United States Environmental Protection Agency

Growing Toward More Efficient Water Use:

Linking Development, Infrastructure, and Drinking Water Policies

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About the EPA office that produced this report:

Development, Community, and Environment Division (DCED)

DCED works with communities, states, and the development industry to help them reach more environmentally friendly development alternatives while improving economic conditions and quality of life. DCED provides information, education, and technical assistance. For more information about EPA's smart growth program, visit <www.epa.gov/smartgrowth>.

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1. Land Use Decisions and Water Systems

In many communities, growth has brought problems related to water. Growth affects costs of water infrastructure, demand for water, and efficiency of water delivery. However, the relationship is a dynamic one: water policies influence growth decisions and outcomes—which in turn affect infrastructure and water resources.

Communities face two growing and related issues: huge financial needs for water infrastructure and concerns about the availability of water. Drinking water utilities will have to increase their spending by $263 billion over the next 20 years to maintain adequate service,[1] money that will come from either increased water rates or taxes or both. Cities and towns in the arid West have long faced water scarcity; now cities across the country—even in areas with plentiful rainfall—are facing water shortages. The city of Frederick, Maryland, was forced to impose a building moratorium in 2001 as it scrambled to secure a new source of water and build a new treatment plant.[2] A subsequent ordinance setting out priorities for allocating scarce water among development projects remains in effect.[3] On a larger scale, Alabama, Georgia, and Florida have fought in and out of court for 15 years over water allocations from two major river basins that they share. As these three states continue to grow rapidly, resolving their water claims becomes ever more urgent. Even states and provinces along the Great Lakes are taking measures to promote water efficiency and prevent the export of water outside the watershed. Although the Great Lakes are the largest reservoir of fresh water in the world, water experts warn that changes in policies and practices are necessary to preserve the lakes' contribution to the region's quality of life and economic growth.[4]

Water availability and cost are also related to the quality of existing and potential source waters. Utilities must use more chemicals and other treatment methods to bring polluted water up to national standards for drinking water, thus increasing its cost. The quality of source waters depends in part on the ability of surrounding land to filter out potential pollutants. Many areas are working to preserve land that is critical to protecting source waters. Preserving undeveloped land by focusing development in appropriate areas is emerging as a key strategy for maintaining water quality. This topic is covered in greater depth in a recent U.S. Environmental Protection Agency (EPA) publication, "Protecting Water Resources with Smart Growth," and will not be covered in depth here.

This report focuses on the nexus between water and growth. Part I summarizes the challenges of meeting demand for safe drinking water. Part II asks: "Is there a way to accommodate growth that minimizes its effects on water consumption and distribution costs?" Part III asks: "What water policies can support this type of growth?"

1.1 Residential and Commercial Water Use in Context

Only 1 percent of the Earth's total water is fresh water available for use. In the United States, nearly two-thirds of this resource is ground water, which supplies water for 95 percent of rural households, half of all agricultural irrigation, and one-third of industrial water needs.

** Available at <www.epa/smartgrowth/publications.htm>*

The remaining third is surface water, which is the primary source for public supply. Public water supplies serve piped water to a minimum of 25 customers and have at least 15 service connections.[5]

This report focuses on public supply. Drawing on both surface and ground water, public supply is the source of water for 85 percent of the U.S. population and represents roughly 12 percent of all freshwater withdrawals in the United States. The U.S. Geological Survey (USGS) estimates that, of this 12 percent, household use accounts for 56 percent of all public water supplied, commercial purposes constitute 17 percent, industrial users account for 12 percent, and public and other uses are 15 percent.[6]

From 1950 to 2000, the population served by public water systems grew 159 percent, from 93.4 million to 242 million people. During the same time, public water use—primarily household, government, and commercial uses—grew 207 percent, from 14 billion to 43 billion gallons per day. Over the same period, total per capita water use has grown from 149 to 179 gallons per day. Per capita water use did not change from 1995 to 2000, but it declined slightly from 184 gallons per day in 1990 to 179 in 1995, perhaps due to conservation efforts that have since been overtaken by other factors.[7]

Although residential, commercial, and government customers account for less than 12 percent of total water use, their use is significant. During droughts or in areas where water is scarce, even relatively small changes in demand can make the difference between normal service and water shortages. Consistent water service is essential to daily life; shortages and price increases make news and can have serious political implications. While local governments often are responsible for ensuring this water supply for residents and businesses, they have little or no control over the largest water users: agriculture and power generation, which together account for about 80 percent of all freshwater withdrawals. Local governments thus focus their policies where they can have some effect: on residential, commercial, and government demand.

1.1.1 Water-poor communities are often high-growth communities

Many areas facing rapid population growth and increasing development pressure already have difficulty providing adequate water to their residents. A 2005 Brookings Institution report showed that 10 of the 15 fastest-growing metropolitan areas are in the relatively arid western states of Nevada, California, Texas, Colorado, Arizona, and Utah.[8] The West also has some of the highest per capita residential water use in the nation. Lack of rain and its residents' landscaping preferences contribute to per capita water use in the West that far exceeds the national average of 179 gallons per day. In Colorado average use is 240 gallons per day, in Utah it is 292, and in Nevada it is 336.[9] The combination of high growth rates and high water use is rapidly depleting aquifers in the region. Aquifers in the Denver region are falling 30 feet per year, and the Texas portion of the High Plains aquifer has decreased by 27 percent over the past 50 years.[10]

> Utah is not only one of the fastest growing areas, it is also one of the thirstiest, with an average per capita use more than double the national average.

Drought can further compound the difficulties of meeting demand even in areas not typically considered to be water poor. A drought that began in 1998 eventually led the Delaware River

Basin Commission to issue a drought emergency in 2001 that reduced allotments for New York City and the four states that draw on its supply.[11] By the summer of 2002, half of the continental United States experienced drought conditions ranging from mild to extreme, triggering widespread water restrictions in many cities across the country.[12]

1.2 Development patterns and water demand

Population and economic growth inevitably create more demand for water. How that growth takes place affects how much additional water is needed and how much it will cost to deliver. The most common characteristics of new conventional growth—large lots, low density, and dispersed development—all increase the cost of delivering water. Homes on large lots and commercial facilities often consume large quantities of water for lawns and landscaping. Low-density, dispersed development requires longer pipes, which lose more water through leakage and raise transmission costs. Infrastructure investments that support water system expansion over the upgrading and maintenance of existing networks can lead to increasingly inefficient systems, greater waste, and higher capital and operating costs.

1.2.1 Large lots increase water demand

Large lots are a major contributor to both residential and commercial water use. Lawn care, car washing, swimming pools, and other outdoor uses can account for 50 to 70 percent of household water use.[13] Lawn care alone accounts for an average of 50 percent of all household water use nationally.[14] Office buildings also use significant quantities of water for landscaping. According to the USGS, "lawn watering and air conditioning use more water than sanitation or cleaning"[15] in commercial buildings. As would be expected, the amount of water used for lawns varies significantly from region to region based on local climate.

However, no matter where they are, areas with low density, large lots, and large lawns require more water than areas with high density, small lots, and small lawns. In 1997, the Minnesota Department of Agriculture estimated that in Minnesota, the average lawn size in more compact urban watersheds measures 0.05 acres (2,250 square feet), while suburban lawns average over four times that size, at 0.21 acres (9,265 square feet).[16] In Utah, planners have determined that water demand drops from approximately 220 gallons per capita per day at a density of two units per acre, to about 110 gallons per acre at a density of five units per acre.[17] In a study of household water use in Sacramento, California, demand by units in the Metro Square development (a neighborhood of 46 single-family homes on compact lots) was 20 to 30 percent less than demand by their suburban counterparts.[18] A study of Seattle-area households found that moving from 12 dwelling units per acre to four units per acre decreases density by 67 percent but increases water use for landscaping by 158 percent per household. Put another way, Seattle homes on 6,500-square-foot lots use 60 percent less water than those on 16,000-foot lots.[19]

Lot size also increases the length, and thus the cost, of the pipes serving households and commercial buildings. Neighborhood water pipes fall into two types: transmission mains that run under or along streets and distribution mains that connect each house or building to the transmission pipes. A house on a smaller lot typically is closer to the transmission main, and thus a shorter distribution main. Neighborhoods with smaller lots will have more houses per block of transmission main, so the cost of that main will be less per house than in neighborhoods with larger lots.

> Lot size has a greater effect on water system costs than how isolated a site is or how far it is from the water service center.

A recent study in the *Journal of the American Planning Association* used an engineering cost model to assess the influence of land use on the cost of water distribution and sewer services. The study estimated service costs at $143 for a household located on a 0.25 acre lot in a compact development near the service center. If the same household moved to a 1-acre lot in a similar location, its annual service cost would be $272, even if it did not increase its water use. If that household used the same amount of water on a 1-acre site in a dispersed development far from the service center, its water and sewer service would cost $388 annually.[20] Although this analysis looked at the cost of both water and sewer service, the cost of water only would be lower than the numbers given here, but the relationships among infrastructure cost, distance, and lot size would remain essentially the same.

The study found that the infrastructure and pumping costs of water service are more sensitive to lot size than any other factor. The principal source of this difference is the longer distribution mains required for larger lots. Costs for water transmission mains will be higher for developments farther away from the water supply source, but transmission mains account for an average of only 16 percent of the total infrastructure and pumping costs.

In some communities, developers—and ultimately property owners—are required to pay the cost of providing water service to new developments. Other communities, however, impose these costs on the existing water system, ultimately passing the costs on to all system users. When existing systems pay to extend service to new, large-lot, dispersed developments, they generally raise all water rates, effectively forcing existing users, including those on small lots in central areas, to pay for service to new users.

1.2.2 Low density means more leakage and increases both demand and cost

All water systems leak. They leak both through pipes and at joints. Depending on their condition, drinking water systems can lose 6 to 25 percent or more of their water through leaks and breaks.[21] In 1995, water systems in the United States leaked 25.3 billion gallons of water per day (approximately 9.2 trillion gallons per year).[22]

> Water systems lose 6 to 25 percent of their water through leaks and breaks.

Two major factors determining leakage are length and system pressure. Longer systems leak more than shorter ones; systems that operate at higher pressures leak more than systems that operate at lower pressures. Systems in low-density areas must use higher pressures to push water through longer mains. Because low-density areas tend to have higher demand for water for lawns, water pressures must be increased even more during dry months.[23]

Once again the form of development affects water use. Development that is more spread out—less dense—needs a longer system than development that is more compact. Therefore, in general, water systems in less dense developments will leak more than systems in compact developments.

Of course, if the central pumping station is located on the urban fringe, nearby low-density users will not generate as much loss as their more distant counterparts in other parts of the metropolitan area. Nonetheless, highly dispersed communities will need longer systems and incur greater loss overall than would more compact communities, regardless of where the main pumping system is located.

Leaks are a financial burden for drinking water systems, imposing costs that are ultimately borne by ratepayers or, if the system is subsidized, taxpayers. According to one researcher:

> Lost water is lost money. . . . If losses are caused by leaks, you've lost the money it cost to produce or purchase that water. In some cases, curbing large water losses from leaks can save a town or district the cost of finding additional water sources. Wasted water means wasted dollars. Since 1989, [the Kansas Rural Water Authority] has completed 564 water loss surveys locating an annual loss of 2.387 billion gallons. The annual costs to purchase or produce this loss would have been $3.586 million.[24]

1.2.3 Building new systems while deferring maintenance on older ones worsens water losses and raises costs

Many water systems throughout the country face maintenance backlogs and looming replacement costs. Older pipes and joints leak more than newer ones, and all pipes need to be replaced at the end of their useful lives.[25] Demand for new water systems in developing areas may lead communities to lay new pipes rather than fix old ones. As a result, the leakage and breaks common to older systems grow, and the cost of operating an increasingly inefficient system grows with them.

The American Water Works Association (AWWA) estimates that large portions of many water infrastructure systems will have to be replaced over the next 30 years.[26] The Government Accounting Office (GAO) estimates that 20 percent of pipelines are already near the end of their useful life in one-third of utilities, and that more than half of pipelines are near the end of their useful life in approximately 10 percent of utilities.[27] Replacing obsolete infrastructure simply to maintain existing service will require utilities to find new revenue, either from rate hikes or public subsidies. EPA estimated that even if utilities could increase their revenue by 3 percent per year (above inflation), they still would be $45 billion short of what they will need to replace deteriorated pipes over the next 20 years. Without revenue growth, they will fall $102 billion short of their replacement needs and $161 billion short of their operations and maintenance needs.

GAO found that roughly 29 percent of utilities defer maintenance because of insufficient funds, noting that "public drinking water utilities are more likely than their privately owned counterparts to defer maintenance and major capital projects."[28] GAO also reported that while most utilities preventatively rehabilitate and replace their system pipelines, roughly 60 percent of water utilities state that the rate of preventative work is less than desired, and many have deferred maintenance, capital expenditures, or both. While many utilities have plans to finance future capital needs, almost half believe that their projected revenues would be insufficient to carry out their plans.

1.2.4 Development on and beyond the fringe can reduce return on investment in infrastructure and raise costs

Another way development patterns affect cost is through the location of new development. Building new infrastructure to serve developments on the urban fringe can decrease the overall return on a community's water infrastructure investment. Often, metropolitan service areas have excess capacity. Adding new developments to the existing network spreads the system's capital costs over a larger customer base, lowering the cost of water service per customer. If, instead, new infrastructure is built for these new customers, the opportunity to improve the efficiency of the existing system is lost, leading to higher costs per customer than if the new customers joined the existing system. This phenomenon can be observed in metropolitan Cleveland, where population shifts have led to overcapacity in parts of its suburban water system, reducing the system's efficiency and raising unit costs for users.[29]

> One local official estimates it costs his city $10,000 more to provide infrastructure to a suburban house than one in the urban core.

These changes directly affect municipalities' and users' bottom lines. According to an official of a large western city, it costs the city $10,000 more to provide infrastructure services to a house on the suburban fringe than one in the urban core.[30] Systems that operate at less than full capacity also increase the per unit cost for water delivery. Recognizing this dynamic, Fluvanna County, Virginia, stated in its 2000 Comprehensive Plan:

> If a water and sewer system is developed, it should be provided in a cost efficient and effective manner. Service costs associated with this type of infrastructure are strongly influenced by a development's location and density. Therefore, any new system should be located within existing communities that are also growth areas. This provision will allow for the county to build upon existing infrastructure while providing new infrastructure in the areas where it is most needed.[31]

2. Smart Growth Can Help Communities Reduce Costs and Conserve Water

The U.S. population will continue to grow. How that growth is accommodated will affect the quantity of water needed and its cost. The research reviewed in Part 1 suggests that more compact growth, use of existing infrastructure, and investment in system maintenance can substantially reduce costs and make current water resources go farther. Communities across the country are using these techniques as part of a "smart growth" strategy.

Smart growth practices promote development that enhances the community, economy, public health, and the environment. The Smart Growth Network,* a coalition of more than 30 environmental, real estate, historic preservation, development, academic, and governmental organizations, has developed a set of principles reflecting the experiences of successful communities around the nation (Exhibit 1). The principles include encouraging compact development and leveraging scarce public funds to improve existing assets, including water systems.

Applying smart growth principles can significantly reduce the cost of water provided by communities and the quantity of water demanded by their residents. More compact development allows for shorter transmission systems, making them more efficient to operate and less susceptible to water loss through leakage. Encouraging compact neighborhood design on smaller lots reduces water demand for landscaping. Directing development to areas served by existing infrastructure and maintaining that infrastructure can make systems more efficienct.

Exhibit 1: Smart Growth Principles

1. Mix land uses.
2. Take advantage of compact building design.
3. Create a range of housing opportunities and choices.
4. Create walkable neighborhoods.
5. Foster distinctive, attractive communities with a strong sense of place.
6. Preserve open space, farmland, natural beauty, and critical environmental areas.
7. Strengthen development and direct it toward existing communities.
8. Provide a variety of transportation choices.
9. Make development decisions predictable, fair and cost-effective.
10. Encourage community and stakeholder collaboration in development decisions.

** A list of the members of the Smart Growth Network partners and resources for communities to use in implementing smart growth are at www.epa.gov/smartgrowth and www.smartgrowth.org.*

2.1 COMPACT DEVELOPMENT

Communities can save money on new infrastructure by developing more compactly. Commercial and residential users that are closer together will need fewer feet of pipe than users that are more spread out. When this development takes place in areas already served by water mains, the cost of infrastructure is further reduced.

2.1.1 Smart growth promotes compact development, reducing infrastructure costs

Robert Burchell of Rutgers University has developed detailed models and estimates of infrastructure cost savings associated with compact development. He estimated that more compact growth nationwide would save $4.77 billion, or 6.5 percent of total water infrastructure costs, from 2000 to 2025.[32] The savings would be particularly significant in the South and the West, where growth has been greatest and is expected to continue.

Another analysis, published by the American Planning Association, provides a more detailed look at the different roles played by lot size and community compactness. In one example, the annual cost of providing water and sewer service to a half-acre lot in a centrally located, dense development is $283 per household, while it is $472 for the same lot in a highly dispersed development far from the water service center. The relationship between increased cost and increased distance from the water center is mostly linear: in the highly compact, small-lot development, each additional mile (from 1 up to 4 miles) from the center adds roughly $50,000 to the 30-year cost of service provision per household. However, in the low-density, large-lot development each additional mile (from 1 up to 5) adds approximately $122,000 to the cost.[33]

2.1.2 Smart growth promotes compact neighborhood design, reducing water demand

As shown in Sections 1.2.2 and 1.2.3, landscaping accounts for approximately 50 percent of household water demand and is also a significant factor in commercial water demand. Water demand for landscaping is directly related to lot size. Compact neighborhood design, which makes maximum use of smaller lots, has less landscaping and thus less demand for water. Ultimately, this could make the difference between a community needing to develop new water sources, with the attendant costs and environmental impact, and using existing water sources efficiently and well into the future.

> EPA and its partners in the Smart Growth Network, a coalition of more than 30 environmental, real estate, historic preservation, development, academic, and governmental organizations, have developed numerous tools and resources to help communities improve their quality of life. Many of these are available at *www.epa.gov/smartgrowth* and *www.smartgrowth.org*.

Smart growth also promotes development with a sense of place, which can include landscaping that reflects distinctive regional ecosystems. Communities can reduce water demand by encouraging use of native plants and ground covers that require little or no irrigation.

2.1.3 Smart growth directs development to existing communities—and their infrastructure

Communities following smart growth principles place a priority on fixing existing water systems and directing development to the areas these systems already serve. Recent studies by AWWA and the Water Infrastructure Network have shown that much of the nation's existing infrastructure will need to be replaced in the coming decades. Already systems are deferring maintenance because of lack of funding and inadequate planning, according to EPA and GAO. Expanding water systems incurs additional financial demands, in some cases further delaying maintenance and replacement. As maintenance and replacement lag, old, badly leaking pipes lose more and more water, raising current costs while the ultimate bill for system renewal continues to grow. Concentrating resources on system maintenance rather than expansion can minimize the cost of delivering water during these crucial decades of system replacement.

To encourage growth in already-developed areas, the state of Maryland has started to help pay to upgrade inadequate city water infrastructure systems. The program’s financial assistance can be used for projects such as upgrading aging and poorly operating water treatment facilities; replacing leaking water mains; and repairing or replacing storage tanks. Local water authorities can also use these funds to connect residences to the public supply if wells are contaminated or inadequate, or to upgrade existing water facilities to meet federal and state standards.[34]

2.2 Spotlight on reduced water cost and use: Envision Utah

Envision Utah is a public-private partnership formed in 1997 to evaluate the economic, environmental, and quality of life benefits that a new approach to growth could yield in the greater Wasatch area (GWA), home to 80 percent of Utah residents. Through extensive public participation and modeling, Envision Utah estimated the potential impacts to the GWA from a "quality growth" approach that advocated strategies such as infill development, open space preservation, and mixed-use construction. The results were based on an estimated population increase to 2.7 million (from the current level of 1.7 million) residents by 2020 and compared against a 1997 baseline approach that assumed no change in the way land was developed or natural resources managed. In both the amount of water demanded and the cost of water infrastructure, the quality growth strategy improved on the current, conventional approach to growth.

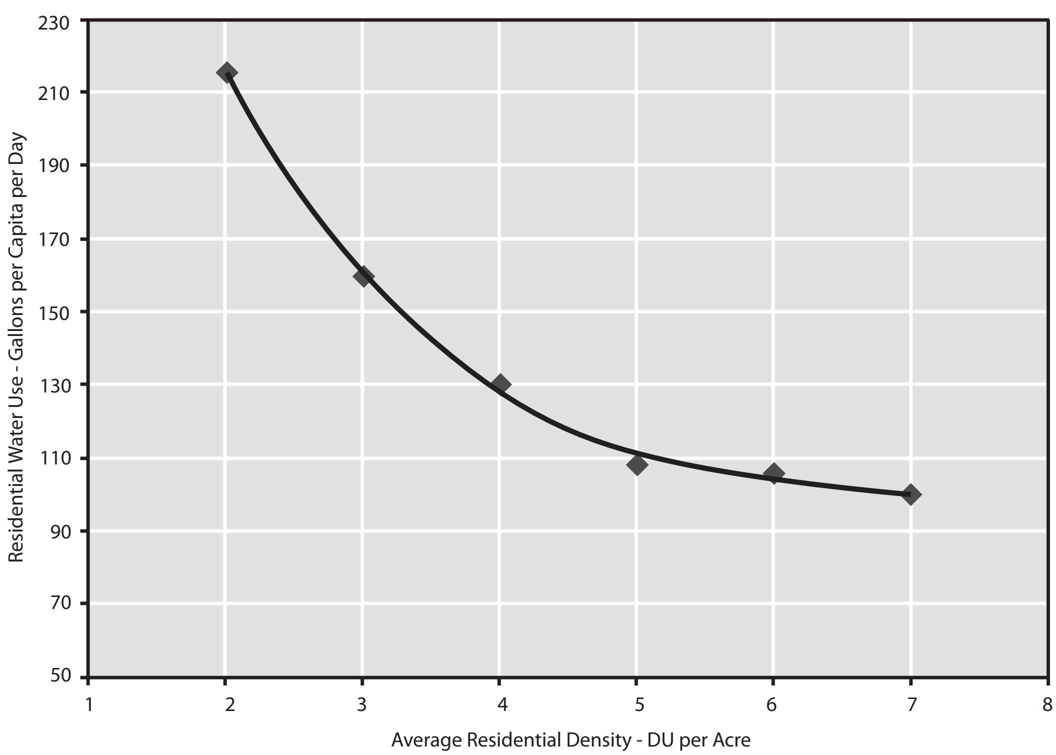
Envision Utah proposed four development scenarios for the project, ranging from low-density, auto-oriented (Scenario A) to very compact, transit-oriented development (Scenario D). The scenario that saves the most money on infrastructure (identified in Exhibit 3) is Scenario C, described as: "The focus of new development and growth on unused land would be walkable and transit-oriented development. There would be more infill and redevelopment and investments would be made to extend public transit systems and alternatives to the automobile."[35]

EXHIBIT 2: Envision Utah Quality Growth Impacts

	Approaches	Baseline	Quality Growth	Quality Growth Savings
Water Demand	• Changes in lot size • Different allocation of population and employment across area • Use of conservation pricing (although overall price of water did not change)	298 gallons per day per capita	267 gallons per day per capita	10.4%
Cost of Infrastructure	• Reduced length of new pipes required • Expanded use of existing infrastructure through infill development	$2.629 billion (in 1999 dollars)	$2.087 billion (in 1999 dollars)	20.6%

EXHIBIT 3: Per Capita Water Use Declines with Higher Densities

Per Capita Residential Water Use as a Function of Residential Density



Dave Eckhoff, PSOMAS Engineering
Source: Tim Watkins, Envision Utah, June 24, 2003

Scenario C's density level also appears to be the most effective in reducing per capita water demand. A study by Envision Utah demonstrated that per capita water demand in the GWA decreases dramatically as development becomes more compact, from approximately 210 gallons per day at a density of two dwelling units per acre to roughly 110 gallons per day at five dwelling units per acre (see Exhibit 3).

Densities beyond five units per acre reduce per capita water demand somewhat, but the water efficiency gains for increased densities are smaller. Although this curve may hold in other areas, only an analysis based on local conditions can determine the level of density where efficiency gains begin to taper off. Also, each community should determine for itself whether to encourage higher densities that save even more water.

3. Policy Options To Better Manage Water Demand

The previous parts of this paper have established that how a community grows affects its water use and the cost of water. This part explores how water policies can affect growth. This section identifies water policies that directly affect water use and cost and indirectly affect growth patterns. Water policies that promote more efficient growth are likely to be doubly effective in helping communities reach their water goals.

The policies discussed here offer a range of options to state and local governments and to utilities. Each policy is described, compared to conventional practice, and linked to community efforts to create water-friendly development practices. Also included, where appropriate, are issues to consider, practice tips, or case studies that can help implement the policy.

3.1 State governments

States indirectly influence local decisions on water rates and infrastructure in two ways.

First, states influence investment in water infrastructure through their administration of the Safe Drinking Water and Clean Water State Revolving Funds (SDW SRF and CW SRF, respectively). States have more discretion under the CW SRF than under the SDW SRF. Under federal law, EPA grants money to individual state funds based on a survey of their drinking water needs. States, in turn, loan money to publicly and privately owned community water systems. Among other functions, states select projects for funding and set interest rates for the revolving funds. Revolving fund loans are made at below-market interest rates—sometimes at zero percent interest—for projects to rehabilitate or replace a system's drinking water source; to consolidate with a stronger system; or to upgrade or replace treatment, storage, or transmission and distribution facilities. From 1997 to 2001, EPA contributed $4.2 billion to the SDW SRF.[36] States matched this with $2.5 billion in state funds.[37] Many states also have their own water infrastructure funding programs.

Second, states have broad authority over local planning and municipal finance. States also have funds that are explicitly directed toward other goals, such as economic development and affordable housing, but that also may be used on water infrastructure. State tax and municipal finance laws govern the ability of localities to raise their own funds, for example, through tax increment funding and local bond issues. Thus, state policies shape the options available to local governments for reconciling water demand and growth.

3.1.1 Administer the state revolving funds to support smart growth

Federal law establishes priorities for loans from the SDW SRF. Top priority must be given to projects that 1) address the most serious risk to human health, 2) are necessary to ensure compliance with safe drinking water standards, and 3) assist systems most in need on a per household basis. These priorities apply to all loan applications, regardless of whether the project contributes to more efficient growth or undermines it. However, states can use smart growth criteria to distinguish among projects that rank equally on the three main priorities and give preference to projects that meet other community goals. Projects that address deterioration in older systems may meet the three main priorities as well as promote the "fix it first" policy discussed in section 3.1.2.

Both the SDW SRF and the CW SRF can support more efficient growth by purchasing undeveloped land or conservation easements on land to protect source water quality. Cleaner source water reduces the cost of water treatment. One study has shown that a 10 percent loss of forest cover in a source watershed raises treatment costs by $8.80 per million gallons treated. The increase in treatment cost is mainly due to the need for more chemical use in the treatment process.[38] Under the Safe Drinking Water Act, a state may set aside up to 10 percent of its revolving fund for land conservation. As of 2003, only $2.7 million of SDW funds have been used to protect less than 2,000 acres of land.

The CW SRF provides more flexibility for states to conserve and restore land. In addition to the preservation of undeveloped land, CW SRF funds may be used to clean up and reuse brownfields. Brownfield redevelopement projects not only reduce the risk of contaminating source water, but also can focus growth on areas that are already served by existing water systems, reducing pressure for system expansion. In 2004, the CW SRF loaned $180 million to projects such as land preservation, brownfield renewal, reducing polluted runoff from agriculture, and other activities.

Case study

The state of Ohio uses CW SRF money to support its Water Pollution Control Loan Fund for brownfield assessment and clean up. A $1.6 million loan covered the cost of treating contaminated subsurface soil and groundwater at a centrally located brownfield in Cleveland. This loan helped Grant Realty to redevelop the site as its new corporate headquarters.[39]

Issues to consider

SRF program officers may need to be educated about the connection between SRF funding and smart growth. Program officers may want to consider whether SRF funding has encouraged growth in areas where growth should be discouraged. They could then develop additional criteria for SRF loans that encourage infill and brownfield development as well as improve water quality.[40]

3.1.2 Fix it first

Some states are looking for ways to direct growth to existing neighborhoods. Many older neighborhoods or small towns have old infrastructure that may need substantial repair. While some older systems have excess capacity, others may not have the capacity to serve new growth, creating a serious barrier to private investment in infill areas. To address these concerns, state policy could favor repairing and upgrading existing systems over new construction. This "fix-it-first" philosophy is most often used for transportation investments—as, for example, New Jersey and Michigan—but could easily be applied to water infrastructure.

State funds powerfully influence how and where growth and development occur. Using these resources to upgrade water infrastructure in existing urban areas reduces development pressure on the urban fringe, thereby preserving critical open space. Further, using state funds to support new development in existing neighborhoods rather than new neighborhoods can improve the efficiency of existing systems and reduce the quantity of water demanded. Finally, the clear identification of priority funding areas can make the development process more transparent and predictable for everyone.

Case study

In its 2001 State Development and Redevelopment Plan, New Jersey classified areas within the state as "areas for growth," "areas for limited growth," and "areas for conservation." These designations determine how future state investments in infrastructure and conservation are allocated.[41] In a similar effort in Michigan, the bipartisan Land Use Leadership Council recommended that state funds be used to "support and encourage compact mixed-use development and infill while discouraging fragmentation and consumption of open space." The council's final report says: "State and federal infrastructure funding should be prioritized to support existing developed areas [and] improve and maintain the effectiveness and integrity of existing infrastructure." The report also embraces the principle that "Infrastructure policies and decisions support and encourage compact and mixed-use development and infill, while discouraging fragmentation and consumption of open space."[42]

Issues to consider

Partnerships are critical to ensure that all involved parties are educated about the policy and how it supports the community's goals. States will need to educate the public about the importance of repairing and upgrading existing systems and how "fix it first" can encourage high-quality development. Elected officials need public support to effectively undertake potentially contentious policy changes.

3.1.3 Authorize the formation of special districts to finance water system expansion

Local governments increasingly are looking to developers to pay more of the cost of expanding water systems to serve new developments. Localities, in turn, rely on state governments to provide enabling legislation for these efforts. Some states have allowed local governments to establish "limited-purpose governments" that finance infrastructure for new developments.

States can authorize local governments to designate areas within their jurisdictions as "special districts" and to authorize in turn the developers of the districts to create limited-purpose governments to serve them. Special districts can issue bonds to fund infrastructure and impose user fees, impact fees, and special assessments on property owners. These fees and assessments repay the bonds and pay for operation and maintenance. Special districts are subject to local regulations, such as zoning, but are financially and administratively independent of the local government. They can issue tax-free bonds, like local governments, but the bonds are not backed by the local government and do not count against local debt limits. Local governments can create special districts just to provide water infrastructure and service, or they can fund a much wider range of facilities, such as sewage, streets, parks, or schools.

This financing mechanism can shift infrastructure costs more directly onto the users of infrastructure. It can save the locality from tying up capital funds in system expansion, preserving resources to upgrade and maintain existing systems. It can provide an alternative to impact fees where impact fees either are not allowed or have proven difficult to assess or implement.

Case study

Several states have authorized special districts. California and Arizona call them "Community Facilities Districts," and Florida calls them "Community Development Districts." Since they were authorized in 1980, about 200 Community Development Districts have been created in Florida. Supporters note that the districts generally have provided good-quality public facilities and services to their residents. They also have helped reduce political battles over infrastructure costs.

Issues to consider

Some of Florida's Community Development Districts have been accused of being unresponsive and undemocratic.[43] State law allows developers to limit homeowners' participation in district decisionmaking for the first six years, and a few developers have retained control far longer.[44] In at least one case, a developer has been accused of steering infrastructure contracts to friends and relatives who have overcharged homeowners for their work.[45] Homeowners also have charged that state and local officials have been lax in overseeing the districts.

Creating special districts fragments government in ways that can make coordination difficult. Special districts may raise the overall cost of public administration, since they establish another local bureaucracy in addition to the existing general-purpose government. Finally, allowing some community residents to essentially opt out of local government services can reduce support for those governments and their ability to provide services to residents not in special districts.

3.1.4 Connect water and land use planning to provide predictability in the development process

In most cases, different levels of government conduct land use planning and water planning. Localities develop general plans that then become the basis for specific area plans, zoning decisions, and building permits. Meanwhile, state water agencies develop integrated resource plans that serve as the basis for water management plans, which are the basis for formal commitments to provide water service ("will serve" letters) and eventually water hookups for individual buildings.

Once development is in place, water agencies have had little choice but to serve it. In cases where existing water supplies have run short, local officials have been forced to halt new development until an adequate water supply can be ensured. In March 2001, Frederick, Maryland, declared a moratorium on new development and annexations after discovering that the city's water system could no longer support its growth. Frederick suffered water shortages during a severe drought in 2002. In the fall of 2002, the city adopted a water allocation ordinance and in 2003 began to issue water allocations. Currently, developers must secure a water allocation and sign a water service contract with the city before applying for a building permit.[46] These restrictions will remain in place until Frederick completes construction of a new water treatment plant.

Making development more predictable is a key principle of smart growth. Further, the better that a community understands its future water availability and the best options to protect water quality, the more likely it is to support a realistic and sustainable approach to growth that minimizes demand, improves efficiency, and protects water quality and future supply. Two recent laws in California attempt to make the development process more predictable by better linking the land use and water planning processes.

California's SB 610 requires water suppliers to estimate their projected water supply/demand balance for jurisdictions served by their systems. Cities and counties are then required to consider this estimate before approving large-scale residential, commercial, and industrial developments. This law does not require cities and counties to reject developments that are inconsistent with the estimated water supply—it only requires that they take water into consideration when deciding whether to approve them.

A second law, SB 221, requires water agencies or appropriate city or county jurisdictions to verify an adequate water supply for developments before they issue building permits.[47] This review is required only for residential developments of 500 units or more, although infill projects and housing developments for low- and very low-income households are exempt.[48]

Incorporating "consistency provisions" into state planning statutes also can help ensure that comprehensive land use plans are consistent with other local plans and regulations. While several states, including Arizona, Connecticut, Florida, and Washington, require land use plans to be consistent with each other, few have gone the additional step of specifically requiring land use and water plans to be consistent. Both consistency provisions and the new California laws can support community efforts to incorporate the water implications of new growth into long-term planning and make the development approval process more predictable.[49]

Case study

In 1990, the state of Washington adopted the Growth Management Act. Among the act's 13 goals are concurrency for public facilities and services, reduction of sprawl into rural areas, and encouragement of development in urban areas. The act requires countywide planning policies that designate urban growth areas and identify sites for county services. Local comprehensive plans then address land use, utilities, capital facilities, transportation, and housing. Both the policies and the plan must be implemented by development regulations, such as zoning, that ensure concurrency and consistency with the urban growth areas. These planning activities must also be consistent with local capital budget decisions.

While it remains controversial, the Growth Management Act is credited with raising the profile of water issues and with making local, water-infrastructure decisionmaking more transparent and predictable.[50]

In the more arid Southwest, where water supplies are increasingly tight, New Mexico has begun to require communities to have the water rights in place before they can build new development. Previously, the state allowed communities to build first and secure the water rights later.[51]

Issues to consider

"Consistency" and "concurrency" requirements get mixed reviews. Requirements for transportation concurrency in Florida have been criticized as ineffective or counterproductive. Transportation concurrency may have encouraged development in previously undeveloped areas because these areas usually have excess road capacity.

3.1.5 Clarify a utility's "duty to serve"

Public utility law generally has held that "a public utility has a duty to serve all customers within its service area who can pay for the cost of service…"[52] The duty to serve can, and at times does, conflict with a utility's or community's efforts to control water costs and ensure adequate quantities for existing customers. In such cases, the duty to serve has traditionally superseded other considerations, sometimes undermining other community goals, such as orderly growth and long-term, stable water provision.

Limited water supplies in many parts of the country, however, have led to a shift in legislation and case law. California laws SB 221 and SB 610 (see Section 3.1.4) exemplify this shift, enabling communities to control the timing and type of development in order to ensure an adequate water supply. Recent legislation in Idaho and Arizona has also weakened the duty to serve and strengthened localities' ability to plan for long-term, sustainable growth. Courts have held that "a city should not be required to undermine its own growth management policy simply because it is a water supplier. Non-municipal suppliers should be subordinate to this policy so long as the policy does not impair their constitutionally guaranteed fair rate of return."[53] Nevertheless, localities' duty to provide water often remains unclear.

Clarifying state law on this subject is critical to localities' ability to plan for future growth with confidence that they will not be undermined by claims for service to new development beyond their desired boundaries. The growing maturity of this issue is also evidence of communities' recognition that the manner in which they grow has a direct and significant impact on water and that their water policies have a direct effect on how they grow.

Case study

In 2003 the state of Washington passed the Municipal Water Supply—Efficiency Requirements Act, which directed the state Department of Health to more closely align water planning with local land use plans. The law specifically requires that water utilities' service areas must be consistent with "local land use plans, comprehensive plans, coordinated water system plans, watershed plans, and development regulations."[54] Since the duty to serve applies only within a utility's service area, carefully delineating service areas that reflect land use plans helps to minimize the conflict between land use and water provision.

Issues to consider

Clarifying the relationship among (in some cases) 100-plus-year-old state water laws, complex property law, and the legal authority of communities to plan for future growth is a complicated task. In many places, local comprehensive plans are inconsistent with development regulations; thus, linking water system plans with comprehensive plans could worsen conflicts between development and water provision. States considering following Washington's lead may wish to provide additional planning assistance to localities. This assistance could be directed toward improving consistency among local plans and their implementing codes and regulations, among other goals.

3.2 Local and regional governments

Municipalities have a powerful effect on system efficiency and the demand for and cost of water. Municipalities that run water utilities affect water demand directly through their infrastructure and pricing policies. As has been discussed, these policies can directly influence water use and development patterns, which in turn affect water use. Localities that wish to ensure efficient water use can focus on system maintenance and set prices that reflect the true cost of water delivery. These policies will encourage compact development that reduces the cost of water delivery. Municipalities can further encourage compact development with zoning, subdivision regulations, infrastructure spending, tax incentives, and other land use policy tools. In particular, local policies that encourage infill development can support states' and utilities' "fix it first" policies, minimizing expensive new extensions. This, in turn, can reduce the cost of water service and the overall demand for water.

3.2.1 Integrate water budgeting into land use planning

As discussed in Sections 3.1.3 and 3.1.4, lack of coordination between land use planning and water planning can frustrate a predictable development decision process. Regardless of how the legal issues surrounding communities' duties to serve are resolved, municipalities can reduce the risk of water shortages by creating water budgets that are based on water supply assessments.

Water planning at the state or regional level often is not detailed enough for communities to match their water use to their water supply. A water budget can help a community to better understand the locally available water resources and compare them to the water demand. Seasonal shortfalls and long-term discrepancies between supply and demand can prompt communities to implement conservation measures, such as xeriscaping, block pricing, or other efforts.

Establishing a water budget may involve appointing a broad-based advisory committee consisting of citizens, landowners and developers, local officials, and experts in water system management. The advisory committee could collect data on water use and trends, identify potential shortfalls, and recommend measures to better align water demand with anticipated resources. The recommendations may provide local governments with guidance and support for integrating demand-reducing measures into local land use plans, regulations, and incentive programs.[55]

The regional aspect of the supply and demand assessment also provides a solid basis for actions that extend beyond local borders to coordinate how and where development takes place. Efforts to direct development to already-developed areas, and especially to compact, central areas, can help to bring a region's water demand into better balance with its limited supplies.

Case study

Albuquerque, New Mexico, recently passed a resolution to develop a regional water budget that details its water "revenue" (supplies) and "expenditures" (uses). The water budget is part of a larger effort within the region to re-examine its traditional approach to water. For decades, Albuquerque had extracted water from an underground aquifer. Recent data, however, indicated that the aquifer was being "mined"—water was being withdrawn faster than it was being replenished—and probably could not meet the community's water needs in the future. The water budget will help the city to manage future water use to avoid deficits.[56]

3.2.2 Use private activity bonds strategically to finance upgrades in existing service areas and planned growth areas

Although some water systems may be able to expand while keeping up with maintenance and replacement of existing pipes, many cannot without additional resources. EPA projects that systems will face up to $205 billion in unfunded but necessary capital expenditures over the next 20 years. [57, 58] One way local governments can finance these expenditures is by issuing private activity bonds. Such bonds can be a cost-effective way of financing needed water system replacement or upgrades that will support infill development and relieve growth pressures outside the existing system.

Communities that decide to develop beyond their existing service areas can conserve financial resources by designating zones or tiers for development. They can delineate and prioritize areas where public funds, in conjunction with private activity bonds or other assistance, will support infrastructure for new growth. Local governments may designate boundaries beyond which no public funds will be available, leaving the cost of infrastructure wholly to the private sector.

In sum, these approaches help communities use public funds to encourage growth in targeted areas and reduce or eliminate subsidies for growth in areas where growth is not desirable.

Case study

Florida's Growth Policy Act recognizes infill development and redevelopment as important to promoting and sustaining urban cores. Florida's definition of urban infill and redevelopment areas includes those where public services, such as water and wastewater, transportation, schools, and recreation, are already available or are scheduled to be provided within five years. A local government with an adopted urban infill and redevelopment plan may issue revenue bonds and employ tax increment financing to finance the plan. These urban infill and redevelopment areas have priority in the allocation of private activity bonds.[59]

Issues to consider

Drinking-water facilities generally are exempt under private activity bond regulations and therefore are eligible for tax-exempt status. However, federally mandated caps limit the amount of tax-exempt private activity bonds that can be issued in a state. States can prioritize bond allocation to support projects that implement smart growth strategies and upgrade water infrastructure.

3.2.3 Introduce service availability fees to better capture the marginal cost of system expansion and household water demand

Local governments can assess service availability fees (also known as exactions, impact fees, service development fees, or facility charges) on a developer to cover the costs of existing and/or future water infrastructure for new development. "Latecomer fees" also may be levied on developments occurring within a reasonable period of time, such as 15 years, after a water system is built. The local water utility may directly levy some service extension fees. A recent study found that 77 percent of drinking water utilities recover some of the cost of service extension through developer contributions.[60]

Service availability fees can reduce water cost and demand in two ways. First, communities can offer full or partial fee waivers for growth in targeted neighborhoods already served by existing infrastructure or for compact projects in undeveloped areas. Second, communities can calculate fees for new construction in outlying areas that more closely approximate the marginal costs of system expansion, rather than its average costs. Another way of assessing fees is to establish zones in which fees are based on distance from existing facility centers.

Many fees are calculated as an average cost of existing system construction or use costs without regard to distance or location, rather than the true marginal cost of expanding a water system to a given project site. Fees that more accurately evaluate the cost of growth and development by location are as predictable for developers as average fees. Further, targeted waivers or fee reductions can encourage development in existing neighborhoods or other compactly designed areas.

Case study

Salt Lake City applies two sets of fees: one to infill sites within existing city lines and one to the growing Northwest Quadrant area.[61] San Antonio waives water and other fees in infill areas the city has targeted for redevelopment. San Antonio also charges lower water rates to customers inside the city limits.[62]

Issues to consider

Some communities have misused service availability fees by spending fee revenue on projects that do not directly benefit the assessed development or to subsidize general revenue. These practices are not allowed under most state laws and are vulnerable to court challenge.[63]

Because the developer will pass on at least a portion of the fees to the homebuyer, fees can raise housing costs. Some cities have exempted or otherwise reduced fees on residences that qualify as "affordable housing" according to the U.S. Department of Housing and Urban Development.

3.2.4 Encourage natural landscaping in residential and commercial buildings

Large grass lawns are a basic feature of traditional landscaping for both homes and businesses. Homeowners' associations and neighborhood covenants often require grass or turf lawns; commercial sites usually incorporate acres of grass. Constant watering and irrigation of these lawns demand large amounts of water, particularly in arid climates. The sandy soils found in arid areas do not hold water well, increasing water demand as commercial building managers and homeowners struggle to maintain a green lawn.

Traditional landscaping is expensive as well as water-hungry. The Conservation Design Forum has estimated that the initial cost of a traditional 10-acre corporate landscape would be 48 percent more than a "sustainable landscape" planted with native plants. Over the first 10 years after installation, the traditional landscape would cost 52 percent more and, in later years, 82 percent more than a sustainable landscape. These estimates include the cost of additional watering for the traditional landscape.[64]

Landscaping that uses native plants will require little additional water beyond what the local climate provides once the plants are established. Xeriscaping explicitly seeks to conserve water through landscaping in which "plants whose cultural requirements are appropriate to the local climate are emphasized, and care is taken to avoid wasting water to evaporation and run-off."[65] Xeriscaping can reduce long-term water use for landscaping by 70 percent or more.[66] Some utilities, particularly those in the arid Southwest such as Tucson and Denver, also offer their customers information on xeriscaping and its benefits.

Local governments can encourage natural landscaping by collaborating with homeowners' associations, local landscapers, and other organizations to educate citizens. Localities could provide financial incentives, such as property tax breaks, for commercial building managers and homeowners who implement and maintain natural landscaping on their properties. Finally, local and regional governments can lead by example by creating natural landscaping demonstration projects on public grounds and parks.

Some local governments, primarily in arid regions, have adopted ordinances that require landscapers to use plants that are adapted to the local climate and need little or no additional water after the plants are established. These ordinances restrict the use of turf, list plants that can be used, or regulate the type of irrigation allowed. Some ordinances exempt single-family homes.[67]

Natural landscaping can foster distinctive communities with a sense of place by creating neighborhoods with native plants and unique regional features. Rather than trying to emulate the grassy yards of less arid regions, property owners in dry areas can reflect their natural surroundings and help create a visual identity for their communities.

Case study

Local governments and utilities are experimenting with incentives for less thirsty landscaping. Las Vegas pays homeowners one dollar for every square foot of turf removed. Denver’s water board recently began a rebate program for homeowners who purchase trees and shrubs with low water needs. The city of Denver launched a Community Conservation Gardens Project that is planting parks with water-conserving landscapes. This project trains teens for work in the landscaping industry, creates beautiful public spaces in both prominent and neglected parks, and serves as a model to homeowners and businesses.

Issues to consider

Natural landscaping and xeriscaping have met with resistance in some communities. Efforts to educate communities about xeriscaping may conflict with entrenched attitudes about what makes lawns, yards, and public places inviting and attractive. Some homeowners' associations have rules that force residents to plant thirsty, non-native grasses in arid areas.

3.3 Utilities

Water utilities play a major role in influencing water demand by setting the rates that determine how much customers pay for water. Many utilities find it difficult to determine fees that capture true costs. Calculating the true cost of delivery for a household or business—the individual user's incremental cost increase to the system—is all but impossible in practice. On the other hand, charging each user rates based on the average cost of serving all users can overcharge users who live in compact, central neighborhoods and can produce the subsidies discussed in Part 1. Furthermore, utilities face political pressure to keep rates low—so low, in fact, that many utilities do not recover their full cost of doing business. Because water is such a basic necessity, utilities also must address concerns that customers with low incomes may not be able to afford rate increases, although poorer inner-city residents would benefit from lower rates that more accurately reflect the lower cost of serving them. In the face of these challenges, utilities have developed a variety of pricing structures. Pricing can reinforce or undercut other policies that encourage compact development.

3.3.1 Fix it first

While states can target financial assistance in ways that encourage repairs and upgrades to existing water networks, the utilities themselves ultimately decide which parts of their systems receive priority for improvements or expansion. Utilities that implement fix-it-first policies can improve their own financial situation, conserve water, and lower costs for their customers. Fix-it-first policies can be especially effective when they are combined with fees for system expansion and local efforts toward redeveloping existing neighborhoods.

Many utilities face declining rate bases as customers move from neighborhoods served by the existing system to outlying areas. Utilities expand their systems to these new neighborhoods, recapturing old customers. At this point, however, the utilities have to pay for building the new systems as well as maintaining the old ones even though they may have roughly the same number of customers. Utilities can recoup their investment and maintain their systems through three mechanisms: they can raise rates on all customers; they can charge service expansion fees to customers or developers in the new neighborhoods; or they can acquire new customers in the old neighborhoods.

How utilities balance their spending among system repair, system replacement, and system expansion and how they set rates and fees are important to their financial health. Utilities often borrow money on the bond market to pay for their capital projects. The interest rate that a utility must pay is determined by the market's assessment of its management, and particularly the utility's management of its physical assets: treatment plants, pipes, and pumps. A fix-it-first policy that stresses maintenance of existing physical assets can contribute to higher bond ratings, lower borrowing costs, and lower overall costs for water delivery.

Moody's Investors Service is one of three major credit-rating agencies that rate bonds and strongly influence utilities' borrowing costs. While some of Moody's key rating factors are clearly beyond utility managers' control—the health of the local economy, for example, or customer income—other rating factors evaluate utility management policies. "Maintenance of assets" is a key rating factor. Moody's also grades utilities on their "strategic focus" and on "regulatory compliance," which indirectly support fix-it-first policies, since compliance and focus are related to the health of the existing system and its orderly expansion.[69]

A recent analysis by Public Financial Management also emphasizes the importance of the fix-it-first policy. It states: "A particular challenge of water and wastewater systems is their ability to meet capital investment requirements of aging systems, and their success in doing so is scrutinized by credit rating agencies." The analysis noted that credit-rating agencies also rewarded utility management strategies that combined fix-it-first policies with fees that assessed new users—rather than all users—for the cost of system expansion.[70]

Case study

Philadelphia's water department is one of the oldest water utilities in the country. Like many older cities, Philadelphia has an aging water system, declining population in its central service areas, and increasing demand in suburban areas. In the early 1990s, Standard and Poor's (S&P) noted that parts of the system were more than 100 years old and needed "extensive repair and replacement." In 1991, the water department had a deficit of $42.5 million on an operating budget of $270.4 million.[71]

The water department made several financial and administrative improvements over the rest of the 1990s. It created a rate stabilization fund dedicated to capital expenses and vastly improved metering and bill collection. In 1996, the city created a Capital Program Office to track the condition of infrastructure and planning and to manage capital improvements. The system's bond rating improved along with its capital and operational reforms, saving the city millions of dollars in interest. By 2001, the water department's bonds had been upgraded to "A-" (S&P) and "A3" (Moody's). Both services highlighted the department's capital improvement program for reconstructing its water conveyance system and improving its water treatment plants.[72]

The Philadelphia Water Department also takes a proactive approach to protecting the quality of its drinking water sources. It helped to develop a watershed land protection collaborative for the Schuylkill River that works to preserve natural lands that have high value for water quality.[73]

Issues to consider

Utilities that are faced with declining customer bases along with increasing repair and replacement costs find it very difficult to maintain their systems even with a fix-it-first policy. Local governments can help these utilities by targeting growth to areas on the existing system.

Utilities can focus system upgrades in the targeted areas to make them more attractive to new development. When that development occurs, the increase in customers will generate new revenue that often pays both for the targeted upgrades and for other improvements to the existing system. This can generate an upward spiral of system improvement supporting redevelopment that funds further system improvement.

3.3.2 Set rates that fully cover costs

A recent GAO report found that over one-quarter of public utilities charge rates that do not cover the full cost of water service, including depreciation, debt service, taxes, and operations and maintenance.[74] These artificially low rates encourage customers to use more water than they would if they paid full price. Inadequate rates also contribute to the gap that exists in many systems between available funds and the cost of needed repairs and replacement.

> Over one-quarter of municipalities charge water rates that do not cover their costs.

Water utilities may be publicly or privately owned. Public water utilities generally calculate rates differently than investor-owned utilities. Public water utilities often use the "cash needs" approach, which considers operation and maintenance expenses, tax equivalents (e.g., payments in lieu of taxes), debt-service payments (including both interest charges and repayment of principal), contributions to specified reserves, and capital expenditures not financed by either debt or contributions. Private and investor-owned utilities more commonly use the "utility" approach, which considers operation and maintenance expenses, taxes, depreciation, and a rate of return on the value of the utilities' assets less accumulated depreciation.[75] The utility approach is more likely to generate adequate revenue, in part because it explicitly considers the utility's cost of capital and the cost of depreciation. Public authorities may wish to consider the utility approach. However, neither approach will result in adequate revenue unless maintenance and system replacement needs are carefully assessed.

Unrealistically low water rates undermine efforts and incentives to reduce water use by all users. Those who use little water receive a small subsidy, while those who use large amounts of water receive larger subsidies. This encourages water-consumptive growth patterns and deprives those who choose less water-consumptive lifestyles of the full benefits of their choice. In fact, customers who use less water may be charged for the cost for new drinking water supplies that would not be needed if water were priced correctly.

Case study

A 2003 water-pricing study by an advisory committee in Fort Worth, Texas, found that rates were failing to cover increasing costs of electricity, security, environmental compliance, and pipe replacement. Residential users were paying nearly 8 percent less than the cost of their water consumption, and commercial users were underpaying by more than 5 percent. In response, the Fort Worth Water Department raised rates and changed its rate structure to encourage conservation.[76] The rate structure is discussed further in the case study for the next section, 3.3.3.

Issues to consider

For public water utilities, changes may require the approval of a board of directors, composed in part of elected officials. In private investor-owned water utilities, rate changes are subject to approval by the state public utilities commission (or public services commission). In some cases, utilities may be subject to legislation or other regulation that limits the amount, frequency, and type of fee increases.

3.3.3 Implement conservation pricing

Consumers pay for water in two ways: hookup (connection) fees and volume charges.[77] A connection fee may be a flat rate, vary by type of unit added to the system, or vary by the size of meter used for the new unit. Typically, residential connection fees vary with the size of the meter. Some systems use a more complex calculation, varying fees by lot size, value of the property, or distance from the treatment station.

Volume charges ("rates") can be uniform—the same amount for each gallon used—or can employ "block pricing" under which rates vary with water consumption. When used to promote conservation, this practice—also known as conservation pricing or incremental pricing—increases water rates for higher levels of water use. Base amounts sufficient to meet basic household needs are assessed at the lowest per unit rate. Additional blocks (e.g., the next 5,000 gallons consumed) of water consumed are charged at incrementally higher rates. Similar efforts apply surcharges for use beyond a base amount in times when demand is greatest and supply is lowest; seasonal or drought-impacted charges are two examples. Peak charges encourage conservation, especially for uses such as lawn watering, when conservation is most needed. According to a 2002 survey of 153 systems, 36 percent of the systems charged uniform rates, 30 percent charged declining block rates, and 30 percent charged increasing block rates.[78] Thus, less than one-third of water utilities surveyed use rate structures that encourage conservation.

Water rate structures that charge less for higher levels of consumption encourage more water use and more water-consumptive development patterns. Like the artificially low water rates discussed above, discounts for high water use not only penalize users who live in water-efficient neighborhoods, but also increase the likelihood that those users will eventually have to pay for new water supplies and new water plants.

Case study

In February 2004, the Fort Worth Water Department raised rates to cover increasing costs. Rate hikes were higher for households that consumed the most water. Under the new rates, customers using less than 1,000 cubic feet per month pay $1.66 per 100 cubic feet, those using between 1,000 and 3,000 cubic feet pay $1.98 per 100 cubic feet, and households using more than 3,000 cubic feet pay $2.40 per 100 cubic feet. The average household in Fort Worth consumes about 12,000 cubic feet per year.[79] Following the rate hike, in July 2004, city-wide water consumption was 11 percent less than the average of the previous four years.[80]

Issues to consider

Commercial customers are accustomed to discounts for volume and may perceive conservation pricing as a threat to economic development. Conservation pricing could generate higher costs that unduly burden low-income households. Utilities can protect against this by ensuring that the base block quantity is adequate to meet basic household needs and that higher fees are levied on amounts necessary only for more discretionary purposes.

From the utility perspective, block rates can make revenue less stable than uniform pricing systems, and their success at encouraging water conservation can vary. Studies have shown that, without other conservation measures or overall rate hikes, conservation pricing reduces water demand by 5 to 8 percent or more.[81]

Finally, the political nature of rate increases makes it a potentially difficult issue for many utilities. Public education and outreach[82] or citizens' advisory committees that coordinate research and offer recommendations[83] can mitigate this challenge.

3.3.4 Implement zone pricing for water users

Typical water-pricing structures spread costs evenly among all customers without regard to the actual price of delivering water to them. A 1995 Rutgers study on New Jersey infrastructure estimated that the cost of providing water to households in dispersed developments was roughly 13 percent higher than the cost of doing so in a more compact area.[84] Elevation, as well as distance from the water plant affects the cost of pumping water to a user. Yet, as already discussed, most utilities charge uniform rates, regardless of the higher cost of serving dispersed development, developments at higher altitudes, and large-lot developments. Utilities can set up rate structures wherein customers in lower-cost areas pay less for water than those in higher-cost areas. Such rates more accurately reflect the additional costs of pumping treated water to distant locations or to higher elevations.

Some utilities set lower rates for customers inside city limits, but this discount usually is not based on the difference in cost of service. These lower rates are intended to compensate city residents whose tax revenues support subsidies given by their city governments to the utilities. Zone pricing goes further by tying the price of water more explicitly to the cost of delivering water to the zone and the cost of maintaining the system infrastructure that serves the zone. It may consider factors such as density, distance from treatment center, and elevation to better reflect the cost-effectiveness of water delivery in compact, centrally located neighborhoods. Zone-based costs may also better capture utility expenditures on system upgrades and expansion in the absence of adequate hookup fees.

By setting up rates to reflect the true cost benefits of water conveyance and operation and maintenance, utilities can help encourage development that uses less water and is more efficient to serve. Further, zone pricing helps to make individual users responsible for the cost of serving them, ensuring that those who impose lower costs on the system receive the benefit of lower prices.

Case study

The Cleveland Division of Water (CDOW), the regional water purveyor for most of the Cleveland area, is one of the few systems in the United States that employs spatially variable user rates. This system recovers costs from pumping to higher elevations, which happen to correspond to areas of less density and more dispersed development. Customers located in CDOW's three higher-pressure zones pay rates that are 1.7, 2.0, and 2.3 times greater than those in the lowest pressure zone. On average, residents outside of the city (but inside the CDOW service area) pay approximately twice as much as city residents for their water. Although intended to cover extra operating costs, this ratio also corresponds closely to CDOW's expenditures for capital improvements: 65 percent of all CDOW capital improvement dollars funded projects outside the city, while 35 percent were spent in the city—a ratio of nearly two to one.[85]

Issues to consider

Some water users may perceive zone pricing as unfair, while others may perceive the current pricing system as unfair. Utilities may want to educate consumers about the relationship of costs to the new prices.

3.3.5 Engage a citizens' advisory committee on water

Local resident and stakeholder involvement in developing strategies to address water issues can be effective in tackling current problems and preempting future ones. Collecting and considering the opinions, concerns, and needs of utility customers can better inform plans to service future growth and development. Involving citizens in the discussion of tradeoffs between options improve their understanding and reduce chances of litigation over final decisions.

A citizens' advisory committee (CAC) is usually made up of representatives of the community and selected expert groups. CACs meet regularly, developing trust as well as knowledge of the issues. These groups can effectively represent customer needs and concerns and are useful in addressing potential conflicts in the community. Citizen involvement can not only help identify opportunities to reduce water demand or make existing systems more efficient, it can also lead to stronger stakeholder involvement in related development decisions, thereby enlisting residents in determining their community's future.

Many communities already have organizations that are developing plans to protect sources of drinking water. These groups are often broadly based, including local officials and watershed associations as well as citizens. They may provide a useful forum for addressing water demand and growth issues.

Case study

In Boston, a citizen "watchdog" group was formed during the late 1970s in response to concerns about expanding the water supply and was later financially supported by the water utility district. Instead of promoting additional sources for Boston's water supply, the citizen group helped lead a conservation effort that focused on finding and fixing leaks. Due to this and other conservation measures (e.g., customers received free water-saving devices, and the utility increased water rates), water demand dropped by 16 percent between 1985 and 1992. The Boston experience was "orderly, constructive, and economical, albeit very time-consuming."[86]

Issues to consider

Despite their benefits, CACs can be, as mentioned above, time-consuming and challenging to manage. Participants must be sure that their involvement is taken seriously and will be used constructively to shape project goals and outcomes, particularly since they often are uncompensated. Advisory groups must be on guard for citizens who come to the table with an explicit agenda that could undermine the group's larger goals and efforts to create consensus, cooperation, and compromise. Finally, substantial time and resources may be needed to support the group.

End Notes

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