Kuwait J. Sci. Eng. **30**(1) 2003

Household demand for water: A case study in Kuwait

JASEM M. AL-HUMOUD AND IBRAHIM AL-GHUSAIN

Kuwait University, Department of Civil Engineering
P.O.Box 5969, Safat 13060, Kuwait, Tel: (+965) 967-4825; Fax: (+965) 481-7524
E-mail: jasem@civil.kuniv.edu.kw

ABSTRACT

This paper reports the results of a research study undertaken to determine water consumption in Kuwait. The consumption and other related data were collected randomly from different households within Kuwait. In addition, the paper gives forecasts for water consumption (demand) in Kuwait. The government of Kuwait heavily subsidizes water production. These subsidies add a heavy burden to the current fiscal deficit. Results of the analyses indicated that there is considerable waste of fresh water by the average Kuwaiti household. Predictions of future water demand included in this study may help the government in its efforts to reform its subsidy policy. The paper concludes with useful remarks to both the water authority (Ministry of Electricity and Water) and the citizens of Kuwait on water usage rationalization.

Keywords: Forecasting; Households; Kuwait; Water Consumption.

INTRODUCTION

Signs of water scarcity worldwide are numerous. Water tables are falling, lakes are shrinking, rivers are becoming more polluted and wetlands are disappearing. Engineering solutions to water shortages include schemes such as building river diversions (e.g. in California, U.S.A), and the construction of dams and other expensive projects, some with questionable environmental consequences (Postel 1992).

Since 1950, global water demand has more than tripled to an estimated annual level of 4,340 km^3 in 1993 (Shiklomanov 1990). Because of improved standards of living, the per capita water use worldwide has also increased dramatically to 800 m^3 per year. This amount is 50% more than what it was in 1950, and it continues to grow. To meet this rising demand, responsible policy-makers have mainly emphasized the construction of "water development" projects, particularly dams and river diversions. Today, more than 36,000 large dams have been built around the world to control floods and provide energy, irrigation, industrial supplies, and drinking water to a growing global population (Falkenmark 1989 and PRB 1993).

The problem of securing reliable water supplies has been an issue of great importance to the people of Kuwait since the earliest days of settlement in the region. Today, as the population and industrial developments grow, the water supply issue promises to become more acute.

Covering an area of 17,818 km^2, Kuwait lies in the northwestern corner of the Arabian Gulf. The Kuwait mainland extends between latitudes 28°C 30′ and 30° 06′ north, longitudes 46° 30′ and 48° 30′ east, and measures about 200 km from the most northern point to the most southern points, and about 170 km from east to west between the longitude extremes. The weather of the country is typical of a desert (arid) region and receives only about 100 mm (3.94 in) of rain annually. This precipitation is highly variable from year to year (40 - 240 mm) and ground water is scarce, complicating water development efforts (MOP, 2001). In the past the people of Kuwait relied on a scant number of wells to satisfy their water needs. Those wells, supplemented with fresh water transported by boats from Basra, Iraq, were the main source of water supply to the people. Transporting water by boats continued for some time, and in 1939 a company was established to manage the fleet of water carries from Iraq at the same time constructing three reservoirs on the shore for storage. The first major breakthrough in the supply & water came in 1951 when Kuwait Oil Company (K.O.C) built a small sea water desalination plant with a capacity of 80,000 gallon per day at the port of Al-Ahmadi (Mina Al-Ahmadi), and distributed part of the water to the town of Kuwait. The first major desalination plant was built in 1953 with a capacity of 1 million gallons per day (mgpd). In 1978, another desalination plant was build in Doha with a capacity of 42 mgpd (MEW 2001 and MOP 2000).

The country was and is very anxious to exploit all available groundwater, both freshwater for drinking and brackish water for irrigation. Fresh groundwater is considered a matter of prime importance. Fresh groundwater was discovered in limited quantities at both Al-Rawdhatain and Umm Al-Aish fields. Pumping operations commenced in 1962, with the estimated natural reserve of bothy fields about 40,000 million gallons. In 1980, the Rawdhatain Water Production and Bottling Project started to produce 1800 m^3/year of mineral water. The Umm Al-Aish field is currently producing 8000 m^3/year of water (MEW 20001, Omar *et al.* 1996).

Along with fresh water, the country makes use of its large supply of brackish groundwater (1200 - 7000 ppm). The Ministry of Electricity and Water (MEW) distributes this water to the consumers through separate networks parallel to the fresh water network. The brackish water is intended to be used for various purposes such as blending with distilled water, irrigation, livestock watering and construction works. Fresh and brackish water are stored by two different means in Kuwait; one is by ground reservoirs, and the other is by elevated tanks (towers). The present storage capacities of the different reservoirs for both fresh and brackish water are presented in Table 1. The consumption of fresh and brackish water has been increasing with the increase of population.

Table 1. Types and capacities of storage reservoirs for fresh and brackish water

Type of Water	Ground Reservoirs		Elevated Tanks (Towers)	
	Number	Capacity (MIG)	Number	Capacity (MIG)
Fresh	64	2143	39	25
Brackish	26	498.8	15	9.6

As can be noted in Fig. 1, the average consumption of water has increased gradually, with the exception of the years 1990, 1991 and 1992. This lack of increase is explained by the invasion of Iraq and the start of the Gulf War. During that period, water production was interrupted tremendously. In addition, the population was at it lowest levels, due to the large exodus of people from the country. Figure 2 shows the per capita consumption is increasing yearly as well, with a slight drop during 1998. The data for the years 1990 and 1991 is not available because of the Gulf War. By the end of the year 2000, the total length of the entire water network was 131,45 Km. It is worth mentioning that the number of consumers connected to the fresh water network totaled 111,581 by the year 2000, while consumers connected to the brackish water network totaled 67,657 by the end of the same year (MEW, 2001).

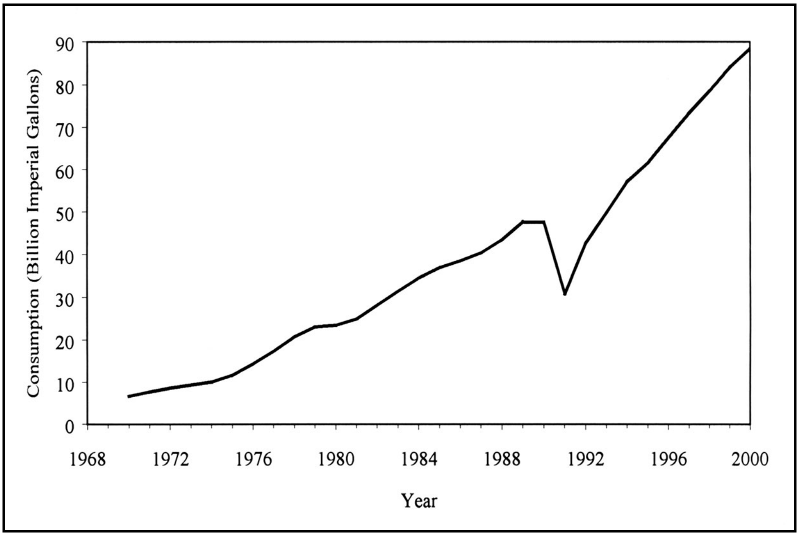

Fig. 1. Fresh Water Consumption (1970-2000)

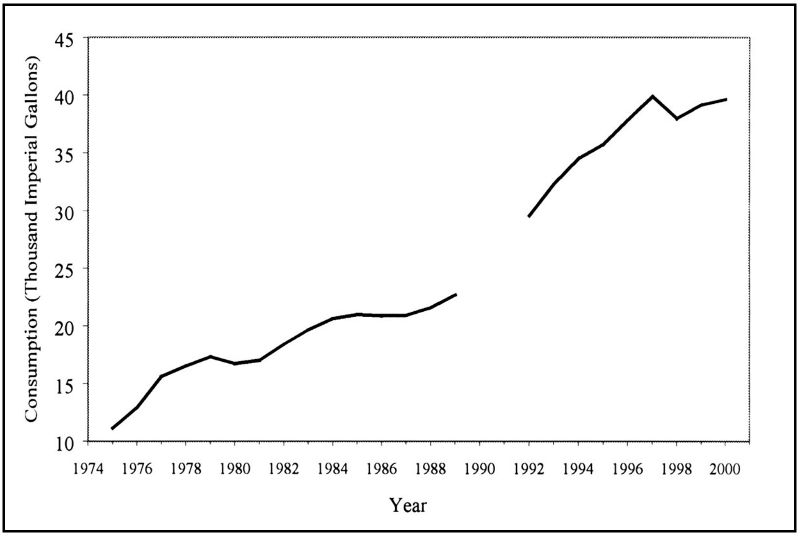

Fig. 2. Per capita consumption of fresh water (1975-2000)

Another point to add is that in the affluent State of Kuwait, nearly 98 percent of the population reside in Metropolitan Kuwait. A unique characteristic of the State of Kuwait and other nations of the Gulf Cooperation Council (GCC) is the constant change in the expatriate population from year to year. Each year, a significant percentage of Kuwait's expatriate population (62% of Kuwait's population are non-Kuwaitis) leave the State upon termination of their contracts. These individuals are replaced by incoming expatriate workers, mostly from Egypt, India, Bangladesh, and Sri Lanka.

THE STUDY

Following a comprehensive review of the related literature and the establishment of organizational structure for the implementation of the research, a survey plan was designed. The computation of the sample size, the development of a questionnaire, the determination of sampling technique and sample population were all addressed in the survey design. The computation of the sample size was made in accordance with the commonly utilized statistical equation (Walpole and Myers, 1985). A confidence level of 95%, and an error level of $\pm 5\%$ were considered to be appropriate by the research team. By utilizing a recommended value of 0.5 for the standard deviation (for maximum possible standard error of the mean), the minimum required sample size may be computed from the following equation:

$$\sqrt{N} = [(z_{1-\alpha/2} * S)/e] \quad (1)$$

where:

N = the minimum required sample size.

Z = the number of units of the standard deviation in a standard normal distribution curve ($Z = 1.96\%$, $\alpha = 5\%$).

α = significance level.

S = standard deviation (0.5 when the true population standard deviation is not known).

e = acceptable error ($\pm 5\%$).

Equation 1 and the above input values result in a minimum sample size of 385.

A simple yet structured questionnaire was designed and pre-tested to obtain information on households' socio-economic and residence characteristics, as well as the daily water-consuming activities of sample households. The questionnaire, after being pre-tested and modified, was distributed to a systematic random sample of 3000 households residing in the five governorates of Metropolitan Kuwait. Special care was taken to ensure the representativeness of various socio-economic groups in the sample. The random sample of 3000 households were interviewed in person. The objective of the study was to examine the water supply and consumption situation in Kuwait. The interviews were conducted by senior year Kuwait university undergraduates. The objective of the study was to examine the water supply and consumption in Kuwait.

Living conditions

The first aspect of the study was concerned with the living conditions, house sizes, average monthly income, etc. It was found that the majority of the families, or 24%, consists of four people, and that 68% of the population live in two-story housing. Most of the houses surveyed (86%) had a garden or a yard that they water. All of the 3000 households in the survey had at least one car, 10% had six cars, 48% had five cars, 17% had three cars, 8% had two and only 2% had one car per household. These results are shown in Table 2. About 27% of the heads of the households that were surveyed made between 3,343-5,010 US dollars per month, 22% made more than 6,680 dollars, 21% make between 2,341-3,340 dollars, 14% make between 1,670-2,338 dollars, 13% make between 5,010-6,680 dollars, and only 3% make less than 1,670 dollars per month. Each head of household was also asked about the level of education that he or she had.

The average monthly water bill varied from house to house; 39% had a bill between 104-167 dollars per month, 30% had greater than 234 dollars, 17% between 171-234 dollars, and 14% had a bill between 67-101 dollars per month.

Table 2. Number of cars per household

Number of Cars	Percentage (%)
1	2
2	8
3	15
4	17
5	48
6	10
Total	100

Water use

Since people in Kuwait use both fresh and brackish water daily, the respondents were each asked to give an idea of what kind of water they use in their different daily activities.

Half of the households, or 50%, use bottled water, while 40% use tap water, and 10% use them both for drinking. It was also discovered that 44% of the people water their garden with fresh water, 29% with brackish water and 14% use both types of water for gardening (see Table 3). It was also found that 44% of the households with gardens water them at least three times per week, 12% twice, and 2% once a week (see Table 4).

Table 3. Type of water people prefer to drink

Type of Water	Percentage (%)
Bottled water	50
Tap water	40
Bottled water & tape water	10
Total	100

Table 4. Number of times garden is watered each week

Number of times per week	Percentage (%)
1	2
2	12
3	43
4	32
5	10
6 - 7	1
Total	100

An interesting element in the survey was a question regarding the number of times clothes are washed each week. It was found that 44% of the respondents do their wash seven days a week, 23% twice, 13% four times, 12% three times, 5% once, 2% five times and 1% six times a week (Table 5). Washing the entire house (floor scrubbing) consumes a lot of water; 46% of the people wash their houses once a week, 31% twice, 13% three times, 4% four times, and 6% at least five times per week (Table 6).

Table 5. Number of times clothes are washed per week

Number of Washes per Week	Percentage (%)
1	5
2	23
3	12
4	13
5	2
6	1
7	44
Total	100

Table 6. Number of times floors are scrubbed each week

Number of Washes per Week	Percentage (%)
1	46
2	31
3	13
4	4
5 - 7	6
Total	100

The use of a shower or bath is another cause of high water consumption. Our results show that every member of the household takes a shower or bath once a day or once every other day.

Finally, an attempt has been made to find out what bothers people most about the water. It was found that the color of the water is the most bothersome item to them. Forty-four percent of the people are bothered by color alone, 40% are bothered about the color and other related factors, such as taste, impurity, etc., and 16% are bothered by other factors than the color of the water.

Forecasting water consumption (demand)

Forecasting water demand in Kuwait carries major policy implications for both the Kuwaiti government and the water industry. Kuwait's government heavily subsidizes water consumption. While 1000 Imperial gallons (4,545 m^3) of water costs MEW KD 2.7 to produce, the customer is charged KD 0.8 for it. These subsidies add a heavy burden to the already large fiscal deficit. Predictions of future water consumption (demand) would help the government in its efforts to reform its subsidy policy and find alternative methods of reducing its deficit. Also, the water sector invests continuously in expanding its production capacity. It would be useful indeed to form an idea about the future demand for this public utility. This research uses time series methodology in forecasting water consumption, which has never been used in forecasting consumption and/or demand for public utilities in Kuwait.

In times series, the series is first examined by computing the autocorrelation function (ACF) and the partial autocorrelation function (PACF) for the original series (Granger & Newbold 1986; Mills 1990) or by formal unit root analysis (Dicky *et al.* 1986). The correlograms associated with ACF and PACF are often good visual diagnostic tools (Hanke & Reitsch 1995). The tentative model is then estimated. A number of alternative parameter estimation procedures are commonly used. These various procedures typically yield quite similar estimates when the sample size is large. However, for shorter series, there can be larger differences, particularly if the model involves substantial moving average terms. The full-maximum likelihood approach is usually preferred in those cases for which different estimation procedures yield significantly different results (Newbold & Bos 1994). The residuals from the tentative model are examined to determine whether or not they are white noise. The adequacy of the model is also indicated by the Box-Ljung statistic (Ljung & Box 1978). Model inadequacy is indicated by large absolute values for the residual autocorrelations, and consequently large values for the Box-Ljung statistic. If the residuals are white noise, the tentative model is probably a good approximation of the underlying stochastic process. If they are not, then the process is started all over again.

The model finally selected can then be used for forecasting. Forecasts can be made for a single period or several periods in the future. Confidence intervals can also be constructed about these estimates. In general, the further into the forecast, the larger the confidence intervals. Therefore, as more data become available, the same model can be used to revise the forecasts by choosing different time origins (Box & Jenkins 1970, Hoff 1983, Chatfield 1989).

As in our case, a series of 30 observations, representing total annual water consumption in Kuwait during the period from 1970 to 2000, was collected. As seen before, Fig.1 gives a plot of the original series. A close inspection of the figure suggests that water consumption in Kuwait experienced exponential growth over the sample period with the exception of the period 1990-1992, as was explained earlier in the paper. The series suggests a constant proportional growth rate of approximately 8% per annum. This was estimated using the regression:

$$Ln\ C_t = b_0 + b_1\ T + u_t \tag{2}$$

where C_t is the total annual water consumption in period t, T is time, b_0 and b_1 are constants and u is the error term. The coefficient b_1 represents the (constant) proportional rate of growth (r), given by:

$$r = (dC/dT)/C. \tag{3}$$

The final model was estimated using the SAS program (SAS/ETS Software 1991) and it can be written as follows:

$$Y_t + 96.6 = 0.11(Y_{t-1} + 96.6) + e_t\ . \tag{4}$$

The model shown above in Fig.3 and in Table 7 appears to provide a good fit to the water consumption. None of the Q statistics values are significant and none of the residual autocorrelations are very large in the autocorrelation check of

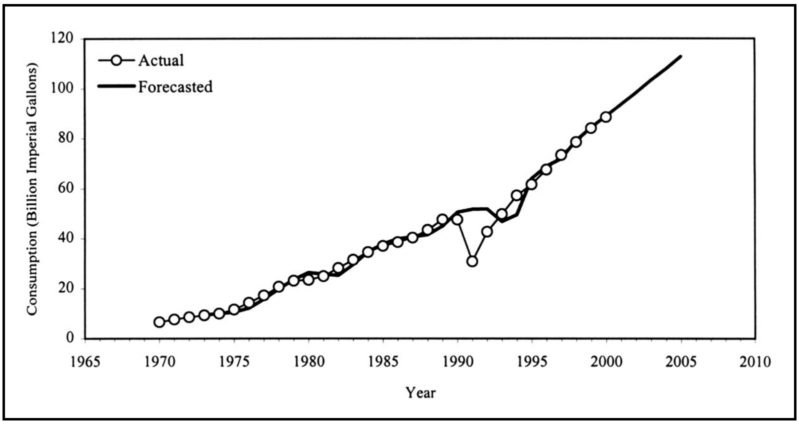

Fig.3. Actual and forecasted water consumption in Kuwait

residuals, indicating that the model provides a good fit to the data. The seasonal moving average parameter estimate of 0.11 is significant. In addition, the Akaike's Information Criterion (AIC) (Akaike 1974, Harvey 1981) and Schwartz's Bayesian Criterion (SBC) (Schwartz 1978) which measure the goodness of fit are small, indicating good fit of the model. Moreover, more elaborate models did not produce superior results. Therefore, this model adequately describes the behavior of the water consumption time series. Figure 3 shows how close the forecasted values given by the model are to the actual values; the results suggest a very good fit. In addition, Table 8 lists the forecasts with their associated forecast standard errors (Std Error) and 95 percent confidence limits. Note that the forecast standard errors increase and the 95 percent confidence limits widen for each future period.

Table 7. Statistical Analysis Results

Parameter	Estimate	Std. Error	t-value	Approx. Pr > |t|	Lag
MU	-96.60151	338.49424	-0.29	0.7753	0
MA1	0.11182	0.40863	0.27	0.7844	12

Constant Estimate	-96.6015
Variance Estimate	2530673
Std. Error Estimate	1590.703
AIC	406.8082
SBC	408.1643
Number of Residuals	24

To Lag	Chi-square	DF	Pr > Chi-sq	Autocorrelations					
6	11.93	5	0.9035	0.013	-0.588	-0.070	0.135	0.083	0.032
12	12.97	11	0.9370	-0.046	-0.058	-0.018	0.086	0.092	-0.048
18	13.56	17	0.9757	-0.079	-0.021	0.001	0.031	0.039	0.007
24	13.63	23	0.9854	-0.019	-0.010	0.004	0.001	-0.002	-0.002

Table 8. Lower and upper 95% levels of water consumption.

Year	Actual Water consumption	Forecast	Std.	L95	U95	Residual
1970	6638	-	-	-	-	-
1971	7688	-	-	-	-	-
1972	8572	-	-	-	-	-
1973	9303	9525.40	1696.21	6200.89	12849.91	-222.40
1974	10023	10090.40	1696.21	6765.89	13414.91	-67.40
1975	11602	10627.40	1696.21	7332.89	13981.91	944.60
1976	14328	12225.40	1696.21	8900.89	15549.91	2102.60
1977	17312	15810.40	1696.21	12485.89	19134.91	1501.60
1978	20699	19941.40	1696.21	16616.89	23265.91	757.60
1979	23067	23586.40	1696.21	20261.89	26910.91	-519.40
1980	23443	26357.40	1696.21	23032.89	29681.91	-2914.40
1981	24917	25714.40	1696.21	22389.89	29038.91	-797.40
1982	28181	25196.40	1696.21	21871.89	28520.91	2984.60
1983	31470	29558.40	1696.21	26233.89	32882.91	1991.60
1984	34522	34637.40	1696.21	31312.89	37961.91	-115.40
1985	36904	37738.96	1685.83	34434.79	41043.13	-834.96
1986	38469	39866.84	1685.83	36562.67	43171.02	-1397.84
1987	40306	40650.08	1685.83	37345.90	43954.25	-344.08
1988	43422	41542.18	1685.83	38238.01	44846.36	1879.82
1989	47605	44996.56	1685.83	41692.39	48300.73	2608.44
1990	47546	50540.73	1685.83	47236.56	53844.90	-2994.73
1991	30814	51689.76	1685.83	48385.59	54993.93	-20875.76
1992	42641	51856.03	2384.04	47183.40	56528.66	-9215.03
1993	49456	46776.23	1685.83	43472.05	50080.40	2979.77
1994	57165	49496.04	1685.83	46191.87	52800.22	7668.96
1995	61577	63972.28	1685.83	60668.11	67276.45	-2395.28
1996	67464	68902.14	1685.83	65597.97	72206.32	-1438.14
1997	73284	71872.75	1685.71	68568.83	75176.67	1411.25
1998	78496	79230.68	1685.71	75926.76	82534.61	-734.68
1999	84070	84257.87	1685.71	80953.95	87561.79	-187.87
2000	88452	88975.23	1685.71	85671.30	92279.15	-523.23
2001	-	93637.76	1685.71	90333.84	96941.68	-
2002	-	98257.99	2383.95	93585.54	102930.43	-
2003	-	103347.15	4129.11	95254.23	111440.06	-
2004	-	107870.77	5330.66	97422.86	118318.68	-
2005	-	112863.33	7347.81	98461.88	127264.77	-

CONCLUSION

Forecasting water demand in Kuwait carries major policy implications for both the Kuwaiti government and the water industry. Kuwait's government heavily subsidizes water consumption, which adds a heavy burden to the already large fiscal deficit. Also, the water sector invests continuously in expanding its production capacity. It would be very useful indeed to form an idea about the future demand for this public utility.

Total annual water consumption in Kuwait is predicted to reach 1.13 billion Imperial gallons (5.14 million cubic meters) in the year 2005. However, this figure could be as high as 1.3 billion Imperial gallons (5.91 million cubic meters). This represents an increase of 17.5% to 25% over the current consumption rates. Such an increase would definitely add constraints to the budget.

It is apparent that people in Kuwait are bothered most about the color of the water that reaches their houses. That is why the majority of the people surveyed use bottled water for drinking. It is noticed as well that people in Kuwait waste a lot of water. The water authority and the Government should start a public campaign in advising and guiding people on consuming water. One way to encourage the people to reduce water consumption is by increasing the charge rates for water use. In view of the rapidly increasing cost of water supply schemes, inflation, and the financial crises the country is going through (especially after the Gulf War), the above rates seem to be unreasonably low. The water authority should advise the consumers to use more of the brackish water for their daily chores, such as irrigation, landscaping, household purposes, live-stock watering and construction works. They could also make a separate network of the brackish water to the toilets. Perhaps the water authority should have two different water rates: one for fresh water and a lower one for brackish water. By the same token, the water authority should study the reduction in the volume of water consumption for personal washing and bathing, by replacing the conventional sprays with ones that could reduce water flow.

The implications for the budget suggest that a more effective rationalization of water consumption may be needed. This may require use of partial subsidization and multiple tariff pricing system. If conditions continue as they are, the above results suggest that Kuwait may need to consider expanding the current water supply by at least 20% to cope with the increase in demand.

The Ministry of Electricity and water should seriously think of using wastewater treated effluents. In many places around the world, secondary treated wastewater is used for irrigation. In fact, tertiary treated effluents (BOD 5 - 10 mg/l) are produced in Kuwait. Such high quality effluents can be used for irrigation. Alternatively, they could be discharged into artifically constructed wetlands, which may represents a viable option. In addition, the cost of producing tertiary effluents is low compared to producing fresh water in Kuwait. It costs less than KD 0.6 to produce 1000 Imperial gallons (4.545m^3) of tertiary treated effluent compared to KD 2.7 per 1000 Imperial gallons (4.545m^3) of fresh water. For example, the fresh water production from the Ministry of Electricity and Water (MEW) in the year 2000 was 8943×10^6 Imperial gallons at a cost of KD 245,938,000.000. On the other hand, the treated wastewater from the treatment plants in the country was $33{,}166 \times 10^6$ Imperial gallons at a cost of KD 19,899,600.00. That is a difference of KD 226,038,400.00.

ACKNOWLEDGEMENTS

The authors are very thankful to the distingished reviewers of the Journal. The authors also wish to thank the Ministry of Electricity and Water (MEW) for their help and support.

REFERENCES

Akaike, H. 1974. A new look at statistical model identification. IEEE Transaction on Automatic Control, AC **19**: 716-723.

Box, G. & Jenkins, G. 1976. Time Series Analysis: Forecasting and Control. Holden-Day, San Francisco.

Chatfield, C. 1989. The Analysis of Time Series: An Introduction (4th edition) Chapman and Hall, London.

Dickey, D.A., Bell, W.R & Miller, R.B. 1986. Unit roots in time series models: Tests and applications. The American Statistician, **40**: 12-26.

Falkenmark, M. 1989. The massive water scarcity in Africa: Why isn't it being addressed? Ambio **18(2)**.

Hankee, J.E. & A.G., 1995 Business Forecasting. (5th edition) Prentice Hall International, Inc, Englewood Cliffs, New Jersey.

Harvey, A.C. 1981. The Economic Analysis of Time Series. John Wiley & Sons, Inc. New York.

Hoff, J.C. 1983. A Practical Guide to Box-Jenkins Forecasting. Lifetime Learning Publication, Belmont, CA.

Ljung, G.M. & Box, G.E.P. 1978. On a measured of lack of fit in time series models. Biometrica, **65** 279-303.

Postel, S. 1992. Last Oasis: Facing Water Scarcity. W.W. Norton & Co., New York, USA.

MEW, Ministry of Electricity & Water, 2001. Statistical Year Book (Water). Edition **26** "B".

MOP, Ministry of Planning, 2000. Annual Statistical Abstract, Edition 36.

Newbold, P. & Bos, T. 1994. Introductory Business and Economic Forecasting. South-Western Publishing Co., Cincinnati, Ohio.

Omar, S.S., Alyqub, & Senay, Y. 1996. Geology and Groundwater Hydrology of the State of Kuwait, Gulf Arabian Penin. Study **1**: 9-51.

PRB 1993. "World Population Data Sheet", Water Resources Institute, World Resources.

SAS/ETS Software: Applications Guide 1. 1991. Time Series Modeling and Forecasting, Financial Reporting, and Loan Analysis. Version **6**, 1st Edition. Cary, N.C. USA.

Schwartz, G. 1978. Estimating the dimensions of a model. Annals of Statistics **6**: 461-464.

Shiklomanov, I.A. 1990. Global Water Resources, Nature and Resources **26(3)**.

Walpole, R.E., & Myers, R.J. 1985. Probability and Statistics for Engineers and Scientists (3rd Edition) Macmillan Publishing Co., New York.

WRI, World Resources Institute 1992. World Resources 1992-1993. Oxford University Press, New York.

Submitted : *18/4/2001*
Revised : *1/6/2001*
Accepted : *10/6/2002*

احتياجات المياه المنزلية
دراسة عملية في دولة الكويت

جاسم محمد الحمود و إبراهيم الغصين
قسم الهندسة المدنية – جامعة الكويت
ص.ب. 5969 الصفاة 13060

خلاصة

إن هذه الورقة العلمية هي نتيجة بحث لدراسة استهلاك المياه في دولة الكويت. بيانات ومعلومات عن استهلاك الماء جمعت عشوائياً من منازل مختلفة في دولة الكويت. بالإضافة فإن هذا البحث يعطي التصور المستقبلي لاستهلاك (إنتاج) المياه في دولة الكويت. إنتاج المياه في دولة الكويت مدعوم حالياً من قبل الحكومة بشكل كبير جداً، بحيث أنه أصبح يشكل عبئاً على الميزانية. لذلك فإن التنبؤ المستقبلي لكمية استهلاك المياه يعطي الحكومة الصورة الصحيحة لإعادة صياغة الدعم للإنتاج. نتائج الدراسة تبين بأن هناك كميات كبيرة من المياه تهدر من قبل المنزل الكويتي. في نهاية الدراسة هناك ملاحظات مهمة لوزارة الكهرباء والماء وللمواطن الكويتي لترشيد استهلاك المياه.