

In the Matter of:

IN RE: CHESTER WATER AUTHORITY TRUST

COURT OF COMMON PLEAS OF DELAWARE COUNTY, PENNSYLVANIA
ORPHANS' COURT DIVISION
NO. 217-2019

Expert Report of

Howard J. Woods, Jr., P.E.

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49 Overhill Road
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July 9, 2019 & Expanded August 9, 2019



I am Howard James Woods, Jr., P.E. and my address is 49 Overhill Road, East Brunswick, New Jersey. I have been retained by Chester Water Authority (“CWA”) to evaluate the impact on customer rates of the dissolution of the CWA and sale of the system to an investor-owned water utility. I have also been asked by CWA to offer an opinion as to the overall condition and management of the CWA. I am a registered Professional Engineer in the Commonwealth of Pennsylvania and I am an expert in water utility management and rate setting. My resume is provided in Appendix A.

In discharging this assignment, I compared the rates and charges of the CWA to three Pennsylvania investor-owned water utilities. These are AQUA Pennsylvania (“AQUA”), Pennsylvania American Water (“American”) and SUEZ Water Pennsylvania (“SUEZ”). I developed a comparison of typical monthly bills that would be paid by residential, commercial and industrial customers at base rates currently in effect for CWA and at currently authorized base rates for the three investor-owned water utilities. I also developed a cost comparison for four large employers located in the City of Chester and I developed a comparison of charges for CWA’s wholesale customers.

In addition, I have reviewed the CWA’s recent financial and operating results to assess the overall condition of the CWA. Based on this analysis it is my conclusion, which I have reached to a reasonable degree of engineering certainty, that it would be in the public interest to have CWA continue its operations and provide service to its customers without interruption.

Rates

The investor-owned water utility rates now in effect provide a reasonable point of comparison and a basis for assessing the impact of a sale of the CWA system to any of the investor-owned utilities considered in my analysis. The Pennsylvania Public Utility Commission (“PAPUC”), which regulates the rates implemented by these three entities, has had a long-standing policy of promoting standard tariff pricing for its multi-jurisdictional investor-owned utilities. Standard tariff pricing results in uniform rates across the utility’s service areas regardless of the political jurisdiction in which service is provided and regardless of the actual cost of providing service in any one area. This policy of fostering standard tariff pricing has been in effect for decades. While it is not possible to predict the length of time needed to merge all elements of a tariff of an acquired water utility into the rate structure of the acquiring entity, the end point of the merger with respect to rates is not in doubt. Ultimately, rate payers in the acquired service territory will pay the standard tariff rates of the acquiring entity. As an example of this, I will focus in AQUA.

The recent settlement of AQUA's base rate case embodies the principal of rate consolidation into a uniform tariff. In the settlement of this case, AQUA consolidated 22 water rate divisions into 14 and twelve of these 14 divisions were so similar as to allow the tariffs to be organized into three Rate Zones with similar, if not identical, fixed service charges and volumetric rates. As noted in the Joint Petition for Settlement: "The rates of all of the rate divisions that will continue to exist under the Settlement Rates have been moved closer to each other and to Rate Zone 1 in order to facilitate further consolidation with the Main Division in future cases."¹

CWA rates are significantly lower than current AQUA Main Division rates. It is these rates that CWA customers would ultimately pay if the system were to be sold to AQUA. The objective of PAPUC's standard tariff pricing is to cause all customers of the utility to share equally in the total cost of service provided by the regulated entity. This approach avoids situations wherein the true local cost of service could result in extraordinary and unaffordable rates. While this is a laudable goal, those customers who are served by systems with an inherently lower revenue requirement pay more for service than they would absent standard tariff pricing. It is an essential assumption in the standard tariff pricing model that over the long term, all systems will experience some unique and costly improvement need and as a result, all customers would one day benefit from standard tariff pricing. While AQUA has suggested that they would seek PAPUC approval of a ten-year rate freeze, the PAPUC is not bound in any way to approve rates resulting from such a request. Clearly, approving a rate freeze in any one area would mean that customers served by AQUA in other areas would see the impact of the rate freeze as costs that should be paid by customers in the acquired system are shifted to other customer groups. While CWA customers could potentially enjoy the short-term benefit of constant rates for a period of time, ultimately, those lower rates would merge with the AQUA Zone 1 Main Division rates. To avoid speculating on what level these rates will rise to in the future, I have confined my analysis to a comparison of the rates now in effect.

I developed a comparison between current CWA rates and current AQUA Main Division rates for various customer types at typical usage. While CWA charges different volumetric rates in its Village Green West and Village Green East service areas, within those areas, the fixed service charges and volumetric rates are the same regardless of the customer type. By contrast, AQUA's volumetric rates vary by customer class (e.g., residential, commercial, industrial). A comparison of charges billed monthly to

¹ Pennsylvania Public Utility Commission v. Aqua Pennsylvania, Inc. and Aqua Pennsylvania Wastewater, Inc.; Docket Nos. R-2018-3003558 and R-2018-3003561; Joint Petition for Settlement; Para 33.b.; p. 13.

typical residential, commercial and industrial customers in the Village Green East, Village Green West and AQUA Main Division can be seen in Table 1.

For residential customers, present AQUA Main Division rates would result in an 121% increase over present CWA Village Green East rates. A residential customer in the City of Chester served through a 5/8-inch meter and using 5,000 gallons per month would see a monthly CWA bill of \$35.15. In the Village Green West area, a comparable CWA customer would pay a monthly bill of \$41.70. At current Aqua rates, the bill would be \$77.72 per month.

I prepared a similar comparison of typical charges at CWA rates and at rates for American and SUEZ. The results of these calculations are also shown in Table 1. For a residential customer using 5,000 gallons per month in the City of Chester, American rates would result in a monthly bill of \$77.59, which is 120.7% higher than the comparable CWA bill. Using SUEZ rates, the monthly bill would be \$59.76 or 70% higher than the CWA bill.

Affordability is a significant issue in the City of Chester. According to the US Census Bureau, the Median Household Income (“MHI”) in the City of Chester (2010-2016) is \$27,217 and 36.9% of the population is in poverty.² Assuming a typical residential bill is \$35.15 (see Table 1, Village Green East), the annual cost of water represents 1.55% of the MHI in Chester City. By comparison, AQUA Main Division rates represent 3.43% of the MHI. In a recent American Water Works Association Benchmarking Survey, at the 75% Percentile, water charges for water only utilities represented 0.59% of the MHI. At the 25% Percentile, water charges represented 0.92% of MHI.³ In other words, fewer than 25% of the respondents to the AWWA survey had charges that amounted to more than 0.92% of MHI while the current AQUA Main Division rates would lay claim to 3.43% of the typical family’s household income in the City of Chester. This is more than twice the amount of the MHI dedicated to paying CWA rates and charges for drinking water service.

While a comparison of the annual water charges to MHI is a useful way to consider affordability, it is also helpful to look at the dollar differential presented by a comparison of CWA and investor-owned utility rates. A residential customer in the City of Chester would pay \$42.57 less per month for water service at CWA rates than they would pay at AQUA rates. Annually, this amounts to over \$510 in real

² <https://www.census.gov/quickfacts/fact/table/chestercitypennsylvania,PA/PST045217>

³ 2017 AWWA Utility Benchmarking; American Water Works Association; Denver CO; 2017; p. 74.

Table 1: Comparative Charges for Typical CWA Customers							7/9/19
		Present CWA Rates		Aqua PA	PA American	SUEZ PA Feb 1, 2019	
		Village Green West	Village Green East	May 24, 2019 Rates Main Division	Rate Zone 1		
Residential Customer							
Meter		5/8-inch	5/8-inch	5/8-inch	5/8-inch	5/8-inch	
Use Per Month (Gallons)							
3,000	Monthly Charge	\$ 29.86	\$ 25.93	\$ 52.51	\$ 53.15	\$ 41.65	
4,000	Monthly Charge	\$ 35.78	\$ 30.54	\$ 65.11	\$ 65.37	\$ 50.70	
5,000	Monthly Charge	\$ 41.70	\$ 35.15	\$ 77.72	\$ 77.59	\$ 59.76	
Percent Change at 5,000 Gal				121.11%	120.74%	70.01%	
Commercial Customer							
Meter		2-inch	2-inch	2-inch	2-inch	2-inch	
Use Per Month (Gallons)		57,661	57,661	57,661	57,661	57,661	
	Monthly Charge	\$ 388.41	\$ 316.80	\$ 717.78	\$ 685.20	\$ 544.11	
Percent Change from CWA				126.57%	116.29%	71.75%	
Industrial Customer							
Meter		4-inch	4-inch	4-inch	4-inch	4-inch	
Use Per Month (Gallons)		5,934,601	5,934,601	5,934,601	5,934,601	5,934,601	
	Monthly Charge	\$ 18,217.22	\$ 14,278.58	\$ 46,641.20	\$ 43,876.48	\$ 44,692.90	
Percent Change from CWA				226.65%	207.29%	213.01%	
Notes:							
(1) CWA Rates effective July 1, 2010.							
(2) Aqua Pennsylvania Rates and Rules Governing The Distribution of Water...;Schedule of Rates; Tariff Water - PA P.U.C. No. 2; Original Page 12.1, Original Page 12.2, Original Page 12.3 and Original Page 12.4 for Rate Zone 1, Main Division Effective May 24, 2019.							
(3) Pennsylvania American Water Company; Rates Rules and Regulations Governing the Distribution and Sale of Water Service; Effective January 1, 2018; Rate Zone 1, First Revised Page 16.1 and 16.2.							
(4) SUEZ Water Pennsylvania; Rates, Rules and Regulations Governing the Distribution of Water; Effective February 1, 2019; Tenth Revised Page 6, Sixth Revised Page 6A and 6B.							
(5) This is a comparison of base rates. Surcharges and credits authorized by the PUC for the investor-owned utilities for interim periods, such as the Distribution System Improvement Charge surcharge, which are periodically merged into and made part of the base rates, are not included in this analysis. To the extent that such surcharge rates are in effect from time to time, these would result in an increase in the investor-owned system bills shown here. For example, the DSIC rate authorized for PAWC at July 1, 2019 was 0.68% of the customer bill. A residential customer using 5,000 gallons would see a bill of \$78.12 as opposed to the base rate amount shown above of \$77.59, resulting in a bill that is 122% higher than CWA's Village Green East current bill.							

savings. For individuals at the low end of the economic spectrum, these are meaningful savings.

For commercial or public customers, a typical customer served through a 2-inch meter and using a class-average 57,660 gallons per month would see a bill of \$316.80 in Village Green East. The comparable Village Green West charge would be \$388.41. At current AQUA rates, these customers would see a monthly bill of \$717.78, a 126% increase over present Village Green East rates.

For industrial customers, the class "average" industrial use is 5,934,000 gallons per month. Assuming this is associated with a single 4-inch meter, the monthly charges for Village Green East and Village Green West would be \$14,278 and \$18,217 per month, respectively. The comparable charge at current AQUA Main Division rates would be \$46,641 per month, which represents an increase of 227%. While this represents an average impact on the class of customers, I completed a series of specific calculations for individual customers showing the impact for specific metering arrangements and known volumetric use. This is discussed later in this report.

While impacts on commercial and industrial customers are harder to quantify in general terms, the differences between AQUA Main Division rates and CWA rates are significant. Increases in excess of 100% in the cost of an essential utility service could result in a loss of sorely needed jobs and related tax revenues. Table 2 through Table 5 show the impact of moving from CWA rates to investor-owned utility rates for four large employers in the City of Chester. Crozer-Chester Medical Center would see their total annual water bill increase from \$260,660.67 to \$735,170.51. This is a 182% increase. Harrah's Casino would see its water charges increase from \$120,274.93 to \$326,791.37 – a 172% increase. Widener University would experience an increase in annual water charges from \$219,399.43 to \$315,582.65 or an increase of 44%. The impact on Weidner University is lower because a material portion of the University's bill is for private fire service and AQUA's rates for this service are currently lower than CWA's rates. Kimberly Clark would see a 207% increase in annual water charges from \$895,756.24 to \$2,754,236.78, an increase of \$1,858,480 per year.

Tables 2 through 5 also show comparisons for American and SUEZ rates and the results are similar. Crozer-Chester Medical Center would see a 225% increase in its annual water cost with American and a 129% increase with SUEZ. Harrah's Casino would see increases in its cost of water of 204% with American and 118% with SUEZ. Widener University would see lesser impacts with American and SUEZ but these cost increases would be 36% and 6%, respectively. In each case Widener sees a smaller impact than the other large employers because of the relative difference in private fire charges for the investor-owned

TABLE 2: COMPARISON OF CHARGES FOR CROZER-CHESTER MEDICAL CENTER												
Meter Charges	AT CWA VILLAGE GREEN EAST RATES			AT AQUA PA MAIN COMMERCIAL RATES			At PA American Zone 1 Rates			At SUEZ PA Water Rates		
METER SIZE	QUANTITY	MONTHLY CHARGE	ANNUAL FIXED CHARGES	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA
5/8-inch	5	\$ 12.10	\$ 726.00	\$ 18.00	\$ 1,080.00	48.76%	\$ 16.50	\$ 990.00	36.36%	\$ 14.50	\$ 870.00	19.83%
3/4-inch	1	\$ 18.36	\$ 220.32	\$ 30.90	\$ 370.80	68.30%	\$ 25.00	\$ 300.00	36.17%	\$ 14.50	\$ 174.00	-21.02%
1-inch	3	\$ 27.54	\$ 991.44	\$ 52.50	\$ 1,890.00	90.63%	\$ 41.60	\$ 1,497.60	51.05%	\$ 30.05	\$ 1,081.80	9.11%
1-1/2-inch	1	\$ 61.56	\$ 738.72	\$ 101.10	\$ 1,213.20	64.23%	\$ 67.90	\$ 814.80	10.30%	\$ 60.11	\$ 721.32	-2.36%
2-inch	3	\$ 104.87	\$ 3,775.32	\$ 143.90	\$ 5,180.40	37.22%	\$ 108.60	\$ 3,909.60	3.56%	\$ 102.96	\$ 3,706.56	-1.82%
3-inch	1	\$ 222.59	\$ 2,671.08	\$ 289.00	\$ 3,468.00	29.84%	\$ 202.60	\$ 2,431.20	-8.98%	\$ 193.12	\$ 2,317.44	-13.24%
4-inch	0	\$ 365.90	\$ -	\$ 470.00	\$ -	0.00%	\$ 254.30	\$ -	0.00%	\$ 321.90	\$ -	0.00%
6-inch	3	\$ 663.01	\$ 23,868.36	\$ 970.00	\$ 34,920.00	46.30%	\$ 380.60	\$ 13,701.60	-42.60%	\$ 643.80	\$ 23,176.80	-2.90%
4 inch Fire	1	\$ 241.06	\$ 2,892.72	\$ 93.70	\$ 1,124.40	-61.13%	\$ 193.33	\$ 2,319.96	-19.80%	\$ 66.76	\$ 801.12	-72.31%
6 inch Fire	3	\$ 482.11	\$ 17,355.96	\$ 206.40	\$ 7,430.40	-57.19%	\$ 290.00	\$ 10,440.00	-39.85%	\$ 110.98	\$ 3,995.28	-76.98%
SUBTOTAL	21		\$ 53,239.92		\$ 56,677.20	6.46%		\$ 36,404.76	-31.62%		\$ 36,844.32	-30.80%
	USE (THGAL)	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA
		VARIABLE		VARIABLE			VARIABLE			VARIABLE		
VOLUME BILLED	84,035		\$ 206,257.95		\$ 685,392.107	232.30%		\$ 774,107.44	275.31%		\$ 558,423.32	170.74%
	QUANTITY	MONTHLY CHARGE	ANNUAL FIRE CHARGE	MONTHLY CHARGE	ANNUAL FIRE CHARGE	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIRE CHARGE	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIRE CHARGE	INCREASE OVER CWA
Fire Hydrant Charges	3	\$ 32.30	\$ 1,162.80	\$ 46.00	\$ 1,656.00	42.41%	\$ 26.87	\$ 967.32	-16.81%	\$ 43.00	\$ 1,548.00	33.13%
TOTAL CHARGES			\$ 260,660.67		\$ 735,170.51	182.04%		\$ 847,884.28	225.28%		\$ 596,815.64	128.96%

TABLE 3: COMPARISON OF CHARGES FOR HARRAH'S CASINO													
Meter Charges		AT CWA VILLAGE GREEN EAST RATES			AT AQUA PA MAIN COMMERCIAL RATES			At PA American Zone 1 Rates			At SUEZ PA Water Rates		
METER SIZE	QUANTITY	MONTHLY CHARGE	ANNUAL FIXED CHARGES	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	
3-inch	1	\$ 222.59	\$ 2,671.08	\$ 289.00	\$ 3,468.00	29.84%	\$ 202.60	\$ 2,431.20	-8.98%	\$ 193.12	\$ 2,317.44	-13.24%	
4-inch	1	\$ 365.90	\$ 4,390.80	\$ 470.00	\$ 5,640.00	28.45%	\$ 254.30	\$ 3,051.60	-30.50%	\$ 321.90	\$ 3,862.80	-12.03%	
8 Inch Fire	2	\$ 872.86	\$ 20,948.64	\$ 360.10	\$ 8,642.40	-58.74%	\$ 444.66	\$ 10,671.84	-49.06%	\$ 181.96	\$ 4,367.04	-79.15%	
SUBTOTAL			\$ 28,010.52		\$ 17,750.40	-36.63%		\$ 16,154.64	-42.33%		\$ 10,547.28	-62.35%	
	USE (THGAL)	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	
		VARIABLE		VARIABLE			VARIABLE			VARIABLE			
VOLUME BILLED	38,126		\$ 92,264.41		\$ 309,040.97	234.95%		\$ 350,111.78	279.47%		\$ 252,232.58	173.38%	
TOTAL CHARGES			\$ 120,274.93		\$ 326,791.37	171.70%		\$ 366,266.42	204.52%		\$ 262,779.86	118.48%	

TABLE 4: COMPARISON OF CHARGES FOR WIDENER UNIVERSITY													
Meter Charges		AT CWA VILLAGE GREEN EAST RATES			AT AQUA PA MAIN COMMERCIAL RATES			At PA American Zone 1 Rates			At SUEZ PA Water Rates		
METER SIZE	QUANTITY	MONTHLY CHARGE	ANNUAL FIXED CHARGES	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	
5/8-inch	59	\$ 12.10	\$ 8,566.80	\$ 18.00	\$ 12,744.00	48.76%	\$ 16.50	\$ 11,682.00	36.36%	\$ 14.50	\$ 10,266.00	19.83%	
3/4-inch	1	\$ 18.36	\$ 220.32	\$ 30.90	\$ 370.80	68.30%	\$ 25.00	\$ 300.00	36.17%	\$ 14.50	\$ 174.00	-21.02%	
1-inch	1	\$ 27.54	\$ 330.48	\$ 52.50	\$ 630.00	90.63%	\$ 41.60	\$ 499.20	51.05%	\$ 30.05	\$ 360.60	9.11%	
2-inch	9	\$ 104.87	\$ 11,325.96	\$ 143.90	\$ 15,541.20	37.22%	\$ 108.60	\$ 11,728.80	3.56%	\$ 102.96	\$ 11,119.68	-1.82%	
3-inch	5	\$ 222.59	\$ 13,355.40	\$ 289.00	\$ 17,340.00	29.84%	\$ 202.60	\$ 12,156.00	-8.98%	\$ 193.12	\$ 11,587.20	-13.24%	
4-inch	4	\$ 365.90	\$ 17,563.20	\$ 470.00	\$ 22,560.00	28.45%	\$ 254.30	\$ 12,206.40	-30.50%	\$ 321.90	\$ 15,451.20	-12.03%	
6-inch	3	\$ 663.01	\$ 23,868.36	\$ 970.00	\$ 34,920.00	46.30%	\$ 380.60	\$ 13,701.60	-42.60%	\$ 643.80	\$ 23,176.80	-2.90%	
8-inch	1	\$ 1,587.60	\$ 19,051.20	\$ 1,697.00	\$ 20,364.00	6.89%	\$ 736.90	\$ 8,842.80	-53.58%	\$ 1,030.16	\$ 12,361.92	-35.11%	
4-inch Fire	5	\$ 241.06	\$ 14,463.60	\$ 93.70	\$ 5,622.00	-61.13%	\$ 193.33	\$ 11,599.80	-19.80%	\$ 73.44	\$ 4,406.40	-69.53%	
6-inch Fire	8	\$ 482.11	\$ 46,282.56	\$ 206.40	\$ 19,814.40	-57.19%	\$ 290.00	\$ 27,840.00	-39.85%	\$ 122.08	\$ 11,719.68	-74.68%	
8-inch Fire	1	\$ 872.86	\$ 10,474.32	\$ 360.10	\$ 4,321.20	-58.74%	\$ 444.66	\$ 5,335.92	-49.06%	\$ 181.96	\$ 2,183.52	-79.15%	
Unmetered Fire	1	\$ 482.11	\$ 5,785.32	\$ 206.40	\$ 2,476.80	-57.19%	\$ 290.00	\$ 3,480.00	-39.85%	\$ 122.08	\$ 1,464.96	-74.68%	
SUBTOTAL	98		\$ 171,287.52		\$ 156,704.40	-8.51%		\$ 119,372.52	-30.31%		\$ 104,271.96	-39.12%	
	USE (THGAL)	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	
		VARIABLE		VARIABLE			VARIABLE			VARIABLE			
VOLUME BILLED	19,356		\$ 48,111.91		\$ 158,878.25	230.23%		\$ 178,337.44	270.67%		\$ 128,826.32	167.76%	
TOTAL CHARGES			\$ 219,399.43		\$ 315,582.65	43.84%		\$ 297,709.96	35.69%		\$ 233,098.28	6.24%	

TABLE 5: COMPARISON OF CHARGES FOR KIMBERLY CLARK												
Meter Charges		AT CWA VILLAGE GREEN EAST RATES		AT AQUA PA MAIN COMMERCIAL RATES			At PA American Zone 1 Rates			At SUEZ PA Water Rates		
METER SIZE	QUANTITY	MONTHLY CHARGE	ANNUAL FIXED CHARGES	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA	MONTHLY CHARGE	ANNUAL FIXED CHARGES	INCREASE OVER CWA
1-inch	1	\$ 27.54	\$ 330.48	\$ 52.50	\$ 630.00	90.63%	\$ 61.40	\$ 736.80	122.95%	\$ 30.05	\$ 360.60	9.11%
4-inch	2	\$ 365.90	\$ 8,781.60	\$ 470.00	\$ 11,280.00	28.45%	\$ 613.50	\$ 14,724.00	67.67%	\$ 321.90	\$ 7,725.60	-12.03%
6-inch	3	\$ 663.01	\$ 23,868.36	\$ 970.00	\$ 34,920.00	46.30%	\$ 1,227.00	\$ 44,172.00	85.07%	\$ 643.80	\$ 23,176.80	-2.90%
8 inch (FS)	1	\$ 872.86	\$ 10,474.32	\$ 360.10	\$ 4,321.20	-58.74%	\$ 444.66	\$ 5,335.92	-49.06%	\$ 181.96	\$ 2,183.52	-79.15%
10-inch	1	\$ 1,442.99	\$ 17,315.88	\$ 548.30	\$ 6,579.60	-62.00%	\$ 625.11	\$ 7,501.32	-56.68%	\$ 260.05	\$ 3,120.60	-81.98%
SUBTOTAL			\$ 60,770.64		\$ 57,730.80	-5.00%		\$ 72,470.04	19.25%		\$ 36,567.12	-39.83%
	USE (THGAL)	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA	RATE (\$/THGAL)	ANNUAL VOLUME CHARGE	INCREASE OVER CWA
VOLUME BILLED	355,910.00	VARIABLE	\$ 834,985.60	VARIABLE	\$ 2,696,505.98	222.94%	VARIABLE	\$ 2,591,141.86	210.32%	\$ 4.0700	\$ 1,448,553.70	73.48%
TOTAL CHARGES			\$ 895,756.24		\$ 2,754,236.78	207.48%		\$ 2,663,611.90	197.36%		\$ 1,485,120.82	65.80%

utilities. This mitigates the increase in volume charges for Widener, which ranges from 167% to 270%. Kimberly Clark could expect to see a 197% increase in its cost of water with American rates and a 66% increase with SUEZ rates

I also developed a comparison of billings to CWA wholesale utility customers assuming the wholesale rates for AQUA and American were implemented in the aftermath of a sale of the system to either of these two entities. I also looked at SUEZ and their tariff does not authorize a wholesale rate. As a result, I did not attempt to make a rate comparison for SUEZ.⁴ The annual charges calculated for American and AQUA include the Susquehanna River Basin Commission (“SRBC”) charge of \$0.33 per thousand gallons. This is a charge levied by SRBC and collected by CWA. A new owner of the CWA system would also be obligated to collect this fee. The median increase that wholesale customers could expect under existing AQUA and PAWC rates is 262% and 124%, respectively using 2017 sales volumes and existing CWA rates⁵. I have summarized the comparison for each wholesale account in the tables on the following pages.

In the case of the hypothetical AQUA acquisition, wholesale billings to AQUA would cease. Instead, the PAPUC would most likely recognize that some portion of the cost of production and transmission is being supported by rates paid by retail customers in the receiving system. This would not be the case in a PAWC acquisition where AQUA would see significant rate increases as a result of such a transaction.⁶

While the percentage increases are significant, it is important to focus on the dollar impact. For Artesian, under the AQUA rates, the increase in annual billings is \$9.8 million. In 2017, Artesian Resources had total Utility Operating Expenses of \$38,277,000 (ref. 2017 Artesian Annual Report, page 34). An increase in purchased water expense of \$9,793,610 would represent a 25.6% increase in O&M costs. A

⁴ If CWA were to be acquired by SUEZ, I would expect the PA PUC to allow the existing CWA wholesale rates to be implemented by SUEZ pending the completion of a full cost of service allocation study and a subsequent rate case. At the time of the subsequent rate increase, the initial rates for wholesale would be replaced by rates determined by the cost allocation study.

⁵ Existing CWA rates are the fixed service charges effective 7/1/2010 and the wholesale volumetric rates effective 7/1/2016.

⁶ AQUA’s projected test year level of expense incorporated a 10% rate increase for CWA even though such a rate increase has not been implemented by CWA. By comparison to a hypothetical sale of the CWA system to American, the City of Chester settlement rate increase of 10% would clearly be in the interest of AQUA ratepayers when compared against the range of cost increases (64% to 150% per Table 7) that would result if PAWC rates were put into effect.

10% CWA rate increase would increase Artesian’s purchased water cost by \$352,162. This represents 0.92% of Artesian’s total O&M.

TABLE 6: COMPARISON OF CWA WHOLESALE BILLINGS TO PROJECTED BILLINGS AT AQUA PENNSYLVANIA WHOLESALE RATES

2017					
Name	Village Green East/West	Account #	At CWA Rates	At Aqua May 24, 2019 Rates	Percent Change
Artesian	West	02804078342	\$ 3,889,199.92	\$ 13,682,809.87	252%
Suez Water - Delaware	East	02804078342	\$ 160,129.26	\$ 642,601.80	301%
Suez Water - Bethel	West	02804078342	\$ 1,148,054.13	\$ 4,374,072.90	281%
Oxford Borough	West	02800078368	\$ 191,943.72	\$ 715,644.00	273%
London Grove Municipal Authority	West	02803078371	\$ 336,090.84	\$ 1,178,235.24	251%
Kennett Square Borough	West	02803078371	\$ 264,012.52	\$ 921,980.05	249%
Aqua Pennsylvania	West	02802078370	\$ 189,732.60	\$ -	-100%
Aqua Pennsylvania	East	024796078362	\$ 416,061.51	\$ -	-100%
Aqua Pennsylvania	West	024400000000	\$ 4,390.80	\$ -	-100%
Aqua Pennsylvania	East	02169079212	\$ 127,795.60	\$ -	-100%
2018					
Name	Village Green East/West	Account #	At CWA Rates	At Aqua Proposed Rates	Percent Change
Artesian	West	02804078342	\$ 3,868,012.96	\$ 13,607,485.30	252%
Suez Water - Delaware	East	02804078342	\$ 166,750.35	\$ 670,055.10	302%
Suez Water - Bethel	West	02804078342	\$ 1,194,452.22	\$ 4,551,609.00	281%
Oxford Borough	West	02800078368	\$ 190,500.68	\$ 710,122.40	273%
London Grove Municipal Authority	West	02803078371	\$ 341,501.96	\$ 1,197,473.03	251%
Kennett Square Borough	West	02803078371	\$ 263,066.52	\$ 918,616.80	249%
Aqua Pennsylvania	West	02802078370	\$ 189,213.16	\$ -	-100%
Aqua Pennsylvania	East	024796078362	\$ 422,392.73	\$ -	-100%
Aqua Pennsylvania	West	024400000000	\$ 4,390.80	\$ -	-100%
Aqua Pennsylvania	East	02169079212	\$ 128,579.60	\$ -	-100%

TABLE 7: COMPARISON OF CWA WHOLESALE BILLINGS TO PROJECTED BILLINGS AT PAWC WHOLESALE RATES					
2017					
Name	Village Green East/West	Account #	At CWA Rates	At PAWC Rates	Percent Change
Artesian	West	02804078342	\$ 3,889,199.92	\$ 8,474,837.08	118%
Suez Water - Delaware	East	02804078342	\$ 160,129.26	\$ 397,165.82	148%
Suez Water - Bethel	West	02804078342	\$ 1,148,054.13	\$ 2,660,820.43	132%
Oxford Borough	West	02800078368	\$ 191,943.72	\$ 441,476.04	130%
London Grove Municipal Authority	West	02803078371	\$ 336,090.84	\$ 734,484.01	119%
Kennett Square Borough	West	02803078371	\$ 264,012.52	\$ 576,309.82	118%
Aqua Pennsylvania	West	02802078370	\$ 189,732.60	\$ 413,304.26	118%
Aqua Pennsylvania	East	024796078362	\$ 416,061.51	\$ 1,040,920.14	150%
Aqua Pennsylvania	West	024400000000	\$ 4,390.80	\$ 7,201.20	64%
Aqua Pennsylvania	East	02169079212	\$ 127,795.60	\$ 298,320.84	133%
2018					
Name	Village Green East/West	Account #	At CWA Rates	At PAWC Rates	Percent Change
Artesian	West	02804078342	\$ 3,868,012.96	\$ 8,428,342.79	118%
Suez Water - Delaware	East	02804078342	\$ 166,750.35	\$ 413,820.05	148%
Suez Water - Bethel	West	02804078342	\$ 1,194,452.22	\$ 2,768,520.69	132%
Oxford Borough	West	02800078368	\$ 190,500.68	\$ 438,126.42	130%
London Grove Municipal Authority	West	02803078371	\$ 341,501.96	\$ 746,358.59	119%
Kennett Square Borough	West	02803078371	\$ 263,066.52	\$ 574,233.84	118%
Aqua Pennsylvania	West	02802078370	\$ 189,213.16	\$ 412,164.36	118%
Aqua Pennsylvania	East	024796078362	\$ 422,392.73	\$ 1,056,845.26	150%
Aqua Pennsylvania	West	024400000000	\$ 4,390.80	\$ 7,201.20	64%
Aqua Pennsylvania	East	02169079212	\$ 128,579.60	\$ 300,170.34	133%

Overall Condition & Management

I have reviewed the financial and operating results for CWA for the last few years. CWA has demonstrated its ability to consistently comply with water quality rules and regulations promulgated by the United States Environmental Protection Agency (“USEPA”) and by the Pennsylvania Department of Environmental Protection. Not only does CWA comply with the minimum requirements of the rules and

regulations, it has also committed to the Partnership for Safe Water and has developed an exemplary track record of producing the highest quality water for its customers. The Partnership for Safe Water is a voluntary effort between six drinking water organizations⁷ and more than 300 water utilities. The goal of the Partnership is to provide a new measure of public health protection to millions by encouraging utilities to voluntarily improve performance beyond current regulatory requirements. The preventative measures are based around optimizing treatment plant performance and distribution system operation. The result is the production and delivery of superior quality water to all utility customers. CWA has recently been awarded the Phase IV Excellence Award for compliance with the Partnership goals. To reach this level, CWA continuously operated at the Directors Award level for fifteen years, it completed self-assessments of their treatment operations and submitted the operation to a review by a team of utility optimization experts from the Partnership Program. The Phase IV Excellence in Water Treatment award demonstrates full optimization of the treatment process and achievement of all Partnership goals and operating procedures. There is only one other system in all of Pennsylvania to achieve this level of performance.⁸ CWA is performing at the highest levels with respect to water quality and treatment and they are doing so at a comparatively low cost of service for their customers.

CWA is financially sound. I have reviewed CWA's balance sheets and income statements for the past several years and found that:

1. The CWA revenues consistently produce net operating income in excess of expenses. Revenues, which are primarily generated by rates for service rendered, cover the full cost of service;
2. Operating Income for the past three years has averaged \$3.3 million per year;
3. Coverage ratio (net income excluding depreciation and interest divided by debt service) exceeds 2.0 reflecting strong financial performance;
4. Cash on hand generally exceeds 250 days of cash operating expenses; and
5. Annual investments in utility plant exceed the rate of depreciation and reflect reasonable levels of investment needed to maintain safe, adequate and proper service.

⁷ The Partnership is a joint effort of the USEPA, the American Water Works Association, the Association of Metropolitan Water Agencies, the Association of State Drinking Water Administrators, the National Association of Water Companies and the Water Research Foundation.

⁸ The Carlisle Borough Municipality has also achieved Phase IV recognition.

In addition to its sound financial and operating performance, I note that CWA has a current cost of service allocation study (2015, Gannett Fleming), they maintain a Source Water Protection Plan and they have an a forward looking capital improvement plan for water main rehabilitation, upgrades to pumping facilities and upgrades to storage facilities. Supply is adequate for current and future needs of the service area. The CWA has the ability to withdraw 60 million gallons per day from its Susquehanna River and Octoraro Creek supplies.

Based on these findings and my experience in managing and operating water utilities over the past forty years, it is my opinion to a reasonable degree of certainty, that CWA is a well-managed and operated water utility.

Appendix 1: Resume of Howard J. Woods, Jr., P.E.

HOWARD J. WOODS, JR., P.E.

KEY EXPERIENCE

Mr. Woods has over 42 years of experience in water and wastewater utility engineering and operations. In his career he has worked for US EPA, engineering consultants and in numerous senior engineering and operational roles at a large investor-owned utility. His experience is well rounded, covering all aspects of public water and wastewater operations and management including outsourcing, acquisitions, maintenance, water production, filtration, distribution, water quality, wastewater collection and treatment, regulatory compliance and safety.

Mr. Woods managed numerous water and wastewater management contracts. He has assisted clients in outsourcing management activities and transferring ownership of complete utility systems. He has advised clients on alternative contracting approaches and reduced operating costs by renegotiating plant operations contracts. He has helped clients reduce operating expenses and he has provided expert testimony in construction arbitrations, contamination incidents and utility rate and service proceedings.

EDUCATION

Masters of Civil Engineering, Water Resources – Villanova University

Bachelor of Civil Engineering (cum laude) – Villanova University

ACCOMPLISHMENTS

- Directed and managed the procurement process leading to the sale of a municipal wastewater system in Southeastern Pennsylvania. The sale of the Upper Dublin Township Sanitary Sewer System will yield \$20,000,000 for a system serving approximately 8,000 connections and having annual revenues of \$3,000,000. Advised the Township on alternative outsourcing and contracting approaches, reduced interim operating expenses by 30% prior to the sale by renegotiating the plant operations contract.
- Prepared an analysis of ownership alternatives for Lower Makefield Township's sanitary sewer collection system. Managed a procurement process that led to the receipt of a \$17 million bid for the potential sale of a system serving 10,700 residential and commercial customers.
- Assessed an existing public private partnership contract and future contracting alternatives for the Jersey City Municipal Utilities Authority (JCMUA). Recommended alternative contract terms and assisted JCMUA in negotiating a new ten-year operations agreement saving approximately \$3,000,000 per year.
- Assisted Greater Ouachita Water Company, a non-profit Louisiana water and sewer utility, in evaluating operating contract alternatives. Provided assistance in identifying qualified operators to be invited to bid a multi-year full-service operating contract. Assisted in evaluating bids and in contract negotiations.

ACCOMPLISHMENTS (CONTINUED)

- Completed an independent assessment of ownership and operating alternatives for the Township of Sparta water utility. The study evaluated current operating and financial conditions of the utility and considered two alternative service delivery approaches: contract operation and a sale of the system to an investor-owned utility.
- Completed an assessment of the financial and operating impacts of a proposal by a Pennsylvania municipality to dissolve its municipal water and sewer authority. The authority served multiple political subdivisions and dissolution would have resulted in regulation by the Pennsylvania Public Utility Commission. The additional regulatory burdens identified and limitations on municipal financing capacity resulted in a recommendation to retain authority ownership and operations.
- Completed an analysis of ownership alternatives for the Bristol Township Sewer Department. Reviewed capital needs and financing arrangements, rate structure and system revenues, operational costs and regulatory compliance issues. Assessed potential interest in the acquisition of the system by other municipal and investor-owned entities and assessed the possible impact of a sale on rates and service quality. The study recommended retention of the system by the Township and offered recommendations to reduce costs and improve staffing levels.
- Completed the assessment of a potential water utility acquisition by a Pennsylvania Municipal Authority. Assisted the Authority in developing a bid proposal for the acquisition and assessing the impact on revenue requirement and consumer rates resulting from the acquisition.
- Provided litigation support to Cornwall Borough Municipal Authority in its efforts to prevent Cornwall Borough from dissolving the Authority. Provided expert testimony on the service and financial impacts of dissolving the Authority. Developed capital plans for the Authority and provided expert testimony regarding the need to construct certain fire protection and other distribution improvements.
- Completed an assessment of an investor-owned utility offer to acquire the assets of Pennsylvania Municipal Water & Sewer Authority. Evaluated the acquisition and rate proposal, developed independent assessments of the value of the assets consistent with Pennsylvania Act 12 and prepared recommendations for the Authority's use in considering the proposal.
- Completed an evaluation of the revenue requirement associated with the decommissioning of a wastewater treatment plant and the diversion of wastewater to a regional treatment works for the North Wales Water Authority. Assessed the rate impact to customers of potentially retaining and improving an existing wastewater treatment plant and the rate impact of joining a regional treatment system. The evaluation supported the decision to regionalize the sewage treatment function.
- Developed a risk assessment model for a Pennsylvania Municipal Utilities Authority to allow the Authority to prioritize investments on numerous wells threatened by regional perfluorinated compound contamination. The assessment balanced risk of

ACCOMPLISHMENTS (CONTINUED)

- contamination, cost and feasibility of providing treatment, the use or regional alternative supplies owned by the Authority and regional interconnections/system acquisitions.
- Assisted the Banco Gubernamental de Fomento para Puerto Rico, Autoridad para el Financiamiento de la Infraestructura de Puerto Rico and Pricewaterhouse-Coopers in developing a new operating contract for the Puerto Rico Aqueduct and Sewer Authority (PRASA). The contract was developed, bid and awarded in less than six months, cutting the normal procurement time by nearly two-thirds. The value of the contract was \$300 million per year.
 - Completed an independent assessment of the planning and engineering decision making for a major water treatment plant renovation project undertaken by Aquarion Water Company of Connecticut in Stamford Connecticut. Evaluated process selection decisions, project sizing and regulatory compliance issues and testified before the Connecticut Department of Public Utility Control on the findings of the evaluation.
 - Completed audits of water production operations and water quality management functions at Aquarion Water Company of Connecticut, Aquarion Water Company of Massachusetts and Aquarion Water Company of New Hampshire. Assessed operational procedures and staffing levels, reviewed risk management plans including emergency response plans and dam safety programs, evaluated programmed and preventative maintenance systems and developed recommendations to assist the Company in lowering the cost of service while reducing risk and improving reliability.
 - Completed an audit of the watershed and environmental management functions at Aquarion Water Company of Connecticut. Assessed watershed management, monitoring and operational procedures, reviewed compliance tracking systems, reviewed risk management strategies and developed recommendations to assist the Company in reducing risk and improving reliability and watershed protection efforts.
 - Completed a management audit of the water distribution function at Aquarion Water Company of Connecticut. Evaluated system monitoring and maintenance practices, assessed the impact of the use of contract maintenance and construction services to reduce Company workforce levels. Developed recommendations to improve the Company's programmed and preventative maintenance systems, corrosion control procedures and non-revenue water control programs.
 - Completed a management audit of the engineering and planning functions at Aquarion Water Company of Connecticut. Evaluated the Company's planning practices and procedures and developed recommendations to assure the efficient application of capital to the renewal, replacement and expansion of the Company's extensive utility plant assets.
 - Assisted Greater Ouachita Water Company, a Louisiana non-profit water and sewer utility, in identifying the cause of water quality complaints resulting from poor color removal filtration processes. Recommended improvements to minimize capital

ACCOMPLISHMENTS (CONTINUED)

- modifications of the chemical feed, filter backwash and spent wash water treatment systems.
- Completed a Comprehensive Technical Assistance (CTA) project for the City of New Brunswick (NJ) Water Utility. The CTA, which was Ordered to be completed by the New Jersey Department of Environmental Protection, developed operating procedures to rectify numerous performance limiting factors that contributed to several drinking water quality issues and Safe Drinking Water Act Rules compliance issues. Completion of the CTA allowed a major component of the Consent Order to be satisfied.
 - Provided ongoing technical and operations assistance to the Shelter Island Heights Property Owners Corporation related to the operation and maintenance of the community water and sewer utilities. Developed recommendations for asset maintenance and renewal as well as employee safety.
 - Completed a Vulnerability Assessment for a municipally-owned public water system in northern New Jersey. Organized, planned and conducted the assessment using the RAM-WSM methodology. Evaluated existing physical protection systems at utility facilities, developed threat assessments and adversary sequence analyses, prepared recommendations to reduce risk.
 - Completed an energy management evaluation for the Elmira (NY) Water Board and provided operator training on energy management strategies. Recommendations from the study allowed the client to reduce energy expenses by 30% through a series of operational modifications.
 - Completed an energy management audit of the Pittsburgh Water and Sewer Authority and identified strategies for reducing power consumption. The results of this investigation provided the foundation for the Authority and its contract manager to develop and implement more effective maintenance and operations procedures to reduce energy costs.
 - Served as an expert witness in a matter involving the diversion of service by a large commercial customer of Atlantic City Municipal Utilities Authority (ACMUA). Statistically analyzed customer water use and billing records by relating water use variables (e.g. weather, occupancy rates, and restaurant output) to recorded consumption. Identified periods of service diversion and assisted ACMUA in the collection of revenues and penalties due.
 - Served as an expert witness in a matter involving excess billing of a large commercial customer of a New Jersey public utility. Statistically analyzed usage patterns over a ten-year period and identified periods of excess billing. Assisted the customer in negotiating a \$50,000 settlement of the dispute.
 - Provided litigation support in a dispute involving cost of service allocations made by Erie City Water Authority (ECWA) in establishing rates covering a ten-year period beginning in 2004. Prepared an expert report addressing the cost allocation methods used by ECWA and demonstrated that the determination of the ECWA revenue

ACCOMPLISHMENTS (CONTINUED)

- requirement was fair and reasonable and that the allocation methods used to assign costs to various rate classes were done using reasonable professional judgment and standard professional care.
- Provided litigation support in a dispute involving water rates billed by Passaic Valley Water Commission to retail customers in the Borough of Lodi. Reviewed past rate setting practices and related rate covenants in the Lodi water system lease, prepared expert testimony and assisted the Passaic Valley Water Commission in developing rates consistent with the Court's Order.
 - Developed a rate study and assisted in the renegotiation of a sewer service agreement between Ridgelyfield Borough and Palisades Park Borough. The rate study formed the basis of a settlement of ongoing litigation and provided a cost allocation methodology incorporated into a new service agreement between the municipalities.
 - Developed rate studies for the Village of Ridgewood Water Utility for 2010 through 2016 to satisfy a Court Order to re-evaluate and re-adopt rate resolutions in response to a Complaint by Midland Park, Glen Rock and Wycoff. Developed allocation factors for shared municipal services and developed the revenue requirement for each year for the Water Utility. Produced a final rate design consistent with the Court Order.
 - Developed a model of the major water resources facilities in the Passaic, Pompton, Ramapo and Hackensack River Basins that allows the calculation of the safe and dependable yield of the Wanaque/Monksville, Point View and Oradell Reservoir systems under varying drought conditions. The model is being used by Passaic Valley Water Commission to evaluate long-term water supply management strategies and to plan for future water supply needs.
 - Assisted New York City Department of Environmental Protection in compiling a report on the estimated safe yield of the City water supply reservoir system. A current assessment of safe yield was required by agreement of the Parties to the 1954 US Supreme Court Decree governing the use and export of water from the Delaware River Basin. Provided additional consulting assistance on plans to assure system reliability during planned repairs to the Roundout-West Branch Tunnel, an aqueduct that transports up to 800 million gallons of water per day to the City from the Delaware Basin reservoir system.
 - Developed an analysis of the costs of the Hickory Log Creek Reservoir and the yield sharing arrangements between the City of Canton and the Cobb County-Marietta Water Authority. Developed recommended methods to assess the impact of US Army Corps of Engineers operating policies on future operating and capital cost allocations.
 - Prepared a long-range water supply needs forecast for the Passaic Valley Water Commission. Analyzed water use patterns within the Commission's retail service area and for over two-dozen large contract customers. Produced population forecasts for the service area and individual water demand forecasts for each contract sale-for-resale customer using statistical and numeric forecasting techniques. The forecast projects total annual demand, average day, maximum month and maximum day

ACCOMPLISHMENTS (CONTINUED)

- demands and forms the basis for other ongoing facility and operations planning efforts.
- Prepared a long-range water supply needs forecast for the North Wales Water Authority. Analyzed water use patterns within the Authority's retail service and identified the water supply requirement for the Authority's share in a regional water supply system. Produced customer forecasts for the service area and individual water demand forecasts for large industrial customers and existing and potential wholesale water customers. Applied statistical and numeric forecasting techniques to assess trends in unit water use for each customer class. The forecast projects total annual demand, average day, maximum month and maximum day demands and forms the basis for other ongoing facility and operations planning efforts.
 - Developed a Water Allocation Permit renewal and extension application for the Passaic Valley Water Commission. Secured a new 25-year permit for the diversion of surface water from the Pompton and Passaic Rivers. The new water diversion permit for the Commission supports more flexible operations and more efficient source utilization. The Commission serves a retail service population of 325,000 and effectively serves an additional 260,000 people through sale-for-resale connections.
 - Prepared a cost of service allocation study for Passaic Valley Water Commission, a regional water system that serves a large urban retail service population and a significant outlying area through direct retail and wholesale water sales. Allocated costs based on standard methodologies to Owner Cities, External Cities Retail and Wholesale classes of service. The Commission has annual revenues in excess of \$71 million.
 - Prepared a cost of service allocation study for three Pennsylvania Municipal Utilities Authorities considering a joint water supply expansion project. Evaluated and allocated anticipated construction and operating costs for the plant expansion and assigned costs of existing facilities using a commodity-demand allocation method. Developed a recommended tariff design to allow for the fair recovery of prospective costs associated with the expanded facilities.
 - Prepared a cost allocation study and tariff design study for Bedminster Municipal Utilities Authority. The study developed an integrated five-year financial plan for the Authority and allocated the revenue requirement among water and sewer services. Rates were developed to allow the Authority to properly recover costs from its various water and sewer customer classes.
 - Developed a commercial rates study for Whitemarsh Township Authority that resulted in the modernization of the Authority's commercial rate structure. A system comprised of 33 different rate costs was replaced with a uniform rate structure including a fixed service charge based on water meter capacity ratios and volumetric changes for the quantity of water actually used.
 - Developed a residential rates study for Whitemarsh Township Authority that evaluated the cost/benefits of converting a fixed-rate EDU tariff to a volumetric tariff. Developed recommendations for new rates for the ensuing five-years.

ACCOMPLISHMENTS (CONTINUED)

- Developed an initial tariff study for Branchville Borough. The Borough had constructed a new community sanitary sewer system to replace hundreds of on-lot disposal systems and small, individual wastewater treatment systems located throughout the Borough. Using engineer's estimates of operating costs, developed a total revenue requirement and allocated that revenue requirement to three classes of customer service. Developed an initial rate structure designed to recover the projected full revenue requirement.
- Prepared a cost of service allocation study for Southeast Morris County Municipal Utilities Authority, a regional water system that serves a suburban retail service population and several wholesale water customers. Allocated costs based on standard methodologies to various classes of residential, commercial industrial and wholesale service. Developed a plan to move each service class to full-cost pricing over time.
- Developed a five-year comprehensive business plan for Passaic Valley Water Commission. This plan moved the Commission from an annual operating budget to a five-year budget that links operating costs, capital construction and debt service requirements to customer growth and revenue requirements and rates. The plan was instrumental in obtaining an improved bond rating and positioning the Commission to undertake a major capital improvement program.
- Developed a five-year comprehensive business plan for the North Wales Water Authority. This plan established a rolling five-year operating and capital budget that links operating costs, capital construction and debt service requirements to customer growth and revenue requirements and rates. The plan was instrumental in maintaining current rates while also maintaining the Authority's AA bond rating.
- Served as an expert witness in an arbitration involving a dispute between a New Jersey municipal water department and A.C. Schultes, Inc., a well contractor. Assisted A.C. Schultes in supporting its claim for a contract modification and the recovery of unanticipated expenses. The arbitrator awarded the contractor 100% of its cost claim.
- Served as an expert witness in a matter involving the alleged contamination of a New Jersey municipal water system with heavy metals and organic chemicals. Reviewed over 38,000 discrete water quality sample results, analyzed the operational records of the system and developed a computer model (EPANET2) depicting water flow and water quality changes over a period spanning two decades. Assisted the client in successfully defeating a threatened class action lawsuit at the certification level.
- Served as an expert witness in a matter involving the alleged contamination of nearly 600 private wells in an area near Fairbanks, Alaska. Evaluated alternatives for the provision of alternate water supplies including the extension of an investor-owned water system, a publicly-owned water system, and a variety of on-site treatment and supply options. Assisted in the defense of the former owner of the site where the contamination was later alleged to have originated.

ACCOMPLISHMENTS (CONTINUED)

- Served as a mediator involving a dispute between the Long Beach Township Water Department and Don Siegel Construction Co., Inc., a pipeline installation contractor. Assisted the parties in resolving various construction cost claims and in interpreting the contract construction documents. Litigation over the disputes was avoided.
- Assisted a regional developer in obtaining wastewater planning approval for a project in an area determined to be in an “overload” condition by Pennsylvania DEP. This effort required the facilitation of negotiations between regional wastewater entities for wastewater conveyance and treatment services, expert consulting with a municipality and PA DEP concerning the municipality’s update to its Act 537 facilities plan, and coordination with other engineering consultants to secure final permit approvals.
- Developed a review of alternatives for the renovation or replacement of the Ridge Road Reservoir for Perkasio Regional Authority. Analyzed alternatives for reconstructing or replacing an in-ground water distribution reservoir. Developed a scope of services for a site geotechnical evaluation and assessed the potential cost of various renewal strategies.
- Reviewed engineering plans and operational practices in numerous water and wastewater rate adjustment proceedings and quality of service proceedings for the New Jersey Division of Rate Counsel. Assessed utility engineering design and construction plans, developed alternatives to utility proposed projects, and evaluated the utility companies' ability to render safe, adequate and proper water or wastewater service. Provides expert testimony in the following utility rate, franchise expansion and service quality proceedings:
 - Acacia Lumberton Manor Fire Service Complaint BPU
Docket No. WC01080495
 - Andover Utility Company
BPU Docket WR17070726
 - Applied Waste Water Management Rates
BPU Docket No. WR03030222
 - Applied Waste Water Management Base Rates
BPU Docket No. WR08080550
 - Applied Waste Water Management Franchise
BPU Docket No. WE03070530
 - Applied Waste Water Management Andover Franchise
BPU Docket No. WE04111466
 - Applied Waste Water Management Hillsborough Franchise
BPU Docket No. WE04101349
 - Applied Waste Water Management Oakland Franchise
BPU Docket No. WE04111467
 - Applied Waste Water Management Union Twp Franchise
BPU Docket No. WE050414
 - Applied Waste Water Management Tewksbury Franchise
BPU Docket No. WR08100908

ACCOMPLISHMENTS (CONTINUED)

- Aqua NJ Freehold Franchise Extension Review
BPU Docket WE09120965
- Aqua NJ Pine Hill Franchise
BPU Docket No. WE05070581
- Aqua NJ Upper Freehold Franchise
BPU Docket No. WE05100822
- Aqua NJ Readington Wastewater Franchise
BPU Docket No. WE07030224
- Aqua New Jersey Base Rate Case
BPU Docket No. WR07120955
- Aqua New Jersey Acquisition of Bloomsbury Water
BPU Docket WE09050360
- Aqua New Jersey Acquisition of Harkers Hollow Water
BPU Docket WM09020119
- Aqua New Jersey Base Rate Adjustment
BPU Docket No. WR09121005
- Aqua New Jersey Base Rate Adjustment
BPU Docket No. WR11120859
- Aqua New Jersey Base Rate Adjustment
BPU Docket WR14010019
- Aqua New Jersey Base Rate Adjustment
BPU Docket WR18121351
- Aqua New Jersey DSIC Foundational Filing
BPU Docket No. WR12070685
- Aqua New Jersey Byram Franchise & Acquisition
BPU Docket No. WE15080957
- Aqua New Jersey Cliffside Park Acquisition
BPU Docket No. WE16040307
- Aqua New Jersey Acquisition of Oakwood Village
BPU Docket WM16080739
- Aqua New Jersey Base Rate Adjustments
BPU Docket No. WR16010089
- Aqua NJ Distribution System Improvement Charge
Foundational Filing
BPU Docket No. WR16010090
- Atlantic City Sewerage Company Base Rate Adjustment
BPU Docket No. WR09110940
- Atlantic City Sewerage Company Base Rate Adjustment
BPU Docket WR11040247
- Atlantic City Sewerage Company Base Rate Adjustment
BPU Docket WR14101263
- Bayonne MUA – United Water NJ/ Kohlberg, Kravis, Roberts Joint
Venture Operations & Financing Agreement
BPU Docket No. WM12080777

ACCOMPLISHMENTS (CONTINUED)

- Bayview Water Company Rates
BPU Docket No. WR01120818
- Camden and United Water Environmental Services,
Inc. Management Services Agreement Modifications
BPU Docket No. WM12050457
- Borough of Haledon Rates
BPU Docket No. WR01080532
- City of Orange Privatization Review
BPU Docket No. WO03080614
- Crestwood Village Loan Approval
BPU Docket No. WF04091042
- Crestwood Village Water Co Base Rates
BPU Docket No. WR07090706
- Elizabethtown Water Co. v. Clinton Board of Adjustment
BPU Docket No. WE02050289
- Elizabethtown Water Company Rates
BPU Docket No. WR03070510
- Elizabethtown Water Company Franklin Franchise
BPU Docket No. WE05020125
- Elizabethtown Water Company Purchased Water Adjustment Clause
BPU Docket No. WR04070683
- Environmental Disposal Corporation Main Extension Agreement
BPU Docket No. WO04091030
- Environmental Disposal Corporation Rates
BPU Docket No. WR04080760
- Environmental Disposal Corporation Rates
BPU Docket No. WR07090715
- Environmental Disposal Corporation Change in Control
BPU Docket No. WM15040492
- Fayson Lake Water Company Rates
BPU Docket No. WR03040278
- Fayson Lake Water Company Base Rates
BPU Docket No. WR07010027
- Fayson Lake Water Company Base Rates
BPU Docket WR14050405
- Fayson Lake Water Company Base Rates
BPU Docket WR17101041
- Gordon's Corner Water Company Rates
BPU Docket No. WR03090714
- Gordons Corner Water Co Base Rate Adjustment
BPU Docket No. WR10060430
- Gordons Corner Water Co Base Rate Adjustment
BPU Docket No. WR12090807

ACCOMPLISHMENTS (CONTINUED)

- Gordons Corner Water Co Base Rate Adjustment
BPU Docket WR14040325
- Gordons Corner Water Co Base Rate Adjustment
BPU Docket WR18030268
- Jensens Deep Run Franchise Transfer
BPU Docket No. WE10070453
- Lake Valley Water Company Rates
BPU Docket No. WR04070722
- Mahwah Tank Maintenance Privatization
BPU Docket No. WO15050548
- Middlesex Water Company Rates
BPU Docket No. WR03110900
- Middlesex Water Company Rates
BPU Docket No. WR05050451
- Middlesex Water Company Base Rates
BPU Docket No. WR07040275
- Middlesex Water Co Transmission Main Prudency Review
BPU Docket No. WO08020098
- Middlesex Water Company Base Rates
BPU Docket No. WR09080666
- Middlesex Water Company DSIC Foundational Filing
BPU Docket No. WR12111021
- Middlesex Water Company Base Rates
BPU Docket No. WR12010027
- Middlesex Water Co DSIC Foundational Filing
BPU Docket No. WR14050508
- Middlesex Water Company Base Rate Adjustment
BPU Docket No. WR15030391
- Middlesex Water Company Base Rate Adjustment
BPU Docket No. WR17101049
- Montague Water Company Rates
BPU Docket No. WR03121034
- Montague Sewer Company Rates
BPU Docket No. WR03121035
- Montague Sewer Company Rates
BPU Docket No. WR05121056
- Montague Water Company Acquisition
BPU Docket No. WM10060432
- Montague Water & Sewer Company Rates
BPU Docket No. WR12110983
- Mount Holly Water Company Rates
BPU Docket No. WR03070509
- Mount Olive Villages Water & Sewer Franchise
BPU Docket No. WE03120970

ACCOMPLISHMENTS (CONTINUED)

- Mount Olive Villages Sewer Base Rate Adjustment
BPU Docket No. WR16050391
- Mount Olive Villages Water Base Rate Adjustment
BPU Docket No. WR16050390
- New Jersey American Water Company Rates
BPU Docket No. WR03070511
- New Jersey American Water Company Rates
BPU Docket No. WR06030257
- New Jersey American Water Acquisition of Mt. Ephraim and Approval of Municipal Consent
BPU Docket No. WE06060431
- New Jersey American Water Purchased Water Adjustment Clause
BPU Docket No. WR05110976
- New Jersey American Water Company – Mantua Franchise
BPU Docket No. WE07060372
- New Jersey American Water Co – Rocky Hill Franchise
BPU Docket No. WE07020103
- New Jersey American Water Company Rates
BPU Docket No. WR08010020
- New Jersey American Hopewell Township Franchise
BPU Docket No. WE07120981
- New Jersey American Water Co/City of Trenton
Joint Petition for Approval of the Sale of Water System
BPU Docket No. WE08010063
- New Jersey American Water Company Petition for Approval of a
Distribution System Improvement Charge (DSIC)
BPU Docket No. WO08050358
- New Jersey American Water Co Management Audit
BPU Docket No. WA09070510
- New Jersey American Water Base Rate Adjustment
BPU Docket No. WR10040260
- New Jersey American Water Company Franklin Franchise Review
BPU Docket No. WE11070403
- New Jersey American Water Company Base Rate Adjustment
BPU Docket No. WR11070460
- New Jersey American Water Company Base Rate Adjustment
BPU Docket No. WR15010035
- New Jersey American Water Company DSIC Foundational Filing
BPU Docket No. WR15060724
- New Jersey American Water – Eastampton Franchise Review
BPU Docket No. WE17020139
- New Jersey American Water – Shorelands Water Co Acquisition
BPU Docket No. WM16101036

ACCOMPLISHMENTS (CONTINUED)

- New Jersey American Water Co Howell Franchise Review
BPU Docket No. WE17111148
- New Jersey American Water Base Rate Adjustment
BPU Docket No. WR17090985
- New Jersey American Water Acquisition of Mt. Ephraim Sewer
BPU Docket WM19010117
- New Jersey Natural Gas Rates
BPU Docket No. GR07110889
- Oakwood Village Sewer Change in Control
BPU Docket No. WM07070535
- Oakwood Village Sewer System Change in Control
BPU Docket No. WM15091006
- Parkway Water Company Rates
BPU Docket No. WR05070634
- Pinelands Water Company Rates
BPU Docket No. WR03121016
- Pinelands Wastewater Company Rates
BPU Docket No. WR03121017
- Pinelands Water Company Rates
BPU Docket No. WR08040282
- Pinelands Wastewater Company Rates
BPU Docket No. WR08040283
- Pinelands Water Company Rates
BPU Docket No. WR120807342
- Pinelands Wastewater Company Rates
BPU Docket No. WR12080735
- Pinelands Water Company Rates
BPU Docket No. WR15101200
- Pinelands Wastewater Company Rates
BPU Docket No. WR15101202
- Pinelands Water Company Rates
BPU Docket No. WR19030417
- Pinelands Wastewater Company Rates
BPU Docket No. WR19030418
- Rahway Operational Services Agreement Review
BPU Docket No. WO16070678
- Rock GW, LLC Determination of Applicability of Board Regulation
BPU Docket No. WO08030188
- Rock GW, LLC Determination of Applicability of Board Regulation
BPU Docket No. WO10100739
- Roxbury Water Company Rates
BPU Docket No. WR09010090
- Roxciticus Water Company Change in Control
BPU Docket No. WM15080982

ACCOMPLISHMENTS (CONTINUED)

- SB Water & Sewer Company Acquisition
BPU Docket No. WM16030197
- Seabrook Water Company Franchise
BPU Docket No. WC02060340
- Seaview Harbor Water Company Change in Control
BPU Docket No. WM13100957
- Shorelands Water Company Rates
BPU Docket No. WR04040295
- Shorelands Water Company Base Rates
BPU Docket No. WR10060394
- Shore Water Company Rates
BPU Docket No. WR09070575
- South Jersey Water Supply Change in Control
BPU Docket No. WM07020076
- Suez Arlington Hills Wastewater Rates
BPU Docket No. WR16060510
- Suez Water NJ DSIC Foundational Filing
BPU Docket No. WR13030210
- Suez Water NJ Borstad Water Company Acquisition
BPU Docket No. WE15111247
- Suez Water New Jersey Base Rate Adjustment
BPU Docket No. WR15101177
- Suez Water Toms River Base Rate Adjustments
BPU Docket No. WR15020269
- Suez Water Toms River DSIC Foundational Filing
BPU Docket WR13111128
- Suez Water NJ – USG Cottonwood Agreement
BPU Docket No. WR15070856
- Suez Water NJ Electrical Efficiency Contract Eval.
BPU Docket No. WO17050494
- Suez Water Princeton Meadows Deferred Accounting
BPU Docket WF17030186
- SUEZ Water NJ Acquisition of West Milford MUA
BPU Docket WM17111189
- SUEZ Water NJ Base Rate Adjustment
BPU Docket WR18050593
- SUEZ Water NJ Acquisition of Independence MUA
BPU Docket WM18010008
- SUEZ Water NJ Acquisition of West Milford MUA
BPU Docket WM17111189
- SUEZ Water NJ Acquisition of East Brookwood
BPU Docket WM18040449
- United Water Acquisitions Evaluation
BPU Docket No. WM02060354

ACCOMPLISHMENTS (CONTINUED)

- United Water Arlington Hills Franchise
BPU Docket No. WE07020084
 - United Water Arlington Hills Sewerage Base Rates
BPU Docket No. WR08100929
 - United Water New Jersey Base Rates
BPU Docket No. WR07020135
 - United Water New Jersey Base Rates
BPU Docket No. WR08090710
 - United Water New Jersey Base Rates
BPU Docket No. WR11070428
 - United Water New Jersey DSIC Foundational Filing
BPU Docket No. WR12080724
 - United Water New Jersey Management Audit
BPU Docket: WA05060550
 - United Water New Jersey Affiliate Transaction Review – JPI Painting
BPU Docket No. WO10060410
 - United Water New Jersey Affiliate Transaction
Review – Utility Service Contract
BPU Docket No. WO10060409
 - United Water New Jersey Mt Arlington Franchise
Extension Review
BPU Docket No. WE09121006
 - United Water New Jersey Vernon Township Franchise
Extension Review
BPU Docket WE10110870
 - United Water New Jersey Vernon Township Franchise
Extension Review
BPU Docket WE11030155
 - United Water Great Gorge/Vernon Sewer Base Rates
BPU Docket No. WR10100785
 - United Water Toms River Base Rates
BPU Docket No. WR080830139
 - United Water Toms River Base Rates
BPU Docket No. WR12090830
 - United Water West Milford Sewerage Base Rates
BPU Docket No. WR08100928
 - Village Utility Inc Franchise and Initial Tariff
BPU Docket 180808926
-
- Assisted the New Jersey Division of Rate Counsel in assessing drought conditions effecting water utilities in New Jersey during the 2002 drought. Analyzed proposals for water supply interconnections to mitigate drought impacts, developed position statements regarding pricing alternatives, and provided a critique of State water supply management initiatives prior to and during drought conditions.

ACCOMPLISHMENTS (CONTINUED)

- Assisted the New Jersey Division of Rate Counsel in assessing the need for a Distribution System Improvement Charge (DSIC) to allow regulated water utilities to accelerate the recovery of capital investments in water distribution assets (BPU Docket WO10090655). Provided financial analyses of current and prospective distribution renovation programs. Reviewed and commented on draft language for a generic rule making.
- Assisted the Delaware Public Advocate in assessing drought conditions effecting water utilities in northern New Castle County during the 2002 drought (PSC Docket No. 323-02). Reviewed water utility operations prior to and during the drought emergency, assessed the effectiveness of use curtailments, developed recommendations to assure proper, cost-effective resources management for future drought conditions.
- Assisted the Delaware Public Service Commission in a determination of rate base for Artesian Water Company in PSC Docket 08-96. Evaluated selected plant facilities and proposed projects to determine the need to impute revenues for under-utilized facilities in establishing new base rates.
- Assisted the Delaware Public Service Commission in an evaluation of the Initial Tariff filing submitted by Tidewater Environmental Services, Inc. (PSC Docket No. 11-274WW) for wastewater service in a development known as "The Ridings." Evaluated projected operating expenses and rate base claims and developed recommendations that avoided a potential 17.5% rate increase.
- Prepared an assessment of the water supply capacity certification and water conservation plan submitted by United Water Delaware in PSC Docket 09-282 on behalf of the Delaware Public Service Commission. Evaluated the capacity of the sources of supply available to the Company with respect to projected demands and the requirements of the Delaware Water Supply Self-Sufficiency Act of 2003. Assessed the effectiveness of water conservation activities and developed recommendations to improve the efficiency and effectiveness of Company conservation programs.
- Provided expert testimony on behalf of the Delaware Public Advocate in the matter of Inland Bays Preservation Company's request for an increase in wastewater rates before the Delaware Public Service Commission (PSC Docket No. 09-327-WW). Evaluated plant facilities, proposed projects and the allocation of developer contributions in aid of construction to determine rate base. Assessed the level of operating expenses claimed in the filing and recommended adjustments to substantially lower the requested rate increase.
- Provided expert testimony on behalf of the Delaware Public Advocate in the matter of Tidewater Environmental Services, Inc.'s request for a base rate adjustment for seven of its regulated wastewater utility systems (PSC Docket No. 11-329WW). Established independent revenue requirements for each system to assure that costs and rates were properly matched for each independent group of customers served by the Company. Recommended an overall rate adjustment that was equivalent to

ACCOMPLISHMENTS (CONTINUED)

- 60% of the initial rate request and was within 12% of the final Ordered rates in this matter.
- Provided expert testimony on behalf of the Delaware Public Advocate in the matter of Tidewater Utilities, Inc.'s request for a base rate adjustment for its regulated water systems throughout Delaware (PSC Docket 13-466). Provided testimony on engineering and accounting issues related to the determination of the Company's revenue requirement that resulted in a rate settlement equivalent to twenty percent of the Company's filed rate request.
 - Prepared a tariff design evaluation for the Pequannock River Basin Regional Sewer Authority to assess alternative rate structures for service to regional participating municipalities. Evaluated current budgeting and billing systems and alternatives to equitably allocate regional system costs to the participating municipalities.
 - Provided expert testimony on behalf of the Village of Ridgewood Water Utility in a dispute regarding the regional allocation of costs to retail customers serviced beyond the corporate boundaries of the Village. Reviewed historical budgets and actual financial results, developed revised and updated cost allocations for shared services and provided recommendations on retail rates charged within and outside of the Village.
 - Provided expert advice to the Borough of Ridgefield regarding the failure of a 36-inch diameter PCCP water main owned by an investor-owned utility. Assisted the Borough in negotiating a suitable restoration and replacement plan and in negotiations for the recovery of damages resulting from the break.
 - Provided expert testimony on behalf of the Township of Newtown before the Pennsylvania Public Utility Commission (PUC Dkt. No. P-2012-2327738) in regard to a dispute between the Township and Newtown Artesian Water Company regarding the siting of a proposed new well. Evaluated current and future water supply needs, water quality and treatment needs and the revenue requirement of the proposed project relative to other alternatives.
 - Managed 175 municipal and commercial water and wastewater contracts located in seven states for American Water Services/AmericanAnglian Environmental Technologies. Through these contracts, cost effective water and wastewater service was provided to over one million people. Contracts included the 160 MGD City of Buffalo, NY water system and the 30 MGD Scranton Sewer Authority wastewater operations. Directed an operations staff of 700 employees. Eliminated financial losses while improving safety and quality.
 - Directed a marketing and business development staff for AmericanAnglian Environmental Technologies that secured the largest operations and maintenance contract awarded in the US in 1999 and the second best overall performance in the US market. Increased revenues by 28%. Evaluated potential contract operations and design/build projects to identify operating and capital savings on hundreds of potential contracts throughout the United States. Evaluations included Atlanta, Georgia, Scranton, Pennsylvania and Springfield, Massachusetts.

ACCOMPLISHMENTS (CONTINUED)

- Managed the operations of 16 water systems for New Jersey-American Water Company, a regulated investor-owned utility serving one million people throughout NJ. Coordinated the activities of a decentralized operations staff of 440 to provide reliable water service, ensure environmental compliance, control costs, manage and maintain system assets, reduce liability, provide site security and maintain a safe work place, and meet financial objectives. Responsible for the maintenance and operation of all source of supply, treatment, filtration and storage facilities, producing and distributing between 100 MGD and 220 MGD, as well as over 4,000 miles of water transmission and distribution facilities.
- Directed a team of engineering, legal, public relations and financial professionals that planned, designed, permitted and constructed a \$192,000,000 water treatment plant and pipeline system for New Jersey-American Water Company. The intake, constructed in environmentally sensitive areas and the state of the art water filtration plant can be expanded to produce 100 MGD. The project is the principal source of surface water for nearly one million people in southern New Jersey and it was built to allow new regulatory controls on ground water use to go into effect. The project was completed within budget and on schedule.
- Developed the financial model and contract language that allowed water lines to be extended to over 3,000 homes with contaminated private wells in Atlantic County, New Jersey. This program provided the financial assurances needed to construct several miles of water mains, eliminate federal tax liability and reduce costs by 34%.
- Initiated and directed the first study of desalination for public water supply purposes in NJ for the City of Cape May. This project evaluated two desalination technologies and demonstrated that reverse osmosis could be used effectively to treat brackish water at a competitive cost. A full-scale plant has since been placed in service.
- Developed long-range regional water supply plan for Monmouth County, New Jersey, a county that was adding as many as 1,000 water utility customers per year and seriously stressing the water supply. The plan evaluated alternative sources of water, conservation and regional reservoir development. The recommendations avoided \$30,000,000 in capital construction while ensuring a safe supply of water for a 15-year planning period. Negotiated supply sharing operating agreements with the New Jersey Water Supply Authority to implement the plan.
- Directed a staff of engineers and consultants in preparing comprehensive plans for 60 water systems located throughout the United States. Communities served by these systems include: Pittsburgh, Pennsylvania and its surrounding suburbs; Charleston, West Virginia; Richmond, Indiana; E. Saint Louis, Illinois and Monterey, California. Evaluated alternatives and identified the least costly means of providing safe water service for each system. Assessed operations strategies to identify external threats

ACCOMPLISHMENTS (CONTINUED)

- to the reliability and efficiency of these systems. Identified specific capital facility needs and operations strategies for five, ten and fifteen year planning horizons, defined the long term role of each system in prompting regional water supply development, and assessed the impact of future State and Federal water quality regulations on system operations and needs.
- Developed a formula for allocating ground water to 30 water suppliers in southern New Jersey for the New Jersey Department of Environmental Protection and negotiated an implementation agreement with effected suppliers. The New Jersey Legislature adopted the formula in the Water Supply Management Act Amendments of 1992. The allocation formula protects a regional aquifer from over-pumping.
 - Developed a plan to convey storm water through a sixty-foot high railroad embankment in Prince Georges County, Maryland. Evaluated alternative methods and selected one that allowed an existing culvert to be modified to carry higher flow rates. Saved over \$500,000 in construction costs. The Washington Suburban Sanitary Commission and Prince Georges County adopted the design as a standard in their storm water design manual.
 - Negotiated Lakewood, New Jersey's first three-year water and wastewater labor agreement in the face of an impending strike, departing from prior history of year-to-year contract agreements.
 - Provided expert testimony in judicial proceedings involving utility rate adjustments before the New Jersey Board of Public Utilities, the Connecticut Department of Public Utility Control and the New York Public Service Commission. Testified on environmental and operations topics including: rate setting strategies, source of supply improvements, water resources management, treatment to mitigate contamination, staffing levels and operating practices. Testified as to the least costly means of operating and maintaining water and wastewater facilities.
 - Served as a gubernatorial appointee to the New Jersey Water Supply Advisory Council under Governors Florio and Whitman. Advised the NJ Department of Environmental Protection on a variety of water resources management issues.
 - Coordinated the response to an outbreak of giardiasis for the US Environmental Protection Agency. The outbreak affected 20% of the people served by a municipal water system in north-central Pennsylvania. Specified immediate control measures, short-term treatment techniques and long-term treatment improvements to resolve the immediate problem and prevent a recurrence.

AWARDS

John J. Gallen Memorial Award presented by the Villanova University College of Engineering (1988) in recognition of many significant achievements in the field of water supply and distribution, effective leadership in developing regional water supply systems and contributions in the development of comprehensive plans for water supply systems.

George Warren Fuller Award presented by the American Water Works Association (2013) for distinguished service to the water supply field in commemoration of the sound engineering skill, brilliant diplomatic talent and constructive leadership which characterized the life of George Warren Fuller.

REPRESENTATIVE CLIENTS

- A.C. Schultes, Inc.
- Aquarion Water Company of Connecticut
- Aquarion Water Company of Massachusetts
- Atlantic City Municipal Utilities Authority
- Bethlehem Water Authority
- BOC Gases
- Bucks County Water & Sewer Authority
- Camco Management
- Cedar Grove Township
- Consumers New Jersey Water Company
- Delaware Public Advocate
- Delaware Public Service Commission
- D. R. Horton – New Jersey
- Elmira Water Board
- Erie City Water Authority
- Greater Ouachita Water Company
- Harris Defense Group
- Jersey City Municipal Utilities Authority
- Lower Makefield Township
- New Jersey-American Water Company
- New Jersey Division of Rate Counsel
- New Jersey Water Supply Authority
- New York City Department of Environmental Protection
- North Penn Water Authority
- North Wales Water Authority
- Passaic Valley Water Commission
- Pequannock River Basin Regional Sewerage Authority
- Perkasio Borough
- Perkasio Borough Authority
- Pricewaterhouse Coopers, LLP
- Southeast Morris County Municipal Utilities Authority
- Sussex Shores Water Company
- Township of Sparta (NJ)
- U.S. Water, LLC
- Upper Dublin Township
- Village of Ridgewood (NJ)
- Williams Alaska Resource

PROFESSIONAL QUALIFICATIONS

Registered Professional Engineer in Delaware (2004), Maryland (1982), New Jersey (1984), New Mexico (1987), New York (1984) and Pennsylvania (1983).

Licensed to complete RAM-W vulnerability assessments (2002).

PROFESSIONAL ASSOCIATIONS

American Society of Civil Engineers, American Water Works Association (Trustee of New Jersey Section), American Water Resource Management Association, International Water Association, National Ground Water Association, National Fire Protection Association, Water Environment Federation, Tau Beta Pi.

PROFESSIONAL HISTORY

HOWARD J. WOODS, JR. & ASSOCIATES, LLC General Manager	2000 - Present
AMERICAN WATER WORKS COMPANY American Water Services, Inc. Senior Vice President - Operations	1983 - 2000 1999 - 2000
American Anglian Environmental Tech., L.P. Senior Vice President - Business Development	1998 - 1999
American Water Works Service Co. Vice President - Special Projects	1997 - 1998
New Jersey-American Water Co., Inc. Vice President - Operations	1989 - 1997
American Water Works Service Co. Engineering Manager	1988 - 1989
System Director of Planning	1986 - 1988
Division Manager of Operations	1984 - 1986
Division Director of Engineering	1983 - 1984
JOHNSON, MIRMIRAN & THOMPSON Project Engineer	1981 - 1983
U.S. ENVIRONMENTAL PROTECTION AGENCY Environmental Engineer	1977 - 1981

CONTACT INFORMATION

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