Water Rate Structures in the Southwest:

How Southwestern Cities Compare
Using This Important Water Use Efficiency Tool

WESTERN RESOURCE
ADVOCATES

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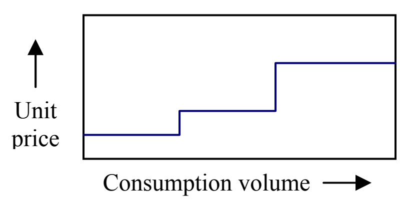
Executive Summary

In the semi-arid and arid Southwest, precious rivers, streams, and aquifers sustain cities and towns by feeding urban water supply systems. Citizens, policymakers, and water utility managers must fulfill the dual role of ensuring a finite supply of water in customer taps and in southwestern rivers and aquifers, as citizens place a high value on both.

Municipal water consumption is a relatively small percentage of overall water use, but it warrants close attention from policy makers. One reason is that municipal uses have been the drivers for new water acquisitions in the Southwest, such as the Clark, Lincoln, and White Pine Counties Groundwater Development Project in Nevada, and these new sources of water often have high costs, both economically and environmentally. Second, municipal water uses, by their nature, must be supplied regardless of how dry a particular year is. In contrast, if snow packs are low and reservoirs empty, agricultural uses may be interrupted, but typically resume again in wetter years (and farmers often are compensated under drought relief programs). Municipal demand is not as flexible, and the high economic values associated with it ensure that most municipal water needs will be met, even in very dry years. The authors believe that water conservation is important in every sector of water use, but this report focuses on the fastest growing sector in Nevada — municipal water use.

Water rate structures play an essential role in communicating the value of water to water customers, thus promoting long-term efficient use. The value of water includes: (1) the utility's operation and maintenance costs; (2) costs to procure and develop additional water supplies to meet growing demands; and (3) social and environmental "opportunity costs" of losing other benefits of the water and natural waterways.

Inclining block rate structures most effectively communicate this value and encourage efficient use when compared to other types of rate structures. Through an inclining block rate design, the unit price for water increases as the volume consumed increases, with prices being set for each "block" of water use. Customers who use low or average volumes of water are charged a modest unit price and rewarded for conservation; those using significantly higher volumes pay higher unit prices.



In a broader regional study, we found a close correlation between cities with dramatically inclining block rates and those with the lowest per capita consumption levels.[1] Along with other conservation and efficiency programs, effective rate structures can help stretch existing water supplies farther and avoid much of the cost, delay, and controversy that result from large, new water development projects. If designed appropriately, inclining block rates:

- Provide water at low prices for basic and essential needs, so all customers can afford it;
- Reward conserving customers with lower unit rates for water;
- Encourage efficient use by sending a strong conservation price signal;
- Assign water supply and development costs proportionately to the customers who place the highest burden on the supply system and the natural supply sources; and
- Do all of the above while still maintaining a stable flow of revenue to the utility.

[1] Western Resource Advocates, *Smart Water: A Comparative Study of Urban Water Use Efficiency Across the Southwest*, December 2003, at 74–86.

Nevada municipalities primarily use an inclining block rate structure, which, if designed properly, can send strong conservation price signals. However, the results from this analysis indicate that although most communities have an inclining block rate structure, there remains to be a lot of room for improvement.

This report discusses the various types of water rate structures and their effect on promoting efficient water use (pages 3 to 8). It then offers a comparison of the rate structures used in the largest Nevada municipalities to see how these cities compare using rate structures as a water efficiency tool (pages 9 to 16).

Introduction

Water rate structures are becoming an important tool for encouraging the most efficient use of our precious water in the arid West. Many cities with water rate structures that accurately reflect the value of water and the costs of obtaining new water supplies have lower per capita water use and can stretch existing water supplies farther. These cities are able to avoid much of the cost, delay, and controversy that accompany large new water development projects. As a result, they're able to preserve the natural river systems that support habitat and the quality of life associated with outdoor experiences here in the West.

This paper offers a guide to the various pricing options that urban water managers and policymakers can use. It explains which options generate the strongest incentive for efficient water use and yield the fairest billing for consumers who place different levels of demand on water supply systems. It then compares a large sampling of current water rate structures in communities throughout Nevada.

Background Information on Water Rate Structures

What Is a Water Rate Structure?

Like retailers of commodities such as electricity, municipal water utilities sell their product (treated water) to their customers, and charge the customers to cover the cost of the product plus the operation and maintenance of its supply and delivery system. Municipal water utilities set the prices for their retail water sales through their ***water rate structures***. If well designed, water rate structures communicate the true cost of water to the consumer. They also play an important role in setting price incentives that promote indoor and outdoor water conservation. Unfortunately, many water rate structures in Nevada cities and towns do not yet effectively accomplish either of these objectives (see pages 9 to 16 for details).

Water rate structures are extremely important in promoting efficient water use, since water consumption levels are directly related to the price signals sent by rate structures. Many people assume that establishing a conservation price signal in a water rate structure translates to higher water bills for most customers. However, this is not necessarily the case. In fact, under well-designed structures, conserving households can actually save money. Innovative rate structures can promote efficient water use while maintaining an equitable and reasonable charge to customers. At the same time, well-designed rate structures can also provide the utility with a reliable revenue flow that covers its operation and maintenance costs.

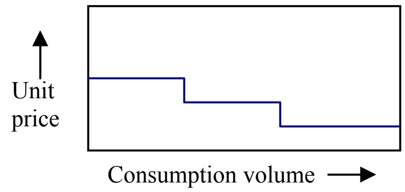
What Are the Different Types of Water Rate Structures?

Most water rate structures are made up of two charges. Both charges play a role in determining how effectively a water rate structure communicates an efficiency message to the customer.

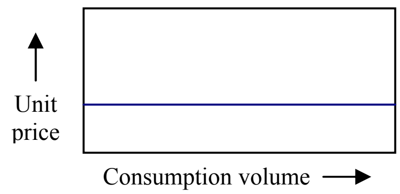
- ***Service charge*** = the fixed service fee per billing period, regardless of consumption level
- ***Consumption charge*** = the price for each unit of water consumed

With these two charges as a basis, the water supply industry uses four general types of water rate structures. However, many variations exist within these types. In addition, some cities and utilities apply hybrid rate structures that combine different components of the four basic types. The unit prices discussed here refer to the consumption charges for water sold to each customer, and do not reflect the service charges. These consumption charges, or ***marginal prices***, reflect the price for using the next measured amount of water, often set as dollars per 1,000 gallons or dollars per 100 cubic feet of water.[2]

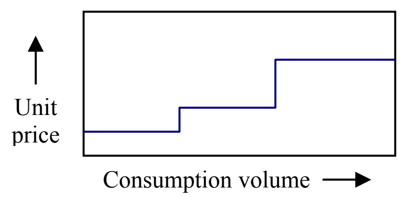
- ***Decreasing block rates***: The unit price for water decreases as the volume consumed increases. The structure consists of a series of "price blocks," which are set quantities of water sold at a given unit price. The unit prices for each block decrease as the price block quantity increases.



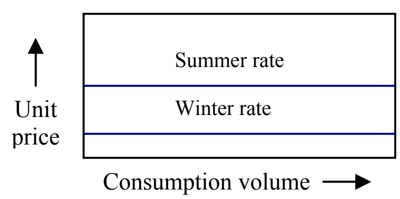
- ***Uniform rates***: The unit price for water is constant, or flat, regardless of the amount of water consumed.



- ***Inclining block rates***: The unit price for water increases as the volume consumed increases. This structure consists of a series of price blocks, where the unit prices for each block increase as the block volumes increase. Those who use low or average volumes of water will be charged a modest unit price; those using excessive volumes will pay higher unit prices. A variety of approaches can be applied to setting each block volume.



- ***Seasonal rates***: The unit price for water is set to vary from season to season. Summer water rates are typically higher than winter rates in order to reflect the fact that water is more valuable, and costs more to provide, in the summer.



[2] Some smaller communities still use a flat consumption charge for all customers (i.e., not metered per unit of individual consumption), since individual metering systems are not adequate or in place.

How Do Water Rate Structures Relate to Efficient Water Use and Conservation?

To promote efficiency, water rate structures must communicate the true cost of water. Only if the price of water reflects the economic value of water will customers know whether it is "worth it" to conserve water. The true economic value of water includes: (1) the utility's operation and maintenance costs; (2) the costs to procure and develop additional water supplies to meet growing demands; and (3) the social and environmental "opportunity costs" of losing other benefits of the water in order to develop and consume the water (e.g., ecological and recreation values of river basins, local/community economies, and values of river flows for diluting pollutants). Failing to integrate all of these social and environmental costs into a water rate structure is equivalent to subsidizing the cost of water. Furthermore, if the retail price of water is lower than its value, customers have an incentive to use too much of it.

Often a utility's "marginal" costs — the costs of meeting an increase in water demand with additional supplies — serve as a useful proxy for the value of water. If efficiency is a priority — and under conditions of limited water supply and increasing population, it should be — it is imperative that water rate structures send accurate signals about water's value. If a utility's rate structure accurately reflects its marginal costs, it should encourage efficiency. In other words, water use efficiency means saving water when doing so costs less than the value of the water saved. Although there are costs associated with saving or conserving water, these conservation costs are often lower than the total economic costs associated with developing and using new water supplies. Such factors usually include the cost of acquiring new water supplies, the cost of building infrastructure to store and deliver water, environmental costs, and socioeconomic costs, among others.

Innovative rate designs can promote efficient water use and still assure utility revenue stability. Water utilities are confronted with the challenge of recovering supply costs with revenues from water sales. System maintenance, facility operation, and procuring and developing future supplies all contribute to the utility's costs. With the exception of tax-based subsidies in some districts, most of these costs are recovered via the water rate structure, tap fees, and other surcharges. Given this arrangement, utilities do not have an obvious incentive to promote conservation, since utility revenues are driven by higher water sales. However, water rate structures can be designed in ways that yield relatively stable and sufficient revenue flows, while still promoting efficient water use. Examples of this "win-win" scenario exist throughout the Southwest.

Which Types of Rate Structures Promote the Most Efficient Water Use?

The *inclining block rate structure* most effectively encourages efficient water use. An inclining block rate structure is set up to charge higher unit prices to customers who use more water and charge lower unit prices to customers who use less. This design is fundamentally fair; customers are charged on the basis of the costs they impose on the utility. Because high-volume users expedite the need for infrastructure upgrades and new supply procurement, these high-volume customers are more expensive for the utility to maintain. It would be unfair to pass the costs generated by these relatively few customers on to those who use more moderate amounts. Thus, if designed correctly, inclining block rate structures reward customers for conservation.

Inclining block rate structures sometimes include block volumes that are individually customized to the specific water needs of each customer — this is called a ***water budget rate structure***. Under this design, each customer is assigned a monthly allotment of water based on the customer's lot size, irrigable area, climate conditions, and household/building occupancy. In most cases, the monthly allotment, or budget, provides enough water for each customer to sustain normal indoor uses as well as actual landscape irrigation needs based on local evapo-transpiration rates. If the customer exceeds the monthly water budget, the excess water use is charged at notably higher unit prices (as with the standard inclining block rate structure). In essence, each account has its own water rate structure attached to it. As a result, efficient customers pay a lower unit rate, while inefficient customers pay a higher unit rate.

Maximum water budget allotment limits can be set to avoid excessive water allotments to large lot owners. One way to do this is to incrementally decrease the water allotment per square foot as the irrigable area of the lot increases. This helps minimize the inequity of allocating water based on wealth (measured via lot size ownership). It also encourages large lot owners to apply a more water-efficient design to a portion of their landscaped yard.

The *seasonal rate structure* also provides a conservation price signal when moving from winter to summer. This design charges a higher unit rate in summer, when outdoor and other discretionary water uses are the highest. Most often, this design applies a uniform rate structure that varies in price from season to season. Thus, on a day-to-day basis within a particular season, the seasonal rate structure does not provide a price incentive for conservation because the unit price is constant regardless of the amount of water consumption each month. An exception to this rule occurs when the seasonal rate changes incorporate inclining block rates (e.g., uniform winter rate and inclining block summer rates).

The *uniform rate structure* and the *decreasing block rate structure* provide no price incentive for water conservation. Although a customer's overall bill will increase as water consumption increases in both of these rate structures, the unit price for water remains constant or decreases, respectively. Thus, the consumer has little or no price incentive to conserve and, in the case of the decreasing block rate structure, the consumer actually has a price incentive to use more water. This can encourage waste.

What Other Factors Affect a Water Rate Structure Design?

Equity for the Customers

Rate structures need to charge customers equitably. This is a challenge, given the wide variety of customers. To meet this challenge, utilities must provide fairly and reasonably priced water to all customer types (i.e., from small volume users to large volume users) and across all customer sectors (e.g., residential, commercial, industrial). Inclining block rate structures meet the criteria for fairness: they charge customers on the basis of the amount of water they consume and also ensure that all customers can afford to pay for water essential uses. This design is inherently fair and reasonable because customers are charged according to the strain they impose on the utility's water supply. An inclining block rate structure allows providers to supply water for essential use at a lower cost per unit of water. This not only provides an incentive to conserve, but also ensures lower income consumers are able to meet their basic water needs at an affordable cost and can eliminate the subsidy to the high-volume users.

Revenue Stability for the Utility

Rate structures must be designed to ensure that the utility recovers its costs. A rate structure that will not allow a utility to recover its operation and maintenance costs will require a subsidy to the utility, typically at the taxpayers' expense. This often occurs when the utility prices the water at or below its average cost of collecting, storing, treating, and delivering the water. Conversely, a utility generally is only allowed to raise revenues that do not exceed and are reasonably related to its ***cost of service***. Therefore, setting fixed service charges and consumption charges must be coordinated with customer demand projections to generate a revenue flow consistent with utility costs, which include operation, maintenance, as well as conservation program costs.

What Factors Can Weaken the Effectiveness of a Water Rate Structure?

High Fixed Service Charges

High fixed service charges can weaken the intended conservation effect of an inclining block rate structure. Setting appropriate fixed service charges is as important as setting consumption charges. When compared to consumption charges, fixed service charges offer a much more consistent revenue stream for a utility to cover its operation and maintenance costs. As a result, water utilities often prefer to set higher fixed service charges. However, a high fixed service charge coupled with relatively low consumption charges can encourage wasteful consumption — much like a "pay by the plate" dinner buffet.

In combination, both the service charge and consumption charge directly affect the ***average price*** for the water. The average price, which is what consumers see reflected in their bills, is defined as the monthly service charge plus the total consumption charges, divided by the total consumption volume. The average price directly affects consumption patterns, because consumers typically respond to the bottom line on their bills. When fixed service charges are factored into an inclining block rate structure, a conflicting message can result. According to studies by the American Water Works Association Research Foundation, "fixed service charges can offset the conservation incentives of increasing marginal rates."[3] This phenomenon occurs when high fixed service charges are used along with small block price increases.

If the block price increases are too small and/or the fixed monthly service charges are too high, the average price curve often declines and eventually becomes uniform, or flat. From the perspective of the customer's pocketbook in this scenario, each additional unit of water purchased will more or less have a constant price attached to it, even if the block prices (marginal prices) are increasing. When this occurs the consumer will not experience any noticeable conservation price incentive.[4]

"Price Insensitivity" as a Result of Minimal Consumption Charge Increases

Inclining block rate structures can also be ineffective in promoting efficient water use if the block price increases are small. This is especially true in districts with an abundance of low-density, residential or commercial development, particularly areas with large, irrigated lawns. An important economic concept known as ***price insensitivity*** explains this phenomenon. In this case, price insensitivity refers to situations where block price increases are too small or negligible relative to a customer's overall water bill and/or disposable income. As a result, the inclining block rates are hardly enough to encourage conservation or demand reduction for high-volume customers with large disposable incomes. For example, a $0.20 block increase (per 1,000 gallons) does not create the incentive for a high-volume residential user to be efficient with lawn irrigation practices. This hypothetical consumer would only pay an additional $2.00 for using 10,000 more gallons in this block.[5] Addressing this problem is very

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[3] Ari Michelsen, J. Thomas McGuckin, and Donna M. Stumpf, *Effectiveness of Residential Water Conservation Price and Nonprice Programs*, American Water Works Association Research Foundation (AWWARF), 1998, at 13.

[4] "A rate structure with increasing marginal prices while the average price is declining sends mixed signals to consumers about their economic incentives to conserve water. Rate structures with any service charges, and in particular relatively large service charges in relation to the per unit cost and total water bill, are apt to create these mixed price signal conditions," AWWARF, at 13–14.

[5] The challenge that many water utilities face is setting block prices that will have a significant effect on customers that use large volumes and have high disposable incomes without creating an inequity, or regressive tax, on lower income brackets. A steeply inclining block rate structure appears to be the most ideal tool for this socioeconomic conundrum. This design would charge

important since a small number of high-volume users can easily use more water, and place more strain on the supply system, than a large number of low-volume users.

Billing Frequency and Communication to Customer

Customers' response to water rates is also influenced by the billing cycle and the ability to track their use. For example, bi-monthly billing cycles can be counter-productive to water conservation efforts. Customers interested in conservation or saving money adjust their home water use on an incremental basis, in response to the consumption reported in each billing statement. This practice is particularly common during the summer irrigation months, when urban water use peaks. With a bi-monthly billing cycle, the summer can be half over by the time customers are notified of their recent consumption quantities. This may preclude many customers from making more efficient water use decisions earlier in the summer during the high water-use months.

Customers are more likely to practice water conservation if they have easy access to their account information. Although billing statements typically summarize each household's water use during the previous month period, other opportunities could be made available on a more frequent basis. For example, as computerized utility accounting systems become more streamlined and modernized, it will be possible to provide real-time account access via the utility website. In-home, remote meter-monitoring technology is also becoming available. With these types of tools, customers will have the opportunity to monitor daily or weekly water use trends and adjust their use accordingly.

How Can I Evaluate My City's Water Rate Structure?

When analyzing water rate structures and billing policies, ask the following questions:

- Do the consumption charges, or marginal prices, send a conservation price signal that clearly demonstrates that water conservation yields lower water bills?
- Does a high monthly service charge decrease the customer's incentive to conserve?
- Are the consumption charge increases in an inclining block rate structure noticeable to all customers, or are high-volume water users unaffected by the modest block price increases?
- Do the water rates reflect the true value of water, incorporating system operation costs, social costs, environmental costs, as well as the costs for acquiring future supply sources?
- Does the billing frequency and statement summary enable the customer to effectively monitor water use and adjust conservation efforts accordingly?

As with most public affairs, local socioeconomic trends and variables must be considered when assessing appropriate water policy implementation. For example, an effective price structure in one community may be ineffective or regressive in another community, depending on the socioeconomic status and demographic makeup.

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substantially higher unit prices for high-volume use, while the low-volume use for basic needs would be charged at a much lower, more affordable rate.

Rate Structure Comparative Analysis of Southwestern Cities

How Do Water Rate Structures Compare Across the Southwest?

In July 2006, we gathered water rate data from the municipal water utilities across the Southwest. This sampling provides a good cross-section of southwestern water providers, both in geographic distribution and community size. Although the variation in rate structures used by municipalities can be seen as a rough indication of how each city prioritizes water conservation, each utility has a different water supply situation and different costs associated with these supplies. As a result, water prices and rate structures can be expected to vary somewhat regardless of each city's commitment to conservation. Table 1 lists the components of each rate structure, as implemented by these water providers in July 2006.

As shown in Table 1, seven of the water providers in the analysis apply some form of an inclining block rate structure. We can be encouraged by the fact that some southwestern cities are taking steps towards promoting efficient water use through their rate structures. In these cases, water is charged at a higher unit rate as consumption volumes increase. The customers that place a higher strain on the supply system pay a higher unit rate for their water; if the rate structure is designed effectively, customers receive a conservation price signal ... use less and pay less per unit.

However, this sampling reveals that many cities have a lot of room for improvement in promoting efficient water use via their water rate structures. We also see variations in the design of the inclining block rate structures, the number of blocks (ranging from two to five), the block volume thresholds, and the block prices. These design characteristics directly affect how well the rate structure promotes efficient water use.

For example, the block price increases and volume thresholds in cities like Tucson and Santa Fe send a strong conservation price signal to most customers. On the other hand, in the city of Las Vegas (Las Vegas Valley Water District), the relative modest block price increase between their four blocks sends a weak price signal. For the customers who exceed 7,500 gallons of use, their unit rate only increases by $0.70 per 1,000 gallons. So, an additional 7,500 gallons of water will only cost an additional $5.25 above the same volume of use in the previous block. There are only modest changes for all subsequent blocks as well, with price increases of $0.63 and $0.64, respectively.

Conversely, with Santa Fe's inclining block rate structure (during summer months), a customer pays $13.20 for the fixed monthly service charge, in addition to paying $4.09 per 1,000 gallons for the first 12,000 gallons used, $6.59 per 1,000 gallons for the next 8,000 gallons used (between 12,000 and 20,000 gallons total), and $9.09 per 1,000 gallons for any water use that exceeds 20,000 total gallons.

Table 1
Water Rates for Residential Accounts
in Southwest Municipalities (5/8" - 3/4" Services) as of July 2006

Municipality [water provider]	Rate structure type	Fixed monthly service charge	Consumption rate: unit rate per 1,000 gallons of water consumed
Albuquerque[(1)]	Seasonal and inclining block rate (three blocks)	$11.41	Nov-March: $1.64 (flat) April-October: $1.64 – up to 300% of average use $2.83 – 300% to 399% avg. use $3.82 – over 400% avg. use
City of Las Vegas [Las Vegas Valley Water District]	Inclining block rate (four blocks)	$4.23	$1.05 – up to 7,500 gal. $1.75 – 7,500 to 15,000 gal. $2.38 – 15,000 to 30,000 gal. $3.02 – over 30,000
Colorado Springs[(2)]	Inclining block rate (three blocks)	$5.70	$2.15 – up to 7,473 gal. $3.71 – 7,474 to 18,694 gal. $5.62 – over 18,694 gal.
Henderson	Inclining block rate (four blocks)	$7.45	$1.38 – up to 6,000 gal. $1.79 – 6,001 to 16,000 gal. $2.33 – 16,001 to 30,000 gal. $3.26 – over 30,000 gal.
North Las Vegas	Inclining block rate (four blocks)	$7.50	$1.37 – up to 10,000 gal. $1.78 – 10,000 to 35,500 gal. $2.31 – 35,500 to 55,500 gal. $3.00 – over 55,500 gal.
Phoenix[(3)]	Seasonal	$4.73	$2.01 – Dec., Jan., Feb., Mar. $2.37 – Apr., May, Oct., Nov. $2.99 – Jun., Jul., Aug., Sep.
Santa Fe[(4)]	Seasonal and inclining block rate (three blocks)	$13.20	Nov-March: $4.09 (flat) April-October: $4.09 – up to 12,000 gal. $6.59 – 12,000 to 20,000 gal. $9.09 – over 20,000 gal.
Tucson[(5)]	Inclining block rate (four blocks)	$5.35	$1.47 – up to 11,220 gal. $5.09 – 11,221 to 22,440 gal. $7.17 – 22,441 to 33,660 gal. $10.03 – over 33,660 gal.

Notes:

(1) The city of Albuquerque measures water use in 100 cubic feet increments, or CCF. One CCF = 748 gallons. To maintain consistency with the other listed cities in the survey, Albuquerque consumption charges and volumes have been converted to "per 1,000 gallons" and "gallons," respectively. Also note, Albuquerque's fixed service fee includes a base rate ($7.83), and a Strategy Implementation Fee ($3.58) totaling to $11.41 per residential account per month. The city of Albuquerque applies "Seasonal Surcharges" that result in a seasonal rate structure with inclining block rates during summer months. The 2005 average winter monthly use for most single-family accounts was 5,236 gallons; this is charged at the "commodity" rate. The higher blocks are determined based on the average use with a surcharge of 1.5 times the commodity rate charged when consumption reaches 300% of average. Twice the commodity rate is charged when consumption

reaches 400% of average. The consumption charge, which is based on water use volume, includes fees for facility rehabilitation, the Sustainable Water Supply Program, the Water Resource Management Program, and the State Water Conservation Charge.

(2) The Colorado Springs Utility measures water use in 100 cubic feet increments, or CCF. One CCF = 748 gallons. To maintain consistency with the other listed cities in the survey, Colorado Springs consumption charges and volumes have been converted to "per 1,000 gallons" and "gallons," respectively. The listed Colorado Springs rates apply to "inside city" customers.

(3) The city of Phoenix Utility measures water use in 100 cubic feet increments, or CCF. One CCF = 748 gallons. To maintain consistency with the other listed cities in the survey, Phoenix consumption charges and volumes have been converted to "per 1,000 gallons" and "gallons," respectively.

(4) The city of Santa Fe applies "Seasonal Surcharges" that result in a seasonal rate structure with inclining block rates during summer months. More specifically, from November through April, water use is charged at $4.09 per 1,000 gallons (kgal). However, from May through October, the city applies the summer surcharges of $2.50/kgal for use over 12,000 gallons, and $5.00/kgal for use that exceeds 20,000 gallons. The end result is a summertime inclining block rate structure with three blocks. In addition, when in drought Stages II, III, or IV, the city charges an additional $15.00/kgal for use over 10,000 gallons, and $25.00/kgal for use over 20,000 gallons. At the time of the data collection for this report, Santa Fe was in a "Stage II" drought condition. However, to maintain a consistent comparison with other cities, Santa Fe's drought surcharges are not included in this comparative table.

(5) Tucson Water measures water use in 100 cubic feet increments, or CCF. One CCF = 748 gallons. To maintain consistency with the other listed cities in the survey, Tucson consumption charges and volumes have been converted to "per 1,000 gallons" and "gallons," respectively.

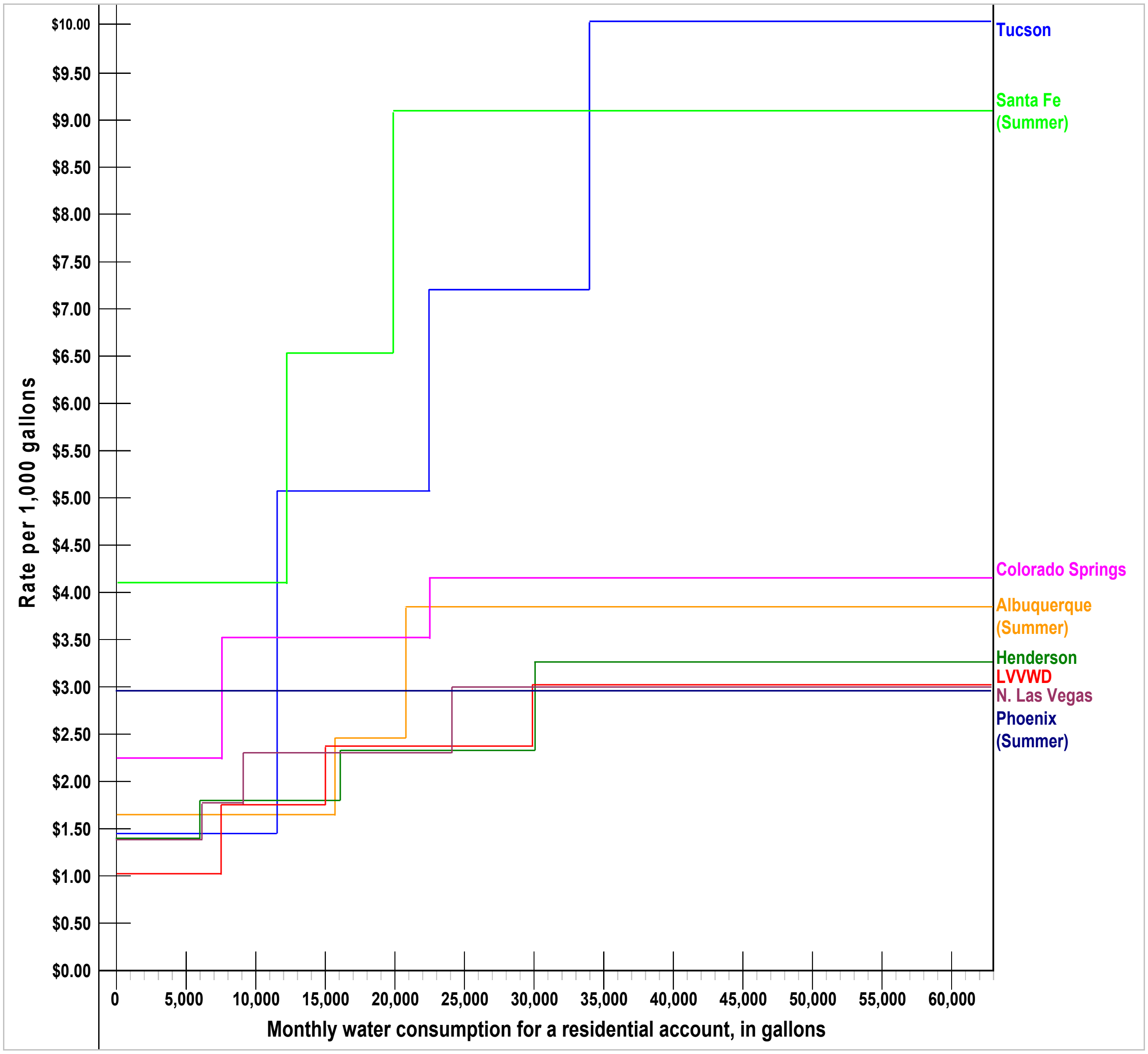
In all inclining block rate structures in the sample, the price blocks are set according to fixed consumption volumes that apply to all customers, regardless of a customer's lot size, household size, or previous water use patterns. None of the seven water providers with inclining block rates applies a ***"water budget"*** allotment design. With a water budget rate structure, individual block volumes would be established for each customer depending on that customer's particular use patterns or needs (which relate to lot size, vegetation evapo-transpiration rates, household occupancy, and other factors). If designed appropriately, cities could attain a higher level of efficiency and equity if they applied a water budget concept to their rate structures. This rate structure design is more common in Colorado — for example, it is already used in Aurora, Centennial Water & Sanitation District, Inverness, Castle Pines, and Cottonwood. In addition, the city of Boulder recently approved a water budget rate structure for future implementation, and the city of Greeley is currently considering it.

How Do Consumption Charges for Water Compare?

The consumption charges billed by a water utility convey the ***marginal price*** of the water, or the price for each unit of water consumed. The analysis of the marginal price curves for the various water rate structures reveals the distinct differences in efficiency incentives. The water providers in this analysis used a variety of inclining block rate structures. Each of these pricing designs has a unique marginal price curve. Plotting all of these marginal price curves on one graph exposes the significant distinction in economic effect of each price structure, as shown in Figure 1. The following two marginal price curve characteristics are especially important to consider when viewing Figure 1:

- Differences in curves between the uniform and inclining block rate marginal price curves; and
- Significant variations in block prices and block volumes amongst the water providers.

Figure 1
Consumption Charges (Marginal Price Curves) of Water Rate Structures in Several Southwest Municipalities, July 2006



Notes: (1) The Santa Fe marginal price curve does not include drought surcharges.
(2) The price graph does not extend beyond 60,000 gallons per month since the vast majority of customers use less than this amount.

Las Vegas Valley Water District, Henderson, and North Las Vegas

The largest member agencies in the Southern Nevada Water Authority — Las Vegas Valley Water District, the city of Henderson, and the city of North Las Vegas — all have adopted an inclining block rate structure that sends a slight conservation price signal. The modest unit price increases that customers experience when they move from one block to the next is relatively insignificant, especially with customers who are accustomed to using (and paying for) large volumes of water. Figure 1 sheds light on this. When compared to the consumption charges in other southwestern cities, the block price increase in the city of Henderson, the city of North Las Vegas and the Las Vegas Valley Water District, appears very modest.

The thresholds set for the three major purveyors target low to moderate water users by setting the first block at a volume that represents indoor use. Subsequent blocks are designed to target outdoor use. Adjusting threshold levels can also help to encourage efficient use by effectively conveying a price signal when consumers surpass each level. This is only effective if thresholds are set at volumes that accurately reflect consumer use patterns.

Santa Fe

Figure 1 graphically reveals the noticeable price increases signals that customers in Santa Fe experience as their water use increases. The block prices increase by significant percentages when customers use higher and higher volumes of water. The amount and percentage increases of Santa Fe's rates send strong efficiency messages to customers. Santa Fe's rates, and those of Tucson, are substantially higher than the rates of all other rate structures in the sampling.

Steep inclining block rate structures can effectively promote efficient water use even if the block prices aren't as high as they are in Tucson or Santa Fe. In other words, the "shape" of the marginal price curve is just as important as the actual price amounts.

Albuquerque

Albuquerque targets moderate- to high-volume users by having thresholds at higher volumes and the steepest increase in price occurring on the last block. The city of Albuquerque's rate structure sends a moderate conservation price signal to high-volume residential users during the summer months; however, more than two-thirds of customers' use is below the 300 percent average winter use threshold and therefore receives no price signal from the surcharge at all. When consumption reaches 400 percent of average winter use, the cost per unit of water for the user is doubled, sending a stronger price signal to those who reach this level of use. However, the city has only three tiers to its rate structure, and therefore a customer can use anywhere between 25,000 gallons or 80,000 gallons and still pay the same price per unit of water. Adding in additional tiers for high-volume users would send a more effective conservation price signal to the largest water users.

Interestingly, Santa Fe and Albuquerque use a seasonal rate structure and an inclining block rate structure in combination, with the inclining block rates only being applied during the irrigation season (i.e., summer months). The use of this combined rate structure adjusts to the changing cost or value of water throughout the year while still providing a price signal within the high demand months.

Tucson

The city of Tucson has a block rate structure that ascends repeatedly up to 33,660 gallons of water. The sharp increase in price from the first block to the second is key in making Tucson's rate structure effective. The first block is price at a modest $1.47 per 1000 gallons, which enables water for essential purposes (such as washing and toilet flushing) to be done for a minimal cost to the consumer. However, once a user surpasses the 11,220-gallon threshold, the price more than triples to $5.09 per thousand gallons. Although subsequent blocks do not increase quite as steeply, there continues to be a large jump in the per unit price with each additional block. This provides a clear price signal to consumers: you use more … you pay more. Both of these communities have large steps from one tier to the next, sending a clear signal to consumers whose use surpasses these thresholds.

Phoenix

Water customers in Phoenix pay for their water via a uniform rate structures. As shown in Figure 1, the marginal price lines for the rate structures in this city are flat. No matter how much water customers use, they pay a constant unit rate for the water. As a result, high-volume use customers in this city have no price incentive to conserve water. In addition, the water supply costs are distributed evenly across all customers, regardless if someone is a low-volume, conserving customer or a high-volume and/or wasteful customer.

The city of Phoenix also uses a rate structure that allows for variations in the price per unit of water throughout different times of the year. However, the increase in the price per unit of water from one season to the next is minimal and likely to go unnoticed by most consumers.

Colorado Springs

Colorado Springs employs a rate structure that targets low- to moderate-volume users by having a steep increase from the first to the second block. The first threshold, which is set at 7,473 gallons, is low enough that many consumers surpass it during the high irrigation months. This, combined with the steep jump from the first block to the next, sends a strong conservation price signal to consumers.

Like Albuquerque, the last threshold in the Colorado Springs rate structure is set below 20,000 gallons and, as such, does not effectively target high-volume users. Adding in additional tiers for high-volume users would send a more effective conservation price signal to the largest water users.

The variety of rate structures used by these cities demonstrates the different conservation pricing strategies employed to reach particular customer types. In some communities, a higher and steeper block rate structure may be necessary to aggressively promote efficient use for <u>all</u> customers, even at relatively low volumes. In other communities, only the higher-volume customers may be the primary target group for dramatically higher rates.

How Do Average Prices for Water Compare?

Generally, water customers respond to the overall water bill, which is reflected in the ***average price***. The average price of water is the fixed service charge (fixed price) plus the consumption charge (marginal price(s) multiplied by consumption volume), divided by the total consumption volume. Therefore, both the fixed service charge and the consumption charges combine to determine the resulting conservation price signal sent to customers.

$$\textbf{\textit{average price}} = \frac{\text{fixed service charge + (consumption volume x marginal price(s))}}{\text{consumption volume}}$$

To maintain a noticeable price signal for the consumer, the average price needs to rise as consumption volume increases. If the average price curve is relatively flat or declines as the consumption volume increases, there is little price incentive to conserve water, since the unit price for water remains relatively constant no matter how much water the customer uses.

Figure 2 compares cities throughout the Southwest with rather different rate structures and displays how the average price for water can be significantly affected by an overall rate structure. The distinct differences in these average price curves should be noted, with the general trends applied to rate structures in other cities.

As shown in Figure 2, Santa Fe's average price curves ascend very quickly when a customer uses more than 12,000 gallons. Customers that exceed these use levels receive a strong price signal as their consumption increases — the more they use, the higher the average price per unit. The steepness of Santa Fe's increasing consumption charge (as shown in Figure 1) is responsible for this trend.

Customers in Albuquerque also receive a price signal that indicates the more they use, the higher the average price per unit. However, the lack of additional tiers at higher volumes, much like that of many cites in Nevada, does not provide a strong incentive for efficiency among high-volume users.

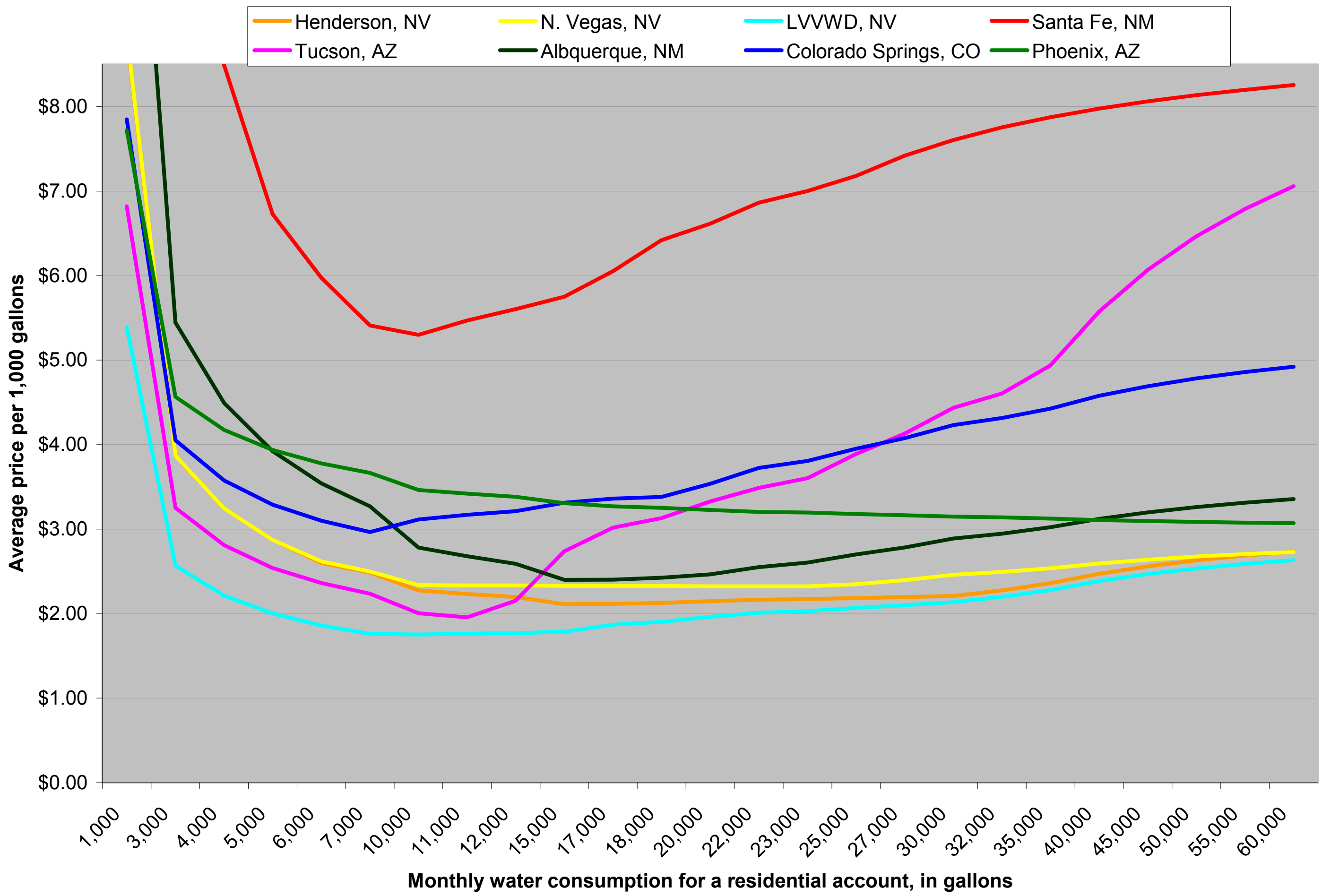
The Colorado Springs rate structure falls between that of Albuquerque and Santa Fe, and, like those cities, its rate structure does provide a price signal to consumers. Although Colorado Springs has only three tiers, the increase in price with each tier is large enough to be noticed by the consumer, thus making it more effective.

In the Las Vegas Valley, the prices set by all three providers, Las Vegas Valley Water District, Henderson, and North Las Vegas, result in an average price curve that does not send an effective conservation price signal to consumers. The price differential between each tier is minimal and therefore is easily overlooked or unnoticed by consumers. Creating a significant jump from one block to the next will ensure that consumers receive a useful conservation price signal. Based on cites throughout the region, a 50 percent increase from one tier to the next is typically a large enough increase to accomplish this goal.

Phoenix's uniform seasonal rate structure (and flat marginal price) results in an average price curve that sends no conservation price signal. As consumption increases, the average price for the water decreases in Phoenix. The customers in this city have no price incentive to be efficient.

Figure 2

Average Price Curves (Fixed Service Fees plus Consumption Charges) of Water Rate Structures in the Southwest, as of July 2006



Conclusion

Water is sold to customers under a wide variety of rate structures from city to city across the southwestern United States. Because water rate structures communicate the value of water to the customers, they can provide a great incentive to improve efficiency of water use. Rates may be the single most effective conservation tool available.

A Current Snapshot of Rate Structures in Southwestern Cities

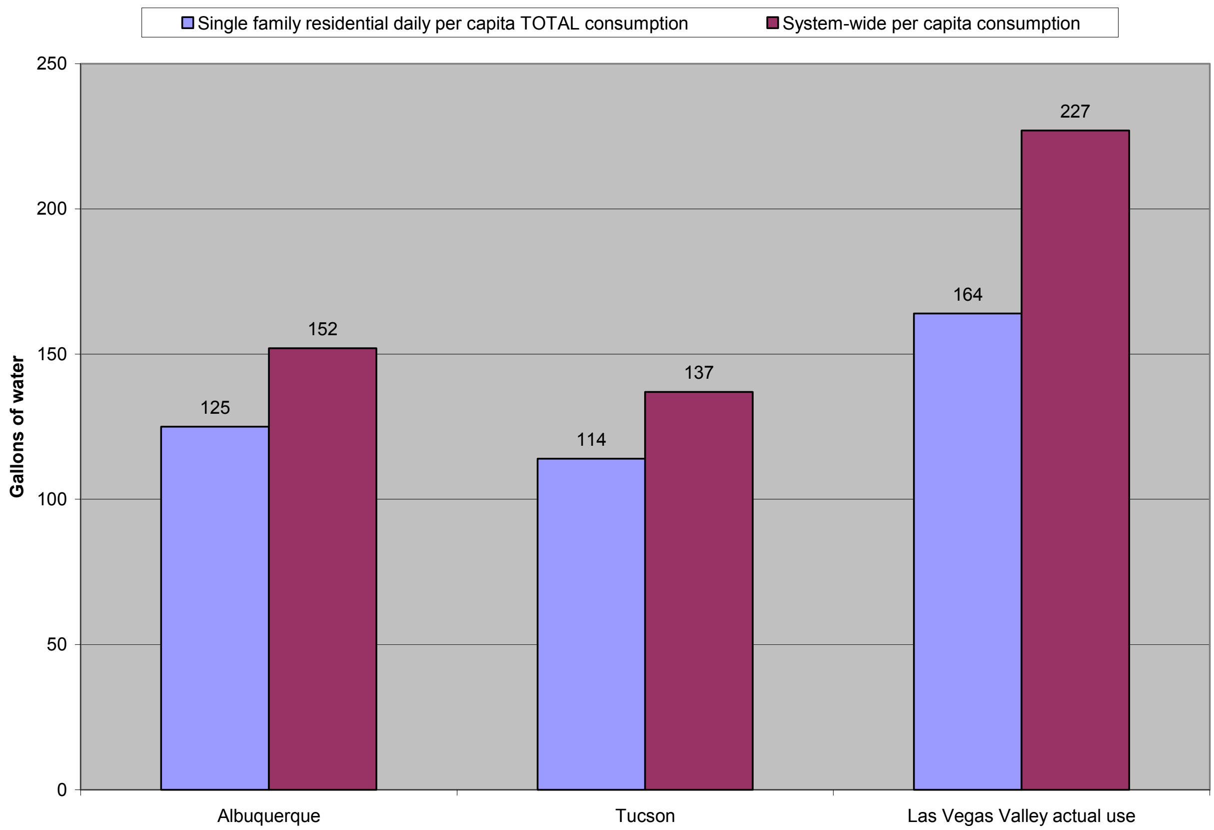
This comparative analysis reveals differences in the way southwestern water utilities charge for the water they sell and, thus, how they communicate the value of water to their customers. Although some southwestern cities have taken steps in recent years to promote efficiency via water rate structures, many more still have a lot of room for improvement. In many cities, customers who use excessive amounts of water pay disproportionately low unit prices for their water. Large-volume customers place the highest strain on the water supply and on southwestern rivers and aquifers, and are thereby accelerating the need for additional water supply and storage. Most of this water development needs come with large price tags and impacts, which, in the end, are paid for by all citizens.

Although inclining block rates can be used to promote efficient water use, as demonstrated by Tucson and Santa Fe, some cities, such as Las Vegas, Henderson, and North Las Vegas, that apply only very modest inclining block rates are not effectively sending a conservation message through their rates. In most of these cases, the block price increases are too minimal to persuade most high-volume customers to use water more efficiently and/or reduce their demand. Phoenix, which has a flat rate structure, sends no conservation price signal at all. In other cities with more steeply inclining block rates, the volumes of each block are set in ways that allow significant levels of inefficient use before price incentives are triggered.

Steps for the Future

A large number of water utilities throughout the West have already moved towards inclining block rate structures in recent years. Many cities that have turned to more aggressive inclining block rates are benefiting from noted decreases in per capita consumption, as shown in Figure 3. As a result, these cities may be able to delay or avoid much of the cost and controversy that accompany new water development and diversion projects. In turn, these communities are helping preserve the natural river systems and aquifers that support our quality of life in the West.

Figure 3
2005 Per Capita Consumption in Albuquerque, Tucson, and the Las Vegas Valley



Notes:

(1) The Las Vegas Valley includes the cities of Las Vegas, North Las Vegas, and Henderson.
(2) Las Vegas Valley gallons per capita per day (GPCD) were calculated using actual use numbers, not weather-adjusted numbers. The use of weather-adjusted numbers in 2005, a cooler and wetter year, would result in a higher GPCD figure.
(3) Tucson, which has the most aggressive rate structure of the three communities illustrated here, also has the lowest per capita consumption.

Our analysis and research indicates that a more effective approach to maximizing efficiency via southwestern municipal water rate structures is to: (1) impose inclining block rates with sharp increases in rates for excessive amounts of water use, while not increasing rates for lower levels of use; and (2) set block volume thresholds at consumption levels that capture inefficient use by more customers. This approach will give southwestern cities more effective rate structures, since the “staircase effect” of rates would be notably steeper and more evident. As a result, water utilities in southwestern cities and towns would be encouraging their customers to use water more efficiently.

Droughts may come and go, but the Southwest will always be a semi-arid or arid desert, with its water “lifeline” being a finite resource. With population growth compounding the demand for water, residents of the Southwest have no choice but to face the challenge and become more efficient in the ways they use water. More effective inclining block rate structures are an important step in the right direction.

For reports and information on water use efficiency and our important water resources, please contact:

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