DERIVING EQUITABLE WATER RATE STRUCTURES FOR SMALL MUNICIPALITIES

by

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ABSTRACT

This paper reviews the various infrastructure problems besetting city, state and national governments, but, because of water's critical importance to the general population, it places great emphasis on small public and private water utilities and the need for equity in water rate structures. Because of the complexity of directly relating budget expenses to water rates, this process is often ignored in the burden of administration detail. The solution is a simplified methodology to aid administrators in their task of establishing equitable water rates.

This solution evolved out of a summer internship with the City of Great Falls, Montana, where the author examined current water rates for equity on a Lotus 1-2-3 spreadsheet. This paper addresses the need for a simplified method of allocating those costs directly to water rates. A detailed explanation of how basic water rate structures are developed is presented. The compilation of a sample case municipal budget and water rate structure development provides a practical walk-through manual for anyone interested. The calculations can be duplicated with most hand-held calculators. The results are easy to follow and have all the essential elements required to be persuasive in the justification of any necessary water rate increases.

CHAPTER 1

INTRODUCTION

> Dramatic changes in economic conditions . . . have had a far-reaching influence on water utility operational and financial management. Accelerating inflation and resulting cost effects on water utility customers, as well as increased awareness of the need for conservation of natural resources have challenged utility managers to continue providing high quality service to water utility customers on an equitable and fair cost basis.[1]

Historically, as the United States expanded and developed westward, its citizens were eager to enjoy the luxury of unpolluted water to their homes. They were also thankful that typhoid, cholera and other deadly diseases were held at bay due to water treatment procedures. Clean and plentiful water has always been considered of prime importance for any burgeoning community, not only for the health of its people but for the expansion of its industries. In 1973, the U.S. Department of Commerce released a report which indicated that plentiful water, good waste water treatment plants and roads were the main requirements for any major industry to move to and remain in a community.

In the past, our country's expansionist growth demanded huge infusions of money and capital goods. The railroads had to be totally built before one item was shipped or one penny could be earned. There was no way to connect one

city to another without the whole system being in place. The same was and is true of gas, electricity, telephone, sewer and water systems. The systems have to be built with all the capacity required to deliver the completed product to its destination at the very beginning of the project. Hence, capital investment is critical for the development of a water system as well as for capital improvements through the life of the system.

It has been noted that:

> Water utilities are extremely capital intensive, requiring nearly $4.00 of gross capital investment for each $1.00 in sales revenue. For comparison, electrical utilities require less than $3.00 of investment per $1.00 of revenue, while the non-regulated general business sector averages barely $0.50 of capital investment per $1.00 of revenue.[2]

There are serious problems in the physical infrastructure of this nation. Although the definition of infrastructure includes roads, bridges, and sewer and water systems, the water utilities are the most critical. A water utility is crucial to the health and safety of the whole populace; a community can survive without roads, bridges and even sewer systems, but not without potable water. Today, across the United States, many public and private water utilities are facing economic crises.

Communities east of the Mississippi have systems that are over a century old and for decades they have been plagued with the problem of regenerating their water utility systems. Only recently, however, have the communities west of the Mississippi been forced to face their aged systems' problems. These

problems, coupled with slow economic growth, have caused severe dislocation in water utility budgets. Unfortunately,

> Many community water systems rely on the original wooden water pipes that were installed at the turn of the century. In 1983, a water supply needs survey was conducted for Montana's incorporated communities. Based on survey results from 75 percent of Montana municipalities and on projections for those 25 percent of Montana municipalities who did not respond to the survey, $100 million was estimated for water supply repairs. This figure does not include the needs of more than 275 rural water systems in the state.[3]

The American Water Works Association reported,

> During the late 1960s and 1970s financial conditions of many water utilities weakened due to increases in operating costs. These increases were, in turn, due to inflation, growth related demands, and public pressure to keep water rates low. Despite growing maintenance needs, water utilities tended to postpone maintenance in order to keep operating costs and corresponding service charges as low as possible.[4]

Today, the main difficulty facing a water utility is the need to maintain existing facilities, replace, and expand the utility without the formerly dependable federal infusions of money. In the past, the federal government was eager to subsidize the utilities and railroads in order to expand the country's frontiers. However, now the federal government has been promoting a policy of "every man for himself," as revenues have almost disappeared. For this reason many utilities are considered self-sufficient enterprise funds. This means that they are responsible for obtaining enough revenue from water rates to pay for operation, maintenance, capital projects and debt service.

Difficult as it is for the decision makers to carry the burden of failing water utilities, they must also face stiff competition from other agencies within the same government (for roads, bridges, sewage plants, distribution lines), as all other infrastructure components are also in dire need of rejuvenation and replacement. If this federal mandate remains a guide to utilities, drastic increases in rate structures must take place.

Administrators must be certain that in terms of accountability all monies are spent frugally and efficiently, and that consumer costs are kept low. However, beyond accountability, administrators can compare revenues to expenses and know if the water utility is running at a deficit. If the small utility is running at a deficit, and most are, the water rates must be increased. However, it is difficult to determine how much the rates need to be increased and to know if the increase will be equitably distributed among the user classes.

Part of the problem facing many municipalities is the lack of sufficient in-house documentation and expertise to convince city commissioners, the Public Service Commission, and the public of the need for increasing water rates. Indeed, few private or public utilities have the staff and time available to become knowledgeable in calculating water rates. Therefore, in order to justify large rate increases, many municipalities are forced to have professional engineering firms complete engineering studies of their water systems. Armed with this professional documentation, administrators then feel secure enough to plead their case before the City Commission, the Public Service Commission and the general

public. Unfortunately, the high cost of these engineering studies can tax a city's already strained budget.

What is needed is a handbook or walk-through exercise that any utility employee could quickly utilize to determine if current water rates reflect actual expenditures and are equitable to the customer. This paper focuses on the practical analysis of deriving equitable water rate structures to aid the administrators in their task of garnering support for increased water fees. As most Montana municipalities use line item budgets to break down the individual water expenditures by functional components, that format is used in this paper. This methodology is consistent with the requirements of the American Water Works Association's *Water Rates Manual* as the correct methodology for creating equitable water rate structures.

This paper reviews the dual role of economic conditions and various regulations that cause problems in the operation of water utilities. Additionally, various sources of financing for water utilities capital projects are surveyed and explained. Finally, a methodical, step-by-step procedure is provided to permit development of equitable water rate structures.

End Notes

[1]American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), iv.

[2]American Water Works Association, A Manual of Water Utility Capital Financing, M29, 1st ed. (Denver, CO: Author, 1988), vi.

[3]Montana Department of Commerce, Governor's Task Force on Infrastructure (Helena, MT: Montana Legislative Council, December 1984), 15.

[4]American Water Works Association, A Manual of Water Utility Capital Financing, vi.

CHAPTER 2

HAMPERING ECONOMIC CONDITIONS AND REGULATIONS

Economic conditions have long been a factor in the delay in addressing failing water systems. Many areas in the United States have lost population, and this has reduced not only the municipalities' tax base but the number of consumers available to pay the utility fees. So, too, private utilities are unable to carry any more debt when their user base disappears. Unfortunately, even with lower tax bases and users, utilities are pressured to continue providing the same level of services.

The problems are exacerbated by voter mandates such as Propositions 13 in California and 105 in Montana which hold property tax levels at previous years' levels. Even with the mandate of capping property tax levels, the Montana Department of Commerce reports that Montana's property taxes are still 49 percent higher than the national average. This makes the administrator's task of raising water rates doubly difficult.

With the loss of federal aid, the states are providing 70 percent of all infrastructure investment. Unfortunately, these monies are targeted for ongoing operation and maintenance, not for new construction or replacement activities.

Thus, the administrators must search for new and innovative ways to finance public water utilities capital improvements. State government will have to assist in the transformation from cities being "federally aid dependent" to "state and local aid dependent" or "independent." In Montana, the Governor's Task Force on Infrastructure recommended the state legislature implement the following to aid in that task:

> Revise existing capital improvement statutes to provide more incentive for their use.
>
> Provide to local governments new revenues that meet the following conditions: (a) eases the property tax burden; (b) allows for expansion of local option taxes; (c) maintains the program of state assistance through the local government block grant.
>
> Increase flexibility for use of short term debt/lease purchase statute by eliminating the $150,000 ceiling which triggers the local election requirement.
>
> Eliminate necessity of 40% turnout for local bond elections.
>
> Provide assistance in planning and financing infrastructure. . . .[1]

Montana municipalities are bound by unique and shortsighted statutes; they are forbidden, by State law, to save any part of their rate revenues from year to year for capital improvements. It has been recommended that the state legislature "provide statutory authority for water, sewer and solid waste programs to create a 'replacement fund' (based on a percent of the operation-maintenance budget) and mandate use of these funds only for replacement, and establish legal authority to carry these funds over from year to year."[2]

Because of hampering statutes in Montana, few replacement programs have been instigated by the municipalities. Currently five small (under 30,000 population) cities in Montana have obtained bond financing for $3,469,943. As just a hypothetical calculation, if half of the remaining 128 Montana municipalities need capital water bond financing, the cost could total over $44,000,000. This debt will have to be paid through increased revenue from water rates charged the consumer.

Unfortunately, utilities face the hard choice of currently carrying more debt or letting their systems deteriorate until a crisis emerges. Rural water districts as well as Special Improvement Districts (SID's) can be created to solve the need for new facilities or improve old distribution systems. Ron Woods of the Montana Public Service Commission indicated that

> Montana law limits the amount of debt that can be incurred by Special Improvement Districts to no more than five percent of the total value of the taxable property of the municipality, and that limit can be expanded only to obtain a water supply. Additionally, no capital debt or SID can be created without a majority vote of the affected taxpayers.[3]

As SID's are guaranteed by the taxing authority of the municipality, it becomes crucial for management to communicate the needs of the utility so the consumer can make the best decision possible.

Revenue Bonds are the typical source of funds for a municipality and they do not require the voted approval of the community. The only limit on Montana revenue bonds is the community's ability to pay.

As shown, the crisis of water utilities did not just appear. It has been compounded by small, incremental changes over time within the environment of water utilities. Within a decade many utilities will have to replace their water distribution systems and/or treatment plants, as they are 25 to 100 years old and deteriorating. "To address the infrastructure crises facing the water utility industry and the continuing need for plant expansion and/or replacement, water utilities will be required to systematically engage in a capital requirement planning process."[4]

The cost to replace these systems will be added to the already burgeoning expenses carried by utilities. One of the major causes of economic dislocation in municipal budgets is existing and new or expanded state and federal regulations. One of the existing constraints that hampers water utilities is water rights law.

Water Rights

Water rights, or lack thereof, are another burden shouldered by many western United States municipalities. Most western states are under the prior appropriation right to water.

> It permitted diversions to both riparian and non-riparian lands and allowed stream diminution. Moreover, it gave the prior appropriator the better right to the extent of his appropriation for beneficial use, according to the principle, first in time, first in right.[5]

Although various attempts at adjudication, or division of the water rights, have been tried, few have been implemented successfully. Thus, many municipalities are at the mercy of "first in time, first in right" users. Recently, the lack of water due to drought and natural climatic conditions in arid states west of the Mississippi has been critical, especially in Oklahoma, Kansas, Colorado, Nevada, Montana, Wyoming, New Mexico, Arizona and California. Many states are finding their underground source water aquifers drying up and they are pressed to identify other ways to obtain water for their citizenry.

For example, the sale and purchase of water rights is becoming a booming business. "Local farmers sold their water rights, which allow them to consume a fixed amount of water annually, to Public Service Company of Colorado for $25 million."[6] Large population centers, which are trying to encourage future growth, understand that only by purchasing additional water rights will they be able to sustain their community's growth. Although irrigation water rights are being sold to municipalities in many states, this practice is limited in other states. Unfortunately for Bozeman, Montana, after purchasing irrigation water rights, it found that under Montana law those irrigation water rights are not transferrable to a municipality. Occasionally, a municipality will have no water rights.

Great Falls, Montana, located at the conjunction of two major rivers, the Sun and the Missouri, is unique in that it owns no water rights. Montana Power Company owns all water rights up river from nearby Marony Dam and recently won a court battle reestablishing the company's rights against the City of Great

Falls and a few hundred other landowners along the Missouri River. Even if the Montana legislature allowed Great Falls to take the water rights by eminent domain, it could be very expensive as the city would have to pay just compensation to Montana Power. Currently, Great Falls has a one-year agreement to draw required water for the city's needs free of charge. However, that could change next year and they could be charged a fee. It is not only the cost which is important, but also the amount of water required to sustain a city.

Because one acre foot of water contains only 325,850 gallons, which will supply a family of four for one year in hot climates, it takes hundreds of acre feet to satisfy a midsize community. In arid northern climates, such as Montana, only 180,000 gallons of water will supply a family of four for one year. The difference is the high evaporative and irrigation trends in hot, arid climates, but the cost difference to the water utility is significant. In Denver, Colorado, water rights are selling for $3,000 to $6,000 per acre foot. Hence, it could easily cost $60 million to obtain water rights for a city of 20,000 people at $3,000 per acre foot. In fact,

> Cities such as Phoenix and Tucson, Arizona have invested in water ranching. Arizona state law makes it difficult to buy rights to water independent of land; therefore, if cities require water, they must acquire the land. About 300,000 acres of Arizona farmland already have been taken out of production.[7]

This causes an additional problem for tax districts because once water rights have been sold off, the farmland's taxable value is drastically reduced, lowering the tax base for the various governmental units. It should be clarified here that most municipalities operate their water utilities as an enterprise fund and tax

revenues do not enter into the equation of water rates. The solution for one governmental agency can cause problems for another.

Environmental Protection Agency Regulations

Given the reduced revenues, one would hope for reduced requirements. However, during the past decade there have been increased environmental and safety standards that administrators must consider any time a new project is implemented. In December 1974, Congress passed the *Safe Drinking Water Act* which requires all water utilities to meet national minimum standards of water purity in order to protect the health of the consuming public.

Each state was given the authority to enforce the drinking water standards regardless of the impact on municipal budgets, and many municipalities have been cited for failing the legislative mandates. "The identified shortcoming pertained to the lack of sufficient, full-time and adequately trained operators; operator apathy towards federal standards; and, most significantly, insufficient funding to meet federal requirements."[8]

In 1986, the U.S. Environmental Protection Agency (USEPA) ruled that municipalities must conduct tests for an additional 100 pathogens in treating their water. Additionally, the EPA's ruling that the treatment plant's disposal of sludge be treated as hazardous waste was detrimental to many municipalities. The sludge consists of particulate matter that precipitates out in the treatment of raw water. Raw water is often drawn directly from the rivers, and any rainfall up-river

can cause muddy water to enter the treatment plants. With the addition of water purifiers the mud particulate drops out, leaving a brownish, glutinous mass that is discharged into holding ponds.

The aluminum that is precipitated out of the treated water reacts with other chemicals found naturally in river water; thus the sludge cannot be returned to a river as any reaction could cause "possible hazardous waste." Because Montana does not have any designated hazardous waste sites, it costs the City of Great Falls $65,000 to have the waste shipped out of state to the nearest designated dump site. These unexpected costs often come out of revenues needed for day-to-day operations and cause dislocation of the utility's total budget and consequent increases in water rates.

Summary

The sluggish economy that has plagued the United States since the early 1980's has combined with limited tax revolts and outdated statutes to cripple many municipal water utilities. Working to overcome these problems is difficult enough; however, some cities also lack sufficient water rights to assure a continued source of water for their systems and their people. Additionally, although increased EPA regulations are aimed at purification of the drinking water, the unexpected spinoffs are higher treatment costs and expensive sludge disposal techniques. Due to unanticipated costs like these, it is becoming more

imperative that water utilities become self-sustaining water enterprise funds and review their sources of capital financing.

End Notes

[1]Montana Department of Commerce, Governor's Task Force on Infrastructure (Helena, MT: Montana Legislative Council, December 1984), 20.

[2]Ibid., p. I-52.

[3]Ron Woods, Water Utility Section, Montana Public Service Commission, Helena, telephone interview with author, 26 January 1990.

[4]American Water Works Association, A Manual of Water Utility Capital Financing, M29, 1st ed. (Denver, CO: Author, 1988), 1.

[5]Robert Dunbar, "Montanans Still Seeking Secure Water Rights," High Country News [Great Falls, MT], 27 August 1980: 1.

[6]"Where Water Is Money in the Bank," Business Week, 15 August 1968: 50.

[7]"Water, Water Everywhere, but Not for Long," The Washington Post National Weekly Edition, 6-12 November 1989: 23.

[8]American Water Works Association, p. 6.

CHAPTER 3

FINANCING METHODS

> Government, by nature, tends to be myopic. Short-term budget and political pressures often crowd out the preparation of long-range plans, so that most of the Government seldom plans more than one or two years ahead. In many cases, this does not permit enough time to make intelligent decisions to properly anticipate new or changed demands for programs or services.[1]

Many of the problems with the nation's infrastructure were caused by neglect and underinvestment in repairing and replacing facilities, as they failed in the past. Other utilities were caught short by the rapid growth of their cities. Unfortunately, the water utilities that deferred required maintenance are now faced with higher rehabilitation costs as well as high interest rates, distressing economic conditions, and a disinterested federal government. These conditions have been the norm across the nation for the past 20 years; additionally, most administrators must face the question of equitable distribution of costs.

Water utilities have the dubious distinction of being on the line every minute that they supply water to a population, so any mistake in the treatment of water could have serious ramifications throughout the city. No other enterprise type fund is more important financially and politically to the

management of a municipality. It is a dependable source of revenue to the city, as few other funds generate their own operating funds; however, not all water utilities are efficient.

> Deficient capital, unskilled management, slipshod accounting and bookkeeping, unreliable operations and maintenance, substandard water quality, poor customer service, non-cost-based rates and ill-prepared rate case applications--a large proportion of the thousands of small water utilities in the United States may have some or all of these problems.[2]

The same charges could be leveled at not only public utilities but also at private water utilities.

Private Water Utilities

Private water companies are especially susceptible to financial default and decayed systems.

> Small water companies share similar operating characteristics. Their owners tend to be inexperienced at running a utility, often because the systems are secondary to their chief business, usually real estate. Many water systems operate with inadequate revenues, caused by their owner's reluctance to raise rates. Such reluctance may stem from fears that high water bills could stifle real estate sales, or spark hostile reactions from friends and neighbors who are on the system. Either way, inadequate rates result, leading to deferred or neglected maintenance and increasingly unprofitable operations.[3]

Private water companies that service small populations have an extremely difficult time as their systems age. Because they lack the economies of scale that large water utilities have, small utilities cannot charge high enough water

rates to pay day-to-day expenses and often have no reserve or replacement funds. "Combine the low sales potential with inefficient equipment and . . . the average company cannot recover the revenues required to survive."[4]

Numerous private systems are already in trouble.

> Bankers generally balked at lending money to water and sewer systems because they could not readily be sold for cash after a default. Equally troubling, the banks could find themselves running the water company if a buyer could not be found after a default.[5]

For example, Butte, Montana is faced with a crumbling water system, and it has been estimated that water rate fees will be "in excess of a 100 percent increase over the five-year term."[6] Costs to improve the system are estimated at over $42 million, which is very difficult for a private company to finance. Because of the importance of financing to a publicly and privately owned utility, the following will review various avenues available to a water utility to rectify this problem.

Private utilities have access to the usual financing methods available to any corporation or business. However, efficient or not, private and public water utilities are expected to generate the revenue required to operate the systems.

Public Water Utility Enterprise Funds

Public water utilities are usually operated as enterprise funds, which are different accounting entities than found in the general budget allocations.

Enterprise funds are established to track revenues and expenditures usually in response to a state statute. Water utilities are very important enterprise funds to any city, not only for benefits provided in potable water, but also for the jobs created. Most municipalities of any size have a water treatment plant, booster pumps, storage tanks, and fire hydrants. All these facilities require trained employees such as meter readers, lab technicians, plant operators, engineers, billing and clerical staff, finance personnel, construction crews and supervisors.

The water department is critical to the health and safety of the whole populace. The water quality for drinking water is regulated by the *Safe Drinking Water Act* (SDWA) of 1974, which stipulates a maximum contaminant level for physical, chemical, biological and radiological substances in the water. Every utility must regularly sample and analyze its water. Any mistake in the treatment of the water could have serious ramifications throughout the city.

Because of water's crucial role, it is very important that administrators develop a financial plan that will address the way to finance capital improvements for a water utility as other sources of revenue disappear. If current water rates are adequate, these funds can be used to finance plant improvements. In some states water utilities pay for needed improvements out of extra revenue generated from water rates. The revenue earned that is not needed for daily operation and maintenance expenses or capital debt service

can be used for replacement or expansion programs. However, in some states water rate income may be limited to replacement of vehicles or other equipment, often with a monetary or time limit. Montana has a three to five year time limit. However, where allowed by law, a few Public Service Commissions are encouraging utilities to increase their rates to lessen the impact of inflation and loss of federal grants. Even with increased rates, gaining financing is the critical factor for any capital improvement project.

There are various methods of capital financing available to municipalities. They include: general obligation bonds, revenue bonds, special assessment districts, state and federal grant funding, or contributions from developers.

Revenue Requirements

In the sparsely populated state of Montana it has been determined that 49 percent of its communities require new or improved water systems.[7] With low tax revenues and tax initiatives that place property tax increases on hold, it is difficult for city planners and state agencies to address these needs through old methods of revenue raising.

When municipal water utilities fail to generate sufficient revenue, it impacts the whole budget, taking monies that are needed elsewhere. When private water utilities fail, it results in bankruptcy for the owner. The questions then become: Who monitors and repairs the water source, the water treatment facility, the distribution lines, and who pays the bills? Every

community with a private or public water system is at risk and residents of these communities face a difficult future of higher water rates.

Unfortunately for the rate payer, if a shortfall is experienced, the utility will not be able to get sufficient aid from the federal government. For example, when the *Environmental Protection Act* announced it would require $83.5 billion to meet the *Clean Water Act* (wastewater) requirements, it was noted that only $2.46 billion had been earmarked for these needs. With these cuts in federal spending, few utilities are economically solvent enough to float general obligation and revenue bond issues, the usual source of long term debt financing. In fact, needed replacement of water distribution systems could bankrupt some small cities and towns.

General Obligation Bonds

General obligation bonds are debt instruments backed by the full faith and credit of the municipality issuing them. The principal and interest are paid back over a 20-30 year period of time. The bonds force the municipality to levy the necessary taxes in order to pay the debt without restricting revenues. Some of the advantages of general obligation bonds are that they are less restrictive in their documentation, covenants, special reserves, and have a higher debt service ratio than revenue bonds. These bonds usually are rated highest by investors and thus are very marketable. They provide the lowest interest rates and lowest marketing costs available to municipalities. Unfortunately, one of the disadvantages of general obligation

bonds is that they require an approval by voters. There may also be debt and interest limitations set by some state statutes. In some states, such as Montana, general obligation bonds are not used to finance major capital projects of utilities.

Special Assessment or Improved Districts

Special assessment or improvement districts are more specialized and delineated projects which may be permitted within a municipality. One subdivision in a city could borrow the money to install water distribution lines, booster station, or whatever is needed. Liens against the property within that district are then assessed and payments made yearly until the debt is repaid. This can be a dangerous activity. For example, one Montana municipality allowed a developer to establish a special assessment district and commit the community to a several million dollar debt. The developer left the community owing the total assessment when the economy failed. Recently, the citizens of the municipality voted to default on their obligation. Although this is a very rare occurrence, this city will be unable to borrow money from any source for a very long time.

Contributions-in-Aid-of-Construction
or Connection Charge

Contributions-in-aid-of-construction or connection charge is another method of meeting the expenses of a water utility. These charges are a one-time charge placed on new connections to a utility facility.

> The fees make newcomers pay for any additional plant needed to serve them. CIAC help ensure that existing customers do not bear the cost of new utility plants needed by new customers. CIAC often are seen as an indication that existing customers are unwilling to pay for infrastructure improvements required for new customers.[8]

The connection charge is a fee to new consumers when they connect to an existing water distribution line. A connection charge ties in with the idea of the benefit principle and the marginal-cost pricing theory. Whenever new customers connect to an existing water utility line, they are the recipients of a "benefit."

> The benefit is a utility system that is available for their usage. The value of the benefit is based upon the new customer's need or demand for the utility. The connection charge is the new customer's payment for this benefit based upon the marginal cost of providing the utility.[9]

This connection charge assures equity within the rate system. Thus, every new customer pays a fair share of the costs incurred when the system was first implemented and paid for.

> This connection charge, derived specifically from the cost of system expansion, is analogous to marginal cost pricing. The new customer demands an incremental or marginal utility system capacity. The new customer's connection charge is equal to the incremental cost of constructing the new customer's increment of the utility system capacity.[10]

Although connection charges are just one of many other sources of revenue available to a water utility, they are important in fostering an understanding of the theory behind water rate structures, as they address the problem of equity in all charges for water.

> Marginal cost is the additional cost of producing or selling a single incremental unit. The two components of marginal costs are: first, the change in operating costs caused by changing the rate of utilization of existing capacity and, second, the cost of expanding capacity, including the operating costs associated with increased capacity. While fully distributed costs are based on embedded historic accounting costs, the calculation of marginal costs involves projecting future operating and capacity costs for a specified time span dependent on forecast increase in the quantity demanded of the service. Such projects must take into account certain features of water utilities, such as relatively high fixed costs, health and safety regulations, and weather-sensitive usage.[11]

> When applying marginal-cost pricing to the water industry, four factors are important. First is that water utilities typically face little competition. Second, marginal costs may be different for different ratepayer classes. Third, marginal costs can be estimated separately for commodity, capacity and customer charges. Finally, marginal cost estimate should account for peak period of use, normally in the warm-weather months, when costs are generally higher. . . . Many analysts contend that marginal cost and seasonal pricing are not only more efficient, but more equitable than average-cost pricing.[12]

Given the marginal cost and benefits assigned to a system, it is also necessary to have ordinances that state the rules and regulations of the utility. Current polity of most water utilities is explained in the City Ordinances. Ordinances often consist of the following items: a listing of how water lines are to be installed, who inspects the lines, the connection charges and the monthly fees as per meter size. Also, the existing rate structure may have a minimum rate, such as $2.75 per metered customer, plus a minimum charge for every meter size except the 8" commercial client. Usually each minimum charge includes a certain amount of water usage; however, regulatory

thinking is changing on this point. The Montana Public Service Commission recommends two separate charges: a customer charge and a usage charge. They do not recommend that the minimum or customer charge include any given amount of water. These ordinances give form to the operation of the water utility as well as having the force of law so as to be enforceable by the municipality.

Revenue Bonds

The final and most popular method of financing municipal capital projects is the revenue bond. When a municipality uses revenue bonds, revenue provided over and above the required debt payment amount is often used for capital improvements. The principal and interest on the revenue bond debt are totally paid by the water rates charged for water service. Because the taxing authority of the municipality is not part of the collateral, the funding is less secure, and exposes investors to greater financial risk than with general obligation bonds. Higher risk, higher interest rates, as well as higher marketing, legal, engineering and trustee fees, are part of the expenses incurred with revenue bonding procedures.

Summary

Once all the charges are considered and proven to be equitable, it is the task of the local governments to explain and convince the customers that their health interests are at stake when water utilities are underfunded.

Unfortunately, it is very difficult to convince a populace that considers itself overtaxed, and sometimes unemployed, to vote for items to expand infrastructure.

In reviewing the various methods open to public utilities for the financing of their capital projects, one can understand the need for innovative thinking by administrators of utilities. The revenue requirements of large and small utilities indicate the need of a clear understanding of general obligation bonds, revenue bonds, contributions-in-aid-of-construction or connection charges, as well as any new method of raising funds. Although the voter, if approving a general obligation bond, is one part of the solution to raising funds, the Public Service Commission is the major player in water rate increases. The Public Service Commission's rules and regulations can be either an aid to a failing utility or a quagmire; it all depends on how they see their water utilities oversight function.

End Notes

[1]United States Office of the Budget, Management for Fiscal Year 1990 (Washington, DC: U.S. Government Printing Office, 1989), 2-1.

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[3]Patrick C. Mann, Water Service: Regulations and Rate Reform (Columbus, OH: The National Regulatory Research Institute, November 1989), 6.

[4]Sue Daly, Report on Specific Problems of Small Water/Wastewater Companies, Ohio Energy and Water Division, Columbus, 17 March 1988: 1.

[5]Lynn R. Adams, Report on Contributions-in-Aid-of-Construction, Florida Public Service Commission, Tallahassee, 1988: 18-20.

[6]Ron Woods, "Rates for Butte Water Could Double," Great Falls [Montana] Tribune, 14 December 1989: 6B.

[7]Montana Legislative Council, Funding Local Government Infrastructure (Helena, MT: Author, December 1986): 4.

[8]Adams, pp. 7-9.

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[10]C.W. Corssmit, "What to Include in Utility Rate Structure Design," American City and County, November 1981: 50; and A.E. Kahn, The Economics of Regulation: Principles and Institutions, Vol. 1 (New York: John Wiley and Sons, 1970), 66.

[11]The National Regulatory Research Institute, Compendium on Water Supply, Drought and Conservation (Columbus, OH: Author, October 1989), 235.

[12]Ibid.

CHAPTER 4

PROBLEMS WITH PUBLIC SERVICE COMMISSIONS

One of the major stumbling blocks to water utility administrators is the rules and regulations imposed on their utility's water rates and capital projects by the Public Service Commissions. Although authority varies from state to state, "45 of 50 states have some form of regulation of both private and/or public water utilities."[1] Public Service Commissions usually enjoy comprehensive authority, some not only surveying fiscal responsibility but water rates and purity of water as well. Although given the charge to "supervise and regulate the operations of public utilities, common carriers, railroads, and other regulated industries,"[2] often Public Service Commissions are viewed as part of the problem rather than the solution. In the state of Montana, even the governor's report on infrastructure recommended that the legislature "initiate a serious review of the adverse effects of Public Service Commission involvement in local management of public utilities, and seek more viable alternatives"[3] (with emphasis on local influence on the review process).

The Montana Public Service Commission oversees the regulation of 158 water systems in Montana and, of that number, 126 are municipal operations and 32 are investor owned. The Montana Public Service Commission

considers the municipal utilities to be "unregulated, except for the revenue increases in excess of twelve percent per year increases allowed, and that are not for other mandated capital improvements."[4] However, it is in the process of applying for rate increases exceeding 12 percent per year that the municipalities become entangled in the rules, regulations and the assembly of lengthy documentation. The utility often lacks the necessary expertise to untangle the requirements set forth to appear before the Commission for increased rates.

Nationwide, many Public Service Commissions "have promoted simplified procedures and encourage use of stipulated short forms for rate case filings. However, Montana is not one of those states."[5] Montana is unique in the fact that any private water utility must apply for even a one percent increase in rates, whereas municipal water utilities have the authority to increase rates up to 12 percent per year without approval. The Montana statutes clearly define the multitude of records required for application of a rate increase before the Public Service Commission. However, often "small Montana municipalities have only been required to have the last two years' operating statements; a projected revenue statement after increase in rates; an estimate of future expenses; and a narrative reason for the rate change request."[6]

Once the required documentation is assembled, defending necessary rate increases to the public and Public Service Commissions is a problem for utility administrators, as they often lack the skill and expertise required to

make convincing requests. Often if a capital improvement project is proposed, the municipality will request an analysis of water rates at the same time. Thus, high priced consultants and engineering firms are hired to perform the task, putting smaller and poorer communities' budgets at risk. For example, the City of Great Falls, Montana is spending $50,000 to have a professional engineering firm conduct an engineering study of their complete water utility system, which would include justification for a raise in water rates of more than the allowable 12 percent per year. Smaller utilities are faced with the same problem of how to justify their rate increases before the Public Service Commissions, but they cannot afford the expertise necessary to convince the Commission.

It has recently been recommended that "the Public Service Commission should not be involved in any way in approving rate increases necessary to finance new construction of utilities owned by local governments."[7] To a limited degree, the Montana Public Service Commission has been released from heavy regulation of communities. The only vestige of regulation that remains is in the water rates. Regardless, it is not likely that the Montana Public Service Commission will be removed from this oversight and regulatory function in the near future relative to municipally owned utility operations. Montana is not unique in regulations.

> Investor-owned water utilities are regulated to one degree or another in forty-six states. Although specific authority varies, state commission regulations of water utilities is governed by the fundamental principles that govern

> commission regulations of all public utilities. These principles encompass such lofty goals as safe, adequate, reliable, and least-cost service; just, equitable, and reasonable rates, prudent investments and management; used and useful properties, fair rates of return; and, above all, regulation in the public interest.[8]

During the 1960's, which were years of ample federal aid and strong tax bases, most municipalities nationwide did not increase their water rates. However, now with declining revenues and increased costs, they find they have to raise their water rates more than the 12 percent at the local level allowed by the Public Service Commission. In Montana, the Public Service Commission regulations require cities to hold public hearings, have two readings, and give the public a chance to challenge any proposed rate increase. Complaints by only one person can force a public hearing and bring into question any rate increase before the Public Service Commission. The Commission then has the power to rule for or against the petition and bind all parties to the determined rate. It should be noted that if the Montana Public Service Commission makes a modification in the rate request, they can only do so based on the records presented at the hearing. Their decision must be supported by the data submitted by the municipality.

In fairness to Public Service Commission employees, there are hazards of operating water utilities without a Public Service Commission also.

> Consumers, particularly those who are linked to small water systems, would be subject to unregulated monopolies controlling an essential public utility. Not only could they be victims of unfettered price escalation, but they would be vulnerable to the failure of management to maintain and improve the water delivery system.[9]

Therefore, some state commissions are intervening in water utilities operations.

> This happens when water companies are established but are under-capitalized or too small to support an adequate management structure. To revive a company at this stage, a commission may consider capital infusions, improved managerial skills through training or pooling, and shared management. To the extent such steps are achieved, other problems -- including low revenues, poor financial record keeping, poor service and declining plant -- could be avoided. Training programs are expensive to implement, although their costs tend to diminish with time for both commission and utility. As a benefit, training programs impose low long-term costs on ratepayers.[10]

Summary

A heavy-handed oversight function by Public Service Commissions can often cause more problems than necessary to the beleaguered water utilities. In particular, extreme requirements for documentation often hamper the small water utility. These utilities, which have inexperienced staffs, are often required to produce in-depth documentation to justify a rate increase, and they understandably fail.

Many states are reevaluating their rate increase request procedures and going to more simplified formats. Other states are offering training sessions in the derivation of equitable water rates and financing techniques. Obviously. there are no easy answers. Only by continuing a dialogue among municipalities, legislators, and the Public Service Commission can the necessary steps be taken to ensure the longevity of water utility systems. The key player in

this scenario is the utility administrator, for it is with this individual that water rate structures originate.

End Notes

[1]The National Regulatory Research Institute, Commission Regulation of Small Water Utilities: Some Issues and Solutions (Columbus, OH: Author, May 1983), 10.

[2]State of Montana, Montana Code Annotated, Title 70, Chapter 1, 11-2220.1, Montana Legislative Council, Helena, 1988.

[3]Montana Department of Commerce, Governor's Task Force on Infrastructure (Helena, MT: Montana Legislative Council, December 1984), I-52.

[4]Ron Woods, Water Utility Section, Montana Public Service Commission, Helena, personal interview with author, August 1989.

[5]The National Regulatory Research Institute, p. 36.

[6]Ron Woods, Water Utility Section, Montana Public Service Commission, Helena, telephone interview with author, 26 January 1990.

[7]Montana Department of Commerce, p. I-78.

[8]The National Regulatory Research Institute, Compendium on Water Supply, Drought and Conservation (Columbus, OH: Author, October 1989), 232.

[9]The National Regulatory Research Institute, An Examination of Alternative Institutional Arrangements for Regulating Small Water Utilities in Ohio: An Abridgement (Columbus, OH: Author, March 1989), 47.

[10]Ibid., p. 14.

CHAPTER 5

THE ADMINISTRATION OF EQUITABLE WATER RATES

Politically sensitive questions are being asked today. Do the commercial customers pay their fair share of water costs? Faced with a rate increase, will a business move out of the city or drill its own well? Will the financially powerful make it very difficult politically for the elected officials? Will the community be labeled "anti-business" if water rates are raised? Will increased water rates limit the number of new businesses wanting to locate in the city? Do not the economies of scale justify the break in water rates for the large consumers? Obviously there are no easy answers, as there are multiple layers of problems connected to each question and answer.

The water utility infrastructure problem is not a small one.

> An estimated 35,000 utilities supply water to 200 million residential customers in the United States, plus industrial and commercial users. Most Americans get their water from large utilities, which tend to be municipally owned. Such systems supply water to 84 percent of those served by central water systems.[1]

All the questions and the scope of the problem can only be addressed by increasing revenues.

An administrator's effectiveness is measured not just by the financial success of the water utility system. Indeed, potable water must first be treated and distributed to the public in the most economical manner and service must be provided at the lowest cost in comparison with other similar sized operating water utilities. The importance of future forecasting of maintenance, expense and expansion cannot be stressed too highly. To be effective, every administrator must constantly keep in mind the future of his/her utility system.

In addition to financial and forecasting expertise, the administrator must meter the volume usage and bill the costs incurred. In the billing procedure there is the critical rate structure that builds equity into the rates charged to the various consumers. Without comprehensive understanding of the rate structure methodology, the administrator will be operating in the dark as to whether or not the utility is efficient, equitable and recapturing the necessary operating costs. This paper addresses in detail this portion of the problem. However, it is also necessary to have a long view toward the future needs of the utility.

Risk management and contingency plans should be the basis for every administrator's decisions. S/he must continually answer "what if?" to every part of the system. For example, administrators should perform a sensitivity analysis on projects in order to determine the impact on the system and rate payer. By looking ahead, the administrator reduces the chances that s/he will be operating by crises management.

Often, unforeseen problems can be handled by the maintenance of an emergency cash reserve fund. For example, Great Falls, Montana was able to cope with an additional $30,000 electrical cost and a $65,000 hazardous waste disposal out of the emergency cash reserve fund. Administrators were then able to budget for these additional expenses in their financial plan the following year.

> The changing priorities of the water utility demands constant attention and innovative financing. If all capital projects are prioritized, any detrimental impacts on the budget will be lessened. The utility should have a good public relations program so that customer feedback may be incorporated into the utility's planning strategies. Finally, utility management should be active in national associations addressing utility matters. In this way, management can learn from the experience of other utilities.[2]

Establishment of water rates is the Achilles heel of water utilities. Rates are the point of all argument and direct contact with the consuming public. They have to be justified not only to the consumer and the Public Service Commissions, but also to the Commissioners, who make the decisions.

Water Rates

The main role of a water utility is providing potable water to its customers. In spite of regulations, economic conditions and political limitations placed on their administrators, all water utilities have the following objectives:

(1) Financial sufficiency -- Generating sufficient revenues to recover operating and capital costs.

(2) Conservation -- Encouraging customers to make efficient use of scarce water resources.

(3) Equity -- Charging customers or customer classes in proportion to the costs of providing service to customer groups.

(4) Implementation -- Having the capability to implement the rate structure efficiently without incurring unreasonable costs associated with reprogramming, procedures modification, and redesigning forms.

(5) Compliance with appropriate legal authorities -- Being consistent with existing local, state, and federal ordinances, laws and regulations.

(6) Effect on customer classes -- Minimizing financial effects on utility customers.

(7) Long-term rate stability -- Producing rates that are reasonably constant from year to year, i.e., the methodology does not produce rates that fluctuate widely from one period to another.[3]

Given these objectives, this paper is a simplified compilation of a variety of methods of allocating actual budget costs to a water utility's water rates. It is not a comprehensive review of the financial operations of any particular water utility. Reference data were drawn from water rate structure reports and surveys from the cities of Great Falls, Montana, Worthington, Minnesota, Fort Collins, Colorado, and Bozeman, Montana. However, the main body of instruction and examples are from the American Water Works Association *Water Rates Manual,* third edition.

This paper is a practical approach to calculating public water rate structures -- first, by identifying the historical revenue requirements and

second, by allocating the cost of providing service to the customers by their usage classification.

Each step is critical to the derivation of the final rate structure design. By using hypothetical numbers, there are no judgments to be made as to the current or future operating expenses or to future water rates. Several formats of the following tables were drawn directly from actual water rate analyses and manuals, but most figures and calculations are, for the sake of simplicity, hypothetically derived. The calculations and allocations are appropriate for a small to midsize municipality. Often, the numbers are purposely rounded to simplify the calculations within the budget allocations.

This paper uses a modification of the cash basis as a method of first allocating the costs involved. "Basic revenue-requirement components considered under the cash basis generally include operation-and-maintenance expense, debt-service requirements, and capital expenditures not debt-financed."[4] As we are only interested in assuring that current water rates reflect total operation and maintenance expenses, we will not include revenue payments or capital expenditures.

The sample utility has total operation and maintenance expenses of $3,355,000, which is the necessary amount to be recovered by water rate charges. Under the Montana Public Service Commission rules, a capital maintenance fund may also be included with the operations and expenses revenue recovered from water rates. The utility is allowed to estimate the

capital maintenance fund needs for only a three to five year budget period, and then that amount is averaged over a five year period. These capital expenditures are only for such items as main and pump replacement, vehicles, and painting or upkeep on storage facilities. Any other capital expenditures must be covered by revenue bonds. Because the present task is to determine only operations and maintenance expense allocations, calculations for a capital maintenance fund expense will not be added.

There are two methods used to allocate water utility costs as recognized by the American Water Works Association: Base-Extra Capacity and Commodity-Demand. Base-Extra Capacity recognizes that base costs vary with the amount of water produced. Added to this base cost are the operation and maintenance and capital costs required under average load conditions or average use. Extra Capacity costs are allocated operation and maintenance and capital costs that are necessary beyond the average daily use of the consumer class. The Extra Capacity costs are further allocated into maximum day and maximum hour use. This method is normally used by public utilities.

Commodity-Demand recognizes that commodity costs vary with the amount of water produced. This figure usually includes chemicals, electricity, gasoline or other items that are directly tied to the amount of water that goes through the system. Demand costs are allocated to meet the peak demands of the consumer. Like Extra Capacity costs, they too are broken down into

maximum day and maximum hour use. This method is normally used by private utilities who have to pay taxes and provide a return on investment to stockholders. A further, more detailed definition and analysis of these two methods will be provided later in this paper. It is recommended that the American Water Works Association manual be used for further research of water rate structure analysis, especially for the Commodity-Demand method, which is mentioned only briefly in this paper.

The fundamental principles involved in establishing rate structures, by both methods, is to assure equitable rates for the consumer of the product: water. Each user must pay its fair share of the total costs generated in the operation of the system. The breakdown by user category is usually residential, commercial and industrial, with occasional categories concerning users outside of the city limits. Not every municipality will have the same designations, but will recognize the different requirements of each user class.

An additional source of revenue for the water utility can be user charges. These charges would be subtracted from the total revenue requirements because they are usually one-time fees charged to developers, commercial and residential users for first time hookup fees to the water system. Also included are non-metered users and monies earned through fines, etc. A few utilities may also include a charge for fire hydrant usage; however, it is difficult to justify these costs unless accurate and historical records have been maintained on the expenses required to maintain fire hydrants.

It is imperative that operating revenues be adequate to cover the required debt service without depending on user fees, because user fees can fluctuate drastically and are subject to high/low economic development cycles. User fees could be viewed as a "beneficial externality" of an expanding economy, but should not be depended upon to pay the day-to-day expenses of the utility.

Other revenues, such as grant and bond income and earnings from interest, are also included in the revenue figures. However, these additional revenues are not included in the cost allocations to be applied to water rates. Thus, they are subtracted from the total gross revenue of the water utilities. The water rates should reflect only the actual costs, less extra revenue sources, to deliver treated water to the consumer.

The final calculations that result are a check of historical costs against currently charged water rates. This simplistic method may not suffice for engineers, economists or rate specialists, but it will work very well for general administrators in municipal governments.

Methods of Budget Allocation

The Commodity-Demand methodology is used primarily by private water utilities, as they are required to pay taxes and depreciate their capital items as well as have a return on investment. All these expenses need to be recovered through the rates they charge their customers. Private utilities may

be governed by different laws than are municipalities; in some states they are almost unregulated in the rates they charge. In other states private and public utilities are regulated under the same rules and regulations.

The major difference between Base-Extra Capacity and Commodity-Demand methods lies in the interpretation of the costs involved. "It is noted that if all elements of cost are properly allocated, use of either the Base-Extra Capacity or the Commodity-Demand method will result in comparable charges."[5]

In the allocation of the budget with the Commodity-Demand methodology, the highest costs are reflected in the demand component. This component indicates the costs necessary to meet all demands placed on the system.

The other component, commodity cost, reflects the variable costs which vary with the amount of water produced. Some of the major costs that vary with the amount of water produced are electrical and chemical costs. The following definitions clarify the major components of the methodology.

> Commodity costs are costs that tend to vary with the quantity of water produced. They usually include costs of chemicals, a large part of power costs, and other elements that increase or decrease almost directly with the amount of water supplied. Costs related to impounded reservoir source of supply or other costs that vary with average daily demands, such as raw water transfer pumping costs, may also be considered as commodity. Purchased water costs, if bought on a unit volume basis, would also be considered as commodity costs. However, recognition of recent practices to include a demand charge in addition to

> commodity charge in purchased water agreements may dictate that demand portions of purchased water costs be allocated to demand components.
>
> Demand costs are associated with providing facilities to meet the peak rates of use, or demands, placed on the system by the customers. They include capital-related costs on the plant designed to meet peak requirements plus the associated operation-and-maintenance expenses. This cost component may be broken down into costs associated with meeting specific demands, such as maximum-day, maximum-hour, or other periods of time that may be appropriate to the utility that has to meet these demands.[6]

The Base-Extra Capacity method gathers costs under a base category that reflects the day-to-day costs of running the water system, and varies with the quantity of water used. These costs are added to the operation and maintenance expenses of the utility as well as the cost for having extra capacity available for average daily load requirements.

Extra capacity costs are generated to address the costs involved to furnish extraordinary usage, or above the day-to-day average consumer needs. Under this methodology, the base is usually the major cost component in gathering costs to be analyzed. Allocations of costs are based on average, peak-day and peak-hour water use characteristics.

This is necessary because a system is usually built to handle the maximum load required by the community. The City of Great Falls, Montana used 52 million gallons of water, which was the total capacity that its treatment plant was capable of providing, when Mount St. Helens erupted. In this example, the entire extra capacity available was used. Every citizen

was hosing down their houses, trees, cars and lawns to wash off the accumulated ash. Although this is an extreme example, it reflects the need for a water utility to have the extra capacity to meet extreme needs of its populace.

More commonly, it is recognized that residential consumers use greater amounts of water early in the morning and after five in the afternoon when family members are home. However, during the day, the residential user puts little demand on the system. Commercial consumers are usually not peak users of water, but maintain a constant and steady stream of demand. Also recognized in the allocation are costs involved in billing, reading meters, and financial management of the utility.

The main emphasis of this paper will be on the Base-Extra Capacity, since municipalities are required to use this method by the Montana Public Service Commission, as are many other states whose state commissions regulate municipal water utilities. Both the Base-Extra Capacity and Commodity-Demand methods share the need to recover in water rate charges the expenses spent in providing continuous and safe drinking water.

There are various limitations placed on municipal water utilities in Montana. For example:

> Depreciation allowances are not allowed to be part of the water rates. Depreciation is not recognized by the Montana Public Service Commission as they view the facilities as already built and financed by revenue bonds and are reflected in the current rates. To also include depreciation

> in the rate calculations would charge the customer twice for the same facility.[7]

Under Title 69, Chapter 7 of the *Montana Code Annotated,* the statute allows an increase of 12 percent per year for a municipality or "cost of debt." The "cost of debt" phrase frees a municipality from Montana Public Service Commission oversight if the municipality has a higher mandate from state or federal regulations. A municipality is free to comply with regulations such as the *Safe Drinking Water Act* to build a treatment facility. Thus, the municipality can raise water rates as high as necessary to cover debt without applying to the Public Service Commission. It is in the derivation of these increased water rates that municipalities and the consumer must be assured of fair and equitable water rate structures.

Summary

This chapter has set the stage for the derivation of equitable water rates. The discussion of financial sufficiency, conservation, equity, implementation, compliance, effects on customer class, and long term rate stability are but a small part of the problems that beset an administrator. S/he must also analyze the past, present and future needs of the water utility as well as choose the best method of budget allocation in deriving water rates. Although the two methods, Base-Extra Capacity and Commodity-Demand, are similar, the administrator must choose the one that best reflects the costs of

the utility, either public or private. For the public administrator, a thorough understanding of the Base-Extra Capacity is necessary.

End Notes

[1]American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), iv.

[2]American Water Works Association, A Manual of Water Utility Capital Financing, M29, 1st ed. (Denver, CO: Author, 1988), 47.

[3]The National Regulatory Research Institute, Compendium on Water Supply, Drought and Conservation (Columbus, OH: Author, October 1989), 233.

[4]American Water Works Association, A Manual of Water Supply Practices: Water Rates, 1.

[5]Ibid., p. 45.

[6]Ibid., pp. 17-18.

[7]Ron Woods, Water Utility Section, Montana Public Service Commission, Helena, personal interview with author, 18 January 1990.

CHAPTER 6

DERIVING WATER RATES BY THE BASE-EXTRA CAPACITY METHOD

The basis for Base-Extra Capacity is the water usage by customer category. This usage can be allocated in various ways, as not every municipality will have the same breakdown of customers. The sample municipality has the following categories: residential and commercial. Many cities will have residential, commercial and industrial, while larger municipalities may also have in-city and outside-city designations. The importance of the allocation is that documentation exists to verify the allocations applied.

The formal definitions of the allocations follow. However, it should be noted that fire protection is not used in the test sample for Base-Extra Capacity, as the documentation often is not available to justify the breakout of the costs in smaller municipalities. In large municipalities where financial cost records are more definitive and complete, this category would just be added to the spreadsheet allocation and handled identically to the rest of the allocations.

> Base costs are costs that tend to vary with the total quality of water used plus those operations and maintenance expenses and capital costs associated with service to

> customers under average load conditions, without the elements of cost incurred to meet water use variations and resulting peaks in demand. Base costs include operation-and-maintenance expenses of supply, treatment, pumping, and distribution facilities, as well as capital costs related to water plant investment associated with serving customers to the extent required for a constant, or average, annual rate of use.
>
> Extra capacity costs are costs associated with meeting rates of use requirements in excess of average and include operation-and-maintenance expenses and capital costs for system capacity beyond that required for average rate of use. These costs may be subdivided into costs necessary to meet maximum-day extra demand, maximum-hour extra demand, or other extra-demand criteria appropriate for a particular utility.
>
> The definition of customer costs for this method is the same as for the base-extra capacity method. Direct fire-protection costs are also the same as under the base-extra capacity cost method.
>
> Customer costs comprise those costs associated with serving customers, irrespective of the amount or rate of water use. They include meter reading, billing, and customer accounting and collecting expense, as well as maintenance and capital costs related to meters and services.
>
> Direct fire-protection costs are those costs that are applicable solely to the fire-protection function. Usually, such costs are simply those directly related to public fire hydrants and related branch mains and valves. It should be noted that the costs allocated to the direct fire-protection cost component are usually only a small part of the total cost of fire protection.[1]

Although customer costs allocate the costs of labor and materials in billing, reading meters and financial management of the utility, these costs may be lumped together or allocated separately, depending on the total expenses involved for a particular municipality.

In order to project the future needs of the utility, it is necessary to start with a base year budget history. Thereafter, each year a percentage adjustment will assure that the water rates charged truly reflect the allowable expenses of the utility. Anticipated increases in expenses, i.e., energy costs, additional EPA regulations, personnel labor expenses, etc., also should be factored into the water rate projections for the coming year at that time. A water utility's income projection should include the current rate of inflation as well as increases in labor and regulation costs.

A short list of requirements for budget allocation and the development of water rates follows. For the first-time development of this process, it is easier to do the budget allocation at the end of a given budget year. The reasoning behind this is that the supervisors who spent the money under their authority will have a fresher and more current idea as to how and where the money was spent, and this will permit the correct allocation of percentages.

(1) A tabulation from the line item budget document is required to identify income needed to cover operation and maintenance expenses as well as debt service.

(2) A conference with the various supervisors will produce the required percentage changes and these figures will be the base year allocations. In the summary sheet there may be some combining of the various categories due to the small amount of money allocated to the component in small municipalities. The main thing is that all operation and maintenance

expenses are accounted for and set out by component or combined with the correct component.

(3) An analysis is required of current city ordinances as to rate changes proposed or enacted during the current year.

(4) A compilation of the total or a representative sample of actual water billings as to cost and consumption by all meter sizes, including the number of meters by customer size is required. If a monthly and yearly figure is used, check to be sure it is a representative sample.

(5) A tabulation of the water treatment plant's maximum-day run of the amount of water used should be prepared.

(6) A tabulation of usage calculations by meter size should be prepared.

(7) A conference with the Finance or Utility Director will indicate any capital projects or required changes in the budget.

The table arrays the allocation of operations and expenses from the sample budget document without the percentage calculations. Note that the following figures are rounded for simplicity in calculation. The percentage is calculated by dividing the amount under each allocation by the total costs.

Customer service expenses are incurred in providing administrative and utility billing activities. Also included in the customer service are meter reading and service, and can be recognized as a separate part of customer costs or combined in the customer billing and collection column.

Although all the methodology and calculations are based on using a hand-held calculator, the figure repetitions lend themselves to a computerized spreadsheet application. If a computer is available in the municipality, a Lotus 1-2-3 or Quattro spreadsheet template could be quickly created and preserved from year to year to verify equity of the current water rates. All the calculations were performed on a HP-12C calculator, so there may be some minor rounding errors when duplicating the process.

Tables 1, 2 and 3 array a sample total allocation of percentages and costs derived from the decisions of the supervisors. The first year the figures will necessarily be rough estimates, but in each succeeding year the percentage allocations should reflect more of the reality of the expenses incurred in operating the water utility system. These figures have purposely been broken down into individual components so the calculations can be easily understood. These three tables would normally be on one spreadsheet. However, the step-by-step process accelerates understanding of the derivation of the figures.

Table 2 allocates the percentages for maximum-day and maximum-hour costs. Each percentage shown is the percentage of the total budgeted amount for that particular item.

Table 3 is the final step in allocating the remaining costs that are attributed to meter and customer costs. The percentage allocations are derived as shown in Tables 1 and 2.

Table 1. Allocation of operation and maintenance expenses by percentage: Step 1 (in terms of $1,000).*

Item	(1) Total Budget ($)	(2) Base ($)	(3) Percentage (2)÷(1)
Pumping	580	557	96%
Lab & Test	670	550	82%
Distribution	805	96	12%
Gen Administration	400	45	11%
Customer Billing	660		
Meter	240		
Total O&M	$3,355	$1,248	

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 17.

Table 2. Allocation of operation and maintenance expenses by percentage: Step 2 (in terms of $1,000).*

Item	(1) Total Budget ($)	Extra Capacity			
		(2) Max Day ($)	Percent-age (2)÷(1)	(3) Max Hour ($)	Percent-age (3)÷(1)
Pumping	580	23	4%		
Lab & Test	670	120	18%		
Distribution	805			242	30%
Gen Administ	400	70	17%	14	4%
Cust Billing	660				
Meter	240				
Total O&M	$3,355	$213		$256	

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 17.

Table 3. Allocation of operation and maintenance expenses by percentage: Step 3 (in terms of $1,000).*

Item	(1) Total Budget ($)	(2) Meter ($)	Percent-age (2)÷(1)	(3) Cust. ($)	Percent-age (3)÷(1)
Pumping	580				
Lab & Test	670				
Distribution	805			467	58%
Gen Administ	400	255	64%	16	4%
Cust Billing	660			660	100%
Meter	240	240	100%		
Total O&M	$3,355	$495		$1,143	

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 17.

After the total or summary budget numbers are in place, the various water department supervisors should review the cost allocations and percentages. Once the initial allocations are completed, the following year's allocations will be easier to determine by the supervisors, as they will have had one year of experience in the process. However, it is recommended that new cost codes for the various allocations be set up so that as the money is spent it is automatically credited to the proper rate allocation and not dependent on a supervisor's memory. This would simplify the year-end task, as the costs would be automatically allocated to the proper components.

Table 4 reflects the total allocations of operations and expenses without the individual component percentage calculations. Each line of the line item

budget was allocated in the same manner to generate this form. Any variation of this is certainly acceptable; this table is only a guide in the cost allocation by the utility supervisors. Note that the figures are rounded for simplicity in calculations. The total percentage is calculated by dividing the total amount under each allocation by the total costs.

Table 4. Total allocation of operation and maintenance expenses.

Item	Budget ($)	Base ($)	Extra Capacity		Cust. ($)	Meter ($)
			Max Day ($)	Max Hour ($)		
Pumping	580	557	23			
Lab & Test	670	550	120			
Distribution	805	96		242		467
Gen Administration	400	45	70	14	255	16
Customer Billing	660					660
Meter	240				240	
Total O&M	$3,355	$1,248	$213	$256	$495	$1,143
Percentage	100%	37%	6%	8%	15%	34%

Once all the budget allocations are completed, and these should take the most amount of time when deriving them for the first time, from then on the allocations should be very easy due to the familiarity with the process. In fact, most of the documentation is already found in the budget document and lends itself to a computerized methodology that would automatically calculate each year.

In Table 5, water customers have been separated into two principal categories: residential and commercial. Because each group has similar demands and usages, they are gathered together under one class, i.e., residential. Customers may also be classified as being either inside or outside of the city, depending on the municipality's service area and metering capabilities.

The underlying assumption is that water utilities are designed to meet the demands of all classes of customers and each customer uses an average amount of water. All facilities that meet average day demand will have all costs placed in the base component. The extra capacity costs are allocated to the maximum daily and hourly demands in excess of the average usage.

Before further allocations can be performed on the way to the end result of a water rate structure, the various meter sizes must be converted into equivalent meter and service ratios. That is engineer's talk for the plain facts that the bigger the meter, or pipe size, the more it costs to purchase, install and maintain, and the more water that will flow through that size pipe. Every pipe or meter is given a gallon per minute (GPM) capacity rating. These capacities are found in almost any engineering book and are the key to equivalent meter ratios. These capacity ratings remain the same nationwide and so are usable in this study.

Table 5. Deriving meter capacities.

Customer Classification	Meter Size	GPM Capacity
Residential	¾"	30
	1"	50
	1¼"	75
	1½"	100
	2"	160
Commercial	3"	300
	4"	500
	6"	1000
	8"	1800

Every municipality may have the same or different meter sizes, and there may be a difference of opinion as to what size is considered commercial; however, the sizes or designations are not critical for these calculations. Unmetered units are not considered, as the volume used is combined with the metered ratios in the total amount of water produced. Although this may cause a small amount of dislocation in the calculations, it is not significant in the overall distribution of costs and allows the total cost of water produced, whether metered or not, to be accounted for.

The first meter size (¾") in the sample utility is considered the base meter size and is designated 1.0 as the hydraulic equivalent. All other equivalent meter ratios are calculated from that one base meter size. The equivalent

ratio is determined by dividing the first meter size GPM into the next larger size: 50/30 GPM = 1.667, or 1.7. This means that a 1" meter allows 1.7 times as much water through the pipe as a ¾" meter. (Refer to Table 6 below.).

Table 6. Deriving hydraulic equivalent meter ratios.

Customer Classification	Meter Size	GPM Capacity	Hydraulic Equivalent
Residential	¾"	30	1.0
	1"	50	1.7
	1¼"	75	2.5
	1½"	100	3.3
	2"	160	5.3
Commercial	3"	300	10.0
	4"	500	16.7
	6"	1000	33.3
	8"	1800	60.0

The next step, shown in Table 7, concerns the number of actual meters by count. Multiplying this number by the hydraulic equivalent gives the number of equivalent meters. This figure is important in the equitable allocation of the total costs to each individual meter by size.

The calculations from Table 7 will be needed in the allocations of costs and volume usage by customer class. The distribution of the volume usage taking into account the extra capacity requirements of the sample municipality follows in Tables 8, 9, 10 and 11. These tables are based on thousands of

gallons per day and summarize water use characteristics by customer class and cost categories.

Table 7. Final computations for hydraulic equivalency.

Customer Classif.	(1) Meter Size	(2) No. Meters	(3) GPM Capacity	(4) Hydraulic Equivalent	(5) (2)x(4) No. Hydraulic Meters
Residential	¾"	15,829	30	1.0	15,829
	1"	1,830	50	1.7	3,111
	1¼"	21	75	2.5	53
	1½"	227	100	3.3	749
	2"	193	160	5.3	1,023
Commercial	3"	105	300	10.0	1,050
	4"	36	500	16.7	601
	6"	44	1,000	33.3	1,465
	8"	5	1,800	60.0	300
		18,290			24,181

The step-by-step methodology depicted in Tables 8-11 will aid in the understanding of the calculations. Normally these would appear on one spreadsheet. Table 8 introduces the information needed to derive the units of service costs in later tables.

Table 8. Units of service: Step 1 (in thousands of gallons).*

Customer Classification	Base	
	(1) Total Annual Use	(2) (1)÷365 Average Day Rate
Residential	2,525,000	6,918
Commercial	1,613,000	4,419
Total	4,138,000	11,337

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 29.

Table 9 arrays the maximum-day capacities of the utility system. These figures will be used in later table allocations.

Table 9. Units of service: Step 2 (in thousands of gallons).*

Customer Classification	Base	Maximum Day		
	(1) Average Day Rate	(2) (3)÷(1) Capacity Factor	(3) Total Capacity	(4) (3)-(1) Extra Capacity
Residential	6,918	230	15,911	8,993
Commercial	4,419	230	10,163	5,744
Total	11,337		26,074	14,737

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 29.

As with the previous tables, Table 10 allocates maximum capacities; however, these are for the maximum hour. These calculations will also be used in later table cost allocations.

Table 10. Units of service: Step 3 (in thousands of gallons).*

Customer Classification	Base	Maximum Day		
	(1) Average Day Rate	(2) (3)÷(1) Capacity Factor	(3) (1)x(2) Total Capacity	(4) (3)-(1) Extra Capacity
Residential	6,918	367	2,538,906	18,471
Commercial	4,419	367	1,621,773	11,798
Total	11,337		4,160,679	30,269

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 29.

Table 11 is the final allocation of units of service and addresses the number of residential and commercial bills. The number of bills is multiplied by the 12 months in a year to give a total of the number of bills generated per year.

Table 11. Units of service: Step 4 (in thousands of gallons).*

Customer Classification	Base			
	(1) Average Day Rate	(2) No. of Billing Units	(3) No. of Equiv. Bills	(4) (3)x(12 mos) Bills
Residential	6,918	17,692	20,718	248,616
Commercial	4,419	631	3,417	41,004
Total	11,337	18,323	24,135	289,620

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 29.

The maximum day capacity factors show a relationship between individual customer classification's maximum rate of use to average day annual usage. Allocation is based on historical water production reports. If the maximum day rate is 2.55 of its average rate, the maximum day capacity factor is 255.

The following example will aid in understanding the maximum day and hour calculations:

> If the maximum day use recorded for a municipality is 37 million gallons per day . . . and the average over a period of years use is 14.27 million gallons a day; 37/14.27 = 2.59, or 1 to 2.59. This means that the maximum day was 2.59 times the rate on the average day. The amount allocated to the base cost on these items which are designed to meet the maximum day demand would be allocated on the ratio of 1 to 2.59, or 39 percent of the base cost. The balance of 61 percent would be allocated to the extra capacity cost for the maximum day.[2]

It is rare that small communities have actual maximum hour consumption rates. Therefore, the rate of consumption used during the year as allocated above can be employed. However, depending on the geographic area of the municipality, many decisions can change the maximum hour. For example, water rationing may result in a lower figure than twice the maximum day rate. However, it is reasonable to use the sample rate calculated for most midsized cities.

Due to the various refinements possible on the allocation of these costs, which are set out in the American Water Works Association's *A Manual of Water Supply Practices: Water Rates,* third edition, it is not possible to duplicate all of them. They identify the relationship between various

components of a utility such as depreciation expense, rate base, payment in lieu of taxes, and inside and outside unit costs of service.

Also, these applications often rely on engineering decisions concerned with the design of the water system under consideration and are usually implemented for large, complex systems. In this study we are simply trying to identify direct operation and maintenance expenses to units of service. In other words, given the amount of water produced at a certain cost, how much is attributable to each component of base, maximum day, maximum hour, customer costs for billing, and metering the system?

Although there may be some small differences in the allocated costs, the end rates will not be greatly influenced one way or the other by the general allocation method proposed in this paper. This exercise is not intended as an engineering study, but as a simplified method of verifying equity within the rates derived from actual budget operation and maintenance costs.

The incremental compilation of the figures derived from the various tables will ultimately give a unit cost of service for the Base-Extra Capacity methodology. "The unit base cost provides a measure of the lowest potential charge in a schedule of rates for delivery of uniform service. . . . [It] establishes an important guide in preventing the potential for establishing a charge that could result in the sale of water below cost."[3]

These types of calculations lend themselves to computerized spreadsheet applications where small changes in the figures will recalculate the final rates.

However, for simplicity and ease of comprehension, each process is painstakingly broken down so the process is understandable. Tables 12, 13 and 14 display the unit cost calculations, which will aid in deriving the final water rates. Notice that these tables compile information from previous tables as noted.

Table 12. Total unit costs of service: Step 1.*

	Total Cost	Base
(A) Units of Service Number of Units		4,138 (from Table 8) Thousand Gallons
ITEM:		
(1) O&M	$3,355	1,248 (from Table 2)
(2) Unit cost		0.30159 (1)÷(A)
Residential:		
(3) Units		2,525,000 (from Table 8)
(4) Allocated cost		$761,515 (2)x(3)
Commercial:		
(5) Units		1,613,000 (from Table 8)
(6) Allocated cost		$486,465 (2)x(5)

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 31 and 35.

Table 13. Total unit costs of service: Step 2.*

	Extra Capacity	
	Maximum Day	Maximum Hour
(A) Units of Service Number of Units	14,737 (from Table 9) Thousand Gallons	30,269 (from Table 10) Thousand Gallons
ITEM:		
(1) O&M	$213,000 (from Table 4)	$256,000 (from Table 4)
(2) Unit cost	$14.4534 (1)÷(A)	$8.457 (1)÷(A)
Residential:		
(3) Units	8,993 (from Table 9)	18,471 (from Table 10)
(4) Allocated cost	$129,979 (3)x(2)	$156,209 (3)x(2)
Commercial:		
(5) Units	5,744 (from Table 9)	11,798 (from Table 10)
(6) Allocated cost	$83,020 (5)x(2)	$99,776 (5)x(2)

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 31 and 35.

Table 14. Total unit costs of service: Step 3.*

	Meter	Customer
(A) Units of Service Number of Units	24,135 (from Table 11) Equivalent Meters	289,620 (from Table 11) Equivalent Bills
ITEM:		
(1) O&M	$495,000 (from Table 2)	$1,143,000 (from Table 2)
(2) Unit cost	$20.5096 (1)÷(A)	$3.9465 (1)÷(A)
Residential:		
(3) Units	20,718 (from Table 11)	248,616 (from Table 11)
(4) Allocated cost	$424,918 (3)x(2)	$981,163 (3)x(2)
Commercial:		
(5) Units	3,417 (from Table 11)	41,004 (from Table 11)
(6) Allocated cost	$70,081 (5)x(2)	$161,822 (5)x(2)

*Format/Source: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 31 and 35.

> Base costs are costs that would be incurred in supplying water at perfect load factor (that is, at a continuous, uniform rate), without costs incurred in providing extra plant capacity for variation in the rate of use beyond a uniform rate. The resulting distribution of cost responsibility for base costs is simply a function of the volume of water used by each class.[4]

The following unit cost is the $20.5096 meter cost divided by 12 months equals $1.7091, or $1.71. The hydraulic equivalent meter ratio is from Table 7. The billing cost is the $3.9465, or $3.95, billing cost shown above. Table 15 is the first breakout of costs by meter size and will be the foundation for the final allocation of costs. This table only identifies and compiles the meter unit cost and the billing costs. Because meter and billing costs can often be charged as a service charge, Table 15 will advance the process further by allocating costs equitably through the equivalent meter ratios.

Table 15. Design of service charges.

(1) Meter Size	(2) Unit Cost	x	(3) Equiv. Meter	=	(4) (2)x(3) Total	+	(5) Billing Costs	=	(6) (4)+(5) Total
¾"	1.71	x	1.0	=	1.71	+	3.95	=	$ 5.66
1"	1.71	x	1.7	=	2.90	+	3.95	=	6.85
1¼"	1.71	x	2.5	=	4.28	+	3.95	=	8.23
1½"	1.71	x	3.3	=	5.64	+	3.95	=	9.59
2"	1.71	x	5.3	=	9.06	+	3.95	=	13.01
3"	1.71	x	10.0	=	17.10	+	3.95	=	21.05
4"	1.71	x	16.7	=	28.56	+	3.95	=	32.51
6"	1.71	x	33.3	=	56.94	+	3.95	=	60.89
8"	1.71	x	60.0	=	102.60	+	3.95	=	106.55

The final allocation of costs in Table 16 exemplifies what costs are allocated to the extra capacity of the system. The extra capacity day and hour costs are carried from the previous table and divided by 365 days to give a charge to be added to total service costs. This will reveal the total amount of money required to recover the revenue necessary to cover the operation and maintenance expenses of the municipality. Most of the previous calculations have followed very closely, if not identically, those proposed by the American Water Works Association's *A Manual of Water Supply Practices: Water Rates,* third edition. We now take a small departure in the calculation of the rates.

Usually at this point it is necessary to establish blocks of usage and allocate a certain volume of water to be included within a certain user rate category. We have chosen not to follow that pathway. The final water rates developed will not have the extra capacity costs multiplied by an additional capacity factor. This will result in a less than 2 percent lesser difference between the two methodologies. Unit base cost and service charge figures remain the same; only the extra capacity day and hour costs will reflect a few pennies difference.

Table 16. Minimum charge and extra capacity charges.*

(1) Meter Size	(2) Total Service Costs		(3) Base Costs		(4) Extra Capacity Day Costs**		(5) Extra Capacity Hour Costs***		(6) +(2)-(5) Total Costs
¾"	5.66	+	.3015	+	.04	+	.02	=	$ 6.02
1"	6.85	+	.3015	+	.04	+	.02	=	7.21
1¼"	8.23	+	.3015	+	.04	+	.02	=	8.59
1½"	9.59	+	.3015	+	.04	+	.02	=	9.95
2"	13.01	+	.3015	+	.04	+	.02	=	13.37
3"	21.05	+	.3015	+	.04	+	.02	=	21.41
4"	32.51	+	.3015	+	.04	+	.02	=	32.87
6"	60.89	+	.3015	+	.04	+	.02	=	61.25
8"	106.55	+	.3015	+	.04	+	.02	=	106.91

*Source/modified format: American Water Works Association, A Manual of Water Supply Practices: Water Rates, M1, 3rd ed. (Denver, CO: Author, 1988), 52.

**Extra capacity day charges of $14.45 ÷ 365 days = $.0395, or $0.04.

***Extra capacity hour charges of $8.457 ÷ 365 days = $.0231, or $0.02.

Table 17, which follows, is a comparison of a typical midsize city's current water rates. These rates are displayed to show the percentage difference between what the rates should be and what they currently reflect. Although the changes needed are not significantly large within themselves, it is when they are multiplied by the thousands of users that the monetary amount becomes significant.

Table 17. Comparison of derived water rates and sample current rates.

Meter Size	(1) Derived Water Rate	(2) Current Water Rates	(3) (2)÷(1) Percentage Difference	(4) (1)-(2) Change Needed
¾"	$ 6.02	$ 4.20	69%	$ + 1.82
1"	7.21	5.50	76%	+ 1.71
1¼"	8.59	6.75	79%	+ 1.84
1½"	9.95	8.00	80%	+ 1.95
2"	13.37	10.25	77%	+ 3.12
3"	21.41	18.50	86%	+ 2.91
4"	32.87	27.50	84%	+ 5.37
6"	61.25	50.00	82%	+ 11.25
8"	106.91	212.50	199%	- 105.59

*Rates from the City of Great Falls Rate Schedule to reflect actual water rates in comparison to derived rates.

The final derived water rate figure is an equitable distribution of the operation and expense revenue that must be raised from the water rates. Although there is a need for an adjustment in the rates, the critical factor is that the percentages and monetary changes shown indicate that there is inequity within the existing rate structure.

Armed with this factual information, the public utility administrator can explain and prove his request for an increase and/or decrease in water rates as the case may be. With the equitable distribution of costs, the facts can stand alone. However, everyone recognizes the political implications of raising any one user category's rates too rapidly to make up for any inequity.

Of prime importance is the recognition that the derived rate structure does not reflect all the costs required to upgrade or expand an existing system. The derived figures should be viewed as an absolute minimum that must be charged each classification of consumer for the base year. One of the great strengths of computer applications in this process is the ability to change the original number by inclusion of capital revenue projects, etc., and very quickly derive the needed water rates. Even the hand calculations can lend rapid solutions to the question: What will be the required equitable water rates? The answer to that question can support a required rate increase. The data generated can also assist the political decision makers in their voting process. Without rates based on verifiable data, the request rates will only be based on conjecture.

Although the above water rate process is imperfect, it is the beginning of a simplified method of equitable distribution of operation and maintenance costs. As each municipality personalizes the methodology for its own problems and solutions, the administrator can adjust budget allocations to reflect the needs of the community. We can do no more than say we have taken the first step on a long journey.

End Notes

[1]American Water Works Association, Manual of Water Supply Practices: Water Rates, 3rd ed. (Denver, CO: Author, 1988), 12.

[2]Thomas, Dean and Hoskins, Inc., Water/Sewer Rate Study, City of Great Falls, MT, 1974, p. 41.

[3]American Water Works Association, p. 45.

[4]Ibid., p. 33.

CHAPTER 7

CONCLUSION

The previous chapters have been an overview of problems facing water utilities in Montana and other states across the nation. Although economic conditions, regulations, Public Service Commissions, administrators and water rate structures are all critical to private and public utilities, other problems not addressed in this paper can also cause economic chaos. Several states, and the federal government, are directing their attention to the various infrastructure problems and are very innovative in their approach to solving them. There have been taxes proposed on gasoline, tobacco, coal, vehicles, etc., to raise the required revenues.

One can hope for a greater coordinated effort on the part of the municipalities, and the states with the federal government. The problems will not go away and there needs to be a mutual effort by everyone to improve our infrastructure system. The water system problems will be solved and funded adequately because the people who have enjoyed excellent, potable water in the past will continue to make the sacrifices necessary to maintain that level of service.

Anomaly

Within this paper, in its explanation of how to derive equitable water rates, is an interesting anomaly. The Montana Public Service Commission requires the Base-Extra Capacity method to derive equitable water rates and, as shown above, this can be very laborious and difficult for the uninitiated in rate structures.

The most complex section is in calculating the extra capacity charges, which in our example reflect only 14 percent of the total budget and only a few pennies difference in the final derived rates in Table 16. It appears it would be much simpler for the small municipality to be held only to deriving the base, customer and meter costs. Perhaps the Montana Public Service Commission should not only investigate short-form rate increase applications, but also a rethinking of the rate structure process by small municipalities.

Nevertheless, it is hoped that this paper, which lends itself to solving only one part of the problem, will aid the administration's ability to address the issue, allocate costs and derive equitable water rates.

> An effective rate structure is essential to a balanced budget. However, providing sufficient income is only one purpose of a good rate structure. By assessing a wide array of factors and identifying which are most important, utility managers can choose or design a rate structure that meets community and utility pricing objectives, furthers city policies, and promotes common philosophies.[1]

It is recommended that water utility administrators become conversant with the methods of deriving equitable water rates. Of prime importance is their meeting with other municipalities to share their combined knowledge in solving the various infrastructure, regulatory and political problems implicated in delivering potable water to the public.

Summary

In conclusion, this paper reviewed national infrastructure problems. The focus was narrowed to water utilities and their specialized problems, such as economic conditions and regulations, financing difficulties, additional burdens placed by Public Service Commissions and other regulatory agencies, the duties of the administrators, and finally a step-by-step process showing how equitable water rates can be derived directly from budget allocations. With fairness as the foundation for water rates, administrators will be able to demonstrate the financial needs of the utility and gain any needed rate increases in the future.

End Notes

[1]Richard D. Giardina, "Developing an Equitable Water Rate Structure," Opflow 15, no. 2 (2 February 1989): 5.

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