paid in most communities, residents would

still be receiving a great deal, especially considering the consistency and reliability of municipal WSS in terms of both quality and availability.

The table below shows the present value of costs over a twenty-year period, at three different interest rates, with the very conservative assumption that the private owner does not need to make any major capital investments (replacing pump, tank and softener for well, or installing a new septic tank) until twenty years from today. Appendix IV offers more detail about these calculations.

Table 2: Cost of Private Well and Septic Ownership versus Cost of Municipal WSS

| Interest rate | 5.0% | 7.5% | 10.0% |
|---|---|---|---|
| PV of private ownership, if replaced in 20 years | $7287 | $5272 | $3935 |
| PV of public ownership, if annual charge = $300 | $3739 | $3058 | $2554 |
| PV of public ownership, if annual charge = $400 | $4985 | $4078 | $3405 |
| PV of public ownership, if annual charge = $500 | $6231 | $5097 | $4257 |
| PV of public ownership, if annual charge = $600 | $7477 | $6117 | $5108 |

In spite of using very high discount rates with greatly postponed capital costs for private ownership, municipal WSS is almost always a cheaper alternative, even if there were to be substantial increases in consumer rates.

This discussion and the calculations above, do not even include secondary benefits, such as increased property values and decreased homeowner's insurance rates, or less tangible (and less easily quantified) advantages in terms of the convenience, quality of life and peace of mind that comes from having regular access to clean water from one's tap.

## Municipal and Consumer Behavior

The main concern for governments concerning water and wastewater utilities is that there is an impending financial crisis as existing systems need to be restructured, repaired, and maintained, while new water and wastewater infrastructure needs to be created. The problem is that, historically, drinking water and wastewater services have been over-subsidized by the government, leading to a public perception that the true value of these services is lower than they actually are. This means that the public is generally not willing to pay as much for these services as they should be and they are thus averse to any rate hikes, believing that they would be overpaying - a false perception that the government is responsible for creating.

Because of this misperception, the public undoubtedly feels that they should still receive the services for the traditional undervalued price. Governments, in conjunction with utilities, must find ways to remedy this situation; covering increasing costs while avoiding unwanted political backlash. To this end, methods could be implemented that would include: increasing use fees while educating the public of the true value of water and wastewater services; encouraging conservation; implementing effective capital asset management plans and considering water distribution systems as assets; and developing local endowments.

### *User Rates*

The natural solution to this predicament is to raise user rates. However, the Water Infrastructure Network reports that "increased water and wastewater rates…can address only a portion of the problem." This is because "[s]ome 60 percent of the U.S. population has experienced no increase…in real household income over the last 20 years,

so for the majority of U.S. families, sharp increases in water and wastewater rates can be expected to have significant economic impacts."[34] Municipalities must find ways to phase in rate increases. This is challenging because "[p]eople undervalue water, which compounds the challenge of getting rate increases accepted."[35] The same report discovered, though, that if municipalities get to know their customers by surveying the sources they trust most to understand their water quality and costs, governments can gradually phase in price increases by running informational campaigns using those sources.

In addition, American Water Works Association (AWWA) provides toolkits that can help government managers to run effective campaigns. For example, the "Avoiding rate shock" toolkit compiles a needed set of brochures, pamphlets, presentations and visual aids that municipalities can use to educate consumers about the true costs of water. Furthermore, the report presents a rate increase success story about the Philadelphia Water Department (PWD) from which other municipalities facing financial crises can benefit. For instance, PWD anticipated a shortfall of $134.8 million in revenue obligations. It submitted a plan to City Council that detailed annual phases during which increases would take place. This plan was successful because (1) it spread an increase over a period of time thus not shocking consumers with an immediate rate hike and (2) it communicated its actions to consumers through an extensive public hearing campaign.[36]

***Public Education***

This is probably the most important aspect of managing the needed price increases the water industry needs to undergo in the near future. Consumers do not always have adequate information about the cost of their utilities. Few customers can

understand items that make up their utility bill and, thus, they need thorough education to comprehend their invoice and the reasons for increased prices. To help consumers to appreciate the elements of their water bill the EFC has even developed a two-page leaflet itemizing the building blocks of an invoice that municipalities can use to educate customers about their charges.

Also, consumers should be informed about the changing government policies towards water financing. A 2003 World Bank Water Pricing Seminar presentation asserts that consumers have competing views: 1) water is so essential that it should be free, and 2) water is so essential it should be priced at full cost.[37] Gradually, the goal of educational campaigns should be to shift people's thinking towards the second tenet (except in the case of low-income customers) because of the shifting trend away from federal subsidization of water/sewer programs. Such campaigns would alleviate the lack of knowledge about the components of a water bill, offer the necessary transparency required of public entities, and help consumers become more accepting of the impending rate increases.

***Conservation***

While this relates to consumer education, it is also a stand-alone principle because it encompasses strategies that help enable consumers to change their behavior as opposed to strictly learning about it. Conservation, realized through decreasing water use, allows consumers to impact household costs most effectively on their own, drastically reducing their water bills and shifting the responsibility for costs from governments and utilities to the consumers themselves. A 2003 Public Utilities Commission report concludes that, besides lowering household expenditures, water conservation can also help mitigate

"severe summer shortages."[38] In addition, the GAO reports that the USDA's most recent forecast projects "declining ground-water levels and increasing population – [indicating] that the freshwater supply is reaching its limits in some locations while freshwater demand is increasing… [And] significant ground-water depletion has already occurred in many areas of the country; in some cases the depletion has permanently reduced an aquifer's storage capacity or allowed saltwater to intrude into freshwater sources."[39] Undoubtedly, such findings are alarming and water consumers need to know these figures and understand the impact they can have by changing their behavior and saving water whenever possible.

Another key finding from the GAO is that history dictates the difficulty of forecasting water usage. "A 1999 USDA study found that past water use projections for 2000 show consistently large differences among the forecasts and large discrepancies between projected and actual water use."[40] Sharing this information with consumers may not only compel them to boost their conservation efforts, but it might also serve as a trigger and a precedent for municipalities to price water consistently closer to its actual cost because of the relative volatility of the resource. Thus, consumers are not the only ones needing to adjust their behavior to ensure a sustainable future for water resources – municipalities themselves can, and should, contribute also. In addition, municipalities can implement management techniques to better deal with financial issues.

***Asset Management***

Asset management "allows utility managers to obtain better information on the age and condition of existing assets, determine the level of maintenance needed to optimize asset performance and useful life, assess the risks associated with the failure of

various assets and set priorities for their maintenance and replacement…"[41] Should this information be gathered, utilities will benefit by acquiring "improved decision making because they have more accurate and integrated information about their capital assets and…more productive relationships with governing authorities, ratepayers, and other stakeholders because they can provide better information in a more transparent way."[42] The GAO report also concludes that future rate increases could better justified if utilities have more comprehensive asset management plans.

In addition, research scientists recommend that "municipalities [should]…manage their water distribution systems to provide an adequate supply of safe water in a cost-effective, reliable and sustainable manner…" To do this, "it is essential that they develop a clear understanding of water main deterioration processes. This understanding will allow municipalities to implement mitigation measures in a timely manner so as to extend the useful service life of the systems to an optimum length of time…"[43]

Regarding such systems as assets provokes one to invest in them and maintain them. They are viewed as something useful and usable in the future, thus promoting sustainable management. For instance, public managers that know a municipality can save substantial costs if they optimize the system in use today, they could take steps to devise plans that would implement such opportunities. Furthermore, policymakers would be more willing to accept such proposals as opposed to ones lacking such explanations since they would contain fiscally responsible financial strategies. This has already been done in a number of municipalities throughout the United States. For instance, the GAO reports that Massachusetts Water Resources Authority and the Seattle Public Utilities, among others, have used asset management "to better target its maintenance resources."[44]

The former "improve[d] its maintenance decisions and eliminate[d] some unneeded maintenance activities…[it] reassessed maintenance practices for 12 equipment systems, such as different types of pumps [and used] the assessment results to improve maintenance planning. [For example the Authority] found it was lubricating some equipment more often than necessary. By decreasing the frequency of oil changes, the utility reported [savings of] $20,000 in oil purchase and disposal costs."[45] Other utilities reported similar evaluation activities that saved money in the long run.

***Local Endowments***

Municipalities can investigate the possibility of either raising taxes or setting aside a portion of their user fees to develop endowments that earn interest. The interest income can then be used exclusively for maintenance or, perhaps, for other operating costs such as debt service, personnel salaries, etc. This idea, though intriguing, does carry potential problems. For example, it may be difficult for governments to afford setting aside any portion of generated revenues. Also, user rates may have to be raised initially, for a set amount of time, to generate an endowment fund large enough to be useful. If this is the case, it may be difficult to sell the idea to the public and the necessary educational campaign might end up requiring prohibitively expensive administrative costs. Certainly, there are potential obstacles to the development of this type of endowment, and the benefits may not outweigh the costs, but, present circumstances dictate that this is an avenue that should at least be explored by local governments.

## Policy Approaches

While communicating the cost and value of drinking water and wastewater services is a key theme, and mitigating concerns through municipal and consumer behavior is important, legislators and policy makes can also play a significant role (in terms of specific ratemaking mechanisms and other innovative regulatory/policy methods) in addressing the financial issues rooted in WSS provision. This section will include targeted policy solutions that focus on both: 1) how similar program costs are recovered and funded by various other utilities - and how each of these can be applied to water and wastewater and, 2) alternatives to direct federal funding of drinking water and wastewater programs.

### *Universal Service Fund*

The Federal Communications Commission (FCC), under direction from the United States Congress, established a federal universal service fund to ensure that all people in the United States have access to fast, efficient, nationwide communications services at reasonable charges. The federal universal service fund is a mechanism by which communications companies are assessed fees to subsidize telephone service to low-income households, high-cost areas, rural health care providers, and schools and libraries. Most companies required to contribute to the universal service fund choose to recover their contributions directly from their customers through a line-item charge on telephone bills. This is not required by the FCC and each company makes its own decisions about whether and how to assess customers to recover its universal service costs.

Companies are able to recoup the costs of the universal service fund from customers because of the inelastic nature of demand for telecommunications services. Because there are no immediate substitutes for landline telephone service (though the argument can be made that internet, mobile telephones, or voice over IP are increasingly challenging this assumption), companies can pass on this additional costs to customers without fear of decreases in demand. Similarly, demand for public drinking water and wastewater services should be equally inelastic, especially in municipalities where private well water and septic systems are unrealistic substitutes, making a universal water fund a feasible mechanism to extract needed resources form the public.

The federal universal service fund and related programs are administered by the Universal Service Administrative Company (USAC), a private, not-for-profit corporation that is responsible for managing the programs under regulations promulgated by the FCC. All companies that provide telecommunications services between states, including long-distance telephone companies, local telephone companies, wireless telephone companies, paging companies, and pay phone providers, are required to provide contributions to the universal service fund. The amount of contributions is based on a specific percentage or contribution factor of interstate and international revenues, and is adjusted each year to account for changes in demand for funding, programming changes enacted by the FCC, and other necessary adjustments.

Most relevant to the USDA Rural Development Water Program is the low-income program that operates under the universal service fund. The qualifications for participating in the low-income program vary by state. The low-income program assists eligible low-income individuals with the establishing and maintaining of

telecommunications services by discounting services provided by local telephone companies. Two of the main features of the low-income program include the Lifeline component and the Link Up component.

The Lifeline component reimburses telephone companies for discounting low-income individuals' monthly bills. The discounts can reach up to $10 per month depending on matching available from each of the states. The Link Up component reimburses local service providers for providing discounted connection charges to eligible low-income individuals. The individuals qualifying for this feature are eligible to save up to 50 percent on installation fees and many are offered a deferred payment schedule for installation charges.

To aid in covering costs of developing rural water and wastewater systems a similar fund could be established. The premise for the establishment of the universal service fund for telecommunications is that telephone service is considered a necessity for daily modern life, yet the cost of activating and maintaining such service can be prohibitively expensive, especially for low-income consumers. An analogous argument can, and should, be made for WSS. Rural communities have traditionally relied on private groundwater wells and septic systems to provide such services. However, water quality issues and health concerns have caused many of these communities to seek the development of public water and sewer systems. But, because of the high costs of these projects, rural communities must turn to the government to aid in construction. While federal funding does exist, it has been diminishing in recent years leading to either increases in service fees or abandonment of projects. A universal service fund, established as a line item charge on individual water bills, could help mitigate the effects

of decreasing government grant money for rural communities, and help target low-income individuals that pay a higher percentage of their income for utility services.

***System Benefit Charges***

In response to the recent deregulation of electric utilities, many states have begun implementing systems benefit charges. Electric utility restructuring benefits consumers by lowering prices, expanding consumer choice, and opening new business opportunities. But restructuring can also result in stranded assets and stranded public benefits. Stranded assets refer to utility assets, such as generation units and purchase contracts. Before the deregulation of the electric industry such assets were developed because under regulated rates they remained profitable. However, post-deregulation competitive markets made such investments and generation schedules more costly than what was previously determined. Then, as the costs of production rose higher than market prices, the value of a power plant became less than the cost of its construction and operation. Under the present system, many of these assets would not have been developed. Stranded public benefits refer to various public benefit programs that have historically been provided by the regulated utility. These programs include low-income energy assistance, various energy efficiency programs, renewable energy acquisition, and research and development.

One way states have begun funding public benefits programs (including low-income energy programs) is through a systems benefit charge on the distribution of all electricity collected by the regulated distribution company which is included in the distribution bills to all customers. The charge is usually based on a per kilowatt hour of consumption. The fees are collected by the distribution company and transferred to the

funds of an administrative agency. The fee level and use categories for the collected funds are determined during the legislative process of developing the charges.

The actual charge in many states will be determined by the state public utility commission. System benefit charges are generally expressed in mills per kilowatt hour generated, with one mill equal to $0.001. For every million kilowatt hours generated, a one mill charge would raise $1,000. Based on the kilowatt hours consumed in 1999, a one mill charge applied nationally, across all consumer end-uses of electricity would raise about $3 billion, and in New York alone would total about $130 million.[46]

System benefit charges address two main policy goals. First, they help low-income families, making energy affordable by providing utility discounts and weatherization. Second, they reduce the wasteful use of energy. Energy efficiency then lowers bills through decreased consumption (as people will conserve energy lest they pay higher consumption charges), slowing the growth of energy generation and delaying the need for additional generation capacity (additional plant construction). A system charge would also be beneficial if applied to rural WSS development.

Similar to the universal service fund, the use of a system charge on water consumption (a small charge based on a per gallon water usage) to provide assistance to low-income individuals would create a progressive transfer of funds that is nationally acceptable, as evidenced by the telecommunications industry. But, unlike the universal service fund, a public benefit argument can be made using a system benefit charge. Because people would be charged based on consumption, conservation is encouraged which promotes efficient water usage. Furthermore, any decrease in consumption due to conservation will lead to lower costs, both to individual water bills and to utilities that

can delay further capital costs for things such as additional sewage overflow captures. Since the costs of such capital improvements and expansions are traditionally spread to all consumers, any reduction in such costs will benefit all consumers.

***LIHEAP***

The Low Income Home Energy Assistance Program was authorized by Title XXVI of the Omnibus Budget Reconciliation Act of 1981 and began in 1982. Its purpose is "to assist low-income households, particularly those with the lowest income, that pay a high proportion of household income for home energy, primarily in meeting their immediate home energy needs." LIHEAP was designed to provide help to low-income households with a minimum of government bureaucracy and a maximum of involvement by civic institutions. LIHEAP evolved from earlier programs created in response to the energy crisis of the 1970s.

Federal dollars for LIHEAP are allocated by the U.S. Department of Health and Human Services (HHS) to the states as a block grant and are disbursed under programs designed by the individual states. Program funds are distributed by a formula, which is weighted towards relative cold-weather conditions and households living in poverty. LIHEAP funds are supplemented, to an extent, by additional state appropriations, programs from energy suppliers and utilities, church donations and local charitable funds administered by the Salvation Army, Catholic Charities and other organizations.

LIHEAP is dependent on the federal appropriations process for its funding and the amount granted to the program varies from year to year. Federal funds for LIHEAP have fluctuated from a high of $2.1 billion in FY 1985 to a low of $1.0 billion in FY 1997. The funding stood at $1.7 billion for FY 2003. The residential energy burden (including

heating, cooling and all other energy uses in the home) for all U.S. households in 2001 was $1,537 per household, or 7.0 percent of income. For LIHEAP recipient households, the figures were $1,301 and 17.2 percent, respectively, or *nearly two and a half times the average burden*.

LIHEAP has nurtured a very positive, effective partnership between the federal government, state governments and the private sector. By leveraging private dollars to supplement federal dollars, LIHEAP has proven that successful relationships can exist between the government, businesses, energy utilities, and community-based social service organizations. The New York State Office of Temporary and Disability Assistance (NYS OTDA) offers its own Home Energy Assistance Program, consisting of two components, regular benefits and emergency benefits.

Under the Regular Benefit component New York State provides benefits to households that pay directly for heat or have heating payments included in their rent. The state calculates household benefits using a point system based on income, percent of income spent on energy, and presence of a vulnerable individual (child, elderly, or disabled) in the household. The point value for 2004-2005 has been set at $50 per point. The minimum number a household can receive is three and the maximum is eight, meaning that the benefit amount ranges from $150 to $400. Under the Crisis Benefits component, eligible households receive emergency benefits based on the type of emergency. In the 2004-2005 program, emergency benefits range from $100 to $400.[47]

By specifically targeting low-income individuals, these programs have garnered public support throughout the nation. A national public opinion poll on LIHEAP, prepared by the Behavior Research Center in 2002, found that 89% of those surveyed

favored the LIHEAP program, while only 6% opposed and 5% had no opinion. In addition, 72% of respondents supported increasing funding. [48] Since access to clean drinking water and wastewater services is no less important than home heating needs, a similar program, targeted to low-income individuals in rural communities should be at least as politically acceptable. Clearly, public support for such programs abounds. A tax funded program, at either the state or federal level (or a combination of both), could alleviate the burden of increasing prices on the most vulnerable individuals, due to decreasing grant money, on socially acceptable terms.

***Bottle Bill Reform***

The Bigger Better Bottle Bill is sponsored in the State Senate by Senator Kenneth Lavalle and by Assemblyman Thomas DiNapoli in the State Assembly. The Bigger Better Bottle Bill (BBBB) will add a $.05 deposit to non carbonated drinks like bottled water, teas, and sports drinks. In addition, it will capture the unclaimed deposits that are currently kept by the deposit initiator (the beverage distributor that initiates the deposit). This money that is not claimed by the consumer would be placed into the Environmental Protection Fund (EPF) to be used by the region where it was generated. The Container Recycling Institute, which studies bottle laws, claims that $179 million dollars could be added to the EPF each year if this bill was passed. The bill would also increase handling fees, the amount of money that retailers get paid for each claimed deposit as a fee for handling the beverage containers, from $.02 to $.03.

The bottle bill has been one of New York's most successful recycling initiatives. Not only has it reduced litter along our roadways and in our public spaces, but it has reduced the burden of solid waste disposal that is shouldered by our municipalities.

Nonetheless, since enactment of the bottle bill in 1982, beverages such as bottled water, sports drinks, juices, and teas have been introduced into the consumer stream, gaining an ever increasing share of the beverage market, and the containers have been introduced into the waste stream. A 2002 study by Scenic Hudson, Inc. even found that the majority of beverage containers littering the Hudson River shorelines did not have a deposit.[49] Furthermore, the bottlers and distributors who initiate the deposit collection system enjoy a five-cent windfall for each returnable container that is not returned. This bill would return those unclaimed deposits, estimated by the Department of Environmental Conservation in 2000 at $85 million annually, to the State for use in environmental programs.

If even only a small percentage of the estimated revenue that would be captured by expanding the bottle bill were diverted to rural WSS programs, the decreases in grant money that is so desperately needed to develop infrastructure would be more than compensated for. In addition to the revenue generated, an expansion of the bottle bill will further encourage recycling and reduce landfill use, decreasing the costs associated with the consumption of this increasingly scarce space and delaying the need to open additional landfills.

Moreover, a 2004 survey of registered voters in New York has found overwhelming support for the bottle bill and its proposed expanded provisions. Of the sample of 800 voters surveyed 84% supported the existing bottle deposit program. 74% of respondents indicated that they would support an expansion of the bottle bill to include noncarbonated beverages such as bottled water, juice, sport drinks, and iced tea. Also,

86% supported a transfer of unclaimed bottle deposits from beverage distributors to the State.[50]

While resistance to an expanded bottle bill has been forwarded by the beverage industry, the public support should make such legislation at least politically feasible. Even if the beverage industry raises prices on their products in response, which some speculate they will do,[51] a positive consequence will still result. Because the main consumers of such bottled beverages are generally affluent, and if the revenues can generate funding for water infrastructure in rural areas whose residents are generally less wealthy, a progressive transfer will result in which the value of water systems is captured.

***Privatization***

Privatization can take many forms from contracting and outsourcing to lease arrangements, asset sales, and public-private partnerships. Growing trends towards smaller government and diminishing public payrolls has stimulated the use of privatization by government officials and managers. These officials are seeking less government involvement in the production and delivery of goods and services that can be provided through alternate service delivery arrangements with private contractors.

Privatization advocates claim that municipalities will receive better services at lower costs. But whether this is true depends on two conditions, competition and government capacity. Competition is necessary because the benefits of privatization are only realized when rival contractors offer greater expertise, proximity to clients, and provide goods and services for lower costs. Governments can then decide which provider can deliver the best product with the lowest cost. However, government also needs to have contract management and program expertise to evaluate contractors. In addition,

the transaction costs associated with privatization must also be considered. These are the administrative costs associated with developing the contract, soliciting RFPs, managing the contracts, and oversight.

The most common form of privatization is contracting, which typically entails a competition among private bidders to perform certain activities. In the case of drinking water and wastewater utilities, such activities typically include operation and maintenance for a set period of time. Typically, public-private partnerships in the field of drinking water and wastewater utilities involve operations and maintenance contracts from 1 to 5 year periods. Another type of contractual arrangement is design-build-operate agreements, in which a private company designs, builds, and operates a facility under one contract. The local government retains ownership of the utility once after construction and the contractor is responsible for the operation and maintenance over the life of the contract, often 10 to 20 years. Sometimes, privatization involves transferring the ownership of utility assets from a municipality to the private sector. After assets have been purchased, the municipality generally has no role in their financial support, management, or oversight. Finally, water utilities can be owned and operated by private investors while providing water services to the general public. Though the utility and infrastructure is owned privately, water quality is regulated and operations are monitored by the government.

Public-private partnership arrangements between municipalities and private companies have become popular since the 1970s. Many towns, cities and counties select private-sector companies to operate, manage, and/or construct WSS facilities and systems. These agreements range from meter reading, billing and customer services,

maintenance, replacement of distribution and collection pipes, and various other functions to design-build-operate arrangements where a municipality retains ownership of the utility, but a private company is brought in to run all or part of the operation. Today, private firms operate more than 2,400 municipally owned water and wastewater facilities.[52] The fact that over 90% of these public-private partnerships are renewed annually indicates their popularity and effectiveness.[53] Furthermore, it has been shown that public-private partnerships between municipalities and private firms can save up to 40% compared to purely municipal operations. This is because the private companies can more readily take advantage of economies of scale, effective cost controls, innovation, and sound asset management practices.[54]

According to the US EPA, privately owned drinking water utilities that are for-profit and/or investor-owned comprise roughly 15% of the 53,000 or so drinking water systems that are privately owned in some form.[55] These utilities are among the most highly regulated industries in the nation. All drinking water utilities, public and private, are regulated under EPA's drinking water standards. In addition, private drinking water utilities are also regulated by state public utilities commissions, which approve rates and capital improvements, monitor compliance with health standards, and assure good service.

Even though there is already significant public sector involvement in drinking water and wastewater utilities, public fear of the transfer of provision of these services still exists. The three main concerns of the public involve service quality and performance, higher prices, and loss of local control. However, each of these fears is unfounded. Though the outright sale of a water system does result in some loss of

control, short term operations contracts can retain some control over the system and ensure a high degree of accountability and performance. When it comes time to renew these contracts the municipality can choose to either retain the incumbent company if the performance was satisfactory or to select a competing company if it was not. Also, as was stated previously, private water utilities are regulated by both the federal and state governments, assuring that quality standards are met.

In addition, a recent study by the AEI-Brookings Joint Center for Regulatory Studies found that privately-owned systems report fewer contaminant violations than do municipally owned systems and that such water systems serving a smaller share of the county population have even fewer violations. In addition, the study finds that "average household water expenditures [are] less in a county with complete private ownership than in a county with complete municipal ownership."[56] These findings make the prospect of privatization of rural community water systems all the more attractive.

Corroborating evidence comes from the GAO. A case study in a 2002 report cites a California drinking water utility that achieved over $200,000 in savings in annual laboratory costs for water quality monitoring. Another case mentions a Georgia utility that implemented a leak-detection program that reduced unaccounted for water (water that represents the difference between the volume that leaves the treatment works and the volume that is metered) by 30%. One more example states that a Massachusetts wastewater utility improved the treatment process and reduced incineration costs by about 75%.[57] All these cases point to efficiency gains that can be achieved through private sector investment and management practices that otherwise go unrealized when water services are left to public provision.

In addition to increased efficiency and costs saving, private sector involvement in water utilities has other advantages. Two of these advantages are risk reduction and alternative funding sources. Traditionally, publicly owned utilities assume all the inherent risks of ownership and operation. Equipment failure, labor disputes, economic risks, demand changes, and environmental conditions are all risks that can put pressure on municipally owned water utilities, risks which are ultimately borne by the public itself. Public-private partnerships provide additional means of managing some of these risks by placing some of the responsibility on the private partner. In addition, these partnerships allow for private financing options for the construction of needed capital projects through private investment or leveraging private debt and equity.

However, economic views of privatization are not all optimistic. Some argue that the for-profit nature of the private sector is an insurmountable obstacle to attracting private involvement in small water systems and rural communities. However, empirical evidence suggests the contrary. According to an EPA Community Water System Survey there are approximately 50,000 water systems in the US that are small utilities serving 10,000 or fewer customers. Of these, about 54% are privately owned and 46% are publicly owned.[58] Beyond this, there are presumably a number of publicly owned systems that are utilizing some form of public-private partnership. This means that there is almost a certain large majority of small water systems that are participating in some form of privatization. If the public sector is willing to get involved in rural water utility development and operation, and the benefits are real, it would behoove local governments to at least consider privatizing these services.

## Conclusions

For municipal water supply and sanitation services to be sustainable, consumers must bear a greater share of the total costs of water provision. Public officials need to help citizens appreciate that municipal water and wastewater utilities offer water at a bargain price, providing water of high quality at low cost. Compared, in present value terms, to the lifetime costs of owning a private well/septic system, community water supply is much cheaper. Educational tools can enhance consumer understanding of costs associated with residential water provision.

While some increases in rates are necessary and inevitable, consumers, municipal leaders and state and federal policymakers will have to work cooperatively to continue to keep household water prices affordable. Consumers can be educated and encouraged to make more efficient use of water services, thus conserving this vital natural resource and, by extension, cutting costs at the level of both individual (reduced costs through decreased amounts of water usage) and municipality (reduced per unit costs through decreased systems stress and associated maintenance costs).

Utilizing innovative policy techniques, and building upon the methods and experiences of other public utilities, both sustainability and affordability (especially for those individuals with most need) can be achieved. Policymakers and public officials need to carefully evaluate the costs and benefits of each of these proposals on a case-by-case, community-by-community basis. Competing concerns about efficiency and equity must be carefully balanced. Although the recommendations herein have the potential to yield enormous benefits for low-income rural communities, legislators need to be cognizant of local circumstances. The acceptability and appropriateness of particular

policy approaches for specific communities needs to be thoroughly evaluated to ensure successful policy implementation.

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TABLE 4. Waterborne-disease outbreaks (n = 8) associated with drinking water — United States, 2002

| State | Month | Class | Etiologic agent | Predominant illness | No. of cases (n = 432) | Type of system* | Deficiency† | Source | Setting |
|---|---|---|---|---|---|---|---|---|---|
| Arizona | Jul | I | Norovirus | Gastroenteritis | 71 | Com | 5 | Well | Golf Course |
| Arizona | Oct | I | *Naegleria fowleri* | Meningoencephalitis | 2 | Com | 2 | Well | Community |
| Connecticut | Jun | I | Norovirus | Gastroenteritis | 142 | Ncom | 2 | Well | Camp |
| Florida | Sep | III | AGI§ | Gastroenteritis, rash | 3 | Ind | 2 | Well | Household |
| Florida | Sep | III | AGI | Gastroenteritis | 5 | Ind | 2 | Well | Household |
| Kentucky | Sep | III | *E. coli* O157:H7 | Gastroenteritis | 2 | Ind | 2 | Well | Household |
| New Hampshire | Jul | III | Norovirus | Gastroenteritis | 201 | Ncom | 2 | Well | Camp |
| New York | Apr | III | *Giardia intestinalis* | Gastroenteritis | 6 | Com | 4 | Well/spring | Trailer park |

* Com=community; Ncom=noncommunity; Ind=individual. Community and noncommunity water systems are public water systems that serve ≥15 service connections or an average of ≥25 residents for ≥60 days/year. A community water system serves year-round residents of a community, subdivision, or mobile home park with ≥15 service connections or an average of ≥25 residents. A noncommunity water system can be nontransient or transient. Nontransient systems serve ≥25 of the same persons for >6 months of the year, but not year-round (e.g., factories or schools), whereas transient systems provide water to places in which persons do not remain for long periods of time (e.g., restaurants, highway rest stations, or parks). Individual water systems are small systems not owned or operated by a water utility that serve <15 connections or <25 persons. Outbreaks associated with water not intended for drinking (e.g., lakes, springs and creeks used by campers and boaters, irrigation water, and other nonpotable sources with or without taps) are also classified as individual systems.

† 1 = untreated surface water; 2 = untreated groundwater; 3 = treatment deficiency (e.g., temporary interruption of disinfection, chronically inadequate disinfection, and inadequate or no filtration); 4 = distribution system deficiency (e.g., cross-connection, contamination of water mains during construction or repair, and contamination of a storage facility); and 5 = unknown or miscellaneous deficiency (e.g., contaminated bottled water or storage container).

§ Acute gastrointestinal illness of unknown etiology.

*Source: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5308a4.htm#tab4*

TABLE 3. Waterborne-disease outbreaks (n = 17) associated with drinking water — United States, 2001

| State | Month | Class | Etiologic agent | Predominant illness | No. of cases (n = 508) | Type of system* | Deficiency† | Source | Setting |
|---|---|---|---|---|---|---|---|---|---|
| Alaska | Jun | I | *Campylobacter jejuni* and *Yersinia enterocolitica*§ | Gastroenteritis | 12 | Ncom | 2 | Well | Bunkhouse |
| Colorado | Feb | III | *Giardia intestinalis* | Gastroenteritis | 6 | Com | 3 | River/stream | Community |
| Florida | Apr | III | AGI¶ | Gastroenteritis | 3 | Ind | 3 | Well | Household |
| Florida | Apr | III | AGI | Gastroenteritis | 4 | Ind | 3 | Well | Household |
| Florida | Apr | III | *G. intestinalis* | Gastroenteritis | 6 | Ind | 2 | Well | Household |
| Florida | Jul | III | AGI | Gastroenteritis | 4 | Ind | 3 | Well | Household |
| Florida | Aug | III | Ethylene glycol | Gastroenteritis | 3 | Com | 4 | Well | School |
| Florida | Sep | III | Ethyl benzene, toluene, xylene | Gastroenteritis | 2 | Ind | 5 | Spring (bottled) | Bottled water |
| Illinois | Oct | II | AGI | Gastroenteritis | 79 | Ncom | 5 | Well | School |
| Indiana | Aug | IV | *Cryptosporidium* species | Gastroenteritis | 10 | Ind | 3** | Well | Household |
| Minnesota | Sep | III | Copper and other minerals | Gastroenteritis | 4 | Ncom | 4 | Well | Church |
| Minnesota | Nov | III | Copper | Gastroenteritis | 28 | Com | 4 | Well | School |
| Ohio | Sep | III | Copper | Gastroenteritis | 2 | Com | 4 | River/stream | Steel plant |
| Pennsylvania | Jun | II | AGI | Gastroenteritis | 19 | Ncom | 3 | Well | Camp |
| Wisconsin | Jan | I | *C. jejuni* | Gastroenteritis | 13 | Ind | 2 | Well | Household |
| Wyoming | Jan | I | Norovirus | Gastroenteritis | 230 | Ncom | 2 | Well | Lodge |
| Wyoming | Sep | I | Norovirus | Gastroenteritis | 83 | Ncom | 3 | Well | Restaurant |

* Com = community; Ncom = noncommunity; Ind = individual. Community and noncommunity water systems are public water systems that serve ≥15 service connections or an average of ≥25 residents for ≥60 days/year. A community water system serves year-round residents of a community, subdivision, or mobile home park with ≥15 service connections or an average of ≥25 residents. A noncommunity water system can be nontransient or transient. Nontransient systems serve ≥25 of the same persons for >6 months of the year but not year-round (e.g., factories or schools), whereas transient systems provide water to places in which persons do not remain for long periods of time (e.g., restaurants, highway rest stations, or parks). Individual water systems are small systems not owned or operated by a water utility that serve <15 connections or <25 persons. Outbreaks associated with water not intended for drinking (e.g., lakes, springs and creeks used by campers and boaters, irrigation water, and other nonpotable sources with or without taps) are also classified as individual systems.

† 1 = untreated surface water; 2 = untreated groundwater; 3 = treatment deficiency (e.g., temporary interruption of disinfection, chronically inadequate disinfection, and inadequate or no filtration); 4 = distribution system deficiency (e.g., cross-connection, contamination of water mains during construction or repair, and contamination of a storage facility); and 5 = unknown or miscellaneous deficiency (e.g., contaminated bottled water or storage container).

§ Six persons had stool specimens that tested positive for *C. jejuni*, and one person had stool specimens that tested positive for *Y. enterocolitica*.

¶ Acute gastrointestinal illness of unknown etiology.

** Intentional bypass of a reverse osmosis filter occurred. Historically, filter bypass has been classified as treatment deficiency rather than as untreated water.

*Source: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5308a4.htm#tab3*

**TABLE 3. Waterborne-disease outbreaks associated with drinking water — United States, 2000 (n = 24)***

| State | Month | Class† | Etiologic agent | Number of cases | Type of system§ | Deficiency¶ | Source | Setting |
|---|---|---|---|---|---|---|---|---|
| California | Jul | I | Norwalk-like virus | 147 | Ncom | 2 | Well | Camp |
| California | Jul | I | *Escherichia coli* O157:H7 | 5 | Ind | 5 | River/creek | Camp |
| California | Sep | III | AGI** | 63 | Ind | 5 | Irrigation system | Football game |
| Colorado | Aug | III | *Giardia intestinalis* | 27 | Ncom | 3 | River | Resort |
| Florida | Mar | III | AGI†† | 19 | Com | 3 | Well | Trailer park |
| Florida | Apr | III | AGI | 21 | Com | 3 | Well | Trailer park |
| Florida | Apr | I | AGI | 71 | Ind | 2 | Well | Community |
| Florida | Jun | III | AGI§§ | 2 | Ind | 2 | Well | Household |
| Florida | Jul | III | AGI | 3 | Ind | 2 | Well | Household |
| Florida | Jul | III | AGI | 3 | Ind | 2 | Well | Household |
| Florida | Aug | III | AGI | 4 | Ind | 2 | Well | Household |
| Florida | Sep | III | *G. intestinalis* | 2 | Ind | 4 | Well | Household |
| Florida | Dec | III | *Cryptosporidium parvum* | 5 | Com | 4 | Well | Community |
| Idaho | Apr | III | *Es. coli* O157:H7 | 4 | Ind | 5 | Irrigation canal | Household |
| Idaho | Jun | III | *Campylobacter jejuni* | 15 | Ncom | 2 | Spring | Camp |
| Idaho | Jul | III | AGI | 65 | Ncom | 2 | Well | Restaurant |
| Kansas | Jun | III | Norwalk-like virus | 86 | Ncom | 2 | Well | Reception hall |
| Minnesota | Jun | III | *G. intestinalis*¶¶ | 12 | Ncom | 2 | Well | Camp |
| New Hampshire | Sep | III | *G. intestinalis* | 5 | Ind | 3 | Well | Household |
| New Mexico | Jul | II | *G. intestinalis* | 4 | Ind | 5 | River | Rafting trip |
| Ohio | Aug | I | *Es. coli* O157:H7 | 29 | Com | 4 | Surface water*** | Fairgrounds |
| Utah | Aug | III | *Ca. jejuni*††† | 102 | Ind | 5 | Irrigation water | Football camp |
| West Virginia | Jun | III | Norwalk-like virus | 123 | Ncom | 3 | Wells | Camp |
| Multistate | Apr–Aug | I | *Salmonella* Bareilly | 84 | Ind | 5§§§ | Municipal/spring§§§ | Wells/bottled water*** |

* An outbreak is defined as 1) ≥2 persons experiencing a similar illness after ingestion of drinking water and 2) epidemiologic evidence that implicates water as the probable source of the illness.

† On the basis of epidemiologic and water-quality data provided on CDC form 52.12.

§ Com = community; Ncom = noncommunity; Ind = individual; community and noncommunity water systems are public water systems that serve ≥15 service connections or an average of ≥25 residents for ≥60 days/year. A community water system serves year-round residents of a community, subdivision, or mobile home park with ≥15 service connections or an average of ≥25 residents. A noncommunity water system can be nontransient or transient. Nontransient systems serve ≥25 of the same persons for ≥6 months/year (e.g., factories or schools), whereas transient systems do not (e.g., restaurants, highway rest stations, or parks). Individual water systems are not owned or operated by a water utility and serve <15 connections or <25 persons. Outbreaks associated with water not intended for drinking (e.g., lakes, springs, and creeks used by campers and boaters; irrigation water; and other nonpotable sources with or without taps) are also classified as individual systems.

¶ 1 = untreated surface water; 2 = untreated groundwater; 3 = treatment deficiency (e.g., temporary interruption of disinfection, chronically inadequate disinfection, and inadequate or no filtration); 4 = distribution system deficiency (e.g., cross-connection, contamination of water mains during construction or repair, and contamination of a storage facility); and 5 = unknown or miscellaneous deficiency (e.g., contaminated bottled water).

** Acute gastrointestinal illness of unknown etiology.

†† Persons also reported rashes in addition to acute gastrointestinal illness.

§§ One person had a stool specimen that tested positive for *Blastocystis hominis*.

¶¶ Eight persons had stool specimens that tested positive for *G. intestinalis*; one stool specimen tested positive for *Dientamoeba fragilis*.

*** Type of water was not specified on report form.

††† Thirty-seven persons had stool specimens that tested positive for *Ca. jejuni*; four persons' stool specimens tested positive for *Es. coli* O157:H7, and three persons had stool that tested positive for *Es. coli* O111.

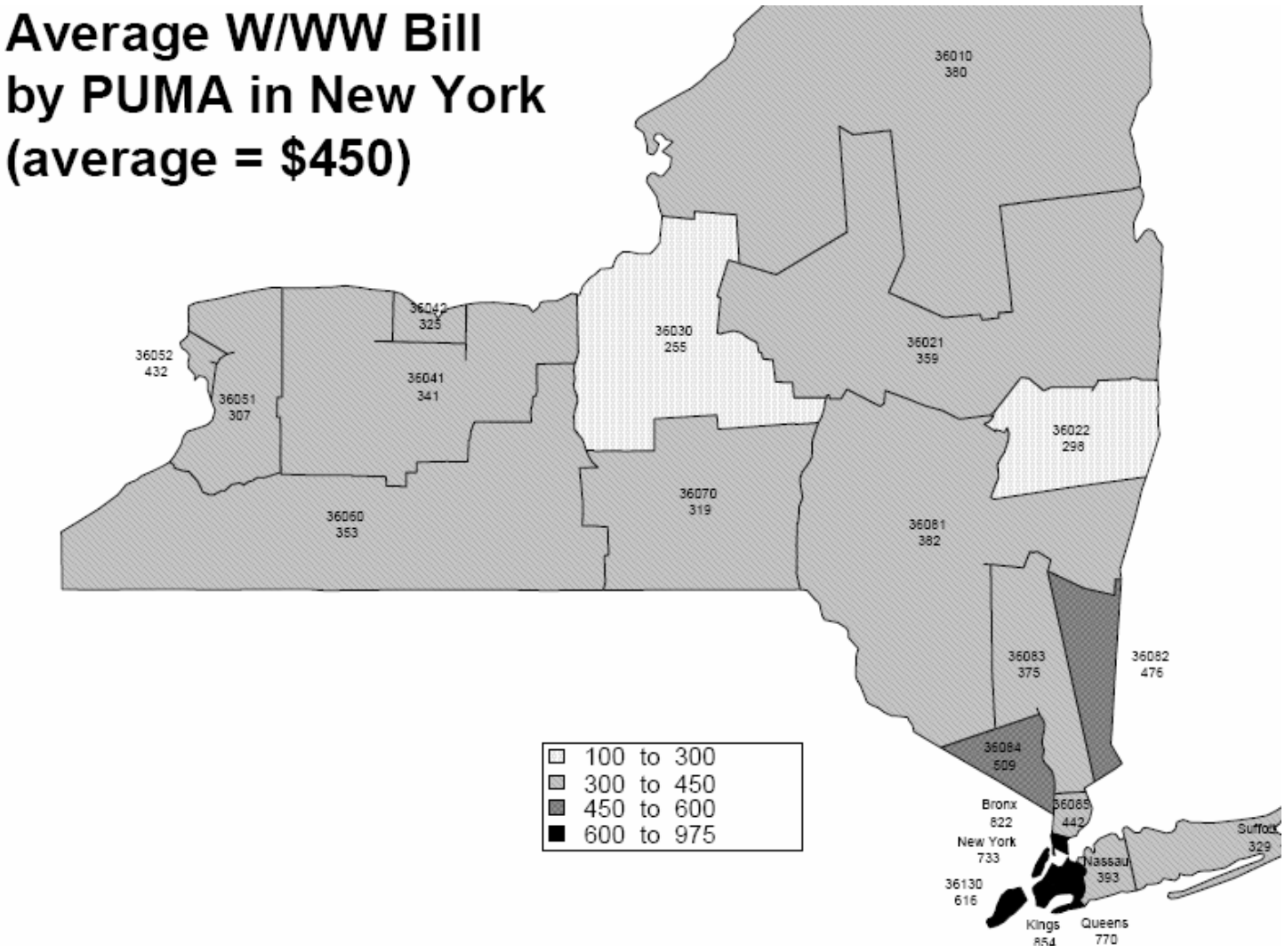
§§§ The outbreak implicated both drinking water from private wells and springs and water bottled by one facility. The bottling facility used two sources of water.

*Source: http://www.cdc.gov/mmwr/preview/mmwrhtml/ss5108a1.htm#tab3*

| Table No. | 1 | 45 | 31 |
|---|---|---|---|
| Table Title | Quintiles of Income - Average Annual Expenditures | Quintiles of Income - Shares of Average Annual Expenditures | Northeastern region by income before taxes |
| Category | Third 20 percent | Third 20 percent | $30,000 to $39,999 |
| Income before taxes | $37,542 | $37,542 | $34,422 |
| Age of reference person | 47.2 | 47.2 | 49.8 |
| Avg # of Persons in consumer unit | 2.5 | 2.5 | 2.3 |
| Avg # of Earners in consumer unit | 1.4 | 1.4 | 1.2 |
| % distribution Male | 53% | 53% | 49% |
| % distribution Black | 11% | 11% | 12% |
| Avg Annual Expenditures | $36,213 | $36,213 | $34,625 |
| Natural gas | $359 | 1.0% | $516 |
| Electricity | $1,018 | 2.8% | $835 |
| Fuel oil and other fuels | $102 | 0.3% | $265 |
| Telephone services | $932 | 2.6% | $899 |
| *Water and other public services* | *$321* | *0.9%* | *$205* |
| Gasoline and motor oil | $1,352 | 3.7% | $1,042 |
| Nonalcoholic beverages | $278 | 0.8% | $264 |
| Alcoholic beverages | $329 | 0.9% | $446 |
| Tobacco products and supplies | $347 | 1.0% | $344 |
| | *Source: US Bureau of Labor Statistics, Consumer Expenditure Survey, http://www.bls.gov/cex/* | | |

| Table No. | 7 | 2400 | 2400 |
|---|---|---|---|
| Table Title | Type of area | Population size of area of residence | Population size of area of residence |
| Category | Rural | Outside urbanized area | Urbanized area - Less than 100,000 |
| Income before taxes | $40,140 | $46,004 | $39,707 |
| Age of reference person | 51.1 | 49.4 | 47.7 |
| Avg # of Persons in consumer unit | 2.4 | 2.5 | 2.4 |
| Avg # of Earners in consumer unit | 1.3 | 1.3 | 1.2 |
| % distribution Male | 50% | 52% | 48% |
| % distribution Black | 5% | 6% | 17% |
| Avg Annual Expenditures | $35,157 | $38,228 | $33,705 |
| Natural gas | $194 | $248 | $321 |
| Electricity | $1,126 | $1,094 | $1,033 |
| Fuel oil and other fuels | $233 | $174 | $49 |
| Telephone services | $875 | $905 | $840 |
| *Water and other public services* | *$225* | *$297* | *$318* |
| Gasoline and motor oil | $1,587 | $1,439 | $1,111 |
| Nonalcoholic beverages | $296 | $262 | $254 |
| Alcoholic beverages | $292 | $333 | $287 |
| Tobacco products and supplies | $372 | $351 | $311 |
| | *Source: US Bureau of Labor Statistics, Consumer Expenditure Survey, http://www.bls.gov/cex/* | | |

| Average annual expenditures and characteristics of all consumer units, Consumer Expenditure Survey, 2000-03 | | | | |
|---|---|---|---|---|
| CEx Survey Item | 2000 | 2001 | 2002 | 2003 |
| Income before taxes | $44,649 | $47,507 | $49,430 | $51,128 |
| Age of reference person | 48.2 | 48.1 | 48.1 | 48.4 |
| Avg # of Persons in consumer unit | 2.5 | 2.5 | 2.5 | 2.5 |
| Avg # of Earners in consumer unit | 1.4 | 1.4 | 1.4 | 1.3 |
| % distribution Male | 53% | 51% | 51% | 50% |
| % distribution Black | 12% | 12% | 12% | 12% |
| Avg Annual Expenditures | $38,045 | $39,518 | $40,677 | $40,817 |
| Natural gas | $307 | $411 | $330 | $392 |
| Electricity | $911 | $1,009 | $981 | $1,028 |
| Fuel oil and other fuels | $97 | $112 | $88 | $110 |
| Telephone services | $877 | $914 | $957 | $956 |
| *Water and other public services* | $296 | $321 | $328 | $326 |
| Gasoline and motor oil | $1,291 | $1,279 | $1,235 | $1,333 |
| Nonalcoholic beverages | $250 | $256 | $254 | $268 |
| Alcoholic beverages | $372 | $349 | $376 | $391 |
| Tobacco products and supplies | $319 | $308 | $320 | $290 |
| *Source: US Bureau of Labor Statistics, http://www.bls.gov/cex/2003/standard/multiyr.pdf* | | | | |




*Source: http://www.nrwa.org/whitepapers/afford/afford04/Figures/figure2.pdf*

| Year | 0 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|
| | | | | | |
| Discount Rate [real interest rate = 5%] | 1.00000 | 1.27628 | 1.62889 | 2.07893 | 2.65330 |
| | | | | | |
| | | | | | |
| *Septic - Recurring Costs* | | | | | |
| Maintenance [yrs 3, 6, 9, 12, 15, 18, @ $375] | $1,390.51 | | | | |
| Pipe Cleaning [yrs 4, 8, 15, 19, @ $150] | $356.44 | | | | |
| Pipe Replacement [yr 11, @ $1000] | $584.68 | | | | |
| **Subtotal PV of Septic Recurring Costs** | **$2,331.64** | | | | |
| | | | | | |
| *Septic - Lifetime Costs (every 20 yrs)* | | | | | |
| Installation [$6500] | $6,500.00 | $5,092.92 | $3,990.44 | $3,126.61 | $2,449.78 |
| | | | | | |
| **Septic - PV of Total Costs** | **$8,831.64** | **$7,424.56** | **$6,322.07** | **$5,458.25** | **$4,781.42** |
| | | | | | |
| *Well - Recurring Costs (Annual)* | | | | | |
| Coloform test [$30] | $373.87 | | | | |
| Salt [$100] | $1,246.22 | | | | |
| **Subtotal PV of Well Recurring Costs** | **$1,620.09** | | | | |
| | | | | | |
| *Well - Lifetime Costs (every 20 yrs)* | | | | | |
| Replacement Pump [$600] | $600.00 | $470.12 | $368.35 | $288.61 | $226.13 |
| Replacement Tank [$350] | $350.00 | $274.23 | $214.87 | $168.36 | $131.91 |
| Softener [$1400] | $1,400.00 | $1,096.94 | $859.48 | $673.42 | $527.65 |
| **Subtotal PV of Well Lifetime Costs** | **$2,350.00** | **$1,841.29** | **$1,442.70** | **$1,130.39** | **$885.69** |
| | | | | | |
| **Well - PV of Total Costs** | **$3,970.09** | **$3,461.37** | **$3,062.78** | **$2,750.48** | **$2,505.78** |
| | | | | | |
| **TOTAL PV of PRIVATE OWNERSHIP** | **$12,801.72** | **$10,885.93** | **$9,384.86** | **$8,208.73** | **$7,287.20** |
| | | | | | |
| ***Equivalent Annual WSS Payment*** | ***$1,025*** | ***$870*** | ***$750*** | ***$655*** | ***$580*** |
| | $12,774 | $10,842 | $9,347 | $8,163 | $7,228 |
| | | | | | |
| | | | | | |

| Annual Municipal WSS Charges | **PV of MUNICIPAL OWNERSHIP** |
|---|---|
| $250 | **$3,115.55** |
| $300 | **$3,738.66** |
| $350 | **$4,361.77** |
| $400 | **$4,984.88** |
| $450 | **$5,607.99** |
| $500 | **$6,231.11** |
| $550 | **$6,854.22** |
| $600 | **$7,477.33** |
| $650 | **$8,100.44** |
| $700 | **$8,723.55** |
| $750 | **$9,346.66** |

| Year | 0 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|
| | | | | | |
| Discount Rate [real interest rate = 7.5%] | 1.00000 | 1.43563 | 2.06103 | 2.95888 | 4.24785 |
| | | | | | |
| | | | | | |
| *Septic - Recurring Costs* | | | | | |
| Maintenance [yrs 3, 6, 9, 12, 15, 18, @ $375] | $1,126.64 | | | | |
| Pipe Cleaning [yrs 4, 8, 15, 19, @ $150] | $285.08 | | | | |
| Pipe Replacement [yr 11, @ $1000] | $451.34 | | | | |
| **Subtotal PV of Septic Recurring Costs** | **$1,863.06** | | | | |
| | | | | | |
| *Septic - Lifetime Costs (every 20 yrs)* | | | | | |
| Installation [$6500] | $6,500.00 | $4,527.63 | $3,153.76 | $2,196.78 | $1,530.19 |
| | | | | | |
| **Septic - PV of Total Costs** | **$8,363.06** | **$6,390.70** | **$5,016.83** | **$4,059.84** | **$3,393.25** |
| | | | | | |
| *Well - Recurring Costs (Annual)* | | | | | |
| Coloform test [$30] | $305.83 | | | | |
| Salt [$100] | $1,019.45 | | | | |
| **Subtotal PV of Well Recurring Costs** | **$1,325.28** | | | | |
| | | | | | |
| *Well - Lifetime Costs (every 20 yrs)* | | | | | |
| Replacement Pump [$600] | $600.00 | $417.94 | $291.12 | $202.78 | $141.25 |
| Replacement Tank [$350] | $350.00 | $243.80 | $169.82 | $118.29 | $82.39 |
| Softener [$1400] | $1,400.00 | $975.18 | $679.27 | $473.15 | $329.58 |
| **Subtotal PV of Well Lifetime Costs** | **$2,350.00** | **$1,636.91** | **$1,140.21** | **$794.22** | **$553.22** |
| | | | | | |
| **Well - PV of Total Costs** | **$3,675.28** | **$2,962.20** | **$2,465.49** | **$2,119.50** | **$1,878.50** |
| | | | | | |
| **TOTAL PV of PRIVATE OWNERSHIP** | **$12,038.35** | **$9,352.89** | **$7,482.31** | **$6,179.35** | **$5,271.75** |
| | | | | | |
| ***Equivalent Annual WSS Payment*** | ***$1,180*** | ***$915*** | ***$730*** | ***$605*** | ***$515*** |
| | $12,030 | $9,328 | $7,442 | $6,168 | $5,250 |
| | | | | | |
| | | | | | |
| Annual Municipal WSS Charges | **PV of MUNICIPAL OWNERSHIP** | | | | |
| $250 | **$2,548.62** | | | | |
| $300 | **$3,058.35** | | | | |
| $350 | **$3,568.07** | | | | |
| $400 | **$4,077.80** | | | | |
| $450 | **$4,587.52** | | | | |
| $500 | **$5,097.25** | | | | |
| $550 | **$5,606.97** | | | | |
| $600 | **$6,116.69** | | | | |
| $650 | **$6,626.42** | | | | |
| $700 | **$7,136.14** | | | | |
| $750 | **$7,645.87** | | | | |

| Year | 0 | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|
| | | | | | |
| Discount Rate [real interest rate = 10%] | 1.00000 | 1.61051 | 2.59374 | 4.17725 | 6.72750 |
| | | | | | |
| | | | | | |
| *Septic - Recurring Costs* | | | | | |
| Maintenance [yrs 3, 6, 9, 12, 15, 18, @ $375] | $929.16 | | | | |
| Pipe Cleaning [yrs 4, 8, 15, 19, @ $150] | $232.86 | | | | |
| Pipe Replacement [yr 11, @ $1000] | $350.49 | | | | |
| **Subtotal PV of Septic Recurring Costs** | **$1,512.52** | | | | |
| | | | | | |
| *Septic - Lifetime Costs (every 20 yrs)* | | | | | |
| Installation [$6500] | $6,500.00 | $4,035.99 | $2,506.03 | $1,556.05 | $966.18 |
| | | | | | |
| **Septic - PV of Total Costs** | **$8,012.52** | **$5,548.51** | **$4,018.55** | **$3,068.57** | **$2,478.70** |
| | | | | | |
| *Well - Recurring Costs (Annual)* | | | | | |
| Coloform test [$30] | $255.41 | | | | |
| Salt [$100] | $851.36 | | | | |
| **Subtotal PV of Well Recurring Costs** | **$1,106.76** | | | | |
| | | | | | |
| *Well - Lifetime Costs (every 20 yrs)* | | | | | |
| Replacement Pump [$600] | $600.00 | $372.55 | $231.33 | $143.64 | $89.19 |
| Replacement Tank [$350] | $350.00 | $217.32 | $134.94 | $83.79 | $52.03 |
| Softener [$1400] | $1,400.00 | $869.29 | $539.76 | $335.15 | $208.10 |
| **Subtotal PV of Well Lifetime Costs** | **$2,350.00** | **$1,459.17** | **$906.03** | **$562.57** | **$349.31** |
| | | | | | |
| **Well - PV of Total Costs** | **$3,456.76** | **$2,565.93** | **$2,012.79** | **$1,669.33** | **$1,456.08** |
| | | | | | |
| **TOTAL PV of PRIVATE OWNERSHIP** | **$11,469.28** | **$8,114.44** | **$6,031.34** | **$4,737.90** | **$3,934.78** |
| | | | | | |
| ***Equivalent Annual WSS Payment*** | ***$1,345*** | ***$950*** | ***$705*** | ***$555*** | ***$460*** |
| | $11,451 | $8,088 | $6,002 | $4,725 | $3,916 |
| | | | | | |
| | | | | | |
| Annual Municipal WSS Charges | **PV of MUNICIPAL OWNERSHIP** | | | | |
| $250 | **$2,128.39** | | | | |
| $300 | **$2,554.07** | | | | |
| $350 | **$2,979.75** | | | | |
| $400 | **$3,405.43** | | | | |
| $450 | **$3,831.10** | | | | |
| $500 | **$4,256.78** | | | | |
| $550 | **$4,682.46** | | | | |
| $600 | **$5,108.14** | | | | |
| $650 | **$5,533.82** | | | | |
| $700 | **$5,959.49** | | | | |
| $750 | **$6,385.17** | | | | |