CHANGES IN WATER RATES AND WATER CONSUMPTION IN TUCSON, 1974 TO 1978

by

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In July 1976, the City of Tucson Water Department, facing serious problems in the financing and operation of their water system, introduced an innovative water rate structure. First, the basic water rates were a departure from previous practice in that the cost of a unit of water to a customer would rise very markedly as his monthly consumption increased. Second, customers living in the higher parts of the City would be charged lift charges in order to recover the additional cost of delivering water to the higher areas of the City. Finally, new customers would be required to pay a System Development Charge in order to recover the cost of developing and enlarging the City's water system. The new water rates proved to be very unpopular and the councilmen who had voted for them were recalled from office. As a result of the rate increases and the furor spawned by the recall campaign, water consumption in Tucson fell markedly after the summer of 1976. This paper describes the changes in water rates made from 1976 and 1978 and the resulting changes in water consumption in Tucson.

CHANGES IN WATER RATES

Until June 1976, the City of Tucson Water Department had a fairly conventional rate structure. Customers were charged a monthly connection fee which covered the first 6 ccf (hundred cubic feet) used each month. The next 14 ccf used each month were charged at a rate which depended on whether the customer was within the city limits or not--customers within the cities of Tucson and South Tucson paid 30¢/ccf while those outside the two city limits paid 52¢/ccf; customers in some isolated areas in the foothills of the Catalina and Tucson Mountains were charged a "Special" rate of 48¢/ccf. Consumption in excess of 20 ccf was charged for a slightly higher rate: customers within the two cities paid 39¢/ccf, those outside the cities paid 56¢/ccf, and customers charged at the Special rate paid 62¢/ccf.

In January 1976, the City's consultants, John Carollo Engineers, recommended a program of improvements to the city's water distribution system. These improvements were to be financed by both issuing bonds and raising water rates. Most of the improvements were made necessary by the growth of the City and the need to meet the very high peak demand for water occurring on summer afternoons resulting from the extensive use of water for lawn sprinkling. The City Water Department had decided that the cost of providing for the afternoon peaks should fall upon customers who increased their consumption on summer afternoons; presuming that high consumption indicated strongly-peaked consumption, they had instructed Carollo to devise a rate structure in which the price of water paid by a customer would increase with his consumption. In this way, the cost of providing for the peak demand would be recovered from customers using large amounts of water.

In July 1976, the City introduced a new rate structure based on Carollo's recommendations. The price of each ccf of water rose from 35¢ to 75¢ as a customer's monthly consumption increased from 6 ccf to 100 ccf. Rates were set by class of customers, rather than by size of service, with different price schedules for each class of customer. The price schedule for Single-Family Residences is shown in Figure 1; the other classes of customers--Duplex-Triplex Residences, Multiple-Family Residences, and Commercial Users--faced similar rate schedules, although the price of a unit of water did not rise as much as it did for Single-Family Residences.

The second feature of the new water rates was the lift charges. The Water Department divided its service area into a number of "Lift Zones", and customers living in the higher areas were charged extra for water. About half of the city's 97,000 customers lived in the base service area where no lift charges were payable. The 28,000 customers living in the first lift zone were charged 20¢ extra for each ccf, and the 16,000 customers in the second lift zone area were charged 40¢/ccf extra; a further 8,000 customers in the third lift zone were charged 60¢/ccf extra, and about 1,500 customers--those in the fourth to eighth lift zones--paid surcharges ranging up to $1.60/ccf. Customers in parts of lift zones where the Water Department had wells were charged the extra lift charges only for water used in excess of that produced by their local wells. For example, each of the 21,700 customers in pressure

subzones 1C and 2C of the first lift zone could use 15.8 ccf each month before lift charges became payable; similarly, the 13,400 customers in pressure subzones 1D, 5D, and 7D of the second lift zone were charged lift charges only for use in excess of 21.3 ccf/month and the 7,500 customers in subzones 1E and 6E of the third lift zone paid lift charges only for consumption in excess of 16.2 ccf/month. A further 2,500 customers in various lift zones were allowed various amounts of water (ranging between two and twenty ccf each month) before lift charges were added to the cost of each ccf of water used.

The third novel feature of the new water rates was the System Development Charges. New customers would be required to contribute toward the development of the Water Department's distribution system and well fields in addition to paying for the new mains connection. The System Development Charges ranged from $750 for a 3/4-inch connection to $126,875 for a twelve-inch connection.

The introduction of the new water rates in July 1976 increased Tucsonans' water bills substantially. Table 1 gives a comparison of water bills for single-family residences under the old and new rate schedules at various levels of consumption. The sample water bills in the Table show quite clearly that the size of a customer's monthly bill would vary greatly depending upon the lift zone in which he was resident and upon the allowance given for water pumped from wells within his pressure subzone. Table 2 shows the variation of water consumption among the Water Department's Single-Family Residence customers for the month. The pattern of consumption in June 1976 was similar to that in July. The figures in Tables 1 and 2 clearly show that many Tucsonans experienced a substantial jump in their water bills between June and July of 1976.

Tucsonans were shocked by the sudden increase in their water bills. The Council and the Water Department received many complaints from the public during July; near the end of that month, the Southern Arizona Homebuilders' Association began legal proceedings against the Council, asking the County Court to strike down the new water rates. In the early days of August there began a campaign to recall from office those councilmen who had voted for the new water rates. The Council responded by dropping the lift charges and suggesting a referendum on water rates. Later, the Council organized a series of "Water Workshops" in an attempt to educate the public on the region's water problems. In September, the Water Department hired Black & Veach to repeat Carollo's study and hired MR West Marketing Research to study consumers' awareness of the local water problems and attitudes toward various means of solving them. The Citizens' Advisory Water Committee was established to look into the matter of water rates and water resources generally. But the recall campaign continued: the petition to recall the four councilmen who had voted for the new water rates was filed on September 14 and the recall election was announced for January 18, 1977.

In the recall election the councilmen who had voted for the new water rates were soundly defeated. The new council took no action on water rates until the Citizens' Advisory Water Committee completed its report on February 1977. The Council made a number of modifications on the Advisory Committee's recommendations and, in March, passed an ordinance bringing new water rates into effect on April 1, 1977. A novel feature of the new water rates was that different rates would be applied in the winter and the summer. All classes of customers would be charged a uniform price for all water consumed in the six winter months between November and April. During the summer, single-family residences, duplexes and triplexes, and multiple-family residences and commercial customers using less thatn 100 ccf/month would be charged according to a schedule of increasing block rates. The new rate schedule faced by single-family residences--which was higher than the 1976 rate schedule--is shown in Figure 1. Larger multiple-family residences and commercial customers would pay a surcharge on consumption in the summer which exceeded their average consumption in the six winter months. The lift charges and the system development charges were not reintroduced.

The City began the first "Beat-the-Peak" campaign in the summer of 1977. The objective of the campaign was not to conserve water, but to reduce the very high peak demands occurring on summer afternoons. Tucsonans were encouraged to refrain from watering their lawns between four and eight in the afternoon and to water on alternate days, depending on which side of the street they lived. But even though the campaign was principally aimed at flattening the peak, the information disseminated is bound to have had some effect upon Tucsonans' total water consumption.

In 1978, the Council raised water rates by about 8% while maintaining the same general rate structure as adopted in 1977. There was virtually no adverse public reaction to this rate increase. In April 1979, water rates were raised by about 6% and increasing block rates for the winter were introduced; residential customers now faced a block rate schedule all year round, although the rate schedules are different in summer and winter. In April 1980, water rates were raised again while maintaining the same rate structure as adopted in the 1979 rate increase. All of the rate schedules faced by single-family residences between 1974 and 1980 are shown in Figure 1, where the marked changes in water rates over these years can be seen quite clearly.

CHANGES IN WATER CONSUMPTION

Water consumption in Tucson fell markedly after the water rate increases of July 1976. Up until the fiscal year 1975/76, the City Water Department's pumpage per capita averaged about 185 gal/day. But in 1976 and 1977, water consumption began to fall: the Water Department's pumpage was only 150

Table 1--Old and New Water Bills in Tucson, June-July 1976

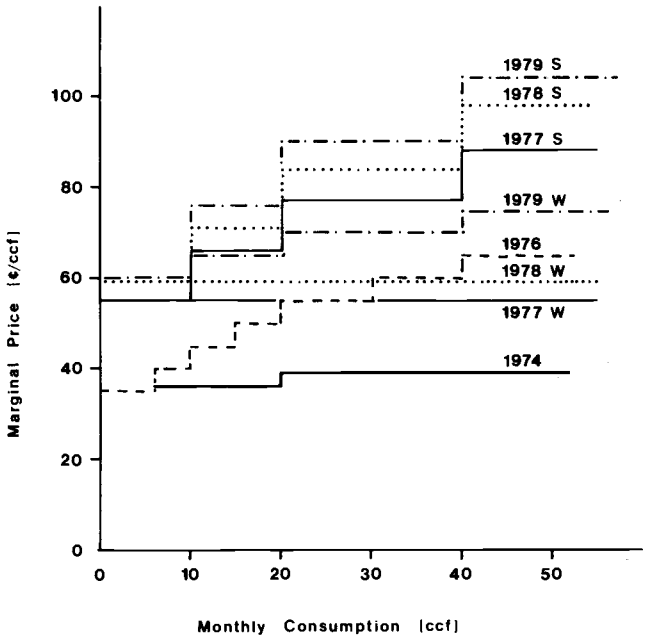
Consumption (ccf)	Old Bill -- 3/4-inch service			New Bill -- Single-Family Residence								
	Inside	Outside	Special	Base Zone	One lift[a]	One lift[b]	Two lifts[a]	Two lifts[c]	Three lifts[a]	Three lifts[b]	Four lifts[a]	Seven lifts[a]
6	3.00	5.00	7.50	4.40	5.60	4.40	6.80	4.40	8.00	4.40	9.20	12.80
10	4.44	7.08	9.82	6.00	8.00	6.00	10.00	6.00	12.00	6.00	14.00	20.00
20	8.04	12.28	15.62	10.75	14.75	11.55	18.75	10.75	22.75	13.15	26.75	38.75
30	11.94	17.88	21.82	16.25	22.25	19.05	28.25	19.85	34.25	24.65	40.25	58.25
40	15.84	23.48	28.02	22.25	30.25	27.05	38.25	29.85	46.25	36.65	54.25	78.25
60	23.64	34.68	40.42	35.25	47.25	44.05	59.25	50.85	71.25	61.65	83.25	119.25
100	39.24	57.08	65.22	61.25	81.25	78.05	101.25	92.85	121.25	111.65	141.25	201.25

a No local supply -- lift charges levied upon all water delivered.
b First 16 ccf free of lift charges.
c First 21 ccf free of lift charges.

Table 2--The Variation of Water Consumption by Single-Family Residences, July 1976

Use Block ccf	Number of Customers in Use Block	
0	3,792	-
1-6	8,275	9.1%
7-10	9,078	9.9%
11-15	12,565	13,7%
16-20	12,409	13.6%
21-30	20,585	22.5%
31-40	13,141	13.3%
41-100	14,639	16.0%
101-500	722	0.8%
501-1,000	12	0.0%
> 1,000		0.0%

The percentages shown are the percentage of active services in each use block.



NOTE: The year of introduction is shown alongside each rate schedule. S and W denote summer and winter rates.

gal/head day in the fiscal year 1976/77, was 142 gal/head day in 1977/78, and fell to 140 gal/head day in fiscal year 1978/79. The use of water during the summer fell more than the average year-round consumption. A number of quantities showing the change in the seasonal variation in water use over the five calendar years from 1974 to 1978 are shown in Table 3. The Table shows that total metered deliveries in the month of June fell by 29% between 1974 and 1978. The year-round average of metered deliveries to single-family residences fell by 30% between 1974 and 1978, but deliveries in the month of June fell by 36% over these four years.

The total amount of water delivered each year was broken down into water used indoors for general sanitary purposes and water used outdoors for sprinkling and cooling by presuming that all of the water delivered during the January, February, and December of each year was used indoors, and that indoor use remained at this level throughout the year. The amount of water used outdoors in the nine months from March to November was taken to be the difference between actual metered deliveries in these months and the average metered deliveries in the three winter months. The figures in Table 3 show that outdoor use per service by all customers decreased by 32% between 1974 and 1978, while indoor use fell by only 15%. Over the same period of time, outdoor use per service by single-family residences fell by 40% and indoor use by single-family residences fell by only 24%. The ratios of indoor use to outdoor use show that in 1974, 35% of the water delivered by the Water Department was used outdoors and that this proportion fell to 30% in 1978.

CONCLUSION

The pattern of water consumption in Tucson has changed markedly since the water rate increases of 1976. Overall, water consumption per capita has fallen by about 20% since 1974, although the amount of water used outdoors for sprinkling and cooling, particularly that by single-family residences, has fallen by a much greater amount. The exact causes of this change in water consumption are uncertain,

Table 3--Changes in the Seasonal Variation in Water Consumption in Tucson, 1974 to 1978

I -- All Customers

	Metered Deliveries--ccf/month			Total Delivered (ccf)	Use - ccf		Ratio
	Average Year-round	Average Jan/Feb/Dec	June		Indoors	Outdoors	
1974	26.4	17.0	42.3	317	204	113	65:35
1975	26.1	17.7	37.7	314	212	101	68:32
1976	23.8	17.7	32.4	286	212	74	75:25
1977	20.7	15.0	27.2	249	180	69	73:27
1978	20.9	14.5	30.1	251	174	77	70:30

II -- Single-Family Residences

	Metered Deliveries--ccf/month			Total Delivered (ccf)	Use - ccf		Ratio
	Average Year-round	Average Jan/Feb/Dec	June		Indoors	Outdoors	
1974	20.0	12.4	33.6	240	149	91	63:37
1975	18.5	11.8	28.2	222	141	80	64:36
1976	16.1	11.5	23.1	193	138	55	72:28
1977	14.0	9.9	19.1	168	119	49	71:29
1978	14.0	9.4	21.5	168	113	55	67:33

All of the figures in this Table are based on the City Water Department's records of water consumption by class of customer for the sixty months from January 1974 to December 1978.

Total outdoor use in each year is the January/February/December average metered deliveries times twelve months.

Total indoor use in each year is the sum over the nine months from March to November of the difference between actual metered deliveries in that month and the January/February/December average for the year.

but are bound to include the increases in water rates, the continuing news of Tucson's water problem, and the Beat-the-Peak campaign. The Beat-the-Peak campaign was principally aimed at flattening the peak, not reducing total water consumption, but it has created an awareness of a water problem in Tucson and has apparently contributed to the fall in water consumption. In any case, continually increasing water rates are now accepted by the public in Tucson.

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