Exhibit No.:	
Issues:	Weather Normalization, Water Utilization Trend Estimates and Customer Service Surveys
Witness:	Edward L. Spitznagel, Jr.
Exhibit Type:	Rebuttal
Sponsoring Party:	Missouri-American Water Company
Case No.:	WR.2008-0311 SR.2008-0312
Date:	September 30, 2008

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2008-0311
SR-2008-0312

REBUTTAL TESTIMONY

OF

EDWARD L. SPITZNAGEL, JR.

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF MISSOURI-AMERICAN WATER COMPANY FOR AUTHORITY TO FILE TARIFFS REFLECTING INCREASED RATES FOR WATER AND SEWER SERVICE	)))))	**CASE NO. WR-2008-0311** **CASE NO. SR-2008-0312**

AFFIDAVIT OF EDWARD L. SPITZNAGEL, JR.

Edward L. Spitznagel, Jr., being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Rebuttal Testimony of Edward L. Spitznagel, Jr."; that said testimony and schedules were prepared by him and/or under his direction and supervision; that if inquires were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge.

Edward L. Spitznagel, Jr.

State of Missouri
County of St. Louis
SUBSCRIBED and sworn to
Before me this 30th **day of** September **2008.**

Lisa Caress
Notary Public

My commission expires: 04/11/2010

LISA CARESS
NOTARY PUBLIC - NOTARY SEAL
STATE OF MISSOURI, JEFFERSON COUNTY
MY COMMISSION EXPIRES 04/11/2010

REBUTTAL TESTIMONY
EDWARD L. SPITZNAGEL
MISSOURI-AMERICAN WATER COMPANY
CASE NO.WR-2008-0311
CASE NO.SR-2008-0312

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REBUTTAL TESTIMONY

EDWARD L. SPITZNAGEL, JR.

WITNESS INTRODUCTION

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.

Q. WHAT IS YOUR PRESENT POSITION?

A. I am Professor of Mathematics in the College of Arts and Sciences at Washington University. I also hold a joint appointment in the Division of Biostatistics of the Washington University School of Medicine.

Q. ARE YOU THE SAME EDWARD L. SPITZNAGEL, JR WHO FILED DIRECT TESTIMONY IN THIS CASE?

A. Yes, I am.

PURPOSE AND SCOPE

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. I will respond to the Staff Report which proposes to use six-year average consumption to estimate future water sales by Missouri-American Water Company ("Missouri-American" or "Company"). I will demonstrate that, contrary to the

statement made on page 29 of Staff's Cost of Service Report, there is statistically significant evidence that water usage does depend upon an important weather variable, the Palmer Drought Severity Index (PDSI). I will also demonstrate that there is a statistically significant downward trend in per-customer per-day water consumption. I will demonstrate both of these for the St. Louis County residential customers, who are the largest-consuming class of MAWC customers, in number and total volume. Generally, my arguments for the St. Louis County residential customers will hold true for the other customer classes for which I propose a weather normalization or trend adjustment.

Q. PLEASE DESCRIBE YOUR EVIDENCE FOR WATER CONSUMPTION BEING DEPENDENT UPON THE PALMER DROUGHT SEVERITY INDEX.

A. This evidence is contained on page 2 of Schedule_ELS-2 from my Direct Testimony, in which both PDSI and year are statistically significant predictors in a general linear model that also incorporated month. Month was included as an additional powerful predictor because under the same weather conditions, people's use of water can vary depending on season of the year. All three predictors were statistically significant with P-values less than 0.0001 or a probability of about 1 out of 10,000 of seeing such a strong relationship as this by chance alone.

Because of the sophistication of that method, it may be difficult to comprehend fully that water consumption is both predictable from available soil moisture, as measured by the PDSI, and from calendar year. I have therefore created an Excel

workbook in which average consumption is predicted from PDSI and from calendar year. The results for the five sites are contained in ten worksheets, two for each site. I will describe the calculations in detail for the Saint Louis County residential customers, with the remaining eight sheets constructed in similar fashion.

Because these regression models are fitted on an annual basis, they do not give the same degree of weather normalization that my original general linear models do, but since they are done in Excel, they should be much more transparent. It is my hope that the Commission will accept my original estimates, based upon the additional support from the separate Excel models.

I averaged consumption over the months of May through December, and averaged PDSI over May through December. These months are the weather-sensitive months, given the fact that December bills reflect usage during the previous quarter, which contains October and November plus a part of September. I originally adopted this methodology because the Commission Staff used it in the 1990's, when I first became involved in weather normalization. The PDSI and consumption data are in the upper half of my spreadsheets. Below the data is an Excel regression of the average May-December consumption on the average May-December PDSI values. Years 2002 and 2003 are not used because of a double problem. In those years, MAWC acquired the water companies of Webster Groves and Florissant, both of which are low-consumption communities. (The Company combines my estimate with their own estimates of Webster Groves and Florissant

consumption to arrive at a final estimate for St. Louis County.) Also, the parent company at the time, RWE, mandated a different system of reporting, which caused an anomaly in the reported usage data as it was introduced. The system was discontinued in 2006. I examined carefully whether a potential anomaly at that time would skew my estimates, and I decided that it would not. To make up for the two missing years, and also to restore some of the statistical power lost due to shifting from monthly models to yearly models, I went back as far as I had data, namely 1990, giving me a total of 15 years. The regression of consumption on PDSI was statistically significant, with a P-value of 0.041. That is, if there is really no relationship between PDSI and consumption, the probability of seeing one as strong as the observed one is just 4.1%. By consensus among scientists and statisticians, any P-value under 0.05 is considered statistically significant, so we conclude that there is an influence of weather on water consumption. Furthermore, this P-value is from a two-sided test, and it can be argued that in this case, a one-sided test would be more appropriate. If one switches to a one-sided test, then the P-value becomes 0.021, or a probability of about 1 out of 50 of seeing such a strong relationship as this by chance alone.

Q. PLEASE DESCRIBE YOUR EVIDENCE FOR WATER CONSUMPTION BEING DEPENDENT UPON CALENDAR YEAR.

A. To demonstrate the ability to predict consumption from calendar year, I averaged consumption over all twelve months of the year, from January through December. I regressed these averages on the same 15 years, 1990-2007, excluding 2002 and

2003, for the reason described above. This regression is found in ELS Appendix B Page 2, along with a time-series graph of the data, containing the least-squares fitted trend line, below it. The downward slope of the line is 1.49 GCD per year, highly significant with a P-value of 0.0127, or a probability about 1 out of 80 of seeing such a strong relationship as this by chance alone. I conclude that for St. Louis quarterly residential consumption, there is strong evidence for both an effect of weather and for decreasing consumption over time.

Q. CAN YOU EXPLAIN WHY THE SLOPE OF THIS LINE IS ABOUT HALF THE YEARLY DECREASE ESTIMATED IN YOUR ORIGINAL TESTIMONY?

A. Yes, that is due to the fact that the last three years, 2005-2007 the weather has been unusually dry. People used more water in response to that lack of moisture, helping to keep the line more upward on its right side. In my original model, PDSI and year are used together, with the result that the downward trend is estimated as if PDSI were constant based on a 30-year average. That is the essence of weather normalization. This year, 2008, has so far been very wet, and we can expect a large drop in consumption relative to the recent past.

Q. STAFF CONCLUDED THAT THERE IS NO RELATIONSHIP OF WEATHER TO WATER CONSUMPTION. WHAT IS THE EXPLANATION OF THEIR FINDING?

A. Staff provided us with a workbook containing daily temperature and precipitation, to which they had added monthly and annual precipitation totals. I conclude that Staff must have tried to link total precipitation with water consumption, probably on a

monthly and an annual basis. It appears that Staff did not take into account the fact that much of that precipitation will not be retained in the soil but rather will be lost to runoff. The amount retained in the soil and thus available to water lawns and other vegetation is approximated by the various drought indices, rather than the total precipitation. In past cases, Staff did use available moisture indices rather than total precipitation. Total precipitation is simply not a good predictor of water consumption because it does not take into account the water retained in the soil and thus available to vegetation.

Q. ARE YOU AWARE THAT THERE HAS BEEN SOME PUBLISHED CRITICISM OF THE PDSI?

A. Yes, I am aware of the criticism. In fact, NOAA provides a variant called the Palmer Modified Drought Index (PMDI) as well as two other Palmer indices, the Hydrological Index and the Z-Index. When I developed the weather normalization methodology for Kentucky-American Water Company, I tried all four of the Palmer indices, as well as an available moisture index developed by Staff here in Missouri. The original PDSI gave the most accurate predictions, tested over 14 different water companies, so that is what I selected, based on that objective criterion.

Q. COMPARED WITH YOUR METHOD, WHAT IS THE EFFECT OF STAFF'S SIX-YEAR AVERAGE METHOD?

A. Over all of Missouri, the last three years have been unusually dry, which had the effect of driving up water consumption. When a simple average is taken, which

does not adjust for the dryness, future consumption will be overestimated. For those instances in which there is a downward time trend, there will be a compounding of this overestimation, since future years are estimated based on past, higher consumption. For St. Louis County quarterly-billed residential customers, which have the greatest volume of use, the effect is quite dramatic. In some cases, notably St. Louis County quarterly-billed commercial users, the opposite is true, but the usage in those classes is considerably less than in the St. Louis County residential customers.

Q. ON A DIFFERENT MATTER, ON PAGE 39, STAFF RECOMMENDS DISALLOWING THE COST OF INCENTIVE PAY BASED THERE BEING TOO SMALL A SAMPLE OF CUSTOMERS, 119 OUT OF 447,000, BEING CONTACTED. CAN YOU COMMENT ON THE RELIABILITY OF SAMPLING A SMALL FRACTION OF THE POPULATION?

A. The accuracy of an estimate depends primarily on the sample size and the estimated proportion. It depends on the population size only if the sample is an appreciable fraction of the population, which it is definitely not in this case. The best way to look at the issue is to calculate from the empirical proportion a single-sided confidence interval for the population proportion. Based on the sample of 111 customers who said they were "satisfied" or "very satisfied" out of the 119 sampled, the lower limit of a single-sided 95% confidence interval is 90% satisfied. That is, we are 95% confident that at least 90% of customers are satisfied. Given the cost of trying to increase the lower bound substantially, perhaps a more realistic

approach would be to think of this as a classic example of statistical process control, in which surveillance is on-going, and its purpose is to detect if the process starts to slip out of control. There are a variety of smoothing rules that enable one to detect "slippage" fast, and the sample size can be chosen based on how quickly one wishes to detect the process going out of control. In addition, a second satisfaction survey, with almost twice as many subjects, 211, was conducted the same year. The larger sample size makes this survey even more accurate than the first one.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Test for time trend, moisture, and month effects:
St. Louis Quarterly Residential, JAN1996-DEC2007,
excluding 2002 and 2003.

The GLM Procedure

Dependent Variable: gallons

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	13	296943.3797	22841.7984	59.99	<.0001
Error	106	40357.5854	380.7319		
Corrected Total	119	337300.9650			

R-Square	Coeff Var	Root MSE	gallons Mean
0.880351	7.228367	19.51235	269.9414

Source	DF	Type I SS	Mean Square	F Value	Pr > F
since_90	1	8158.2307	8158.2307	21.43	<.0001
pdsi	1	10774.6587	10774.6587	28.30	<.0001
month	11	278010.4903	25273.6809	66.38	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
since_90	1	12018.3959	12018.3959	31.57	<.0001
pdsi	1	7517.7234	7517.7234	19.75	<.0001
month	11	278010.4903	25273.6809	66.38	<.0001

Consumption vs Palmer Index (PDSI), St Louis County Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Monthly PDSI values												PDSI
1990	-3.23	0.64	1.00	0.70	2.37	2.40	2.47	2.23	1.31	1.30	1.09	1.99	1.895
1991	-0.01	-0.59	-0.80	-0.78	-0.40	-1.32	0.52	-0.51	-0.51	0.41	0.89	0.98	0.007
1992	-0.31	-0.19	-0.27	-0.38	-1.17	-1.95	-1.32	-1.33	-1.16	-1.68	1.59	1.93	-0.636
1993	2.46	2.46	2.24	2.84	2.47	3.10	4.51	5.17	7.54	6.80	6.95	6.18	5.340
1994	5.44	5.08	3.84	5.58	4.54	3.70	2.67	2.14	1.37	0.99	1.50	1.18	2.261
1995	2.17	1.86	1.14	1.49	3.54	3.04	2.79	3.13	-0.34	-0.56	-0.89	-1.24	1.184
1996	-0.78	-1.10	0.09	0.65	1.55	1.31	1.40	1.24	1.18	0.79	1.35	0.87	1.211
1997	1.12	2.26	-0.30	0.11	0.35	-0.30	-1.01	-0.76	-1.16	-1.20	-1.17	-1.19	-0.805
1998	0.31	1.05	1.99	2.15	1.43	2.49	2.90	2.19	2.01	2.45	2.56	2.19	2.278
1999	2.83	2.91	2.53	2.68	-0.28	-0.28	-0.76	-1.40	-1.69	-2.11	-3.19	-3.12	-1.604
2000	-3.47	-3.25	-3.32	-3.69	0.18	1.22	1.35	1.99	1.63	1.51	1.45	1.10	1.304
2001	1.40	2.41	1.74	1.29	1.44	1.69	1.57	1.77	1.65	2.14	1.88	1.76	1.738
2004	2.21	1.63	1.98	1.28	1.78	1.19	1.61	3.03	2.33	2.82	3.73	3.34	2.479
2005	5.01	4.63	-0.61	-0.88	-1.58	-1.73	-2.33	-1.85	-1.78	-2.02	-2.05	-2.46	-1.975
2006	-2.36	-2.81	-2.32	-2.69	-3.00	-2.61	-2.56	-2.18	-2.33	0.06	0.08	0.24	-1.538
2007	0.83	1.14	-0.28	0.26	-0.49	-0.53	-0.99	-1.28	-1.89	-1.97	-2.55	-2.27	-1.496

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	265.3	246.6	235.7	249.2	229.3	226.2	302.1	281.7	355.0	421.2	266.9	255.0	292.2
1991	260.4	236.8	235.9	248.6	231.1	255.2	359.7	306.9	402.2	438.4	275.8	259.0	316.0
1992	234.4	305.7	252.6	232.6	263.1	271.4	344.6	362.6	352.3	327.9	288.9	251.3	307.8
1993	238.9	252.6	224.1	216.2	252.6	246.9	275.0	303.3	289.4	279.3	263.8	230.4	267.6
1994	228.5	255.7	230.6	224.6	259.8	261.4	325.4	365.8	362.9	364.2	299.1	253.4	311.5
1995	243.5	265.9	234.9	223.8	255.6	238.4	281.3	325.1	339.0	341.8	304.4	259.6	293.1
1996	244.6	270.5	237.3	230.7	258.5	241.2	286.9	338.5	349.6	347.2	289.8	239.1	293.9
1997	236.7	262.5	227.2	219.8	259.7	239.7	285.7	366.7	348.3	369.8	296.4	253.3	302.4
1998	243.0	260.2	224.4	212.6	255.6	240.1	284.1	317.2	300.5	322.4	289.0	246.7	282.0
1999	232.1	252.9	218.6	219.3	249.1	247.1	283.4	357.0	384.9	400.8	326.2	275.3	315.5
2000	256.7	266.3	228.0	212.1	253.8	255.3	282.2	357.0	310.9	320.6	302.6	257.0	292.4
2001	241.6	260.3	219.0	211.1	270.9	263.0	299.0	363.2	351.7	346.3	303.6	241.3	304.9
2004	207.4	231.5	200.2	194.8	228.4	228.4	247.9	265.0	307.2	315.5	250.5	288.8	266.5
2005	214.0	203.9	210.5	195.5	212.0	247.8	313.7	307.5	373.5	353.1	264.9	289.2	295.2
2006	220.4	194.9	203.2	189.4	199.7	229.4	291.8	332.8	363.4	339.1	283.2	214.5	281.7
2007	203.6	209.2	195.5	188.3	212.8	229.7	272.5	354.2	369.5	372.7	311.5	244.4	295.9

Prediction of May-December Consumption from PDSI:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.515207
R Square	0.265438
Adjusted R S	0.2130
Standard Err	13.32369
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	898.0741	898.0741	5.058984	0.041114
Residual	14	2485.289	177.5206		
Total	15	3383.363			

	Coefficien	*ndard Er.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	297.7338	3.559072	83.6549	2.65E-20	290.1004	305.3673
PDSI	-3.8755	1.7230	-2.2492	0.0411	-7.5710	-0.1799

Consumption vs Year, St Louis County Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec Avg GCD
	Consumption, Gallons per Customer Day												
1990	265.3	246.6	235.7	249.2	229.3	226.2	302.1	281.7	355.0	421.2	266.9	255.0	277.8
1991	260.4	236.8	235.9	248.6	231.1	255.2	359.7	306.9	402.2	438.4	275.8	259.0	292.5
1992	234.4	305.7	252.6	232.6	263.1	271.4	344.6	362.6	352.3	327.9	288.9	251.3	290.6
1993	238.9	252.6	224.1	216.2	252.6	246.9	275.0	303.3	289.4	279.3	263.8	230.4	256.0
1994	228.5	255.7	230.6	224.6	259.8	261.4	325.4	365.8	362.9	364.2	299.1	253.4	285.9
1995	243.5	265.9	234.9	223.8	255.6	238.4	281.3	325.1	339.0	341.8	304.4	259.6	276.1
1996	244.6	270.5	237.3	230.7	258.5	241.2	286.9	338.5	349.6	347.2	289.8	239.1	277.8
1997	236.7	262.5	227.2	219.8	259.7	239.7	285.7	366.7	348.3	369.8	296.4	253.3	280.5
1998	243.0	260.2	224.4	212.6	255.6	240.1	284.1	317.2	300.5	322.4	289.0	246.7	266.3
1999	232.1	252.9	218.6	219.3	249.1	247.1	283.4	357.0	384.9	400.8	326.2	275.3	287.2
2000	256.7	266.3	228.0	212.1	253.8	255.3	282.2	357.0	310.9	320.6	302.6	257.0	275.2
2001	241.6	260.3	219.0	211.1	270.9	263.0	299.0	363.2	351.7	346.3	303.6	241.3	280.9
2004	207.4	231.5	200.2	194.8	228.4	228.4	247.9	265.0	307.2	315.5	250.5	288.8	247.1
2005	214.0	203.9	210.5	195.5	212.0	247.8	313.7	307.5	373.5	353.1	264.9	289.2	265.5
2006	220.4	194.9	203.2	189.4	199.7	229.4	291.8	332.8	363.4	339.1	283.2	214.5	255.1
2007	203.6	209.2	195.5	188.3	212.8	229.7	272.5	354.2	369.5	372.7	311.5	244.4	263.7

Prediction of January-December Consumption from Calendar Year:

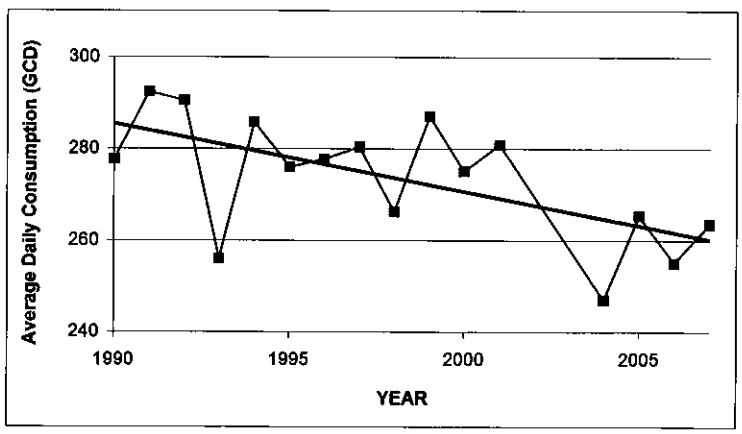
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.6065
R Square	0.3678
Adjusted R S	0.3227
Standard Err	11.0394
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	992.8159	992.8159	8.146587	0.012743
Residual	14	1706.165	121.8689		
Total	15	2698.981			

	Coefficien	*Std Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	3247.997	1042.088	3.116816	0.007575	1012.94	5483.054
YEAR	-1.4887	0.5216	-2.8542	0.0127	-2.6073	-0.3700



Consumption vs Palmer Index (PDSI), St Louis County Commercial Quarterly 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Monthly PDSI values												PDSI
1990	-3.23	0.64	1.00	0.70	2.37	2.40	2.47	2.23	1.31	1.30	1.09	1.99	1.895
1991	-0.01	-0.59	-0.80	-0.78	-0.40	-1.32	0.52	-0.51	-0.51	0.41	0.89	0.98	0.007
1992	-0.31	-0.19	-0.27	-0.38	-1.17	-1.95	-1.32	-1.33	-1.16	-1.68	1.59	1.93	-0.636
1993	2.46	2.46	2.24	2.84	2.47	3.10	4.51	5.17	7.54	6.80	6.95	6.18	5.340
1994	5.44	5.08	3.84	5.58	4.54	3.70	2.67	2.14	1.37	0.99	1.50	1.18	2.261
1995	2.17	1.86	1.14	1.49	3.54	3.04	2.79	3.13	-0.34	-0.56	-0.89	-1.24	1.184
1996	-0.78	-1.10	0.09	0.65	1.55	1.31	1.40	1.24	1.18	0.79	1.35	0.87	1.211
1997	1.12	2.26	-0.30	0.11	0.35	-0.30	-1.01	-0.76	-1.16	-1.20	-1.17	-1.19	-0.805
1998	0.31	1.05	1.99	2.15	1.43	2.49	2.90	2.19	2.01	2.45	2.56	2.19	2.278
1999	2.83	2.91	2.53	2.68	-0.28	-0.28	-0.76	-1.40	-1.69	-2.11	-3.19	-3.12	-1.604
2000	-3.47	-3.25	-3.32	-3.69	0.18	1.22	1.35	1.99	1.63	1.51	1.45	1.10	1.304
2001	1.40	2.41	1.74	1.29	1.44	1.69	1.57	1.77	1.65	2.14	1.88	1.76	1.738
2004	2.21	1.63	1.98	1.28	1.78	1.19	1.61	3.03	2.33	2.82	3.73	3.34	2.479
2005	5.01	4.63	-0.61	-0.88	-1.58	-1.73	-2.33	-1.85	-1.78	-2.02	-2.05	-2.46	-1.975
2006	-2.36	-2.81	-2.32	-2.69	-3.00	-2.61	-2.56	-2.18	-2.33	0.06	0.08	0.24	-1.538
2007	0.83	1.14	-0.28	0.26	-0.49	-0.53	-0.99	-1.28	-1.89	-1.97	-2.55	-2.27	-1.496

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	1073.4	892.3	899.0	995.3	891.6	883.6	1235.0	1187.2	1360.5	1566.6	1122.8	1051.7	1162.4
1991	1085.9	884.0	929.1	995.7	884.0	1023.5	1381.4	1184.8	1455.3	1677.2	1191.4	966.9	1220.6
1992	809.1	1125.0	854.7	740.8	927.9	950.9	1126.0	1244.3	1156.3	1184.3	1058.5	956.1	1075.5
1993	820.5	854.2	788.9	760.7	867.1	876.7	986.3	1153.2	1102.9	1097.5	1048.0	937.5	1008.6
1994	869.6	866.6	844.8	778.2	878.2	910.5	1068.0	1185.6	1148.8	1172.7	1041.9	890.8	1037.1
1995	787.5	858.8	752.0	745.6	840.8	861.6	939.1	1168.7	1175.8	1172.1	1039.6	932.2	1016.2
1996	812.0	820.6	825.8	797.9	827.6	861.3	1002.5	1173.0	1200.9	1187.2	1027.5	899.6	1022.5
1997	790.3	861.1	776.7	788.1	863.9	850.5	1048.9	1243.3	1223.1	1337.4	1077.9	930.0	1071.9
1998	881.1	849.9	805.7	783.5	897.2	928.0	1053.6	1286.4	1248.8	1202.6	1106.1	1001.0	1090.5
1999	804.2	904.6	809.7	868.4	895.7	1029.9	1078.0	1394.6	1396.3	1379.4	1291.5	1019.6	1185.6
2000	918.1	881.1	872.4	813.9	918.7	982.8	1128.6	1372.2	1289.1	1250.5	1229.9	1031.8	1150.4
2001	868.7	915.7	795.0	896.1	996.7	1091.8	1062.4	1437.2	1382.6	1338.6	1206.5	972.7	1186.0
2004	1052.1	613.1	882.4	817.1	773.2	1030.3	1180.3	1050.5	1420.9	1485.8	1179.8	1183.6	1163.0
2005	969.2	731.5	805.2	891.8	801.7	1037.6	1262.5	1210.6	1711.9	1540.2	1167.9	1467.5	1275.0
2006	1006.2	884.9	899.4	899.1	696.3	1017.8	1334.0	1537.1	1568.3	1526.8	1283.4	1093.5	1257.2
2007	967.0	838.6	875.1	772.7	609.5	1047.4	1374.2	1656.7	1467.5	1754.2	1326.7	1051.9	1286.0

Prediction of May-December Consumption from PDSI:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.624112
R Square	0.389516
Adjusted R S	0.34591
Standard Err	76.23257
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	51911.16	51911.16	8.932634	0.009767
Residual	14	81359.67	5811.405		
Total	15	133270.8			

	Coefficien	*ndard Er*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0%*
Intercept	1159.474	20.36352	56.93876	5.7E-18	1115.798	1203.149	1115.798
PDSI	-29.4645	9.858471	-2.98875	0.009767	-50.6088	-8.3202	-50.6088

Consumption vs Year, St Louis County Commercial Quarterly 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	1073.4	892.3	899.0	995.3	891.6	883.6	1235.0	1187.2	1360.5	1566.6	1122.8	1051.7	1096.6
1991	1085.9	884.0	929.1	995.7	884.0	1023.5	1381.4	1184.8	1455.3	1677.2	1191.4	966.9	1138.3
1992	809.1	1125.0	854.7	740.8	927.9	950.9	1126.0	1244.3	1156.3	1184.3	1058.5	956.1	1011.2
1993	820.5	854.2	788.9	760.7	867.1	876.7	986.3	1153.2	1102.9	1097.5	1048.0	937.5	941.1
1994	869.6	866.6	844.8	778.2	878.2	910.5	1068.0	1185.6	1148.8	1172.7	1041.9	890.8	971.3
1995	787.5	858.8	752.0	745.6	840.8	861.6	939.1	1168.7	1175.8	1172.1	1039.6	932.2	939.5
1996	812.0	820.6	825.8	797.9	827.6	861.3	1002.5	1173.0	1200.9	1187.2	1027.5	899.6	953.0
1997	790.3	861.1	776.7	788.1	863.9	850.5	1048.9	1243.3	1223.1	1337.4	1077.9	930.0	982.6
1998	881.1	849.9	805.7	783.5	897.2	928.0	1053.6	1286.4	1248.8	1202.6	1106.1	1001.0	1003.7
1999	804.2	904.6	809.7	868.4	895.7	1029.9	1078.0	1394.6	1396.3	1379.4	1291.5	1019.6	1072.7
2000	918.1	881.1	872.4	813.9	918.7	982.8	1128.6	1372.2	1289.1	1250.5	1229.9	1031.8	1057.4
2001	868.7	915.7	795.0	896.1	996.7	1091.8	1062.4	1437.2	1382.6	1338.6	1206.5	972.7	1080.3
2004	1052.1	613.1	882.4	817.1	773.2	1030.3	1180.3	1050.5	1420.9	1485.8	1179.8	1183.6	1055.8
2005	969.2	731.5	805.2	891.8	801.7	1037.6	1262.5	1210.6	1711.9	1540.2	1167.9	1467.5	1133.1
2006	1006.2	884.9	899.4	899.1	696.3	1017.8	1334.0	1537.1	1568.3	1526.8	1283.4	1093.5	1145.6
2007	967.0	838.6	875.1	772.7	609.5	1047.4	1374.2	1656.7	1467.5	1754.2	1326.7	1051.9	1145.1

Prediction of January-December Consumption from Calendar Year:

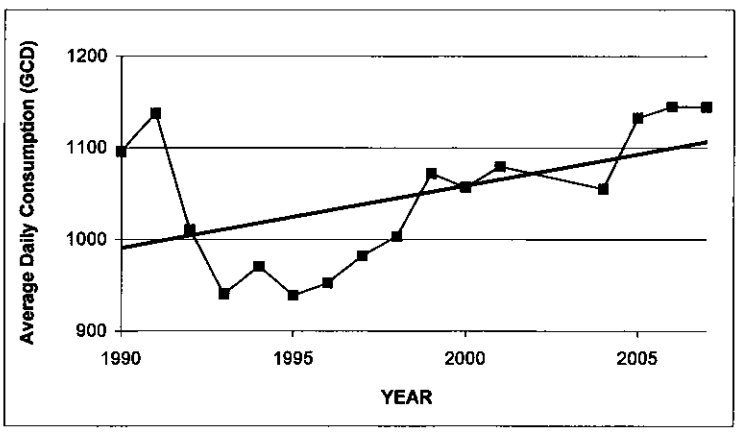
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.498539
R Square	0.248541
Adjusted R S	0.194866
Standard Err	67.19092
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	20904.65	20904.65	4.630434	0.049347
Residual	14	63204.67	4514.62		
Total	15	84109.32			

	Coefficien	*ndard Er.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-12602.8	6342.618	-1.98701	0.066851	-26206.4	1000.73
	6.83097	3.174473	2.151844	0.049347	0.022404	13.63954



Consumption vs Palmer Index (PDSI), St Charles Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Monthly PDSI values												PDSI
1990	-3.23	0.64	1.00	0.70	2.37	2.40	2.47	2.23	1.31	1.30	1.09	1.99	1.895
1991	-0.01	-0.59	-0.80	-0.78	-0.40	-1.32	0.52	-0.51	-0.51	0.41	0.89	0.98	0.007
1992	-0.31	-0.19	-0.27	-0.38	-1.17	-1.95	-1.32	-1.33	-1.16	-1.68	1.59	1.93	-0.636
1993	2.46	2.46	2.24	2.84	2.47	3.10	4.51	5.17	7.54	6.80	6.95	6.18	5.340
1994	5.44	5.08	3.84	5.58	4.54	3.70	2.67	2.14	1.37	0.99	1.50	1.18	2.261
1995	2.17	1.86	1.14	1.49	3.54	3.04	2.79	3.13	-0.34	-0.56	-0.89	-1.24	1.184
1996	-0.78	-1.10	0.09	0.65	1.55	1.31	1.40	1.24	1.18	0.79	1.35	0.87	1.211
1997	1.12	2.26	-0.30	0.11	0.35	-0.30	-1.01	-0.76	-1.16	-1.20	-1.17	-1.19	-0.805
1998	0.31	1.05	1.99	2.15	1.43	2.49	2.90	2.19	2.01	2.45	2.56	2.19	2.278
1999	2.83	2.91	2.53	2.68	-0.28	-0.28	-0.76	-1.40	-1.69	-2.11	-3.19	-3.12	-1.604
2000	-3.47	-3.25	-3.32	-3.69	0.18	1.22	1.35	1.99	1.63	1.51	1.45	1.10	1.304
2001	1.40	2.41	1.74	1.29	1.44	1.69	1.57	1.77	1.65	2.14	1.88	1.76	1.738
2004	2.21	1.63	1.98	1.28	1.78	1.19	1.61	3.03	2.33	2.82	3.73	3.34	2.479
2005	5.01	4.63	-0.61	-0.88	-1.58	-1.73	-2.33	-1.85	-1.78	-2.02	-2.05	-2.46	-1.975
2006	-2.36	-2.81	-2.32	-2.69	-3.00	-2.61	-2.56	-2.18	-2.33	0.06	0.08	0.24	-1.538
2007	0.83	1.14	-0.28	0.26	-0.49	-0.53	-0.99	-1.28	-1.89	-1.97	-2.55	-2.27	-1.496

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	236.5	209.7	218.6	203.5	226.5	232.5	354.8	256.1	332.9	333.3	217.7	226.1	272.5
1991	210.1	229.4	233.4	214.3	231.4	295.0	438.3	379.9	354.2	291.3	225.3	223.4	304.8
1992	216.7	181.4	263.2	204.6	255.4	313.7	411.0	373.7	341.2	286.3	198.7	228.4	301.1
1993	186.3	216.4	204.2	205.4	222.5	254.4	279.1	287.8	273.8	254.4	205.8	223.2	250.1
1994	214.9	217.0	234.4	206.4	237.2	308.6	401.3	359.0	348.5	330.9	233.0	252.4	308.9
1995	245.2	209.1	258.8	224.1	222.7	265.7	372.7	353.0	398.8	317.0	239.6	230.1	299.9
1996	220.4	197.5	215.2	207.2	228.0	273.5	384.8	366.5	419.9	286.6	216.1	215.6	298.9
1997	210.6	202.7	211.3	202.5	237.7	282.6	385.8	489.6	323.3	302.0	227.5	207.2	307.0
1998	222.5	189.9	208.0	211.6	233.5	289.1	308.1	338.7	370.3	281.1	218.0	209.0	281.0
1999	223.2	179.8	195.7	208.7	219.5	304.3	339.9	459.9	455.5	331.9	235.6	232.7	322.4
2000	221.3	190.0	207.4	211.6	249.0	306.3	332.0	336.9	351.9	280.9	208.3	216.9	285.3
2001	207.6	186.1	204.2	194.6	293.2	309.5	352.5	407.8	353.9	264.2	207.5	201.8	298.8
2004	336.1	169.6	231.6	187.1	169.6	294.5	299.9	382.2	390.2	321.0	204.7	131.5	274.2
2005	270.3	188.4	228.7	181.4	225.1	404.8	436.7	435.6	428.8	280.8	212.5	139.6	320.5
2006	362.2	175.4	228.0	158.6	278.9	357.7	430.1	447.6	431.0	307.3	250.0	161.6	333.0
2007	217.1	163.8	209.1	161.9	235.5	319.6	415.1	479.4	383.4	355.5	236.9	169.0	324.3

Prediction of May-December Consumption from PDSI:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.47245
R Square	0.223209
Adjusted R Sc	0.167724
Standard Erro	20.02669
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1613.446	1613.446	4.022872	0.064612
Residual	14	5614.954	401.0682		
Total	15	7228.4			

	Coefficien	*ndard Er.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0*	*pper 95.0%*
Intercept	-3492.78	1890.458	-1.84759	0.085899	-7547.41	561.8457	-7547.41	561.8457
	1.897746	0.946172	2.00571	0.064612	-0.13159	3.927083	-0.13159	3.927083

Consumption vs Year, St Charles Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec Avg GCD
	Consumption, Gallons per Customer Day												
1990	236.5	209.7	218.6	203.5	226.5	232.5	354.8	256.1	332.9	333.3	217.7	226.1	254.0
1991	210.1	229.4	233.4	214.3	231.4	295.0	438.3	379.9	354.2	291.3	225.3	223.4	277.2
1992	216.7	181.4	263.2	204.6	255.4	313.7	411.0	373.7	341.2	286.3	198.7	228.4	272.9
1993	186.3	216.4	204.2	205.4	222.5	254.4	279.1	287.8	273.8	254.4	205.8	223.2	234.4
1994	214.9	217.0	234.4	206.4	237.2	308.6	401.3	359.0	348.5	330.9	233.0	252.4	278.6
1995	245.2	209.1	258.8	224.1	222.7	265.7	372.7	353.0	398.8	317.0	239.6	230.1	278.1
1996	220.4	197.5	215.2	207.2	228.0	273.5	384.8	366.5	419.9	286.6	216.1	215.6	269.3
1997	210.6	202.7	211.3	202.5	237.7	282.6	385.8	489.6	323.3	302.0	227.5	207.2	273.6
1998	222.5	189.9	208.0	211.6	233.5	289.1	308.1	338.7	370.3	281.1	218.0	209.0	256.7
1999	223.2	179.8	195.7	208.7	219.5	304.3	339.9	459.9	455.5	331.9	235.6	232.7	282.3
2000	221.3	190.0	207.4	211.6	249.0	306.3	332.0	336.9	351.9	280.9	208.3	216.9	259.4
2001	207.6	186.1	204.2	194.6	293.2	309.5	352.5	407.8	353.9	264.2	207.5	201.8	265.3
2004	336.1	169.6	231.6	187.1	169.6	294.5	299.9	382.2	390.2	321.0	204.7	131.5	259.8
2005	270.3	188.4	228.7	181.4	225.1	404.8	436.7	435.6	428.8	280.8	212.5	139.6	286.0
2006	362.2	175.4	228.0	158.6	278.9	357.7	430.1	447.6	431.0	307.3	250.0	161.6	299.0
2007	217.1	163.8	209.1	161.9	235.5	319.6	415.1	479.4	383.4	355.5	236.9	169.0	278.9

Prediction of January-December Consumption from Calendar Year:

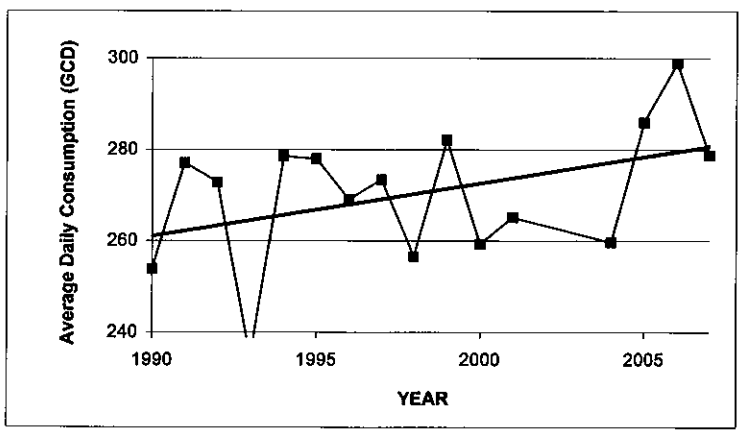
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.414739
R Square	0.172009
Adjusted R S	0.112866
Standard Err	14.33896
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	597.9814	597.9814	2.90839	0.110198
Residual	14	2878.479	205.6057		
Total	15	3476.461			

	Coefficien	*ndard Er*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*ower 95.0*	*pper 95.0%*
Intercept	-2038.01	1353.554	-1.50567	0.154377	-4941.1	865.0728	-4941.1	865.0728
	1.155327	0.677452	1.7054	0.110198	-0.29766	2.608317	-0.29766	2.608317



Consumption vs Palmer Index (PDSI), St Joseph Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Monthly PDSI values												PDSI
1990	0.83	1.37	1.91	1.76	2.86	2.98	3.05	2.88	-0.80	-0.89	-0.68	-0.62	1.098
1991	-0.38	-0.86	0.15	0.81	0.79	-0.61	-0.65	-1.49	-1.80	-1.68	0.46	0.63	-0.544
1992	0.52	0.84	1.15	1.47	-1.07	-1.59	2.05	1.75	2.02	1.53	3.33	3.99	1.501
1993	4.06	3.89	3.66	3.96	3.97	4.06	7.36	6.72	8.26	7.29	6.97	6.35	6.373
1994	5.46	5.45	4.21	5.25	3.81	2.98	2.55	2.10	1.44	1.10	1.44	1.39	2.101
1995	1.51	1.32	0.72	1.11	3.95	3.62	3.86	3.59	-0.10	-0.65	-0.71	-1.04	1.565
1996	-0.76	-1.02	-0.93	-1.25	1.76	1.77	2.48	2.46	2.56	2.42	2.97	2.28	2.338
1997	2.04	3.35	2.55	3.08	2.96	2.30	1.58	1.16	0.88	1.25	1.28	1.69	1.638
1998	1.58	1.70	2.77	2.84	1.47	2.28	2.70	2.37	2.90	3.97	4.69	4.33	3.089
1999	4.30	4.12	3.58	4.23	4.15	3.94	-0.45	-1.09	-0.73	-1.37	-2.04	-2.06	0.044
2000	-2.42	-2.16	-2.33	-2.90	-3.41	0.80	1.07	0.80	0.54	0.46	0.41	0.14	0.101
2001	0.61	2.18	2.09	1.77	2.32	3.19	3.69	3.43	3.40	3.28	2.50	1.99	2.975
2004	0.54	0.40	1.19	-0.65	0.93	1.03	1.83	3.04	2.52	2.66	2.90	2.42	2.166
2005	2.89	3.49	-0.50	-0.60	-0.86	-0.44	-0.74	0.93	-0.45	-0.31	-0.61	-0.68	-0.395
2006	-0.68	-1.09	-0.82	-0.79	-1.59	-2.05	-2.24	0.60	-0.48	-0.26	-0.45	0.19	-0.785
2007	0.15	0.58	0.50	0.63	1.58	-0.06	-0.64	-0.47	-1.03	0.71	0.00	0.85	0.118

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	221.1	113.7	197.7	195.1	112.6	184.7	264.4	137.4	218.6	298.6	128.9	180.4	190.7
1991	216.8	114.5	192.4	196.3	118.4	190.7	285.0	156.7	232.0	332.1	135.0	179.2	203.6
1992	211.4	114.2	193.9	197.2	121.2	181.4	259.6	167.3	184.8	236.4	146.8	165.6	182.9
1993	193.6	143.0	181.5	185.1	144.3	170.1	232.3	155.8	179.4	219.3	149.0	164.4	176.8
1994	187.3	137.5	180.0	187.0	151.8	179.7	245.6	189.6	195.2	261.5	161.1	164.6	193.6
1995	189.1	144.3	183.3	182.1	149.1	172.5	231.9	181.0	191.7	261.0	161.7	165.1	189.3
1996	193.9	142.7	182.4	195.2	161.8	168.7	215.9	170.6	185.6	245.3	163.1	165.5	184.6
1997	194.1	143.6	180.1	185.0	146.5	165.3	251.8	189.3	191.5	266.1	168.0	166.9	193.2
1998	195.4	140.4	171.2	176.0	145.9	167.5	232.8	176.2	177.7	239.5	156.0	161.0	182.1
1999	193.0	144.4	172.1	176.8	137.8	155.7	235.1	145.2	183.4	278.1	168.7	166.9	183.9
2000	200.3	145.1	168.7	175.4	144.0	168.3	244.5	168.2	172.4	252.6	335.2	165.1	206.3
2001	156.1	159.1	164.7	140.6	154.3	164.9	184.0	180.2	179.7	153.5	163.2	138.1	164.7
2004	251.2	133.8	183.4	140.0	113.7	194.3	153.9	174.1	238.2	160.2	128.1	94.5	157.1
2005	211.6	150.7	185.5	129.0	144.9	199.2	172.2	198.2	209.1	161.4	132.6	112.4	166.3
2006	275.0	136.5	177.9	119.2	202.6	220.3	187.7	187.3	201.1	174.0	160.2	133.1	183.3
2007	174.9	128.4	164.3	139.0	156.8	184.3	220.8	213.3	167.7	168.8	141.5	148.4	175.2

Prediction of May-December Consumption from PDSI:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.285395
R Square	0.08145
Adjusted R S	0.01584
Standard Err	13.2287
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	217.2465	217.2465	1.241419	0.283961
Residual	14	2449.981	174.9986		
Total	15	2667.227			

	Coefficien	*ndard Er*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	186.4166	4.307041	43.28183	2.6E-16	177.1789	195.6543
PDSI	-2.10375	1.888146	-1.11419	0.283961	-6.15342	1.945918

Consumption vs Year, St Joseph Residential 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec Avg GCD
	Consumption, Gallons per Customer Day												
1990	221.1	113.7	197.7	195.1	112.6	184.7	264.4	137.4	218.6	298.6	128.9	180.4	187.8
1991	216.8	114.5	192.4	196.3	118.4	190.7	285.0	156.7	232.0	332.1	135.0	179.2	195.8
1992	211.4	114.2	193.9	197.2	121.2	181.4	259.6	167.3	184.8	236.4	146.8	165.6	181.7
1993	193.6	143.0	181.5	185.1	144.3	170.1	232.3	155.8	179.4	219.3	149.0	164.4	176.5
1994	187.3	137.5	180.0	187.0	151.8	179.7	245.6	189.6	195.2	261.5	161.1	164.6	186.7
1995	189.1	144.3	183.3	182.1	149.1	172.5	231.9	181.0	191.7	261.0	161.7	165.1	184.4
1996	193.9	142.7	182.4	195.2	161.8	168.7	215.9	170.6	185.6	245.3	163.1	165.5	182.6
1997	194.1	143.6	180.1	185.0	146.5	165.3	251.8	189.3	191.5	266.1	168.0	166.9	187.4
1998	195.4	140.4	171.2	176.0	145.9	167.5	232.8	176.2	177.7	239.5	156.0	161.0	178.3
1999	193.0	144.4	172.1	176.8	137.8	155.7	235.1	145.2	183.4	278.1	168.7	166.9	179.8
2000	200.3	145.1	168.7	175.4	144.0	168.3	244.5	168.2	172.4	252.6	335.2	165.1	195.0
2001	156.1	159.1	164.7	140.6	154.3	164.9	184.0	180.2	179.7	153.5	163.2	138.1	161.5
2004	251.2	133.8	183.4	140.0	113.7	194.3	153.9	174.1	238.2	160.2	128.1	94.5	163.8
2005	211.6	150.7	185.5	129.0	144.9	199.2	172.2	198.2	209.1	161.4	132.6	112.4	167.2
2006	275.0	136.5	177.9	119.2	202.6	220.3	187.7	187.3	201.1	174.0	160.2	133.1	181.2
2007	174.9	128.4	164.3	139.0	156.8	184.3	220.8	213.3	167.7	168.8	141.5	148.4	167.4

Prediction of January-December Consumption from Calendar Year:

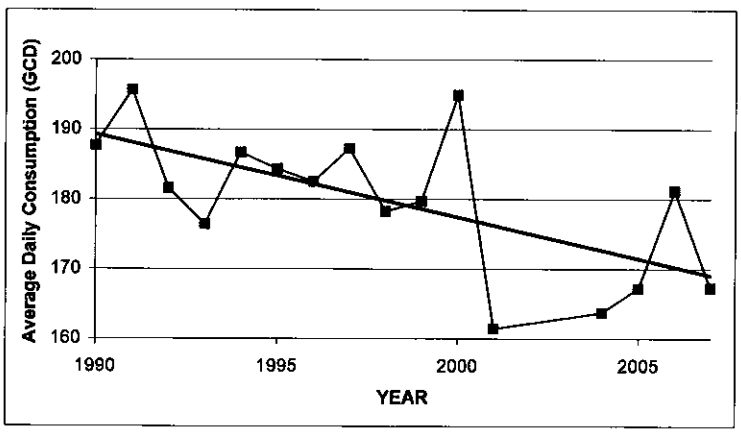
SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.629367
R Square	0.396103
Adjusted R S	0.352967
Standard Err	8.319752
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	635.6148	635.6148	9.18276	0.008994
Residual	14	969.0559	69.21828		
Total	15	1604.671			

	Coefficien	*ndard Er.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	2559.677	785.3593	3.259243	0.005707	875.2484	4244.105
	-1.19113	0.393071	-3.03031	0.008994	-2.03418	-0.34807



Consumption vs Palmer Index (PDSI), Joplin Commercial 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Monthly PDSI values												PDSI
1990	0.81	1.90	2.84	2.52	4.36	3.77	3.21	2.63	2.36	2.37	1.89	2.98	2.946
1991	3.02	-0.66	-1.25	-0.63	-0.99	-1.76	-1.84	-2.15	-1.87	-1.77	-1.11	-0.59	-1.510
1992	-0.91	-0.93	-1.35	-1.57	-1.60	0.28	1.53	1.42	2.32	1.65	3.23	3.65	1.560
1993	3.88	3.68	3.15	2.89	2.89	3.55	3.69	3.51	6.12	5.48	5.49	4.75	4.435
1994	4.21	3.73	3.24	4.68	3.70	2.74	2.72	2.94	2.33	2.18	3.30	2.65	2.820
1995	3.18	2.46	1.66	2.62	3.25	3.89	-0.33	-0.91	-1.35	-1.97	-2.57	-2.48	-0.309
1996	-1.98	-2.46	-2.32	0.41	-0.29	-0.50	-0.23	-0.49	1.17	1.34	2.82	2.10	0.740
1997	1.75	2.33	2.15	1.64	1.62	1.40	1.28	1.68	1.64	1.44	1.17	1.32	1.444
1998	1.71	1.87	2.76	2.19	1.57	1.23	2.00	1.60	1.49	1.84	1.82	1.34	1.611
1999	1.72	1.33	1.36	1.93	2.13	2.35	-0.39	-0.78	-1.15	-1.84	-2.56	-1.79	-0.504
2000	-1.78	-1.81	-1.87	-2.62	-2.68	0.95	1.55	-0.82	-1.17	-1.46	-1.25	-1.38	-0.783
2001	0.11	1.17	-0.74	-1.53	-1.55	0.34	0.60	0.22	0.02	0.36	0.22	0.57	0.098
2004	1.16	0.56	1.14	1.47	0.96	0.67	1.84	1.74	0.84	1.19	2.25	1.74	1.404
2005	3.12	2.86	-0.51	-0.66	-1.20	-1.47	-1.49	-1.43	-1.45	-2.12	-2.05	-2.65	-1.733
2006	-2.78	-3.32	-3.22	-2.79	-2.30	-2.66	-2.34	-2.33	-2.52	-2.55	0.27	0.55	-1.735
2007	1.19	1.20	-0.51	-0.36	-0.58	1.07	0.99	0.85	0.94	-0.18	-0.61	0.00	0.310

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	May-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	865.2	754.8	903.8	817.9	834.0	838.7	1031.8	990.5	983.3	1020.8	789.0	806.5	911.8
1991	862.0	757.7	827.4	866.2	846.6	885.9	1187.8	1015.3	1000.7	1071.7	799.8	800.3	951.0
1992	834.5	755.4	865.8	822.6	769.3	866.0	973.6	850.2	925.4	906.8	753.3	831.3	859.5
1993	748.0	772.6	986.5	846.3	796.3	928.8	934.2	943.4	963.1	924.6	778.2	861.0	891.2
1994	770.9	724.5	779.9	724.9	762.0	799.7	1068.7	876.4	1029.1	990.1	887.0	835.0	906.0
1995	744.8	752.0	901.4	737.3	773.1	865.4	928.2	1045.7	1056.3	960.8	848.9	770.2	906.1
1996	792.1	772.3	819.0	809.7	848.4	846.7	1022.8	981.7	928.0	918.1	823.3	751.8	890.1
1997	759.9	753.4	769.2	763.0	803.9	846.4	952.7	955.0	951.9	905.1	903.8	869.7	898.6
1998	766.5	688.1	800.0	772.3	558.8	936.0	1082.2	984.1	1001.1	955.7	790.4	789.1	887.2
1999	810.8	715.6	812.0	806.7	833.5	855.6	971.2	1089.3	1041.9	854.6	820.7	822.0	911.1
2000	767.7	691.9	958.2	682.3	822.7	940.7	949.4	1027.4	1142.1	987.6	845.1	795.4	938.8
2001	725.8	763.8	774.3	719.2	845.4	874.7	978.5	1072.5	987.5	936.9	698.2	803.6	899.7
2004	1191.5	839.3	1033.6	748.5	353.3	1135.1	866.1	881.2	1478.8	1100.9	744.4	679.4	904.9
2005	1058.8	871.6	959.2	763.1	885.1	1140.4	1066.6	1112.2	1218.3	1106.8	886.4	755.2	1021.4
2006	1480.9	807.4	942.4	740.9	1100.3	1137.3	997.9	1186.7	1472.2	1035.4	1247.9	736.0	1114.2
2007	869.8	733.9	1221.5	730.6	971.4	2224.6	1063.5	1192.5	1141.0	1114.0	1340.1	876.3	1240.4

Prediction of May-December Consumption from PDSI:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.432585
R Square	0.187129
Adjusted R S(	0.129067
Standard Err(	93.16469
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	27973.79	27973.79	3.222913	0.094225
Residual	14	121515.2	8679.659		
Total	15	149489			

	Coefficien	*andard Er.*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	962.031	24.99549	38.48819	1.33E-15	908.421	1015.641
PDSI	-24.1385	13.44578	-1.79525	0.094225	-52.9768	4.699827

Consumption vs Year, Joplin Commercial 1990-2007 Excluding 2002 and 2003

YEAR	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan-Dec Avg
	Consumption, Gallons per Customer Day												GCD
1990	865.2	754.8	903.8	817.9	834.0	838.7	1031.8	990.5	983.3	1020.8	789.0	806.5	886.3
1991	862.0	757.7	827.4	866.2	846.6	885.9	1187.8	1015.3	1000.7	1071.7	799.8	800.3	910.1
1992	834.5	755.4	865.8	822.6	769.3	866.0	973.6	850.2	925.4	906.8	753.3	831.3	846.2
1993	748.0	772.6	986.5	846.3	796.3	928.8	934.2	943.4	963.1	924.6	778.2	861.0	873.6
1994	770.9	724.5	779.9	724.9	762.0	799.7	1068.7	876.4	1029.1	990.1	887.0	835.0	854.0
1995	744.8	752.0	901.4	737.3	773.1	865.4	928.2	1045.7	1056.3	960.8	848.9	770.2	865.3
1996	792.1	772.3	819.0	809.7	848.4	846.7	1022.8	981.7	928.0	918.1	823.3	751.8	859.5
1997	759.9	753.4	769.2	763.0	803.9	846.4	952.7	955.0	951.9	905.1	903.8	869.7	852.8
1998	766.5	688.1	800.0	772.3	558.8	936.0	1082.2	984.1	1001.1	955.7	790.4	789.1	843.7
1999	810.8	715.6	812.0	806.7	833.5	855.6	971.2	1089.3	1041.9	854.6	820.7	822.0	869.5
2000	767.7	691.9	958.2	682.3	822.7	940.7	949.4	1027.4	1142.1	987.6	845.1	795.4	884.2
2001	725.8	763.8	774.3	719.2	845.4	874.7	978.5	1072.5	987.5	936.9	698.2	803.6	848.4
2004	1191.5	839.3	1033.6	748.5	353.3	1135.1	866.1	881.2	1478.8	1100.9	744.4	679.4	921.0
2005	1058.8	871.6	959.2	763.1	885.1	1140.4	1066.6	1112.2	1218.3	1106.8	886.4	755.2	985.3
2006	1480.9	807.4	942.4	740.9	1100.3	1137.3	997.9	1186.7	1472.2	1035.4	1247.9	736.0	1073.8
2007	869.8	733.9	1221.5	730.6	971.4	2224.6	1063.5	1192.5	1141.0	1114.0	1340.1	876.3	1123.3

Prediction of January-December Consumption from Calendar Year:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.701243
R Square	0.491742
Adjusted R S	0.455437
Standard Err	61.81831
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	51762.41	51762.41	13.54504	0.002472
Residual	14	53501.04	3821.503		
Total	15	105263.5			

	Coefficien	*ndard Er*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-20570.4	5835.46	-3.52508	0.003363	-33086.3	-8054.63
	10.749	2.920641	3.680359	0.002472	4.484854	17.01316