REBUTTAL TESTIMONY

OF

EDWARD L. SPITZNAGEL, JR.

1. Q. Please state your name, business address, and employer.

A. My name is Edward L. Spitznagel, Jr., and my business address is Campus Box 1146, One Brookings Drive, St Louis, Missouri 63130. I am employed by Washington University.

2. Q. What is the purpose of your testimony?

A. I am offering rebuttal to the testimony of Charles W. King, Michael Gorman, and Terry Buckner criticizing my weather normalization of Chattanooga water consumption.

3. Q. How do you respond to Charles King's statements that your normalized estimates September 2008 through August 2009 (the attrition year) represent a decrease from 2007 of 2.3 percent in residential consumption and a decrease of 1.4 percent in commercial consumption[1]?

A. There are two ways in which these percentages are misleading.

[1] Direct Testimony of C. King at 13.

First, the weather normalized consumption for the attrition year is compared with the actual consumption in the year 2007. In terms of the Palmer Drought Severity Index, the year 2007 was extremely dry; as can be seen from Appendix A, it had the fourth lowest PDSI averaged over all 12 months and the third lowest PDSI averaged over the months May through December. This is over the 113 years, 1895-2007, for which NOAA has reported the Palmer Drought Severity Index. Naturally, water consumption in 2007 was elevated due to the extremely dry conditions. This apples-and-oranges comparison of my weather normalized consumption estimate with actual usage in an extremely dry year greatly exaggerates the percentage decrease.

The second way in which the percentages are misleading is that they compare the calendar year 2007 with the attrition year September 2008 through August 2009. This represents a time shift of one and two-thirds years rather than a single year, which is what I use as explained below. This further inflates Charles King's percentage changes.

4. Q. What are the annual decreases in consumption based on your normalized estimates?

A. Based on Appendix C of my original testimony, the annual percent decrease in normalized consumption from 2007 to 2008 is 1.43% (100(1 - 143.05/145.13)) for the residential class and it is

0.85% (100(1 - 1034.82/1043.66)) for the commercial class. Both of these are much lower than the percent changes calculated by Charles King.

5. Q. Do you agree with the statement in Mr. King's testimony that you explored various alternatives with "limited success"[2]?

A. No. The described model simply emerged as the best method for estimating water consumption, thus the alternatives, although adequate, were not utilized.

6. Q. How do you respond to Mr. King's assertion that your models contain "a term to represent 'secular' trend"[3]?

A. The word "secular" did not appear in my testimony and therefore should not be attributed to me. Mr. King defines "secular trend" as "the trend in overall consumption independent of weather."[4] A trend can emerge as frequently as monthly, which is why my models are done month-by-month. This accommodate a different change, either up or down, over time for each month and each customer class. This result is supported by the extensive research done for Kentucky American Water Company as mandated by the PSC of the Commonwealth of Kentucky for their 1997 rate case. As explained in my direct testimony, that research involved screening a large

[2] Direct Testimony of C. King at 13.
[3] Direct Testimony of C. King at 14.
[4] Id.

number of candidate predictors by examining data from sixteen different operating companies in five states, including Tennessee. Any trend down (or up) on an annual basis is simply a consequence of the monthly projections.

7. Q. Charles King states that you do "not discuss population growth, commercial changes, or other demographic or economic shifts that may be significant over the period"[5]. How do you respond to this statement?

A. While other factors may be present, they are generally difficult to measure on an annual basis, in order to be incorporated into a model. Instead, all factors impacting usage are captured over time in the historical data. One thing I always check, though, is whether there has been an acquisition of one or more smaller companies. (This happened recently both in St. Louis County and in Lexington, Kentucky.) In such cases, I request that the water company give me their data with the newly acquired customer base removed. I find it more statistically accurate to do the normalization on the continuing customers alone because inclusion of a new customer base, absent the relevant historical data for that new customer base, would disturb the patterns and trends established by the historical community usage.

[5] Id.

8. Q. Mr. King argues that "the individual model results do not follow an orderly pattern that reflects normal monthly temperature variations"[6]. He specifically refers to his schedules 4 and 5 for the 2006 estimates. Should such a pattern be expected?

A. No, not with respect to water consumption. Mr. King operates under the assumption that annual patterns for temperature and predicted consumption should be similar. As explained previously in my direct testimony, I found that temperature was not a useful predictor in the presence of other variables, such as drought and year. For a utility like natural gas used for home heating, one would certainly expect consumption to be tightly tied to temperature. Based on the setting of the thermostat, consumption should be very predictable. With water, however, consumption during the winter months would be expected to remain relatively constant. The reason is that in temperate climates such as Chattanooga, most outside water usage stops when the minimum daily temperature (or low temperature) drops below freezing. Given normal billing lag, one would expect to see approximately the same daily consumption billed in the months of January through April. That is why my models for those months do not include the Palmer Drought Severity Index.

All of the differences noted by Charles King are consistent with natural statistical fluctuation in the estimates. This is

[6] Direct Testimony of C. King at 14.

illustrated by the inclusion of 95% confidence intervals with respect to the 2006 point estimates in Appendix B. "95% confidence intervals" is a statistical term used to express a 95 percent degree of certainty as to the accuracy of an estimate. The two months he considers to be exceptional, January and August, have confidence intervals that substantially overlap those of the neighboring months, which indicates that the estimates for these months actually fall within the same range.

9. Q. Mr. King states that "the secular trend factors display a peculiar seasonal effect"[7]. Would you agree with this statement, and is it a defect in your models?

A. As explained in my response to Question 8, most, if not all, of what he notices is natural statistical fluctuation in the estimates. This is illustrated by the 95% confidence intervals drawn around the actual estimates in Appendix C.

However, I know of other water utilities that experience trends opposite from those noted in this case between the months of January through April and the months of May through December. What characterizes these utilities' customer bases is that there are a fairly large number of new houses being built in new subdivisions. These houses tend to have larger lawns, which increases the per-customer amount of water used in the weather-sensitive months.

[7] Direct Testimony of C. King at 15.

However, in the weather-insensitive months, the water-conserving fixtures and appliances in these new houses cause the per-customer amount of water used to decrease.

10. Q. Is it possible to visualize the net decrease in per-customer consumption over all years for which you have data?

A. Yes. If we omit weather normalization, we can graph Chattanooga consumption from 1994 through 2007, for a total of fourteen years, as seen in Appendix D. Both residential and commercial consumption show downward trends. Because the higher consumption in 2007 is not adjusted for weather, the downward trends, particularly for residential customers, are not quite as large as in the weather-normalized estimates from my original testimony. Since weather normalization is an important aspect of estimation, I recommend using my original estimates, but considering the results in Appendix D as being corroborative of those original estimates.

11. Q. Michael Gorman recommends using 150.5 gallons per customer day for the residential class and 1055 gallons per customer day for the commercial class[8]. Why do his estimates differ so much from your respective estimates of 141.81 GCD and 1029.41 GCD?

[8] Direct Testimony of M. Gorman at 20-21.

A. Michael Gorman considers actual usage based on ten, five and three-year averages and includes the year 2007 in each average. This does not take into account the extremely dry weather experienced in 2007. Weather normalization attempts to predict consumption under normal weather. His residential estimate of 150.5 GCD is virtually the same as his three-year average of 150.7 GCD. Thus, he tacitly assumes that 2007 was a normal year, whereas it was the third or fourth driest year on record, as seen in my Appendix A, Page 1. Appendix D, Page 1 shows the large increase in residential consumption in 2007 as compared with 2005 and 2006. For corroborative purposes, the trend line in Appendix D, Page 1, is at odds with his estimate for the test period September 2008. Similarly, his estimate of 1055 GCD for the commercial class is slightly less than his five-year average of 1061.2 GCD. This average is also high due to the very dry year 2007. Furthermore, the test year is more than three years beyond the midpoint of his five years, and the trend line in Appendix D, Page 2, shows a downward trend of 8.43 GCD per year. Following this downward trend for three years would project an estimate of 1035.91 (1061.2 - 3x8.43). This is much closer to my estimate of 1029.41, even without being concerned about the trend slope being pulled upwards by the year 2007. The trend line in Appendix D, Page 2, is much more consistent with my estimate of 1029.41 than his estimate of 1055.

12. Q. What are Terry Buckner's criticisms of your testimony concerning weather normalization?

A. Mr. Buckner asserts that the "month of the year" model "does not stand the test of reasonableness"[9]. He further states that "the WNA reduction in revenues projected by TAWC in last year's rate case (TRA Docket #06-00290) did not occur."

13. Q. How do you respond to these criticisms?

A. A "test of reasonableness" inherently relies upon making assumptions based on appearance and conjecture. The statistical model that I employ is more reliable than a "test of reasonableness". As described in Questions 8 and 9 above, the apparent inconsistencies that Mr. King and Mr. Buckner criticize are insignificant once the 95% confidence intervals are taken into account. To summarize those points, the 95% confidence intervals for both types of estimates, consumption and trend, show no unexpected pattern.

With regard to the claim that the projected reduction in revenue in the last case did not occur, that is beside the point. The projection was for thirty-year average weather. That is the definition of the weather-normalized estimate. A weather-normalized estimate is not a projection of what would happen if

[9] Direct Testimony of T. Buckner at 5-6.

conditions should turn out to be very dry or very moist. If the utility and the TRA adhere to weather-normalized estimates, the utility should average a fair rate of return over the years, fluctuating high in some years and low in other years. However, projecting consumption on the basis of one the driest years on record will, by definition, result in an over-projection of consumption, a reduction in revenues to the detriment if the utility, and a statistically invalid outcome.

14. Q. Has the model you use been relied upon in past rate proceedings?

A. Yes. For instance, the TRA has accepted my model in each case since 2003 and the Public Service Commission of Kentucky has used my model in setting rates since 1996.

15. Q. Does this conclude your testimony?

A. Yes, it does.

Palmer Drought Severity Index, 1895-2007

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Yearly Average	May-Dec Average
2007	-1.27	-2.13	-2.89	-2.34	-3.05	-3.07	-2.67	-3.91	-4.25	-4.32	-4.38	-4.46	***-3.2283***	***-3.7638***
2006	-1.05	-1.56	-2.12	1.02	0.92	0.85	0.39	0.67	1.82	2.58	2.51	-0.80	0.4358	1.1175
2005	3.90	3.35	2.62	3.02	2.53	2.33	2.85	2.63	-0.48	-1.06	-1.00	-1.18	1.6258	0.8275
2004	3.90	3.52	3.00	2.48	2.18	3.06	3.03	2.93	4.29	4.12	4.71	4.84	3.5050	3.6450
2003	1.47	3.02	1.72	2.57	4.13	4.38	4.94	5.36	5.93	5.02	5.35	4.77	4.0550	4.9850
2002	-0.03	-1.01	0.86	-0.96	-0.56	-1.11	-1.25	-1.83	0.71	1.20	1.99	2.27	0.0233	0.1775
2001	-1.87	-1.18	-1.49	-2.11	-0.03	0.27	1.06	1.18	1.56	-0.34	-0.96	-0.94	-0.4042	0.2250
2000	-2.10	-2.46	-2.57	-1.28	-1.35	-1.01	-1.14	-1.32	-1.18	-2.17	-1.83	-2.07	-1.7067	-1.5088
1999	1.10	0.74	0.52	0.21	0.32	1.11	1.50	-0.79	-1.32	-1.38	-1.68	-2.42	-0.1742	-0.5825
1998	1.70	1.22	0.96	3.37	2.92	3.93	-0.30	-0.84	-1.71	-2.32	-2.91	0.54	0.5467	-0.0863
1997	3.06	2.73	2.94	3.16	3.53	4.17	3.48	2.61	2.80	2.68	2.26	1.68	2.9250	2.9013
1996	1.82	1.25	1.32	1.45	1.68	1.48	1.78	2.04	2.60	2.05	3.04	3.09	1.9667	2.2200
1995	-0.36	-0.25	-0.67	-1.41	-0.55	-0.04	-1.02	-1.42	0.08	0.53	1.45	0.87	-0.2325	-0.0125
1994	1.19	2.23	3.82	4.51	3.93	4.57	4.75	4.82	4.26	4.06	-0.18	-0.87	3.0908	3.1675
1993	-0.27	-0.70	0.65	-0.03	-0.08	-0.71	-1.79	-1.53	-1.30	-1.45	-1.56	0.66	-0.6758	-0.9700
1992	-0.36	-0.72	-0.85	-1.40	0.12	0.95	1.08	1.60	1.64	2.06	2.40	2.81	0.7775	1.5825
1991	2.17	2.59	2.95	2.60	2.02	2.45	1.99	2.23	2.03	1.09	1.09	2.49	2.1417	1.9238
1990	3.55	3.93	3.63	2.87	3.37	2.47	2.21	2.17	1.89	2.53	1.91	3.10	2.8025	2.4563
1989	0.40	0.89	0.54	0.24	1.05	2.94	2.81	2.78	4.33	4.11	4.40	3.69	2.3483	3.2638
1988	-3.82	-3.99	-4.39	-4.19	-4.15	-4.76	-4.45	-4.26	0.27	0.18	0.49	0.16	-2.7425	-2.0650
1987	-2.35	-1.90	-2.42	-2.04	-2.24	-2.13	-2.68	-3.36	-2.97	-3.38	-3.97	-4.13	-2.7975	-3.1075
1986	-2.85	-2.73	-3.45	-4.22	-4.11	-4.68	-5.14	-4.66	-4.22	-3.58	-3.07	-2.70	-3.7842	-4.0200
1985	-1.63	-1.36	-2.32	-2.72	-2.91	-2.23	-2.36	-1.38	-1.94	-1.88	-1.48	-2.12	-2.0275	-2.0375
1984	-0.60	-0.53	-0.78	0.20	2.07	1.69	2.81	-0.36	-0.92	-0.84	-0.68	-1.39	0.0558	0.2975
1983	-0.74	-0.98	-1.72	1.10	1.98	-0.16	-0.93	-1.34	-1.80	-1.68	0.31	0.92	-0.4200	-0.3375
1982	1.63	1.96	1.46	1.19	0.78	0.74	1.05	1.57	1.76	1.79	2.55	2.62	1.5917	1.6075
1981	-3.50	-3.16	-3.37	0.06	0.32	0.63	0.37	0.36	0.72	1.11	0.99	0.94	-0.3775	0.6800
1980	-0.40	-1.21	1.47	1.35	-0.11	-0.83	-1.62	-2.10	-1.99	-2.13	-2.14	-2.88	-1.0492	-1.7250
1979	1.20	1.15	0.83	1.29	2.07	1.98	3.27	2.95	3.42	3.19	3.81	-0.69	2.0392	2.5000
1978	3.12	-1.16	-1.13	-1.22	-0.68	-0.36	-0.65	-0.09	-0.69	-1.29	-1.44	0.53	-0.4217	-0.5838
1977	-0.57	-1.42	0.24	1.28	0.56	1.38	-0.70	0.34	1.91	2.72	3.62	3.09	1.0375	1.6150
1976	-0.02	-0.75	-0.80	-1.99	0.73	1.44	-0.38	-0.65	0.37	1.40	-0.05	0.15	-0.0458	0.3763
1975	2.42	2.26	4.18	3.23	2.97	2.92	2.08	1.54	2.38	2.68	-0.02	-0.04	2.2167	1.8138
1974	4.66	4.42	3.99	3.92	4.86	4.21	3.07	2.89	2.84	2.36	2.39	2.51	3.5100	3.1413
1973	3.06	2.22	3.43	3.59	4.59	4.54	4.10	3.59	3.29	2.97	3.66	4.13	3.5975	3.8588
1972	1.48	1.43	1.28	1.18	1.65	1.95	2.27	1.56	2.16	3.13	3.21	3.77	2.0892	2.4625
1971	0.26	0.48	0.41	0.27	0.64	0.60	1.71	1.35	1.33	1.27	0.79	0.84	0.8292	1.0663
1970	-0.50	-0.87	-1.36	1.14	-0.80	-0.58	-1.30	0.36	0.04	0.44	-0.50	-0.58	-0.3758	-0.3650
1969	-2.13	-1.50	-1.81	-2.06	-2.46	0.56	0.39	0.52	0.77	0.36	0.12	1.12	-0.5100	0.1725

Sorted from Driest to Wettest

Year	Yearly Average	Year	May-Dec Average
1986	-3.7842	1986	-4.0200
1941	-3.6892	1941	-3.8038
1914	-3.6775	***2007***	***-3.7638***
2007	***-3.2283***	1914	-3.6313
1954	-3.1300	1954	-3.5463
1987	-2.7975	1930	-3.1813
1988	-2.7425	1987	-3.1075
1930	-2.6942	1925	-3.1050
1931	-2.6442	1953	-2.7825
1940	-2.6008	1952	-2.6438
1925	-2.5742	1904	-2.4350
1953	-2.5383	1931	-2.2413
1904	-2.3150	1955	-2.1325
1955	-2.2883	1940	-2.1050
1985	-2.0275	1988	-2.0650
1905	-1.8917	1985	-2.0375
1952	-1.8208	1899	-1.8438
2000	-1.7067	1913	-1.8075
1926	-1.2667	1939	-1.7650
1939	-1.2300	1902	-1.7613
1968	-1.2158	1980	-1.7250
1947	-1.1017	1936	-1.7225
1980	-1.0492	2000	-1.5088
1959	-1.0142	1905	-1.5000
1899	-1.0033	1947	-1.4963
1911	-0.9592	1968	-1.4163
1896	-0.9083	1944	-1.0688
1913	-0.8125	1911	-1.0550
1900	-0.7892	1921	-1.0075
1921	-0.7858	1993	-0.9700
1902	-0.7375	1903	-0.9300
1898	-0.6975	1965	-0.8575
1993	-0.6758	1895	-0.7825
1936	-0.5625	1956	-0.7325
1965	-0.5558	1897	-0.6850
1908	-0.5533	1933	-0.6675
1943	-0.5467	1959	-0.6663
1969	-0.5100	1978	-0.5838
1958	-0.5000	1999	-0.5825

Palmer Drought Severity Index, 1895-2007

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Yearly Average	May-Dec Average
1968	0.02	-1.20	-1.27	-0.81	-0.63	-0.68	-0.93	-1.54	-1.75	-1.63	-2.01	-2.16	-1.2158	-1.4163
1967	-0.79	-0.67	-1.21	-1.65	0.98	1.01	2.84	3.08	3.00	2.96	3.33	3.78	1.3883	2.6225
1966	-2.53	-1.98	-2.52	0.47	-0.14	-0.60	0.10	1.16	1.93	2.67	2.94	-0.26	0.1033	0.9750
1965	-0.38	-0.63	1.24	-0.04	-0.54	-0.33	-0.26	-0.52	-0.55	-0.85	-1.31	-2.50	-0.5558	-0.8575
1964	0.11	0.18	0.70	1.67	-0.49	-1.27	-1.23	0.77	0.56	1.27	-0.11	-0.17	0.1658	-0.0838
1963	-0.36	-0.84	1.66	1.22	1.18	1.48	1.91	-0.33	-0.71	-1.81	-1.39	-1.76	0.0208	-0.1788
1962	2.75	3.42	-0.05	0.14	-1.00	-0.46	-0.39	-1.01	0.69	0.58	1.02	-0.13	0.4633	-0.0875
1961	-1.04	0.84	0.87	0.84	0.91	1.56	1.44	1.67	0.86	0.86	0.65	2.38	0.9867	1.2913
1960	-0.39	-0.66	-0.46	-1.25	-1.55	0.45	0.22	0.61	0.67	1.13	-0.19	-0.48	-0.1583	0.1075
1959	-1.71	-1.87	-1.92	-1.34	-1.44	-1.65	-1.85	-1.63	-1.85	0.69	1.23	1.17	-1.0142	-0.6663
1958	-0.66	-0.79	-1.09	0.89	0.93	-0.35	-0.10	-0.05	-0.40	-1.06	-1.47	-1.85	-0.5000	-0.5438
1957	1.43	2.09	-0.92	-0.62	-0.97	-0.23	-1.29	-1.64	1.46	1.62	3.08	3.07	0.5900	0.6375
1956	-2.63	1.29	1.14	2.03	-0.42	-0.76	-0.54	-0.96	-0.78	-1.11	-1.59	0.30	-0.3358	-0.7325
1955	-3.83	-2.94	-1.93	-1.70	-1.83	-1.63	-1.81	-2.17	-2.51	-2.41	-2.25	-2.45	-2.2883	-2.1325
1954	-1.96	-2.51	-2.10	-2.62	-2.32	-2.70	-3.25	-3.66	-4.23	-4.41	-4.35	-3.45	-3.1300	-3.5463
1953	-2.64	-1.78	-1.98	-1.80	-1.53	-1.62	-1.69	-2.71	-2.74	-3.56	-4.28	-4.13	-2.5383	-2.7825
1952	1.81	-0.89	-0.53	-1.09	-1.26	-2.22	-3.14	-2.63	-2.82	-3.29	-2.95	-2.84	-1.8208	-2.6438
1951	1.88	1.63	2.16	2.26	1.47	2.01	1.52	0.67	1.03	0.68	1.37	1.89	1.5475	1.3300
1950	2.81	2.75	2.88	1.74	2.24	2.45	3.20	3.64	3.90	3.12	2.68	2.18	2.7992	2.9263
1949	2.69	1.84	1.43	1.83	1.25	1.45	2.20	2.41	2.21	3.24	2.55	1.93	2.0858	2.1550
1948	-1.89	1.04	1.17	-0.60	-0.98	-1.29	-1.08	-1.05	-1.34	-1.62	2.16	2.38	-0.2583	-0.3525
1947	1.65	-0.53	-0.84	-1.53	-1.68	-1.25	-1.32	-1.15	-1.42	-1.78	-1.45	-1.92	-1.1017	-1.4963
1946	2.05	2.03	-0.66	-0.73	-0.22	-0.37	-0.60	-0.71	-0.58	-0.40	-0.67	-0.68	-0.1283	-0.5288
1945	-1.03	-0.20	-0.99	-0.96	0.47	0.64	0.88	0.94	0.64	0.71	0.77	1.17	0.2533	0.7775
1944	-1.87	1.46	1.88	1.78	-0.78	-1.61	-2.60	-3.06	1.00	-0.36	-0.64	-0.50	-0.4417	-1.0688
1943	-0.53	-0.77	-0.35	-0.42	-0.89	-1.06	0.72	-0.63	-0.24	-0.26	-0.83	-1.30	-0.5467	-0.5613
1942	-4.37	-4.18	-3.85	-4.74	0.06	0.18	1.03	2.49	2.64	2.45	1.74	3.04	-0.2925	1.7038
1941	-2.90	-3.75	-3.55	-3.64	-4.50	-4.26	-2.87	-2.95	-3.54	-3.77	-4.10	-4.44	-3.6892	-3.8038
1940	-4.02	-3.72	-3.48	-3.15	-3.21	-2.60	-2.07	-1.15	-1.67	-1.65	-2.04	-2.45	-2.6008	-2.1050
1939	-1.21	1.24	-0.30	-0.37	-0.93	-0.77	-0.69	-0.83	-1.64	-2.46	-3.20	-3.60	-1.2300	-1.7650
1938	-0.79	-1.65	-1.53	0.55	1.10	1.61	2.68	-0.05	-0.17	-1.06	-0.66	-1.09	-0.0883	0.2950
1937	1.62	1.52	-0.94	-0.74	-0.84	-1.08	-1.12	0.71	0.35	1.32	-0.58	-0.83	-0.0508	-0.2588
1936	1.34	1.38	1.93	2.38	-1.07	-2.22	-1.90	-2.21	-2.26	-1.90	-2.49	0.27	-0.5625	-1.7225
1935	-0.78	-0.81	0.75	1.18	1.24	1.20	-0.16	-0.43	-1.35	-1.58	-1.02	-1.70	-0.2883	-0.4750
1934	-2.65	-2.67	1.22	0.90	0.53	0.59	0.73	1.54	1.40	1.74	-0.07	-0.59	0.2225	0.7338
1933	1.87	2.32	-0.31	-0.45	0.46	-0.68	0.11	0.96	-0.48	-1.27	-2.01	-2.43	-0.1592	-0.6675
1932	1.04	1.48	1.63	1.62	1.20	1.87	-0.64	-0.84	-1.27	1.18	1.42	2.69	0.9483	0.7013
1931	-3.52	-3.63	-3.79	-2.86	-2.48	-3.26	-2.67	-1.72	-2.34	-2.76	-3.52	0.82	-2.6442	-2.2413
1930	-1.22	-1.59	-1.58	-2.49	-2.48	-2.69	-3.47	-3.89	-3.51	-3.30	-3.07	-3.04	-2.6942	-3.1813

Sorted from Driest to Wettest

Year	Yearly Average	Year	May-Dec Average
1895	-0.4775	1908	-0.5725
1903	-0.4575	1943	-0.5613
1944	-0.4417	1958	-0.5438
1978	-0.4217	1946	-0.5288
1983	-0.4200	1935	-0.4750
2001	-0.4042	1926	-0.4425
1981	-0.3775	1970	-0.3650
1970	-0.3758	1896	-0.3550
1910	-0.3367	1948	-0.3525
1956	-0.3358	1983	-0.3375
1942	-0.2925	1937	-0.2588
1935	-0.2883	1963	-0.1788
1948	-0.2583	1898	-0.0900
1897	-0.2500	1962	-0.0875
1995	-0.2325	1998	-0.0863
1999	-0.1742	1964	-0.0838
1933	-0.1592	1919	-0.0750
1960	-0.1583	1924	-0.0325
1946	-0.1283	1995	-0.0125
1938	-0.0883	1927	0.0237
1937	-0.0508	1922	0.0963
1976	-0.0458	1960	0.1075
1918	-0.0458	1900	0.1575
1919	-0.0017	1969	0.1725
1963	0.0208	1910	0.1725
2002	0.0233	2002	0.1775
1924	0.0542	2001	0.2250
1984	0.0558	1918	0.2325
1915	0.0567	1938	0.2950
1906	0.0700	1984	0.2975
1966	0.1033	1923	0.3300
1964	0.1658	1976	0.3763
1934	0.2225	1909	0.4100
1945	0.2533	1920	0.5888
1922	0.3017	1957	0.6375
1909	0.3183	1981	0.6800
1907	0.3233	1932	0.7013
2006	0.4358	1934	0.7338
1927	0.4417	1945	0.7775

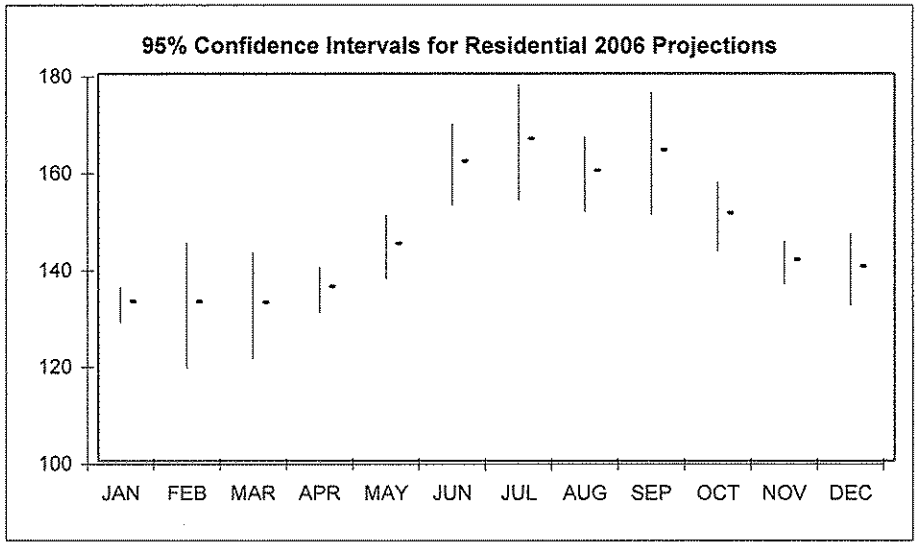
Palmer Drought Severity Index, 1895-2007

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Yearly Average	May-Dec Average
1929	1.17	1.44	2.01	1.54	2.81	3.06	2.70	2.07	2.77	3.05	4.03	-0.55	2.1750	2.4925
1928	-0.95	-1.55	-1.56	0.77	1.24	3.27	2.56	2.73	2.83	3.14	2.78	1.52	1.3983	2.5088
1927	1.08	1.03	1.43	1.57	1.61	1.90	-0.35	-0.16	-0.68	-0.85	-0.94	-0.34	0.4417	0.0237
1926	-2.73	-2.95	-2.94	-3.04	-3.26	-2.69	-2.82	0.79	0.66	0.32	0.97	2.49	-1.2667	-0.4425
1925	-1.04	-1.13	-1.78	-2.10	-2.22	-2.46	-3.17	-3.93	-4.54	-3.07	-2.53	-2.92	-2.5742	-3.1050
1924	0.47	0.56	-0.53	0.41	1.39	1.39	-0.13	-0.68	0.82	-0.71	-1.44	-0.90	0.0542	-0.0325
1923	0.52	0.36	1.15	1.42	1.69	1.58	1.26	1.67	-0.40	-0.79	-0.95	-1.42	0.5075	0.3300
1922	0.33	0.16	1.33	1.03	1.14	1.18	1.35	-0.06	-0.57	-1.12	-1.86	0.71	0.3017	0.0963
1921	-0.48	-0.07	-0.42	-0.40	-0.59	-1.16	-1.20	-0.95	-0.91	-1.07	-0.69	-1.49	-0.7858	-1.0075
1920	-0.69	0.04	0.25	1.64	1.04	1.03	0.68	1.66	1.93	-0.76	-0.70	-0.17	0.4958	0.5888
1919	0.37	-0.41	0.51	0.11	1.09	1.11	-0.36	-0.17	-0.89	-0.37	-0.30	-0.71	-0.0017	-0.0750
1918	-0.18	-0.97	-2.03	0.77	0.63	0.64	-0.09	-0.60	0.47	1.22	-0.04	-0.37	-0.0458	0.2325
1917	1.75	1.23	2.71	2.03	1.85	2.06	2.58	2.38	2.77	0.00	-0.62	-1.31	1.4525	1.2138
1916	2.16	1.59	1.03	0.56	0.92	1.48	3.45	3.37	2.89	2.46	1.78	1.49	1.9317	2.2300
1915	-2.06	-2.27	-2.68	-3.46	0.48	0.53	0.52	1.51	1.76	1.71	2.25	2.39	0.0567	1.3938
1914	-4.05	-4.01	-3.77	-3.25	-3.75	-4.22	-4.28	-3.69	-3.51	-3.42	-3.64	-2.54	-3.6775	-3.6313
1913	1.58	1.53	2.18	-0.58	-0.39	-0.49	-1.20	-1.84	-1.96	-2.04	-3.02	-3.52	-0.8125	-1.8075
1912	0.12	0.11	0.56	1.85	1.94	2.19	2.49	2.23	2.32	1.80	1.16	1.29	1.5050	1.9275
1911	-1.22	-1.53	-1.80	1.48	-0.96	-1.38	-1.54	-1.38	-1.84	-1.96	0.09	0.53	-0.9592	-1.0550
1910	-1.49	-1.40	-2.82	0.29	0.86	1.71	2.30	-0.04	-0.31	-0.55	-1.24	-1.35	-0.3367	0.1725
1909	-1.09	0.46	0.32	0.85	1.49	2.00	2.08	-0.19	0.26	-0.14	-0.89	-1.33	0.3183	0.4100
1908	-0.39	-0.34	-0.59	-0.74	-0.86	-0.67	-0.68	-0.09	-0.45	-0.62	-0.78	-0.43	-0.5533	-0.5725
1907	-1.78	-1.64	-1.98	0.35	0.95	1.40	1.21	0.90	1.56	1.19	1.75	-0.03	0.3233	1.1163
1906	-1.59	-2.29	-1.72	-2.34	-2.53	0.28	1.19	1.47	2.44	2.69	3.43	-0.19	0.0700	1.0975
1905	-2.79	-2.25	-2.74	-2.92	-1.98	-1.52	-1.78	-1.25	-1.48	-0.86	-1.59	-1.54	-1.8917	-1.5000
1904	-1.95	-2.35	-1.79	-2.21	-1.99	-2.02	-2.12	-2.15	-2.50	-3.00	-3.06	-2.64	-2.3150	-2.4350
1903	-2.18	1.02	1.17	1.94	-0.54	0.61	-0.47	-0.69	-1.38	-1.73	-1.55	-1.69	-0.4575	-0.9300
1902	1.87	1.73	1.97	-0.33	-0.98	-0.76	-2.20	-2.44	-1.89	-2.04	-1.98	-1.80	-0.7375	-1.7613
1901	-0.58	-1.39	-1.57	1.17	1.78	1.68	-1.04	1.89	2.31	1.76	1.08	2.14	0.7692	1.4500
1900	-3.11	-2.54	-2.50	-2.58	-2.78	1.60	1.18	0.23	0.18	0.40	1.02	-0.57	-0.7892	0.1575
1899	-0.77	1.05	2.43	0.00	-0.33	-0.91	-1.09	-1.70	-2.31	-2.49	-3.05	-2.87	-1.0033	-1.8438
1898	-1.39	-2.32	-2.24	-1.70	-1.84	-1.96	0.43	0.58	0.62	0.96	1.11	-0.62	-0.6975	-0.0900
1897	-1.86	0.28	1.67	2.39	2.22	-0.22	-0.02	-0.36	-1.27	-1.79	-2.21	-1.83	-0.2500	-0.6850
1896	-2.49	-1.96	-1.56	-2.05	-1.92	0.36	1.64	-0.70	-0.69	-1.17	0.71	-1.07	-0.9083	-0.3550
1895	0.30	-0.76	0.12	0.87	0.83	-0.44	-0.23	-0.52	-1.11	-1.24	-1.72	-1.83	-0.4775	-0.7825

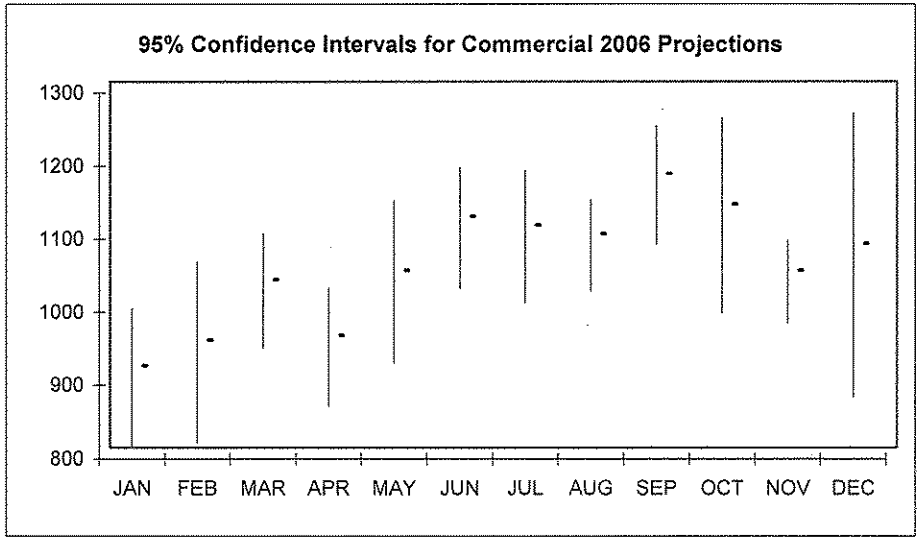
Sorted from Driest to Wettest

Year	Yearly Average	Year	May-Dec Average
1962	0.4633	2005	0.8275
1920	0.4958	1966	0.9750
1923	0.5075	1971	1.0663
1998	0.5467	1906	1.0975
1957	0.5900	1907	1.1163
1901	0.7692	2006	1.1175
1992	0.7775	1917	1.2138
1971	0.8292	1961	1.2913
1932	0.9483	1951	1.3300
1961	0.9867	1915	1.3938
1977	1.0375	1901	1.4500
1967	1.3883	1992	1.5825
1928	1.3983	1982	1.6075
1917	1.4525	1977	1.6150
1912	1.5050	1942	1.7038
1951	1.5475	1975	1.8138
1982	1.5917	1991	1.9238
2005	1.6258	1912	1.9275
1916	1.9317	1949	2.1550
1996	1.9667	1996	2.2200
1979	2.0392	1916	2.2300
1949	2.0858	1990	2.4563
1972	2.0892	1972	2.4625
1991	2.1417	1929	2.4925
1929	2.1750	1979	2.5000
1975	2.2167	1928	2.5088
1989	2.3483	1967	2.6225
1950	2.7992	1997	2.9013
1990	2.8025	1950	2.9263
1997	2.9250	1974	3.1413
1994	3.0908	1994	3.1675
2004	3.5050	1989	3.2638
1974	3.5100	2004	3.6450
1973	3.5975	1973	3.8588
2003	4.0550	2003	4.9850

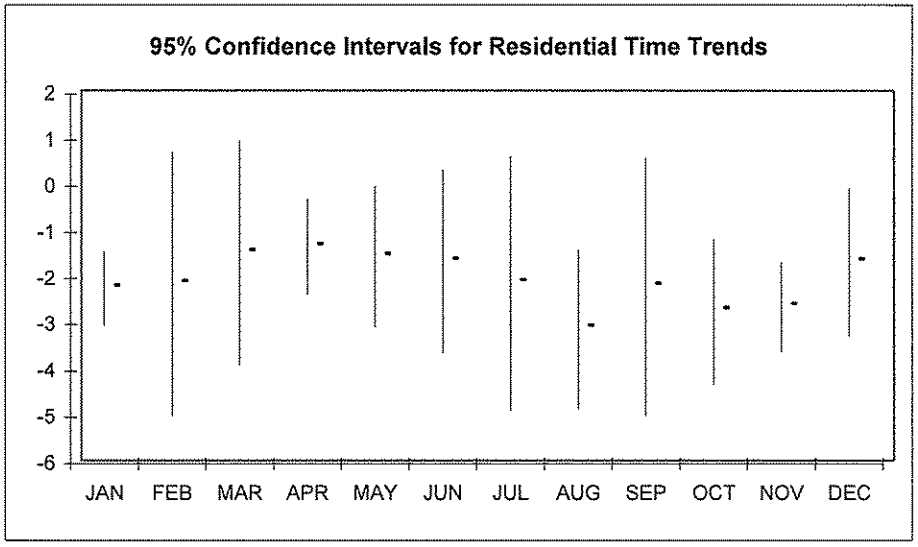
JAN	129.246	136.623	132.935
FEB	119.879	145.851	132.865
MAR	121.734	143.796	132.765
APR	131.331	140.744	136.038
MAY	138.386	151.486	144.936
JUN	153.535	170.375	161.955
JUL	154.580	178.421	166.501
AUG	152.165	167.643	159.904
SEP	151.480	176.863	164.172
OCT	143.992	158.447	151.220
NOV	137.221	146.140	141.681
DEC	132.726	147.727	140.227



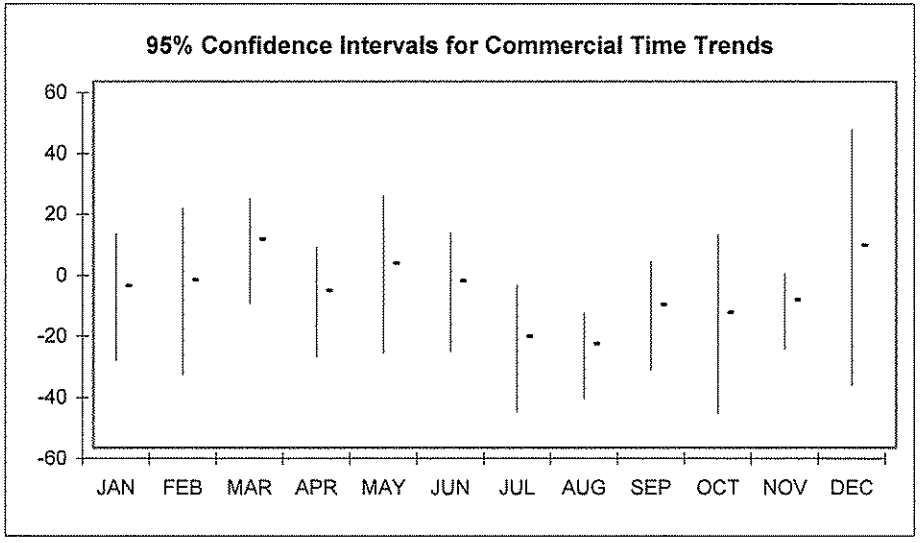
JAN	816.950	1005.890	911.420
FEB	821.770	1070.650	946.210
MAR	951.120	1107.690	1029.405
APR	870.510	1034.010	952.260
MAY	930.670	1153.340	1042.005
JUN	1032.230	1198.960	1115.595
JUL	1013.040	1194.260	1103.650
AUG	1028.020	1155.050	1091.535
SEP	1092.340	1255.730	1174.035
OCT	998.750	1266.170	1132.460
NOV	984.520	1099.210	1041.865
DEC	883.410	1273.340	1078.375



JAN	-3.026	-1.396	-2.211
FEB	-4.978	0.758	-2.110
MAR	-3.872	1.000	-1.436
APR	-2.346	-0.267	-1.307
MAY	-3.047	0.011	-1.518
JUN	-3.607	0.364	-1.622
JUL	-4.849	0.661	-2.094
AUG	-4.823	-1.351	-3.087
SEP	-4.973	0.631	-2.171
OCT	-4.290	-1.122	-2.706
NOV	-3.595	-1.633	-2.614
DEC	-3.255	-0.018	-1.636

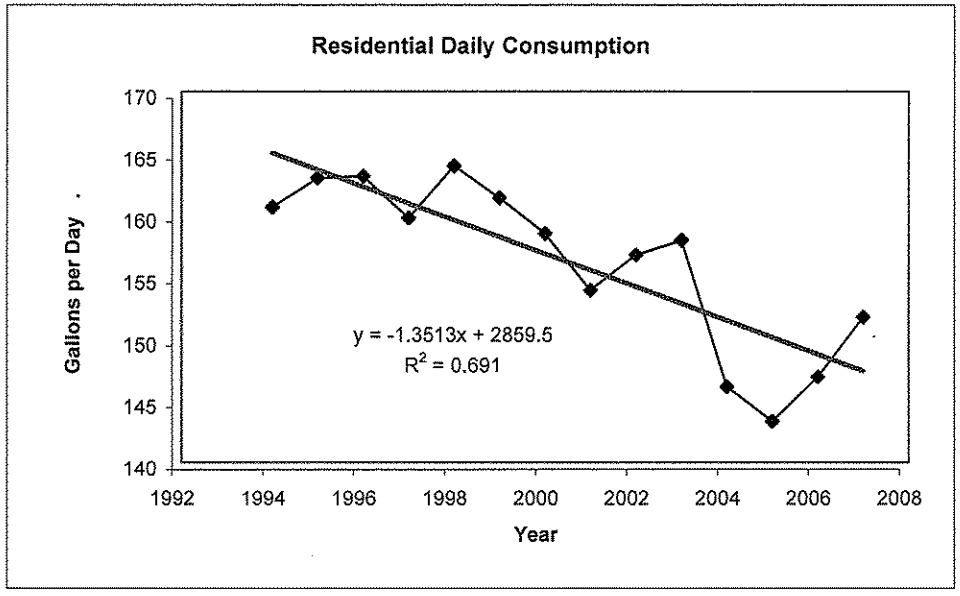


JAN	-27.946	13.785	-7.080
FEB	-32.664	22.304	-5.180
MAR	-9.172	25.408	8.118
APR	-26.728	9.384	-8.672
MAY	-25.542	26.438	0.448
JUN	-25.130	14.182	-5.474
JUL	-44.784	-2.907	-23.845
AUG	-40.410	-11.920	-26.165
SEP	-31.251	4.823	-13.214
OCT	-45.155	13.463	-15.846
NOV	-24.323	0.907	-11.708
DEC	-36.043	48.111	6.034



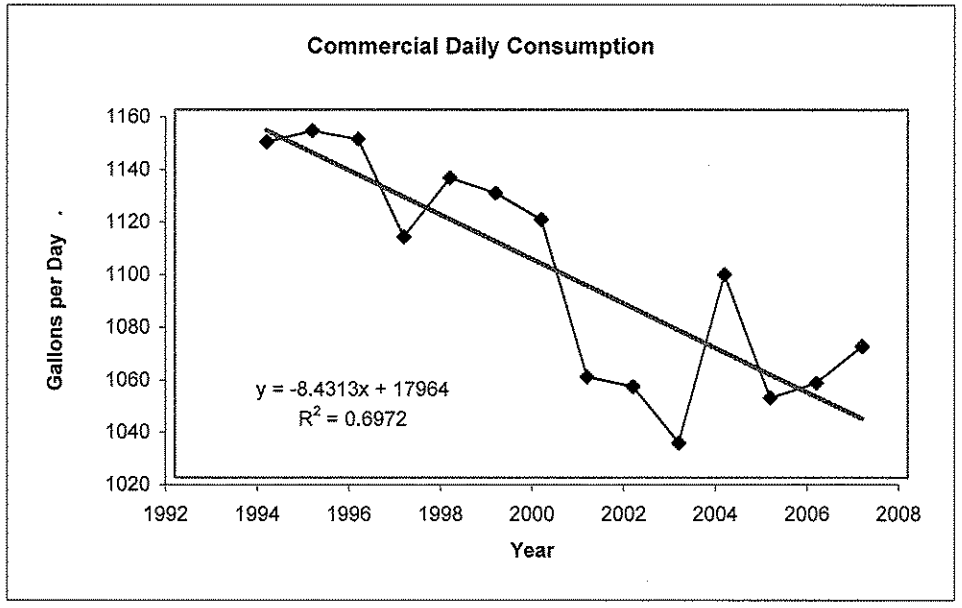
Residential Daily Consumption by Year

Year	Gallons per Day
1994	160.63
1995	162.98
1996	163.12
1997	159.74
1998	163.93
1999	161.36
2000	158.47
2001	153.86
2002	156.75
2003	157.95
2004	146.11
2005	143.30
2006	146.90
2007	151.72



Commercial Daily Consumption by Year

Year	Gallons per Day
1994	1147.85
1995	1152.05
1996	1148.87
1997	1111.75
1998	1134.14
1999	1128.32
2000	1118.28
2001	1058.62
2002	1054.86
2003	1033.30
2004	1097.27
2005	1050.48
2006	1056.22
2007	1070.08



TENNESSEE REGULATORY AUTHORITY

STATE OF MISSOURI

COUNTY OF SAINT LOUIS

BEFORE ME, the undersigned authority, duly commissioned and qualified in and for the State and County aforesaid, personally came and appeared Dr. Edward L. Spitznagel, Jr., being by my first duly sworn deposed and said that:

He is appearing as a witness on behalf of Tennessee-American Water Company before the Tennessee Regulatory Authority, and if present before the Authority and duly sworn, his testimony would set forth in the annexed transcript consisting of 15 pages.

Edward L. Spitznagel, Jr.
Dr. Edward L. Spitznagel, Jr.

Sworn to and subscribed before me
This 12 day of August 2008.

Susan D. Imhoff
Notary Public

My commission expires August 12, 2011

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