EVALUATION OF REAL WATER LOSS CONTROL AND WATER CONSERVATION OPTIONS FOR SUEZ WATER NEW YORK-ROCKLAND COUNTY

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ES EXECUTIVE SUMMARY

Scenic Hudson, Riverkeeper, and the Rockland Water Coalition commissioned this report to evaluate the real water loss control and water conservation programs that Suez Water New York (SWNY) has proposed as a part of its rate filing before the New York State Public Service Commission (PSC) (Case 16-W-0130). The goal of the evaluation is to assess projected costs and performance within the context of national trends and program performance. Based upon those national trends, AIQUEOUS has recommended modifications to SWNY's proposed programs that would more than double water savings and cost-effectiveness, with only minor increases to overall program costs.

ES.1 AIQUEOUS

AIQUEOUS is a water sector software and consulting firm headquartered in Austin, Texas, using cloud technology to help utilities work with customers and contractors to manage their systems. Jonathan Kleinman, President, has 6 years' experience in the water sector and 15 years' experience in the energy conservation / energy efficiency sector. In his energy efficiency experience, Mr. Kleinman has supported many investor-owned utilities across the United States and Canada in the design, implementation, and regulatory reporting of their energy efficiency programs. He has also evaluated energy efficiency potential for the New York State Energy Research and Development Authority (NYSERDA), New York Power Authority (NYPA), and Long Island Power Authority (LIPA).

ES.2 PROPOSED PROGRAMS

As a part of its rate filing currently under review by the PSC, SWNY has proposed to undertake a series of projects and programs to reduce its total water demand by an average of two million gallons per day (MGD), one million MGD from real water loss control and slightly more than one million MGD from a water conservation program portfolio, from 2017-2021. SWNY has estimated the cost of real water loss reduction at $24 million per MGD, and of water conservation at $7 million per MGD. Table ES-1 compares these two programs with other supply-side options as quantified by SWNY.

Table ES-1. Comparison of cost-effectiveness data across supply, system efficiency, and demand management

Project Type	Capital Cost	Other Costs	Total Lifetime Cost
New Supply Wells	$12 million per MGD. Potentially higher costs if treatment needed	$4.8 million per MGD over 20 years	$16.8 million per MGD over 20 years
Water Conservation	$0	$7 million per MGD over 5 years	$7 million per MGD over 5 years
Indirect Reuse	$85 million per MGD	[Not referenced]	[Not referenced]
Direct Reuse – Reclaimed Wastewater	$32 million per MGD	[Not referenced]	[Not referenced]
Interconnection Improvements	$7.8 million per MGD		$7.8 million per MGD
AMI/DMA	$24 million		$24 million per MGD

SWNY's proposed approach to reducing non-revenue water (NRW) and controlling real water losses in its service territory consists of the deployment of Advanced Metering Infrastructure (AMI), District Meter Areas (DMA), and Pressure Reduction Management (PRM), as well as the hiring of an NRW Manager and increasing its main replacement rate from 0.24% to 0.7%. AIQUEOUS believes that the cost-effectiveness of SWNY's proposed real water loss control program needs to be recalculated because AMI yields other benefits that cover the cost of the AMI investment. For example, SWNY's recent "test year" NRW level of 24.55% and assumption that 40% of NRW is apparent losses translates into apparent loss levels of around 3 MGD or 10% of the total system. Reducing apparent losses by 50% could result in revenue increases of 5%, or roughly $4 million annually. Additionally, AMI can reduce billing costs by $5 per customer per month, or roughly $4.4 million. Given the potential savings, both real water loss and conservation savings benefits for AMI can be captured at "zero net cost" for the AMI system. Real water loss reduction costs, therefore, should consist of DMA, PRM, the increase of the main replacement rate, and any leak repair efforts.

SWNY also commissioned Black & Veatch (B&V) to develop its Water Conservation Plan, finalized in April 2016. B&V analyzed water consumption by single family, multifamily, commercial and institutional, and industrial sectors, and also reviewed consumption information in different geographic areas of the service territory. B&V also commissioned a survey of a sample of single family residential customers in an effort to understand market saturation of residential fixtures, and also behaviors tied to indoor and outdoor water use. The proposed 5-year portfolio will deliver 0.68 MGD of water savings at a cost of $4.8 million, at an effective cost of $7 million per MGD. Using terminology from Case 07-M-0548 and the New York Evaluation Plan Guidance for EEPS Program Administrators, SWNY is proposing to meet a "gross" savings target of 1.04 MGD while achieving net savings of

0.68 MGD, with a "net-to-gross" ratio of 0.65.[1] (This is a relatively low net to gross ratio for an entire portfolio.) Table ES-2 presents the relative cost-effectiveness of each of the proposed rebate programs.

Table ES-2. Review of cost-effectiveness of water conservation plan program components

Sector	Program Component	5-Year Cost	Net Savings	Cost per MGD
Single Family Residential	SFR – H.E. Toilets Rebate	$1,211,426	0.076	$15,939,816
	SFR – H.E. Showerheads Rebate	$242,285	0.052	$4,659,327
	SFR – H.E. Washers Rebate	$247,437	0.013	$19,033,615
	SFR – H.E. Washer / Rain Barrel Promo	$95,918	-	N/A
Multi-Family Residential	MFR – H.E. Toilets Rebate	$404,273	0.062	$6,520,532
	MFR – H.E. Showerheads Rebate	$121,282	0.057	$2,127,754
	MFR – H.E. Washers Rebate	$53,903	0.029	$1,858,724
Commercial, Institutional, & Industrial	CII – Audit Program Rebate	$510,314	0.017	$30,018,471
	CIII – Urinal Rebate	$121,282	0.043	$2,820,512
	CII – H.E. Toilets Rebate	$303,135	0.258	$1,174,942
	CII – Spray Rinse Valve / Rebate	$53,903	0.070	$770,043

ES.3 COMPARISONS WITH INDUSTRY BENCHMARKS

AIQUEOUS conducted a literature review and contacted industry experts to collect information on NRW and water conservation portfolios both in the United States and internationally.

Tables ES-3 and ES-4 present the results of the literature review on water loss control programs. The literature review found, in general, that water loss control programs have not historically relied upon AMI deployment, but instead have focused on DMA and PRM, with implementation of continuous acoustic monitoring (CAM) or dedicated NRW staff teams. Available water loss control program cost data also highlight significantly lower costs than proposed by SWNY, on the order of $1 million to $1.5 million per MGD.

[1] The primary difference between net and gross savings stems from the concept of "freeridership." A freerider is a program participant who would have installed a water-conserving fixture in the absence of a program, and collects a rebate from that program while providing no incremental savings. Black & Veatch termed freeridership "baseline" conservation. A program that reports gross savings takes credit for freeriders, a program that reports net savings does not. By virtue of counting "baseline" conservation toward their 1 MGD water conservation target, SWNY claiming a gross savings basis.

Table ES-3. Strategies and Performance from Select Water Loss Control Programs.

Case Study	Population	Production (MGD)	% NRW or CARL	Strategy Type					% Reduction
				AMI	DMAs	CAM	PRM	Teams	
Salzburg, Austria	155,382	8.3			X	X			
De Watergroep, Belgium	2,860,000	112.5			X			X	
Dryanovo, Bulgaria	7,316	0.4	67.30%		X		X		37% reduction in NRW (loss reduction of 487,000 m3/yr)
Razgrad, Bulgaria			67.00%				X		
Pula, Croatia	75,000 / 175,000	6.2	23.00%		X	X	X	X	48.5% reduction in NRW since 2004
Lemesos, Cyprus	158,000	9.5			X	X	X	X	Between 2002 and 2007, leakage was reduced from 138 to 92 litres/connection/day, and ILI from was reduced from 2.66 to 1.96
VCS Denmark Odense, Denmark	160,000	6.6	4.50%		X		X		
Anglian Water, England	4,541,561	290.2					X		
Beaune, France	22,500			X	X	X			Beaune network efficiency increased by 11 points between 2010 and 2011.
Bordeaux, France	724,224	34.4	15.90%		X	X	X		NRW was reduced from 20.39% in 2009 to 18.56% in 2010 and finally 15.6% in 2011
Munich, Germany	1,500,000	65.9	12.60%						
Iren Emilia, Italy	475,000	32.2	19.00%		X				
Malta WSC, Malta	421,364	22.1	13.00%		X		X		
Lisbon, Portugal	564,000	74.4	4.70%		X	X	X	X	
Scottish Water, Scotland	5,116,705	481.8			X		X		Between 2006 and 2013, leakage was reduced from 1,104 Ml/d to 575 Ml/d in 2013 (a nearly 50% reduction)

Source: European Union, 2015

Table ES-4. Cost-Effectiveness of Comparable Water Loss Control Programs

Case Study	Cost per MGD	Strategies Deployed						
		AMI	DMAs	CAM	PRM	GIS	Teams	Notes
SFPUC	$597,377						X	Proactive leak detection and repair if real losses are valued at retail cost of water
Nashville Water Works	$432,724		Temporary				X	
CA DWR	$895,385						X	
Coatia: Pula	$1,310,327		[147]	Limited	Limited	X	X	48.5% reduction in NRW since 2004

Sources: European Union, 2015; Sturm and Thornton, 2007.

Table ES-5 presents the results of the literature review on water conservation portfolios. Because the comparison water systems do not evaluate their programs for freeridership, SWNY's portfolio cost should be estimated at a range of $4.6 - $7.0 million per MGD, depending upon whether the comparison portfolio cost-effectiveness is based upon gross or net savings. The analysis shows that SWNY's proposed water conservation program performance is more expensive than other jurisdictions achieving similar savings levels (e.g., Seattle, Denver), though on a gross savings basis SWNY's cost-effectiveness is comparable to Hillsborough County, FL and Tampa Bay, FL.

AIQUEOUS also reviewed data at the program level, identifying cost-effective program designs that could be offered in place of the more expensive programs in SWNY's proposed portfolio. More cost-effective program options include a CII rebate program and residential irrigation programs. The "program strategy" column, below, refers generally to both rebates and technical assistance (e.g., audits) in the residential and CII sectors, whether indoor (e.g., plumbing fixtures, process loads) or outdoor (e.g., irrigation).

Table ES-5. Water Conservation Program Performance and Cost-Effectiveness.

Utility Name	Sales (MGD)	Conservation Portfolio				Key Performance Indicators	
		Budget ($)	Savings (MGD)	Time Horizon	Program Strategy	% Savings	$/MGD
SWNY Water Conservation Plan*	30	$4,791,071	0.677 or 1.044	2017-2021	Fixture rebates Education ET landscape program	**2.2% or 3.4%**	**$7,076,914 or $4,606,799**
Seattle Public Utilities/Saving Water Partnership, WA	118.4	$10,683,000	3.21	2007 - 2010	Residential Indoor & Outdoor Commercial Indoor Education/awareness	**2.70%**	**$3,328,037**
Cary, NC	16.2	N/A	0.08	2009 - 2013	HET Rebate Program Turf Buy Back	**0.50%**	**N/A**
Denver Water, CO	180	$2,557,766	1.08	2014	Education & Outreach Rebates & Incentives	**0.60%**	**$2,363,916**
Hillsborough County, FL	N/A	$7,260,382	1.46	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor	**N/A**	**$4,972,864**
Tampa Water Department, FL	N/A	$2,684,722	0.63	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor	**N/A**	**$4,261,463**
St. Petersburg, FL	N/A	$4,420,604	2.11	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**N/A**	**$2,095,073**
Austin, TX	150.3	$15,200,541	2.68	2009 - 2011	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**1.80%**	**$5,669,157**
San Antonio Water System, TX	134	$9,250,000	1.95	2015	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**1.50%**	**$4,733,363**

* Note: for SWNY, the first savings value excludes free-ridership (i.e., net savings), the second value includes free-ridership (i.e., gross savings)

Conservation Program Sources: Saving Water Partnership (Seattle), 2006-2010; Town of Cary, 2008-2014; Denver Water, 2015; Tampa Bay Water Region (Hillsborough County, City of Tampa, and City of St. Petersburg), 2016; City of Austin, 2013-2014; and San Antonio Water System, 2015.

ES.4 SUMMARY OF RECOMMENDATIONS

AIQUEOUS recommends a set of modifications to SWNY's real water loss and water conservation programs to achieve greater savings more cost-effectively. These recommendations result in a total of 4.228 MGD in savings – an additional 2.18 MGD – for an incremental investment of approximately $2.5 million. AIQUEOUS also recommends the creation of a shareholder incentive structure for SWNY in the event of exceeding stated real water loss reduction and water conservation performance goals.

ES.4.1 NON-REVENUE WATER MANAGEMENT

In addition to SWNY's proposed deployment of AMI, DMA, and PRM, AIQUEOUS recommends the following additions and changes to the overall NRW Management program:

(1) Hiring an NRW Contractor - SWNY should secure a third-party vendor with the express objective of identifying leaks using DMA data, temporary acoustic monitoring networks, and manual acoustic detection techniques. AIQUEOUS recommends the allocation of $1.5 million for this effort during the first two years of AMI implementation. Based upon results elsewhere, this initiative should result in additional real water loss reduction of 1 MGD (beyond the proposed 1 MGD of real water loss savings).

(2) NRW Manager - AIQUEOUS suggests that the proposed NRW Manager position be filled by a mid- to senior-level staff person who would be effective at managing outside contractors, developing and submitting internal and external reports to key stakeholders, and representing NRW concerns and program performance within the SWNY organization.

(3) Water Main Replacement Rate - AIQUEOUS recommends that SWNY target an annual main replacement rate of 1% (or approximately 10 miles per year), given its average service life for cast iron pipes of 100 years. Additionally, because SWNY has been historically replacing mains at a rate of 0.24%, AIQUEOUS recommends an accelerated rate of 1.5% per year (15 miles) for the next 5 years.

(4) Regular Reporting and Performance Incentive – Starting in 2017, AIQUEOUS recommends that SWNY submit a quarterly NRW report to the New York Public Service Commission (Commission). AIQUEOUS also recommends the adoption of a performance incentive for driving NRW below 15% (per lower end of target set in *Non-Revenue Water Study* for United Water New Rochelle), as well as a penalty should NRW remain above 18% similar to the structure adopted for SWNY's Westchester service territory.

(5) Cost-Effectiveness Analysis – Finally, AIQUEOUS recommends a revised analysis of the cost-effectiveness of the proposed real water loss program. The stated cost of $24 million does not take into account all of the program benefits other than real water loss, and will likely provide more savings than the estimated 1 MGD.

ES.4.2 WATER CONSERVATION PROGRAMS

AIQUEOUS recommends the following modifications and additions to the proposed SWNY Water Conservation Plan:

(1) CII Incentive and Technical Assistance Program – SWNY should re-allocate funds from the proposed CII Audit Program to a new CII Incentive and Technical Assistance program. This program will allow businesses and institutions (including schools, universities, and hospitals) to implement water conservation programs and get paid for delivered water conservation savings. AIQUEOUS estimates that a five-year program cost of $547,411 would result in 24 projects yielding a total of 0.13 MGD of savings. This type of program has been demonstrated to have very low levels of freeridership. The estimated cost-effectiveness of the program would be $4.1 million per MGD.

(2) Residential Direct Install Program – SWNY should allocate $1.21 million toward a single family (with possible extension to multifamily) direct install program. Assuming the use of 0.8 gallons per flush toilets and 1.28 gallons per minute (gpm) showerheads, this program would serve 3,150 residential and save an estimated 0.17 MGD at a cost of $7 million per MGD. Savings could potentially be higher if direct install contractors identify and repair leaks while in the home. The single family and multifamily high efficiency toilet rebate programs would be reduced to 5-year budgets of $322,000 each.

(3) Residential Irrigation Consultancy Program – In addition to its Evapotranspiration irrigation program, SWNY should implement an Irrigation Consultancy program, targeted to SWNY's highest users with in-ground, automatic irrigation systems. The program would provide a one-hour consultation and a $200 rebate toward the purchase and installation of a smart controller. Over the five-year period, AIQUEOUS recommends a budget of $640,000 to provide consultations and smart controllers at 2,000 residences. The expected savings are 0.35 MGD of summer peak savings over the four irrigation months (July through October). The program cost-effectiveness would be $1.8 million per summer peak month MGD. As with the other programs, AIQUEOUS recommends hiring an independent contractor or contractors to implement the consultancies, and to tie at least a portion of contract payment to program performance.

(4) Smart Meter Savings Program - AIQUEOUS estimates that the AMI deployment will provide 0.4 MGD of water conservation savings once fully-deployed, assuming the use of a customer portal and leak alerts. Savings could be higher with the implementation of a behavior-based software program. AIQUEOUS assumes that this software is part of the $14 million cost estimate for the AMI deployment, however any incremental costs beyond the $14 million should be added to this program.

(5) Third Party Evaluation, Measurement &Verification (EM&V) - AIQUEOUS recommends that this budget be increased to $300,000 and that SWNY retain an independent EM&V contractor to perform studies and conduct an annual review of the water conservation program performance. This is consistent with how the Commission oversees the Energy Efficiency Performance Standard programs (Case 07-M-0548).

(6) Water Conservation Manager - Finally, while SWNY has proposed the position of a Water Conservation Coordinator to ensure payment of water conservation rebates, AIQUEOUS instead recommends the hiring of a Water Conservation Manager who would primarily focus on the management of various contractors charged with implementing the water conservation portfolio. This Manager would be sufficiently senior to be held accountable for program performance, and could help negotiate contracts that tie payment to program performance.

As shown in Table ES-6, these proposed recommendations – along with the capture of likely water conservation savings from the AMI deployment – result in a total of 2.23 MGD of total demand reduction, at an effective cost of just over $3 million per MGD.

Table ES-6. Comparison of Proposed Water Conservation Plan and AIQUEOUS Recommendations

	Program		Five-Year Cost Estimate		2021 Savings Estimate (MGD)				
	Proposed	Recommended	Proposed	Recommended	Active - Proposed	Active - Rec.	Baseline	Total - Proposed	Total - Rec.
Admin, Education & Evaluation	Program Administration	Program Administration	$319,786	$319,786					
	Public Information and Outreach	Public Information and Outreach	$480,938	$480,938					
	Res. Conservation Evaluation Studies	Res. Conservation Evaluation Studies	$127,825	$150,000					
	CI Conservation Evaluation Studies	CI Conservation Evaluation Studies	$92,385	$150,000					
	Contractor Admin / Implementation	Contractor Admin / Implementation	$311,560	$311,560					
	Lawn Watering Best Practices Program	Lawn Watering Best Practices Program	$93,419	$93,419					
Single Family Residential	SFR - H.E. Toilets Rebate		$1,211,426	$322,000	0.076	0.020	0.154	**0.335**	**1.099**
		SFR - Direct Install		$1,211,175		0.174			
	SFR - H.E. Showerheads Rebate	SFR - H.E. Showerheads Rebate	$242,285	$242,285	0.052	0.052	0.026		
	SFR - H.E. Washers Rebate	SFR - H.E. Washers Rebate	$247,437	$247,437	0.013	0.013	0.014		
	SFR - H.E. Washer / Rain Barrel Promo	SFR - H.E. Washer / Rain Barrel Promo	$95,918	$95,918	-	-	-		
		SFR - Irrigation Consultancy Program		$640,000		0.115			
		SFR - Smart Meter Program		$ -		0.55			
Multi-Family Residential	MFR - H.E. Toilets Rebate	MFR - H.E. Toilets Rebate	$404,273	$322,000	0.062	0.049	0.109	**0.279**	**0.399**
	MFR - H.E. Showerheads Rebate	MFR - H.E. Showerheads Rebate	$121,282	$121,282	0.057	0.057	0.019		
	MFR - H.E. Washers	MFR - H.E. Washers	$53,903	$53,903	0.029	0.029	0.003		
		MFR - Smart Meter Program		$ -		0.12			
Commercial, Institutional, & Industrial	CII - Audit Program Rebate		$510,314		0.017		-	**0.43**	**0.723**
		CII - Tech Assistance & Incentive Program		$547,411		0.13			
	CII - Urinal Rebate	CII - Urinal Rebate	$121,282	$121,282	0.043	0.043	0.005		
	CII - H.E. Toilets Rebate	CII - H.E. Toilets Rebate	$303,135	$303,135	0.258	0.258	0.029		
	CII - Spray Rinse Valve /Rebate	CII - Spray Rinse Valve /Rebate	$53,903	$53,903	0.07	0.07	0.008		
		CII - Smart Meter Program		$ -		0.18			
		Totals	**$4,791,071**	**$5,787,434**	**0.677**	**1.861**	**0.367**	**1.044**	**2.228**
		Cost-Effectiveness (Dollars per MGD)	**$7,076,914**	**$3,109,652**					

ES.4.3 SHAREHOLDER INCENTIVE

AIQUEOUS recommends that the Commission adopt an incentive mechanism for SWNY, as an investor-owned water utility, similar to the structure implemented in the Commission's Energy Efficiency Portfolio Standard (Case 07-M-0548). This would include the following elements:

(1) Establish publicly-reviewed avoided costs by service area – while the $12 million per MGD avoided cost number is appropriate where additional groundwater wells could be brought online, it is possible that other areas lack groundwater availability for this type of solution. The currently-proposed studies by SWNY should also establish appropriate avoided costs by service territory.

(2) Establish NRW and Water Conservation Goals – taking into account testimony and publicly-available data, the Commission should adopt formal NRW and Water Conservation Goals for SWNY. These should include a target NRW %, real water loss reductions, and conservation program savings.

(3) Create a structure of incentives and penalties – as the PSC did in Case 07-M-0548, the Commission should establish an incentive mechanism to provide SWNY with a portion of the avoided cost benefits delivered by its real water loss and water conservation programs, provided that goals are achieved or exceeded. Similarly, the Commission should establish negative adjustments should program performance fall below performance goals set by the PSC.

(4) Independent, Third Party Review of Results – as in its Energy Efficiency Portfolio Standard, the Commission should require third-party validation of real water loss and water conservation program performance and net benefit performance. AIQUEOUS recommends the use of the Utility Cost Test to determine net benefits.

(5) Re-filing of Plans Every Three Years – finally, the Commission should adopt a real water loss and water conservation program filing schedule on an every-three-year basis, similar to its EEPS schedule. While the five-year plan establishes a long-term, approach, waiting until then to assess lessons learned and make adjustments is too long and inconsistent with energy efficiency industry practices.

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1.0 STUDY OBJECTIVES

Scenic Hudson, Riverkeeper and the Rockland Water Coalition commissioned this report to evaluate Suez Water New York's (SWNY's) real water loss control and water conservation programs proposed as a part of its 2016 rate filing with the PSC within the context of national trends and program performance.

SWNY has proposed to undertake a series of projects and programs to reduce its total water demand by an average of two million gallons per day (MGD), one million MGD from real water loss control and slightly more than one million MGD from a water conservation program portfolio, over a five-year time period from 2017-2021. SWNY has estimated the cost of delivery for real water loss reduction at $24 million per MGD, and for water conservation at $7 million per MGD.

The key questions to be considered in this study are:

- Are these the most appropriate strategies to choose?
- Are these the most cost-effective strategies to pursue?

This report is divided into the following sections:

(1) Proposed Programs – a review of SWNY's proposed real water loss control and water conservation programs, summarizing information from testimony, interrogatory / document requests, and submitted reports;
(2) Comparisons with Industry Benchmarks – comparing SWNY's proposed programs against a literature review on real water loss control and water conservation program portfolios throughout the United States and the European Union;
(3) Proposed Program Modifications – proposed adjustments to SWNY's programs, based upon case studies which appear to offer equal or higher performance at lower cost; and
(4) Propose Model for Integrated Water Resource Planning – a comparison of New York State's historical approach to rewarding energy efficiency and water conservation investments by investor owned utilities, and a recommendation of a framework to provide equal incentives for capital and operating investments in managing water systems.
(5) Summary of Recommendations – the final section recaps those recommendations made in Sections 3 and 4 of the study.

1.1 AIQUEOUS

AIQUEOUS is a water sector software and consulting firm headquartered in Austin, Texas, using cloud technology to help utilities work with customers and contractors to manage their systems. Jonathan Kleinman, President, has 6 years' experience in the water sector and 15 years' experience in the energy conservation / energy efficiency sector. In his energy efficiency experience, Mr. Kleinman has supported many investor-owned utilities across the United States and Canada in the design, implementation, and regulatory reporting of their energy efficiency programs. He has also evaluated energy efficiency potential for the New York State Energy Research and Development Authority (NYSERDA), New York Power Authority (NYPA), and Long Island Power Authority (LIPA).

2.0 PROPOSED PROGRAMS

SWNY's February 2016 rate filing proposes investments in its Rockland County service territory – totaling over $40 million in capital and operating expenses – during the next five years to reduce total system demands via non-revenue water (NRW) reduction and water conservation program implementation. This section reviews those programs by compiling information across testimony, reports, and responses to submitted interrogatories / document requests from the rate case (Case 16-W-0130).

2.1 NON-REVENUE WATER / REAL WATER LOSS CONTROL

SWNY proposes to reduce non-revenue water and control real water losses in its service territory. SWNY's water loss control program consists of the following:

(1) Advanced Metering Infrastructure (AMI) – an investment of approximately $14.5 million over a 4-5 year timeframe would install "smart" water meters and AMI gateways / telemetry across the entire system. This system would automate the delivery of consumption data to SWNY on a much higher frequency (e.g., at 15-minute intervals). In addition to providing real-time consumption data to compare with production data, the AMI network will allow SWNY to alert customers to possible leaks (e.g., if nighttime consumption exceeds a threshold), detect water theft, improve the accuracy of billing and revenue collection, and reduce the overall cost of billing.

(2) District Meter Areas (DMAs) – SWNY will disaggregate its service territory into 56 "sub-districts" consisting of 1,500 to 3,000 connections each, at a cost of approximately $10 million. This disaggregation will allow SWNY to perform nighttime flow analysis and prioritize smaller areas for main replacement and leak detection and repair efforts.

(3) Pressure Reduction Management (PRM) – SWNY will continue to monitor and, where possible, reduce system pressure within DMAs to reduce leakage within the DMA while maintaining system performance within the DMA. SWNY noted two possible strategies, pressure relief valves (PRVs) and variable frequency drives (VFDs), although VFDs offer greater energy savings over PRVs. Between February 2017 and January 2018, SWNY has proposed to spend nearly $770,000 on capital improvements for pressure reduction.

(4) Non-Revenue Water Manager – SWNY plans to hire a dedicated manager of its NRW efforts in the Rockland Service Territory.

(5) Increased Main Replacement Rate – SWNY has indicated that it will increase its main replacement rate from its recent historical average of 0.24% (about 2.5 miles per year) to 0.7%, or about 7.4 miles per year. SWNY indicates that their main replacement costs will grow to $12 million annually, or a cost of about $1.6 million per mile.[2]

According to SWNY's response to Pre-Filing IR STAFF-78, SWNY's non-revenue water (NRW) for its most recent test year involving monthly billing (i.e., the 12-month period ending August 31, 2015) was 24.55%, or somewhat over 7 MGD on average. As a point of comparison, the New York Public Service Commission has recognized an NRW level at or below 18% as an acceptable economic level.[3] See Table 1 for SWNY's most recent, 5-year history.

[2] As a point of comparison, the City of Madison, Wisconsin states that their cost of main replacement is $950,000 per mile.

[3] United Water – New Rochelle. *Non-Revenue Water Study, Final Report*. January 31, 2012.

Table 1. SWNY Non-Revenue Water.

Year	WATER SUPPLIED (MG) [1]	CONSUMPTION (MG) [2]	NRW (MG)	NRW (%)
2010	10,849.998	8,709.987	2,140.011	19.72%
2011	10,606.601	8,137.562	2,469.009	23.28%
2012	10,307.323	8,192.276	2,115.047	20.52%
2013	10,384.026	8,068.39	2,315.636	22.30%
2014	10,513.682	8,447.439	2,066.243	19.65%
TEST	10,862.501	8,196.245	2,666.256	24.55%

Source: Chris Graziano, SWNY, in response to Pre-Filed IR STAFF-78

Donald Distante's submitted testimony indicates that a study in SWNY's New Rochelle territory concluded that 60 percent of that system's NRW was due to real losses. Translating that study to the Rockland County territory data would yield a current annual real leakage (CARL) of over 4 MGD.

In terms of cost-effectiveness, SWNY estimates the cost of its real water loss control efforts at $24 million per MGD, given the estimated investment in AMI and DMAs and the target 1 MGD of real water loss reduction. AIQUEOUS believes that the cost-effectiveness of SWNY's proposed real water loss control program needs to be recalculated because AMI yields other benefits that cover the cost of the AMI investment. For example, SWNY's recent "test year" NRW level of 24.55% and assumption that 40% of NRW is apparent losses translates into apparent loss levels of around 3 MGD or 10% of the total system. Reducing apparent losses by 50% could result in revenue increases of 5%, or roughly $4 million annually. Additionally, AMI can reduce billing costs by $5 per customer per month, or roughly $4.4 million. Given the potential savings, both real water loss and conservation savings benefits for AMI can be captured at "zero net cost" for the AMI system.

Real water loss reduction costs, therefore, should consist of AMI, DMA, PRM ($770,000 according to Paula McEvoy's submitted testimony), the NRW Manager position, and any leak repair efforts. From these costs should be subtracted AMI savings, the economic value of energy savings from PRM, and other "non-water" benefits. Cost-effectiveness should also take into account overall real water loss reductions, for which 2 MGD seems reasonable given SWNY's current NRW levels, New Rochelle territory study, and review of case studies later in this report.

2.2 WATER CONSERVATION

SWNY commissioned Black & Veatch (B&V) to develop its Water Conservation Plan, finalized in April 2016. B&V analyzed water consumption by single family, multifamily, commercial and institutional, and industrial sectors, and also reviewed consumption information in different geographic areas of the service territory. B&V also commissioned a survey of a sample of single family residential customers in an effort to understand both market saturation of residential fixtures and behaviors tied to indoor and outdoor water use. Following that analysis, B&V proposed the program portfolio shown in Figure 1.

Figure 1. Proposed SWNY Water Conservation Plan (Table 9-1)

Table 9-1 Total Program Costs and Estimated Water Savings

PROGRAM		FIVE-YEAR COST ESTIMATE		2021 SAVINGS ESTIMATE (MILLION GALLONS / DAY)		
				Active	Baseline (Passive)	Total
Admin, Education & Evaluation	Program Administration (rebate admin)	$319,786	$1,425,913	N/A	N/A	N/A
	Public Information and Outreach	$480,938				
	Res. Conservation Evaluation Studies	$127,825				
	CI Conservation Evaluation Study	$92,385				
	Contractor admin / Implementation	$311,560				
	Lawn Watering Best Practices Program	$93,419				
Single Family Residential	SFR - H.E. Toilets Rebate	$1,211,426	$1,797,066	0.076	0.154	0.335
	SFR - H.E. Showerheads Rebate	$242,285		0.052	0.026	
	SFR - H.E. Washers Rebate	$247,437		0.013	0.014	
	SFR - H.E. Washer / Rain barrel Promotion	$95,918		0.000	0.000	
Multi-Family Residential	MFR - H.E. Toilets Rebate	$404,273	$579,458	0.062	0.109	0.279
	MFR - H.E. Showerheads Rebate	$121,282		0.057	0.019	
	MFR - H.E. Washers Rebate	$53,903		0.029	0.003	
Commercial, Institutional Industrial	CII - Audit Program Rebate	$510,314	$988,635	0.017	0.000	0.430
	CII - Urinal Rebate	$121,282		0.043	0.005	
	CII - H.E. Toilets Rebate	$303,135		0.258	0.029	
	CII - Spray Rinse Valve / Rebate	$53,903		0.070	0.008	
Totals:		$4,791,072	$4,791,072	0.677	0.367	1.044

The proposed 5-year portfolio is estimated to deliver 0.68 MGD of water savings at a cost of $4.8 million, at an effective cost of $7 million per MGD. B&V also estimates “baseline” conservation improvements of 0.37 MGD, appearing to treat 100% of the baseline conservation as program freeridership by assuming that all installations

associated with baseline conservation will receive rebate payments.[4] Using terminology from Case 07-M-0548 and the *New York Evaluation Plan Guidance for EEPS Program Administrators*, SWNY is proposing to meet a "gross" savings target of 1.04 MGD while achieving net savings of 0.68 MGD, with a "net-to-gross" ratio of 0.65 (which is low for a full program portfolio). It is unusual to assume that all baseline conservation or energy efficiency would be captured in the portfolio and count as freeridership. For the purpose of this study, AIQUEOUS is using SWNY's estimates of gross and net savings without adjustments.

AIQUEOUS' review of the cost-effectiveness of the individual rebate programs shows that a number of the rebate programs are significantly more expensive than the average of $7 million per MGD. This is most notable for the single family toilet rebates, single family clothes washer rebates, and the CCI audit rebate. Table 2 provides this comparison.

Table 2. Review of cost-effectiveness of water conservation plan rebate programs

Sector	Program Component	5-Year Cost	Net Savings	Cost per MGD
Single Family Residential	SFR – H.E. Toilets Rebate	$1,211,426	0.076	$15,939,816
	SFR – H.E. Showerheads Rebate	$242,285	0.052	$4,659,327
	SFR – H.E. Washers Rebate	$247,437	0.013	$19,033,615
	SFR – H.E. Washer / Rain Barrel Promo	$95,918	-	N/A
Multi-Family Residential	MFR – H.E. Toilets Rebate	$404,273	0.062	$6,520,532
	MFR – H.E. Showerheads Rebate	$121,282	0.057	$2,127,754
	MFR – H.E. Washers Rebate	$53,903	0.029	$1,858,724
Commercial, Institutional, & Industrial	CII – Audit Program Rebate	$510,314	0.017	$30,018,471
	CIII – Urinal Rebate	$121,282	0.043	$2,820,512
	CII – H.E. Toilets Rebate	$303,135	0.258	$1,174,942
	CII – Spray Rinse Valve / Rebate	$53,903	0.070	$770,043

To explain why these costs are so high, take SWNY's single family toilet rebate program as an example. The plan calls for the expenditure of roughly $750,000 on 10,000 single-family, high efficiency toilets that would be installed in the absence of the rebate program. This expenditure provides zero net savings, and is part of the plan to

[4] The primary difference between net and gross savings stems from the concept of "freeridership." A freerider is a program participant who would have installed a water-conserving fixture in the absence of a program, and collects a rebate from that program while providing no incremental savings. Black & Veatch termed freeridership "baseline" conservation. A program that reports gross savings takes credit for freeriders, a program that reports net savings does not. By virtue of counting "baseline" conservation toward their 1 MGD water conservation target, SWNY claiming a gross savings basis.

accelerate the installation of 5,000 high-efficient toilets. Were SWNY to offer more cost-effective programs, total portfolio savings could be increased without increasing program costs.

2.3 EVALUATION OF THE COST-EFFECTIVENESS OF SWNY OPTIONS

Prior to comparing the SWNY programs to industry benchmarks, it is helpful to compare the cost-effectiveness of these programs with supply-side options in the SWNY system. Table 3 presents this comparison based upon data from Paula McEvoy of SWNY. While the "gold standard" cost comparison is the cost of a new supply well, it is possible that certain portions of SWNY's service territory cannot drill new wells for additional supply. [5] In that case, cost-effectiveness might be established by a comparison with direct or indirect reuse ($32 million and $85 million per MGD, respectively). As the cost of supply side alternatives increases, the cost-effectiveness of more aggressive real water loss control or water conservation programs improves. This could mean that more aggressive, and more expensive, real water loss control or water conservation programs might be appropriate in subsets of SWNY's territory.

Table 3. Comparison of cost-effectiveness data across supply, system efficiency, and demand management

Project Type	Capital Cost	Other Costs	Total Lifetime Cost
New Supply Wells	$12 million per MGD. Potentially higher costs if treatment needed	$4.8 million per MGD over 20 years	$16.8 million per MGD over 20 years
Water Conservation	$0	$7 million per MGD over 5 years	$7 million per MGD over 5 years
Indirect Reuse	$85 million per MGD	[Not referenced]	[Not referenced]
Direct Reuse – Reclaimed Wastewater	$32 million per MGD	[Not referenced]	[Not referenced]
Interconnection Improvements	$7.8 million per MGD		$7.8 million per MGD
AMI/DMA	$24 million		$24 million per MGD

Source: Response by Paula McEvoy to Interrogatory / Document Request No. STAFF-129 AMT-7, Case 16-W-0130

[5] For example, the western portion of SWNY's territory which has a good deal of shallow bedrock. Daniel VanAbs, personal communication, June 2016.

3.0 COMPARISONS WITH INDUSTRY BENCHMARKS

Scenic Hudson, Riverkeeper, and the Rockland Water Coalition sought to understand how SWNY's proposed approaches compared with industry benchmarks and best practices. AIQUEOUS conducted a literature review and contacted industry experts to collect information on NRW and water conservation portfolios both in the United States and internationally.

Data on NRW and water conservation program performance are both sparse and difficult to obtain. Additionally, water system characteristics are highly site-specific. Consequently, many of the benchmarks come from service territories that do not exactly share SWNY's characteristics. All experts contacted by AIQUEOUS cautioned the application of program results to other service territories.

Nevertheless, AIQUEOUS uses these benchmarks to place SWNY's proposed programs in context and to inform recommendations in the next section, rather than to evaluate SWNY's proposed performance. Generally, the industry benchmarks demonstrate higher savings at a lower relative cost than proposed by SWNY for their real water loss and water conservation programs.

3.1 REAL WATER LOSS CONTROL

Following the literature review and discussions with industry experts, AIQUEOUS centered benchmarking efforts on two resources:

(1) European Union. *EU Reference document Good Practices on Leakage Management WFT CIS WG PoM: Case Study document*. 2015.
(2) Sturm, R. and J. Thornton. "Water Loss Control in North America: More Cost Effective than Customer Side Conservation – Why Wouldn't You Do It?" 2007.

The European Union report provided extensive descriptions of the programs used to manage either or both apparent and real water losses, both of which make up NRW, and also provided indicators of pre-program level NRW or Current Annual Real Leakage (CARL). Sturm and Thornton provided more cost-effectiveness data than the European Union study, although a number of case studies reported projected rather than actual program costs and results. AIQUEOUS removed "projected" case study results from its cost-effectiveness benchmarks.

Table 4 summarizes the best practices across the European Union case studies. Water systems ranged in size from less than 1 MGD to nearly 500 MGD, and had NRW or CARL rates ranging from less than 5% to nearly 70%. AIQUEOUS evaluated all of the case studies to assess whether and how the following strategies were implemented:

(1) AMI – only one case study included the implementation of advanced metering to reduce NRW, and this was in partnership with Veolia Water.
(2) DMA – virtually every case study involved the use of district meter areas. Some utilities installed an extensive network of DMAs across their entire territory, with as few as 500 connections per DMA. Others created a "tiered" DMA network, starting with larger DMAs and then deploying medium- and small-sized DMAs in areas with high estimated leakage and degraded assets. Utilities used DMAs to analyze nighttime flows to identify areas with probable leakage.

Table 4. Strategies and Performance from Select Water Loss Control Programs.

Case Study	Population	Production (MGD)	% NRW or CARL	Strategy Type					% Reduction
				AMI	DMAs	CAM	PRM	Teams	
Salzburg, Austria	155,382	8.3			X	X			
De Watergroep, Belgium	2,860,000	112.5			X			X	
Dryanovo, Bulgaria	7,316	0.4	67.30%		X		X		37% reduction in NRW (loss reduction of 487,000 m3/yr)
Razgrad, Bulgaria			67.00%				X		
Pula, Croatia	75,000 / 175,000	6.2	23.00%		X	X	X	X	48.5% reduction in NRW since 2004
Lemesos, Cyprus	158,000	9.5			X	X	X	X	Between 2002 and 2007, leakage was reduced from 138 to 92 litres/connection/day, and ILI from was reduced from 2.66 to 1.96
VCS Denmark Odense, Denmark	160,000	6.6	4.50%		X		X		
Anglian Water, England	4,541,561	290.2					X		
Beaune, France	22,500			X	X	X			Beaune network efficiency increased by 11 points between 2010 and 2011.
Bordeaux, France	724,224	34.4	15.90%		X	X	X		NRW was reduced from 20.39% in 2009 to 18.56% in 2010 and finally 15.6% in 2011
Munich, Germany	1,500,000	65.9	12.60%						
Iren Emilia, Italy	475,000	32.2	19.00%		X				
Malta WSC, Malta	421,364	22.1	13.00%		X		X		
Lisbon, Portugal	564,000	74.4	4.70%		X	X	X	X	
Scottish Water, Scotland	5,116,705	481.8			X		X		Between 2006 and 2013, leakage was reduced from 1,104 Ml/d to 575 Ml/d in 2013 (a nearly 50% reduction)

Source: European Union, 2015

(3) CAM – some utilities installed "continuous acoustic monitoring" networks to detect the specific or probable locations of leaks. While AMI and DMAs can compare production and consumption data within a DMA, these data only identify the likelihood of leakage, not its location. Acoustic monitoring, whether manual (e.g., "listening sticks") or permanent, is needed to determine the location needing repair. CAM was not a prerequisite for achieving significant reductions in NRW.

(4) PRM – water systems can both manage background leakage and energy consumption by reducing system pressure via "pressure reduction management" techniques. Ironically, identifying and fixing leaks in a system can increase system pressure, causing new leaks or increasing background leakage. PRM as a strategy is important to ensure that leak repair efforts do not cause new problems.

(5) "Teams" – finally, many case studies focused on the importance of having teams dedicated to finding and resolving water loss. While this always included teams in the field to identify leaks, in some cases it included teams in the office (to correct billing issues) and evaluating databases (to identify anomalies and data inaccuracies).

Across the case studies, improvements in NRW or CARL ranged from 25% to 50%, with implementation timelines ranging from three to 11 years.

The Scottish Water case study is notable due to its rigorous focus on a set of performance indicators (PIs) to effectively and efficiently manage its CARL, which it reduced by 50% between 2006 and 2013. These PIs included the following (European Union, 2015):

- Primary Leakage PIs:
  - Total leak detection man-hours
  - Total pressure management man-hours split by activity
  - Number of detection sweeps completed (by type)
  - Number of leaks detected by type
  - Number of leak repairs completed (by type)
  - Number / % dry holes
  - Leak repair times; by standard leak types (breakdown of total repair time required: reported, scheduled, hydraulic fix, etc.)
  - DMA volume reductions (in month and annual averages)
  - NRW estimates; monthly and year average (pragmatic / practical process for ongoing estimation of NRW)
  - Leakage savings per repair
- Secondary Leakage PIs:
  - Leaks located by service territory / section
  - Percentage of properties covered by DMAs
  - Number / type of leaks detected per man-hour
  - Leaks repaired by service territory / section
  - Number / type of leakage repair per FTE
  - Average FTE count for leak detection
  - Average number of detection surveys per FTE
  - Average number of detection surveys by DMA stock
  - Number of connections surveyed per FTE
  - Length of mains surveyed per FTE
  - Cost per leak found by contractor per section
  - Hours per leak found by find technique per region
  - Cost per MGD saved by contractor per region
  - DMA with highest percentage of repairs with no visible savings

While an extensive list, reviewing these PIs demonstrate Scottish Water's ability to use them to identify those strategies and staff providing the best performance, and then spread any identified "best practices" across the rest of its system.

Table 5 summarizes four case studies for which implementation costs and "in the field" results were available. Using inflation-adjusted data where appropriate, costs range from less than $0.5 million to $1.3 million per MGD. The most recent case study, from Croatia, involved a 6 MGD system that saw a nearly-50% reduction in NRW between 2004 and 2014. The U.S.-based case studies were almost all team-based efforts; however, those case studies did not report total water loss reduction levels.

Table 5. Cost-Effectiveness of Comparable Water Loss Control Programs

Case Study	Cost per MGD	Strategies Deployed						
		AMI	DMAs	CAM	PRM	GIS	Teams	Notes
SFPUC	$597,377						X	Proactive leak detection and repair if real losses are valued at retail cost of water
Nashville Water Works	$432,724		Temporary				X	
CA DWR	$895,385						X	
Coatia: Pula	$1,310,327		[147]	Limited	Limited	X	X	48.5% reduction in NRW since 2004

Sources: European Union, 2015; Sturm and Thornton, 2007.

3.2 WATER CONSERVATION

AIQUEOUS also conducted a literature review of water conservation portfolios to assess program performance and cost-effectiveness results. The review began with the same list of conservation programs identified in B&V's Water Conservation Plan for SWNY (Appendix 8), and then expanded to try to ensure coverage of water systems of a comparable size and climate as SWNY. AIQUEOUS also contacted individual utilities to try to obtain program-specific results where data were not readily available on websites or in public records. Table 6 presents the results of this research.

Because the comparison water systems do not evaluate their programs for freeridership, SWNY's portfolio cost should be estimated at a range of $4.6 - $7.0 million per MGD, depending upon whether the comparison portfolio cost-effectiveness is based upon gross or net savings. The analysis shows that SWNY's proposed water conservation program performance is more expensive than other jurisdictions achieving similar savings levels (e.g., Seattle, Denver), though on a gross savings basis SWNY's cost-effectiveness is comparable to Hillsborough County, FL and Tampa Bay, FL).

Table 6. Water Conservation Program Performance and Cost-Effectiveness.

Utility Name	Sales (MGD)	Conservation Portfolio				Key Performance Indicators	
		Budget ($)	Savings (MGD)	Time Horizon	Program Strategy	% Savings	$/MGD
SWNY Water Conservation Plan*	30	$4,791,071	0.677 or 1.044	2017-2021	Fixture rebates Education ET landscape program	**2.2% or 3.4%**	**$7,076,914 or $4,606,799**
Seattle Public Utilities/Saving Water Partnership, WA	118.4	$10,683,000	3.21	2007 - 2010	Residential Indoor & Outdoor Commercial Indoor Education/awareness	**2.70%**	**$3,328,037**
Cary, NC	16.2	N/A	0.08	2009 - 2013	HET Rebate Program Turf Buy Back	**0.50%**	**N/A**
Denver Water, CO	180	$2,557,766	1.08	2014	Education & Outreach Rebates & Incentives	**0.60%**	**$2,363,916**
Hillsborough County, FL	N/A	$7,260,382	1.46	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor	**N/A**	**$4,972,864**
Tampa Water Department, FL	N/A	$2,684,722	0.63	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor	**N/A**	**$4,261,463**
St. Petersburg, FL	N/A	$4,420,604	2.11	1996 - 2014	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**N/A**	**$2,095,073**
Austin, TX	150.3	$15,200,541	2.68	2009 - 2011	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**1.80%**	**$5,669,157**
San Antonio Water System, TX	134	$9,250,000	1.95	2015	Residential Indoor & Outdoor Commercial Indoor & Outdoor	**1.50%**	**$4,733,363**

* Note: for SWNY, the first savings value excludes free-ridership (i.e., net savings), the second value includes free-ridership (i.e., gross savings)

Conservation Program Sources: Saving Water Partnership (Seattle), 2006-2010; Town of Cary, 2008-2014; Denver Water, 2015; Tampa Bay Water Region (Hillsborough County, City of Tampa, and City of St. Petersburg), 2016; City of Austin, 2013-2014; and San Antonio Water System, 2015.

From this data set, there is no water system that exactly matches SWNY's characteristics of size (30 MGD on average), climate, and proposed savings target of roughly 0.6% of production per year.

- Cary, North Carolina is about half the size of SWNY (16.2 MGD), but has limited its conservation efforts to a high-efficiency toilet rebate and turf buy-back program.
- Denver Water has achieved the same proportion of savings at a lower proposed cost (of roughly $2.4 million per MGD), but is a larger utility (180 MGD) and is in a drier climate.
- Seattle Public Utilities (SPU) has achieved a comparable proportion of savings (0.7% per year) at a greater level of cost-effectiveness to that proposed by SWNY; SPU has implemented a more comprehensive portfolio including rebates and technical support for residential irrigation / landscape, commercial irrigation / landscape, and CII process rebates.
- San Antonio Water System (SAWS) is achieving a significantly higher percentage of savings (1.5% of production in a single year) at a comparable to lower cost ($4.7 million per MGD) with a comprehensive

portfolio; however, SAWS is a significantly larger utility (134 MGD) in a hotter and drier climate than SWNY.

However, program level reviews identify opportunities to cost-effectively enhance the proposed SWNY Water Conservation Plan, specifically alternatives to the high efficiency toilet and CII audit programs. For example, SPU, Denver Water, and Tampa Bay Water all offer a CII rebate program at costs between $1.6 to $5.6 million per MGD. The Denver Water program, at $1.6 million per MGD, focuses on CII processes, cooling towers, and clothes washers. SAWS' program that targets irrigation for "high use" residential customers costs $5.4 million per MGD on an annual basis, but only costs $1.8 million per summer peak MGD across the four irrigation months (July through October) (Karen Guz, 2016). These program-level comparisons indicate that there are more cost-effective program designs that could be included in the SWNY water conservation portfolio.

4.0 PROPOSED PROGRAM MODIFICATIONS

Based upon AIQUEOUS' review of industry benchmarks for both water loss control and water conservation programs, AIQUEOUS recommends modifications to SWNY's proposed approaches. These recommendations result in a total of 4.228 MGD in savings – an additional 2.18 MGD – for an incremental investment of approximately $2.5 million.

4.1 REAL WATER LOSS CONTROL

Given SWNY's current NRW level of 24.55% and 5-year history of being over the PSC's recommended economic level of 18%, AIQUEOUS recommends that SWNY implement a focused, manual program over the next few years in parallel with its longer-term, proposed deployment of DMA and AMI. This $1.5 million investment should yield an additional 1 MGD in real water loss reduction. AIQUEOUS also recommends a regular reporting structure to provide transparency of its program efforts, and a fiscal structure to incentivize SWNY to drive significant NRW reductions. While continuous acoustic monitoring is an effective tool, AIQUEOUS recommends deferring any investment in CAM until a subsequent phase of NRW and real water loss management efforts.

4.1.1 NRW REDUCTION CONTRACTOR

The 4-5 year timeline for AMI deployment leaves real water loss savings "on the table" that could be captured now by dedicating a team to real water loss reduction. To manage long-term overhead expenses, SWNY should secure a third-party vendor with the express objective of identifying leaks using DMA data, temporary acoustic monitoring networks, and manual acoustic detection techniques. The NRW Manager would oversee the contract, and would refer the identified leaks to SWNY (or another third-party contractor) for repair. While SWNY could elect to use existing staff in lieu of a third-party contractor, the use of a contractor allows more flexible and focused deployment of resources and can tie payment to performance.

AIQUEOUS recommends the allocation of $1.5 million for this effort during the first two years of AMI implementation. While results may vary, this level of effort should result in short-term real water loss reduction of 1 MGD, in addition to the 1 MGD targeted by the proposed implementation of AMI, DMA, and PRM

4.1.2 NRW MANAGER

AIQUEOUS suggests that the proposed NRW Manager position be filled by a mid- to senior-level staff person who would be effective at managing outside contractors, developing and submitting internal and external reports to key stakeholders, and representing NRW concerns and program performance within the SWNY organization. Especially if SWNY were to earn performance incentives and / or be subject to penalties depending upon NRW levels, SWNY would benefit from a candidate with professional experience and the curiosity and interest in technology to be able to integrate data from AMI, DMA, and other sources.

4.1.3 5-YEAR ACCELERATION OF MAIN REPLACEMENT PROGRAM

SWNY's proposal to increase its annual main replacement rate from 0.24% to 0.7% will more closely align its efforts with recommended industry practice. The American Water Works Association (AWWA) recommends that water systems replace system mains at the estimated end of their useful life. If, for example, the average service life for pipe mains throughout a system is 100 years, then the water system should plan for an average annual

replacement rate of 1% (1/100) per year. Figure 2 presents AWWA's estimated average service life by pipe material. For a Northeast Medium and Small utility, the longest estimated service life is for cast iron pipes at 125 years. Using 125 years as a benchmark, the recommended average main replacement rate would be 0.8%. With a lower average service life, AWWA recommends a faster rate of main replacement.

Based upon SWNY's estimated average service life of 100 years, AIQUEOUS recommends that SWNY target an annual main replacement rate of 1% (or approximately 10 miles) (SWNY, 2016). Additionally, because SWNY has been replacing mains at a rate of 0.24%, it is possible that system mains have degraded past the point of their useful service life and are contributing to SWNY's currently-high levels of NRW.

AIQUEOUS recommends: an accelerated rate of 1.5% per year (15 miles) for the next 5 years.

Figure 2. Average Estimated Service Lives by Pipe Materials (average years of service).

Derived Current Service Lives (Years)	CI	CICL (LSL)	CICL (SSL)	DI (LSL)	DI (SSL)	AC (LSL)	AC (SSL)	PVC	Steel	Conc & PCCP
Northeast Large	130	120	100	110	50	80	80	100	100	100
Midwest Large	125	120	85	110	50	100	85	55	80	105
South Large	110	100	100	105	55	100	80	55	70	105
West Large	115	100	75	110	60	105	75	70	95	75
Northeast Medium & Small	115	120	100	110	55	100	85	100	100	100
Midwest Medium & Small	125	120	85	110	50	70	70	55	80	105
South Medium & Small	105	100	100	105	55	100	80	55	70	105
West Medium & Small	105	100	75	110	60	105	75	70	95	75
Northeast Very Small	115	120	100	120	60	100	85	100	100	100
Midwest Very Small	135	120	85	110	60	80	75	55	80	105
South Very Small	130	110	100	105	55	100	80	55	70	105
West Very Small	130	100	75	110	60	105	65	70	95	75
LSL indicates a relatively long service life for the material resulting from some combination of benign ground conditions and evolved laying practices etc. *SSL indicates a relatively short service life for the material resulting from some combination of harsh ground conditions and early laying practices, etc.*										

Source: American Water Works Association. Buried No Longer: Confronting America's Water Infrastructure Challenge. 2013.

4.1.4 REGULAR REPORTING AND FINANCIAL INCENTIVE

Finally, AIQUEOUS recommends: a fixed structure for SWNY to report its efforts on NRW to the Commission. At a frequency to be set by the Commission, ideally quarterly until an NRW level of 18% or less has been achieved, SWNY would be required to update the Commission on the following metrics:

- System-wide level of NRW;
- DMA-specific levels of NRW;
- Total expenditures on leak detection, both cost and level of effort;
- Number of detection sweeps completed (by type);
- Number of leaks detected by type;
- Number of leak repairs completed (by type);
- DMA volume reductions (in month and annual averages); and

- Leakage savings per repair.

AIQUEOUS understands that, in the case of the SWNY New Rochelle territory, the Commission has accepted a financial penalty to SWNY while NRW levels remain above 18%.[6] Based on this precedent and upon the Commission's history of energy efficiency program performance in New York, AIQUEOUS recommends that the Commission consider an incentive pool for over-performance on NRW, for example at or below a 15% NRW level. If the Commission were to approve an avoided cost of water at $12 million per MGD for SWNY, then SWNY shareholders should earn a portion of NRW program benefits for any real water loss reduction that costs less than $12 million per MGD. As discussed above, total costs of real water loss reduction should take into account any revenue increases, productivity improvements, O&M cost reductions, and other benefits from an NRW program. This option is discussed in considering integrated water resource planning, below.

4.2 WATER CONSERVATION

Based upon AIQUEOUS' review of SWNY's proposed Water Conservation Plan, and the identification of cost-effectiveness improvements in the single family HET rebate and CII audit programs, AIQUEOUS recommends additional investments across three new programs: CII Incentive and Technical Assistance, Residential Direct Install, and Residential Concierge Program. AIQUEOUS also recommends that SWNY set, in its Water Conservation Plan, savings targets associated with AMI deployment and a "smart meter" program. At an additional cost of roughly $1 million, these changes would increase the total savings delivered by the 5-year Water Conservation Plan by 1.18 MGD, and improve the cost-effectiveness of the conservation portfolio to roughly $3.1 million per MGD.

4.2.1 CII INCENTIVE AND TECHNICAL ASSISTANCE PROGRAM

A review of the CII consumption data provided by B&V shows fairly sizable fluctuations in water use between winter and summer months. Figure 3 demonstrates ratios between winter and summer consumption of nearly 160% (growth of 2 MGD), with a spike in 2015 of nearly 200% (growth of 3.5 MGD). This seasonality suggests the opportunity to conserve a significant amount of water in summertime end uses such as cooling towers and landscape irrigation. Program performance in other jurisdictions, discussed earlier in this study, also highlights the opportunity to reduce water consumption on year-round end uses.

[6] In the Order Adopting Terms of Joint Proposal as Revised and Establishing a Multi-Year Rate Plan for Case 09-W-0828, the Joint Proposal caps an allowed NRW (called Lost and Unaccounted for Water or LAUF water) rate at 18%. Levels of LAUF above that value would result in United Water Westchester absorbing LAUF costs above the cap. It did not, however, set incentives for exceeding performance (e.g., getting LAUF below 18% with incentives starting at LAUF of 16%).

Figure 3. Seasonality of Use for Commercial Customers (Figure 3-8 from Water Conservation Plan)

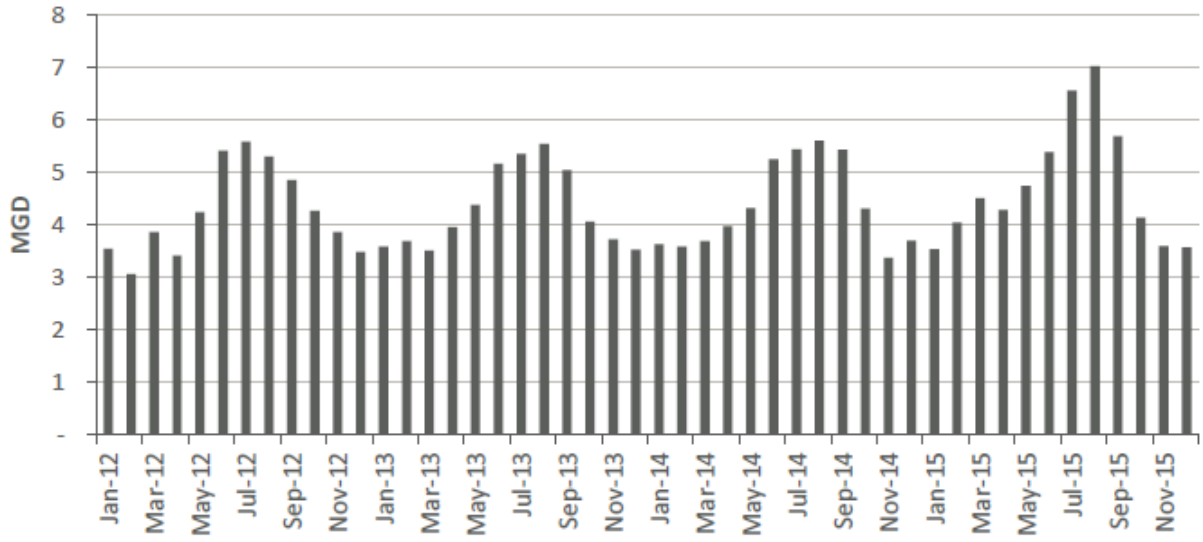


Figure 3-8 Seasonality of Use for Commercial Customers

As an alternative to implementing the proposed CII audit program, AIQUEOUS recommends a new CII Incentive and Technical Assistance program. The incentive program will allow businesses and institutions (including public and private schools, universities, and hospitals) to implement water conservation programs and get paid for delivered water conservation savings. Eligible projects and technologies would include, but are not limited to:

- Conversion from water-cooled equipment (e.g., chillers, cooling towers, ice makers) to air-cooled equipment;
- Cooling tower adjustments to reduce total water consumption or recycle cooling tower water for other purposes;
- Water-efficient commercial kitchen equipment;
- High-efficiency or waterless plumbing fixtures (e.g., toilets, urinals, pre-rinse spray valves, showerheads, faucet aerators);
- Commercial laundries;
- Industrial process improvements;
- Rainwater harvesting or water reuse; and
- Outdoor landscape and irrigation improvements.

Projects must reduce water consumed on the SWNY system (i.e., not reduce water consumed on private wells) and cannot shift consumption to other ground or surface water. SWNY will pay a customer incentive of $3 million per annual average MGD saved by a project, capped at 50% of the project cost or a two-year simple payback (based upon SWNY retail rates).

The program will also provide technical assistance to CII customers to identify project opportunities at their facilities, independently review proposals from vendors, validate equipment installation according to incentive agreements, and verify savings levels. Rather than providing comprehensive “audits,” which are often effective technical documents but ineffective at spurring customer action, this technical assistance would target

"walkthroughs" to quickly identify significant opportunities and move CII customers to soliciting bids from potential vendors. This technical assistance can be provided by third-party "Project Expediters," contractors who specialize in developing water conservation projects and get paid from a portion of the project rebate. Connecting payment on technical assistance to project implementation helps to keep technical assistance activities "tactical" rather than "academic." SWNY could also hire these same Project Expediters to perform measurement and verification services on completed projects, verifying equipment installation and performance.

AIQUEOUS estimates that a five-year program cost of $547,411 would result in 24 projects yielding a total of 0.13 MGD of savings. This type of program has been demonstrated to have very low levels of freeridership. The estimated cost-effectiveness of the program would be $4.1 million per MGD.

4.2.2 DIRECT INSTALL PROGRAM

The proposal for a single-family, high-efficiency rebate toilet program stemmed from B&V's survey results indicating a high percentage – nearly 75% – of toilets requiring only 1.6 gallons per flush (gpf) (see Figure 4). As a result, SWNY has proposed a high-efficiency toilet rebate program that would limit eligibility to homes built prior to 1994, maximizing program savings by focusing on pre-EPACT toilets. B&V estimated baseline market activity in SWNY territory of 10,000 toilet purchases over the 5-year program period. The proposed rebate program would accelerate the replacement of 5,000 additional toilets, and B&V assumed that the program would end up paying rebates to all 15,000 replacements at an effective cost of $16 million per MGD saved.

An alternative approach is to target the retrofit of the pre-EPACT toilets and avoid paying rebates to freeriders. Given 67,450 households across the service territory, and assuming an average of 2.43 toilets per home, there would be over 42,000 toilets in the service territory with a flush volume of 3 gpf or higher. The same budget as allocated to the High Efficiency Toilet Rebate Program budget could be spent to replace toilets and one showerhead at 3,150 household units over the 5-year period. Additionally, the program could make use of the most efficient toilets on the market, for example, Niagara Conservation's ultra-high efficiency toilet with a flush volume of 0.8 gpf. Additionally, Niagara Earth manufactures a 3-spray showerhead rated at 1.25 gpm, below the 2 gpm flow rate assumed in the High Efficiency Showerhead rebate program. Setting performance standards – such as requiring 1 gpf or less in the program – can drive the most efficient products in the market without explicitly picking a given brand or model

Figure 4. Proportion of Toilets by Age (and Efficiency) (Table 4-4 from Water Conservation Plan)

Table 4-4 Proportion of Toilets by Age (and Efficiency)

AGE OF TOILET WSD = WATER SAVING DEVICE INDICATED	ASSUMED FLUSH VOLUME (GALLONS)	NUMBER OF TOILETS				WEIGHTED AVERAGE FLUSH VOLUME (GALLONS)	PROPORTION CURRENTLY EXISTING
		TOILET 1	TOILET 2	TOILET 3	ALL TOILETS		
Before 1980	4.0	154	130	80	364	3.66	25.7%
Before 1980 (WSD)	3.5	36	33	15	84		
1981 - 1992	3.5	146	143	94	383		
1981 – 1992 (WSD)	3.0	27	30	15	72		
After 1992	1.6	1,081	974	553	2,608	1.6	74.3%
Total		1,444	1,310	757	3,511		100%

The program design would target households with higher wintertime GPCD and offer, following a pre-qualifying list of questions, a "walk-through" assessment performed by a contractor. This assessment would identify the age and condition of existing toilets and showerheads, and would identify any leaks present at the home. At the consent of the homeowner, the contractor would replace toilets and showerheads and repair leaks that can be accessed at plumbing fixtures, all at no cost to the homeowner.

AIQUEOUS recommends**:** allocating $1.21 million toward a single family (and possibly multifamily) direct install program. Assuming the use of the Niagara products or similar, this program would serve 3,150 homes and save an estimated 0.17 MGD at a cost of $7 million per MGD. To continue to promote the WaterSense brand, AIQUEOUS recommends the continuation of the high efficiency toilet rebate programs but at lower levels, $322,000 each over five years for the single family and multifamily program. Because one of the advantages of a direct install program is the ability to "dial up" or "dial down" participation, SWNY could expand the program at a later date to address capacity issues. This would be reasonable, given its cost of $7 million per MGD compared to the avoided cost of $12 million per MGD.

4.2.3 RESIDENTIAL IRRIGATION CONSULTANCY PROGRAM

While the proposed SWNY portfolio focuses on indoor fixtures, the only program component targeting outdoor irrigation other than public education is its already existing ET-based program. Despite the long existing ET and public education programs, SWNY Rockland has a fairly significant summer peak in its single family residential sector, somewhat consistently 4 MGD each year (ranging from 3.75 MGD in 2013 to 4.5 MGD in 2015). Figure 5 shows that for all customers, this summer peak is roughly 133% of a consistent, wintertime consumption of roughly 12 MGD.

Figure 5. Seasonality of Use for Single-Family Residential Households (Figure3-5) add source B & V?

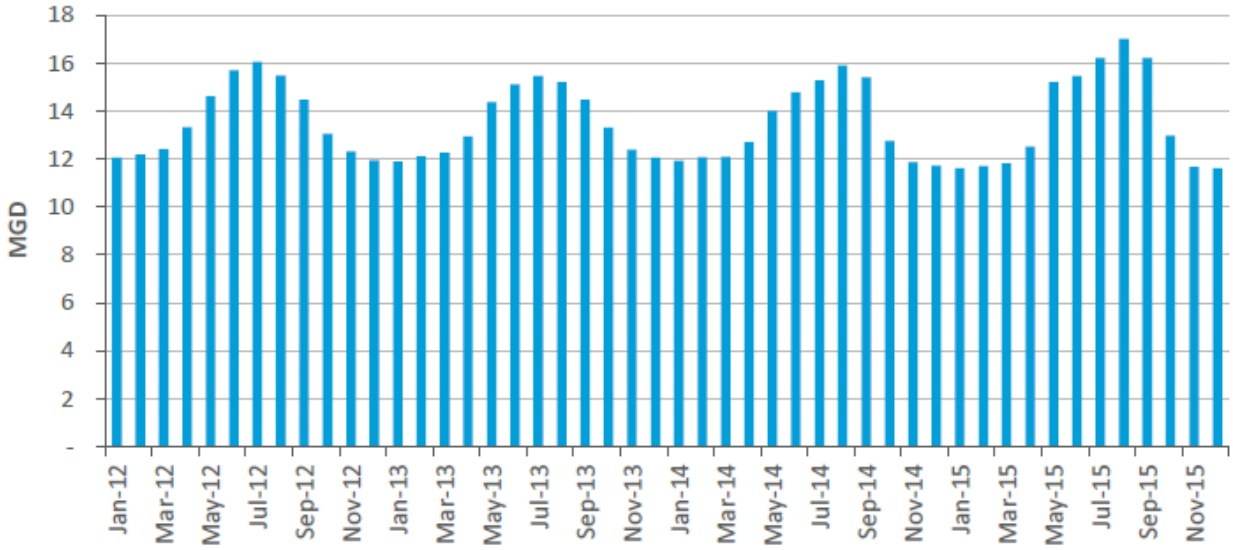
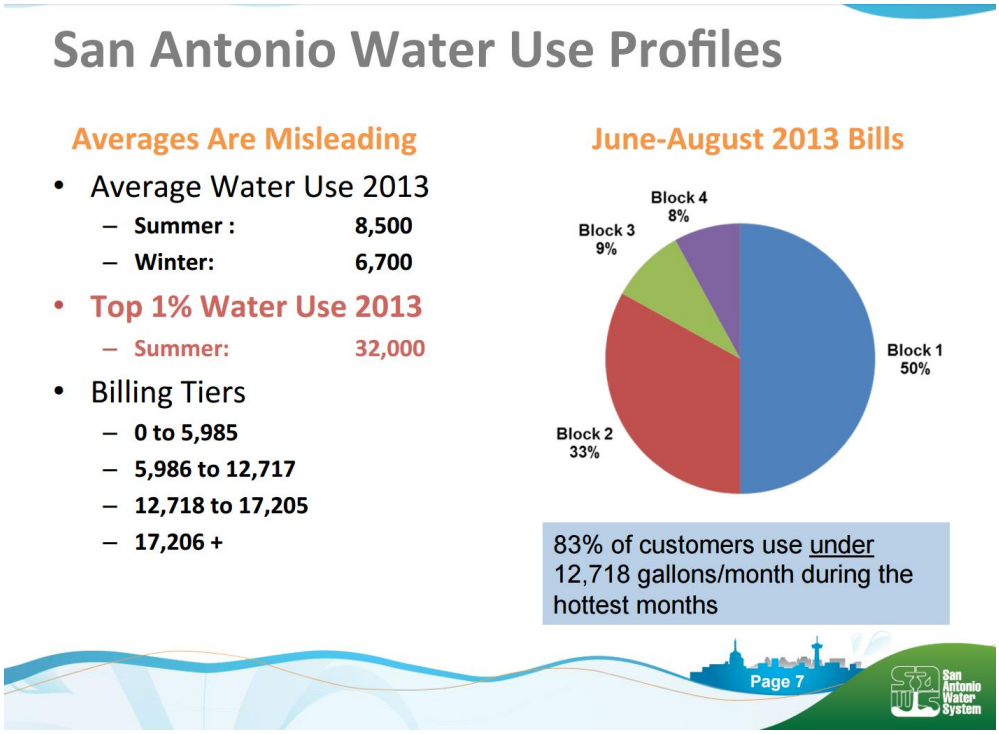


Figure 3-5 Seasonality of Use for Single-Family Residential Households

Nationally, water conservation program experience highlights that so-called "super users," or those residential customers with the highest consumption, drive this summer peak. For example, in San Antonio, the average summer peak is 8,500 gallons per month, an increase of 1,800 gallons over the 6,700-gallon winter month average (a ratio of 127%, similar to the SWNY system). However, as shown in Figure 6, the average summer monthly consumption for the Top 1% of users is 32,000 gallons. This type of situation is not limited to southern climates. AIQUEOUS is currently working with a water utility in central Ohio where, for a pilot program group, the winter average consumption is 5,000 gallons per month, and the summer peak ranges from 25,000 to 35,000 gallons per month. All of these "super user" customers – whether in San Antonio or in Central Ohio – have one thing in common: in-ground, automatic irrigation systems.

Figure 6. Summer Peak Set by Super Users at San Antonio Water System



Source: Karen Guz, 2016a.

Figures 7 and 8 present a similar profile of "super users" in the SWNY service territory, with a relatively sizeable saturation of automatic irrigation systems. Figure 7 shows more than 20,000 customers with more than 200 GPCD average consumption. Figure 8 demonstrates the portion of residential customers with in-ground sprinkler systems ranging from 29% in Haverstraw to 50% in Stony Point. Based upon the data from SAWS and central Ohio, one would expect communities with a higher percentage of in-ground automatic irrigation systems to have a higher total per capita water use. Figure 9 confirms this, with Clarkstown and Stony Point having the highest difference between "indoor" and "total use" GPCD.

Figure 7. Distribution of Single-Family Residential Household Use.

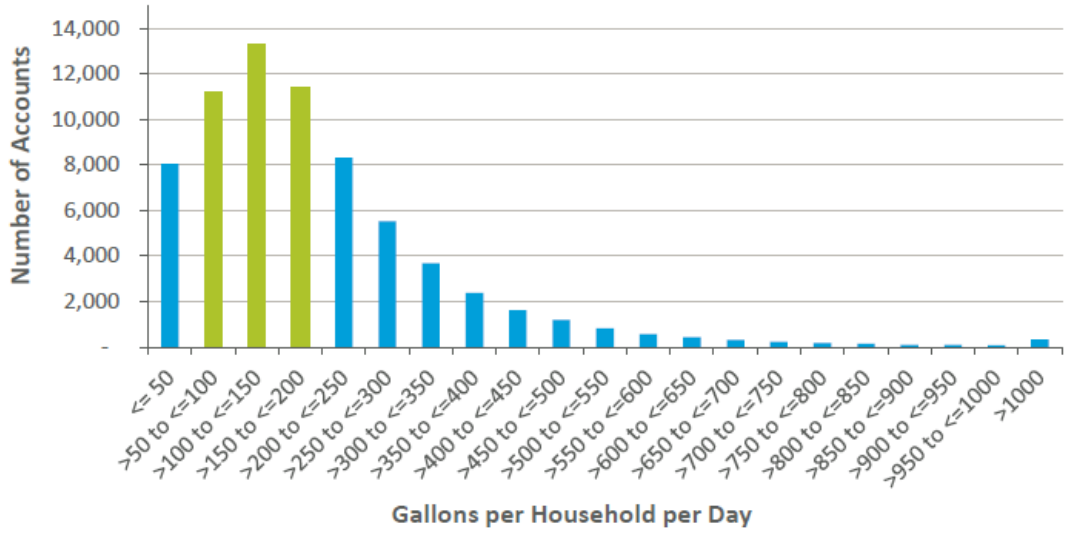


Figure 3-4 Distribution of Single-Family Residential Household use (2015)

Source: SWNY Water Conservation Plan. 2016.

Figure 8. Reported Irrigation Equipment by Town in SWNY Rockland Service Territory

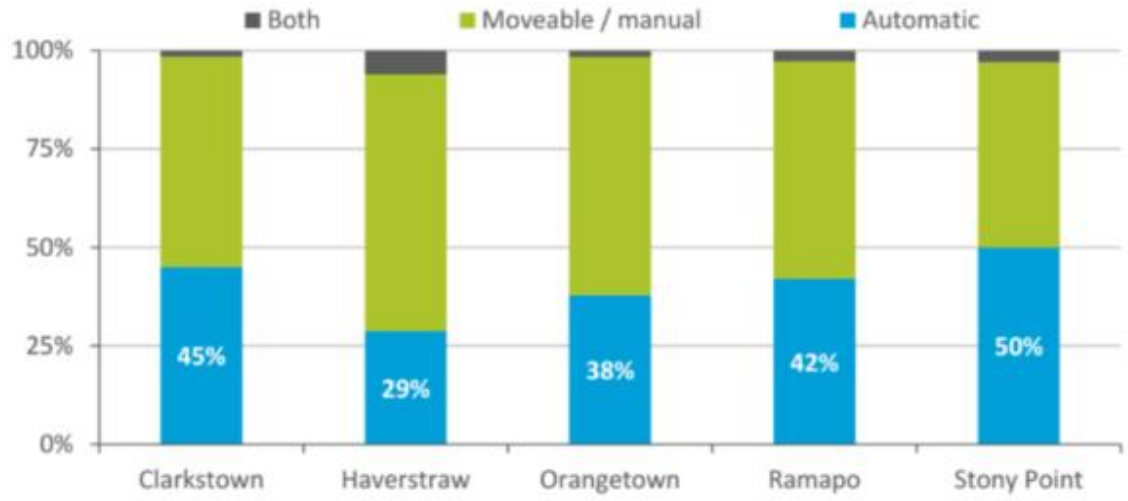


Figure 4-11 Reported Irrigation Equipment by Town

Source: SWNY Water Conservation Plan. 2016.

Figure 9. Per Capita Consumption (Gallons per Capital Per Day) by Town (Table 5-1)

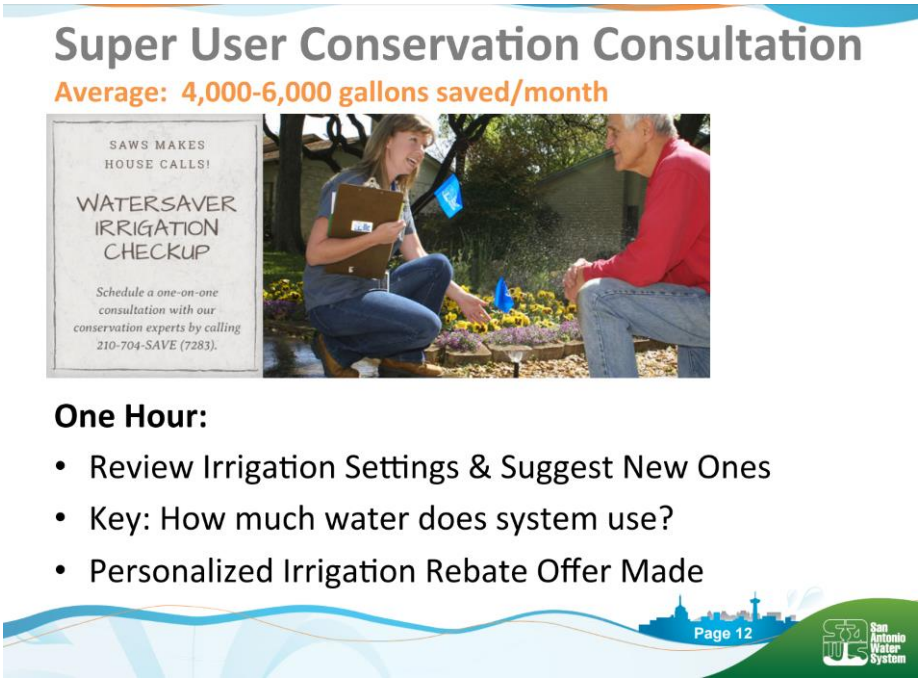
Table 5-1 Per Capita Consumption (Gallons per Capita per Day)

TOWN	INDOOR USE (GPCD)		TOTAL USE (GPCD)	
	AVG.	MEDIAN	AVG.	MEDIAN
Clarkstown	57.8	51.6	70.7	58.9
Haverstraw	54.4	49.9	59.8	54.4
Orangetown	54.8	50.4	66.3	55.2
Ramapo	54.1	48.0	62.6	55.5
Stony Point	54.6	48.1	69.6	58.1
All Survey Data	55.2	49.6	66.2	56.3

Source: SWNY Water Conservation Plan. 2016.

AIQUEOUS recommends: the adoption of SAWS's "super user" conservation consultation approach to drive summer water conservation savings at high-use, single family accounts. As shown in Figure 10, this program consists of a one-hour review of irrigation settings and the recommendation of new settings, an on-site discussion of how much water the irrigation system uses, and a personalized irrigation rebate offer. The typical cost for a SAWS 1-hour consultation is $120 and it has yielded about 2,000 gallons per month in savings (Karen Guz, 2016b). The program focuses savings on the four summer peak months (July-October), yielding savings in those months at a cost of $1.8 million per MGD. SAWS has found that targeting the highest users among these customers can double the cost-effectiveness of the program.

Figure 10. Super User Conservation Overview



Source: Karen Guz, 2016a.

As an additional feature, SWNY could offer a rebate toward the purchase of a "smart" irrigation controller such as Skydrop or Rachio's Iro. Skydrop, for example, claims 35% savings following installation of its app-enabled controller, which could equal over 5,000 gallons per month in summer month savings. AIQUEOUS is currently implementing a pilot program in central Ohio across 30 customers to validate these savings claims, and will have data available by the end of 2016.

AIQUEOUS recommends: the implementation of an Irrigation Consultancy program, targeted to SWNY's highest users with in-ground, automatic irrigation controllers. The program would provide a one-hour consultation modeled after the SAWS program, and a $200 rebate toward the purchase and installation of a smart controller. Over the five-year period, AIQUEOUS recommends a budget of $640,000 to provide consultations and smart controllers at 2,000 residences. The expected savings are 0.35 MGD of summer peak savings and 0.12 MGD of average annual savings, at a cost-effectiveness of $1.8 million per summer peak MGD and $5.6 million per average annual MGD. As with the other programs, AIQUEOUS recommends hiring an independent contractor or contractors to implement the consultancies, and to tie at least a portion of contract payment to program performance.

4.2.4 SMART METER SAVINGS PROGRAM

Given SWNY's proposed $14 million investment in AMI, AIQUEOUS recommends accounting for anticipated water conservation savings in the overall Water Conservation Portfolio. The City of Santa Barbara, California estimated a 20% reduction in demand across 20% of its customers, or a 4% overall demand reduction from AMI deployment (City of Santa Barbara, 2015). Santa Barbara's program included the use of a web portal that allowed customers to view their water usage patterns, and the ability to provide leak and / or high use threshold alerts via the web or text. A behavioral efficiency pilot program implemented in tandem with AMI by East Bay Municipal Utility District (East Bay MUD) in the San Francisco area found a 4.6%-6.6% decrease in water consumption as compared to a control group (WaterSmart, 2015).

During the AMI bidding process, AIQUEOUS strongly recommends that SWNY vet the accompanying software for usability, intuitiveness, and the quality of customer communication. In conversations with utilities that have reviewed AMI vendors, there is a wide range of quality. Additionally, to make the most of the investment, AIQUEOUS recommends that SWNY consider a software solution that integrates meter-to-customer data management.

Using a 4% demand reduction for single family, multifamily, and commercial customers, AIQUEOUS estimates that the AMI deployment will provide 0.4 MGD of savings once fully-deployed. At an avoided cost of $12 million per MGD, this provides roughly $4.8 million in ratepayer benefits. SWNY could solicit bids for behavior-based program such as those offered by WaterSmart or DropCountr, to determine whether the incremental investment would yield additional cost-effective savings.

4.2.5 THIRD-PARTY EVALUATION, MEASUREMENT AND VERIFICATION (EM&V)

SWNY has proposed roughly $220,000 over the 5-year program period to fund the evaluation of residential and CII water conservation. Typical practice in the energy efficiency industry is to allocate between 2-4% of the total portfolio budget toward both market studies and the independent verification of reported program savings. This

independent verification has been important in ensuring the accuracy and revision of reported savings values (e.g., per toilet, per showerhead, per CII project) and also better understanding of market conditions. While utilities frequently hire these EM&V contractors, they view themselves as independent entities with the responsibility of providing objective findings to regulatory commissions and the public. It is through their efforts that the transparency of program results is seen as valid investments by ratepayers. AIQUEOUS recommends that this budget be increased to $300,000 and that SWNY retain an independent EM&V contractor to perform studies and conduct an annual review of the water conservation program performance. Guidelines for the EM&V effort can be found in the Commissions Energy Efficiency Portfolio Standard (Case 07-M-0458).

4.2.6 WATER CONSERVATION MANAGER

Finally, while SWNY has proposed the position of a Water Conservation Coordinator to ensure payment of water conservation rebates, AIQUEOUS instead recommends: the hiring of a Water Conservation Manager who would primarily focus on the management of various contractors implementing the water conservation portfolio. This Manager would be sufficiently senior to be held accountable for program performance, and could help negotiate contracts that tie payment to program performance.

5.0 PROPOSING A MODEL FOR INTEGRATED WATER RESOURCE PLANNING

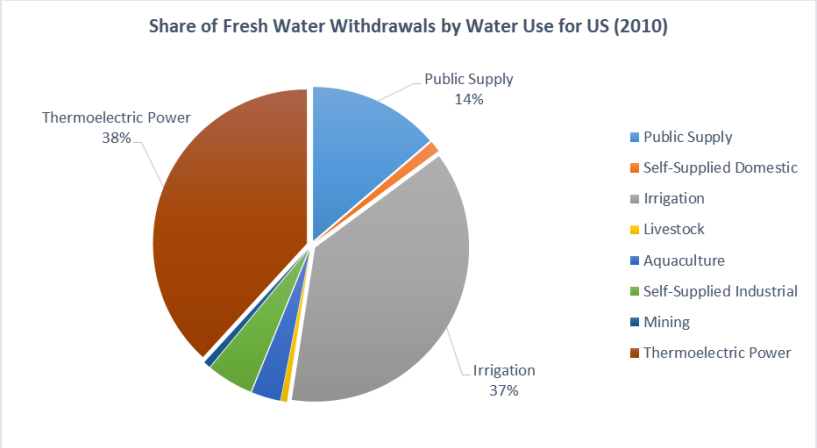
The primary challenge with the implementation of the above recommendations is that SWNY's financial incentives do not align with the implementation of effective NRW or water conservation programs. While SWNY can recover lost revenues through the implementation of water conservation programs, the utility only earns shareholder incentives through capital investment. This has not been historically true in New York for energy efficiency programs, where utilities have been allowed to earn shareholder incentives for successful program performance. New York's energy efficiency program history played a role in leading up to the 21st Century Electricity System CEO Meeting on November 5, 2013 (AEE, 2013) and the current Reforming the Energy Vision (REV) proceeding. Based upon the interconnections between the energy and water sectors in New York, and to continue to drive policy leadership, AIQUEOUS recommends that the PSC use its past and present approach to New York's energy efficiency portfolio standard as a model for integrated water resource planning.

5.1 NEW YORK'S WATER-ENERGY NEXUS

In contrast to the national average, New York State's two highest end uses of fresh water withdrawals are thermoelectric power and public supply. According to the USGS, the only entity that conducts periodic analysis of water use in the United States, over one-third of national freshwater use went to both thermoelectric power generation and irrigation in 2010, with only 14% being used for public water supply (see Figure 11). However, in New York State, nearly half of all freshwater use is for thermoelectric power, with another 40% of water use for public supply (see Figure 12). As an historically water-rich state, with almost 14% of the surface area covered by inland and coastal water, New York has not aggressively focused on water conservation and water reliability (USGS, 2010).[7] The Alliance for Water Efficiency, in developing their national scorecard in 2012, only awarded New York a "C" grade (Alliance for Water Efficiency, 2012). This stands in contrast to New York's #9 national ranking in the most recent scorecard from the American Council for an Energy Efficient Economy (ACEEE, 2015).

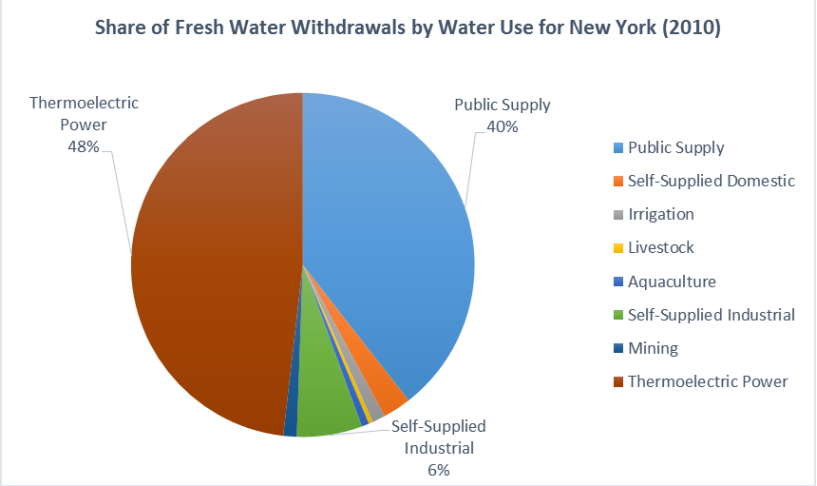
[7] http://water.usgs.gov/edu/wetstates.html

Figure 11. Share of Fresh Water Withdrawals by Water Use for the United States (2010)



Source: USGS, 2015.

Figure 12. Share of Fresh Water Withdrawals by Water Use for New York (2010)



Source: USGS, 2015.

The inherent competition between thermoelectric power and public supply uses for freshwater resources in New York – to say nothing of ensuring environmental flows and recreational and scenic waters – suggests that it may be time for New York to "Renew its Water Vision." The following section makes recommendations for how this renewal could be undertaken, and how to align SWNY's incentives with NRW and water conservation efforts.

5.2 NEW YORK'S CHANGING ENERGY EFFICIENCY REGULATORY ENVIRONMENT

In 2008, the New York Public Service Commission established shareholder incentives for utility energy efficiency programs (ACEEE, 2016). This was a part of the state's "15 by 15" initiative, seeking to achieve a 15% reduction in energy consumption by 2015. Between 2009 and 2011, investor-owned utilities earned incentives or incurred negative adjustments for its electric or gas energy efficiency portfolio standard (EEPS) based upon the extent to which those utilities achieved their energy savings targets. To provide the context of an order of magnitude, in the

2012 through 2015 incentive period, the Commission established incentive pools totaling $36 million for electric utilities and $14 million for gas utilities. The Commission designed these incentives to align utility performance on energy efficiency programs with shareholder interests, and in part through making these incentives available, New York State has achieved 1% incremental energy savings *per year* through 2015 (ACEEE, 2016).

The PSC's Renewing the Energy Vision proceeding seeks to move away from top-down mandates of energy efficiency targets, instead focusing on financial incentives for utilities and the creation of utility-run marketplaces where energy efficiency, demand response, and other "distributed energy resources" (DERs) compete on a cost basis to meet demand. Moving forward, the REV proceeding has established roles for utilities and market participants, required the utilities to initiate Utility Distribution System Implementation Plans (DSIPs), and established three mechanisms – metrics, clawback, and platform revenues – to incentivize the utilities to improve operational and system efficiency and to save money (AEE, 2016).

5.3 TOWARD A RENEWED WATER VISION

AIQUEOUS recommends that the Commission adopt an incentive mechanism for investor-owned water utilities, similar to the structure implemented in 2008 in Case 07-M-0458. In the specific case of SWNY, AIQUEOUS suggests the following approach:

(1) Establish publicly-reviewed avoided costs by service area – while the $12 million per MGD avoided cost number is appropriate where additional groundwater wells could be brought online, it is possible that other areas lack groundwater availability for this type of solution. The currently-proposed studies for new supply by SWNY should also establish appropriate avoided costs by service territory.
(2) Establish NRW and Water Conservation Goals – taking into account testimony and publicly-available data, the Commission should adopt formal NRW and Water Conservation Goals for SWNY. These should include a target NRW %, real water loss reductions, and conservation program savings.
(3) Create a structure of incentives and penalties – similar to its 2008 order, the Commission should establish a shareholder incentive mechanism to provide SWNY with a portion of the avoided cost benefits delivered by its NRW and water conservation programs, provided that goals are achieved or exceeded. Similarly, the Commission should establish negative adjustments should program performance fall below performance targets that the PSC sets.
(4) Independent, Third Party Review of Results – as in its energy efficiency portfolio standard, the Commission should require third-party validation of NRW and water conservation program performance and net benefit performance. AIQUEOUS recommends the use of the Utility Cost Test to determine net benefits.
(5) Re-filing of Plans Every Three Years – finally, the Commission should adopt an NRW and water conservation program filing schedule on a three-year basis, similar to its EEPS schedule. While the five-year plan establishes a long-term approach, waiting until then to assess lessons learned and make adjustments is too long and inconsistent with energy efficiency industry practices. that have proved effective.

This approach can help to align SWNY's financial interests with the goal of long-term, safe, affordable, and sustainable water resource management on the behalf of ratepayers. After two implementation cycles (2017-2019 and 2020-2022), the Commission could decide how to adjust this structure, as necessary.

6.0 SUMMARY OF RECOMMENDATIONS

AIQUEOUS recommends a set of modifications to SWNY's real water loss and water conservation programs to achieve greater savings more cost-effectively. These recommendations result in a total of 4.228 MGD in savings – an additional 2.18 MGD – for an incremental investment of approximately $2.5 million. AIQUEOUS also recommends the creation of a shareholder incentive structure for SWNY in the event of exceeding stated real water loss reduction and water conservation performance goals.

6.1 NON-REVENUE WATER MANAGEMENT

In addition to SWNY's proposed deployment of AMI, DMA, and PRM, **AIQUEOUS recommends the following additions and changes to the overall NRW Management program:**

(1) Hiring an NRW Contractor - SWNY should secure a third-party vendor with the express objective of identifying leaks using DMA data, temporary acoustic monitoring networks, and manual acoustic detection techniques. AIQUEOUS recommends the allocation of $1.5 million for this effort during the first two years of AMI implementation. Based upon results elsewhere, this initiative should result in additional real water loss reduction of 1 MGD (beyond the proposed 1 MGD of real water loss savings).

(2) NRW Manager - AIQUEOUS suggests that the proposed NRW Manager position be filled by a mid- to senior-level staff person who would be effective at managing outside contractors, developing and submitting internal and external reports to key stakeholders, and representing NRW concerns and program performance within the SWNY organization.

(3) Water Main Replacement Rate - AIQUEOUS recommends that SWNY target an annual main replacement rate of 1% (or approximately 10 miles per year), given its average service life for cast iron pipes of 100 years. Additionally, because SWNY has been historically replacing mains at a rate of 0.24%, AIQUEOUS recommends an accelerated rate of 1.5% per year (15 miles) for the next 5 years.

(4) Regular Reporting and Performance Incentive - Starting in 2017, AIQUEOUS recommends that SWNY submit a quarterly NRW report to the New York Public Service Commission (Commission). AIQUEOUS also recommends the adoption of a performance incentive for driving NRW below 15% (per lower end of target set in *Non-Revenue Water Study* for United Water New Rochelle), as well as a penalty should NRW remain above 18% similar to the structure adopted for SWNY's Westchester service territory.

(5) Cost-Effectiveness Analysis – Finally, AIQUEOUS recommends a revised analysis of the cost-effectiveness of the proposed real water loss program. The stated cost of $24 million does not take into account all of the program benefits other than real water loss, and will likely provide more savings than the estimated 1 MGD.

6.2 WATER CONSERVATION PROGRAMS

AIQUEOUS recommends the following modifications and additions to the proposed SWNY Water Conservation Plan:

(1) CII Incentive and Technical Assistance Program – SWNY should re-allocate funds from the proposed CII Audit Program to a new CII Incentive and Technical Assistance program. This program will allow businesses and institutions (including schools, universities, and hospitals) to implement water conservation programs and to get paid for delivered water conservation savings. AIQUEOUS estimates that a five-year program cost of $547,411 would result in 24 projects yielding a total of 0.13 MGD of

savings. This type of program has been demonstrated to have very low levels of freeridership. The estimated cost-effectiveness of the program would be $4.1 million per MGD.

(2) Residential Direct Install Program – WNY should allocate $1.21 million toward a single family (with possible extension to multifamily) direct install program. Assuming the use of 0.8 gallons per flush toilets and 1.28 gallons per minute (gpm) showerheads, this program would serve 3,150 residential and save an estimated 0.17 MGD at a cost of $7 million per MGD. Savings could potentially be higher if direct install contractors identify and repair leaks while in the home. The single family and multifamily high efficiency toilet rebate programs would be reduced to 5-year budgets of $322,000 each.

(3) Residential Irrigation Consultancy Program – In addition to its Evapotranspiration irrigation program, SWNY should implement an Irrigation Consultancy program, targeted to SWNY's highest users with in-ground, automatic irrigation systems. The program would provide a one-hour consultation and a $200 rebate toward the purchase and installation of a smart controller. Over the five-year period, AIQUEOUS recommends a budget of $640,000 to provide consultations and smart controllers at 2,000 residences. The expected savings are 0.35 MGD of summer peak savings over the four irrigation months (July through October). The program cost-effectiveness would be $1.8 million per summer peak month MGD. As with the other programs, AIQUEOUS recommends hiring an independent contractor or contractors to implement the consultancies, and to tie at least a portion of contract payment to program performance.

(4) Smart Meter Savings Program - AIQUEOUS estimates that the AMI deployment will provide 0.4 MGD of water conservation savings once fully-deployed, assuming the use of a customer portal and leak alerts. Savings could be higher with the implementation of a behavior-based software program. AIQUEOUS assumes that this software is part of the $14 million cost estimate for the AMI deployment, however any incremental costs beyond the $14 million should be added to this program.

(5) Third Party Evaluation, Measurement &Verification (EM&V) - AIQUEOUS recommends that this budget be increased to $300,000 and that SWNY retain an independent EM&V contractor to perform studies and conduct an annual review of the water conservation program performance. This is consistent with how the Commission oversees the Energy Efficiency Performance Standard programs (Case 07-M-0548).

(6) Water Conservation Manager - Finally, while SWNY has proposed the position of a Water Conservation Coordinator to ensure payment of water conservation rebates, AIQUEOUS instead recommends the hiring of a Water Conservation Manager who would primarily focus on the management of various contractors charged with implementing the water conservation portfolio. This Manager would be sufficiently senior to be held accountable for program performance, and could help negotiate contracts that tie payment to program performance.

As shown in Table 7, these proposed recommendations – along with the capture of likely water conservation savings from the AMI deployment – result in a total of 2.22 MGD of total demand reduction, at an effective cost of just under $3 million per MGD.

Table 7. Comparison of Proposed Water Conservation Plan and AIQUEOUS Recommendations

	Program		Five-Year Cost Estimate		2021 Savings Estimate (MGD)				
	Proposed	Recommended	Proposed	Recommended	Active - Proposed	Active - Rec.	Baseline	Total - Proposed	Total - Rec.
Admin, Education & Evaluation	Program Administration	Program Administration	$319,786	$319,786					
	Public Information and Outreach	Public Information and Outreach	$480,938	$480,938					
	Res. Conservation Evaluation Studies	Res. Conservation Evaluation Studies	$127,825	$150,000					
	CI Conservation Evaluation Studies	CI Conservation Evaluation Studies	$92,385	$150,000					
	Contractor Admin / Implementation	Contractor Admin / Implementation	$311,560	$311,560					
	Lawn Watering Best Practices Program	Lawn Watering Best Practices Program	$93,419	$93,419					
Single Family Residential	SFR - H.E. Toilets Rebate		$1,211,426	$322,000	0.076	0.020	0.154	**0.335**	**1.099**
		SFR - Direct Install		$1,211,175		0.174			
	SFR - H.E. Showerheads Rebate	SFR - H.E. Showerheads Rebate	$242,285	$242,285	0.052	0.052	0.026		
	SFR - H.E. Washers Rebate	SFR - H.E. Washers Rebate	$247,437	$247,437	0.013	0.013	0.014		
	SFR - H.E. Washer / Rain Barrel Promo	SFR - H.E. Washer / Rain Barrel Promo	$95,918	$95,918	-	-	-		
		SFR - Irrigation Consultancy Program		$640,000		0.115			
		SFR - Smart Meter Program		$ -		0.55			
Multi-Family Residential	MFR - H.E. Toilets Rebate	MFR - H.E. Toilets Rebate	$404,273	$322,000	0.062	0.049	0.109	**0.279**	**0.399**
	MFR - H.E. Showerheads Rebate	MFR - H.E. Showerheads Rebate	$121,282	$121,282	0.057	0.057	0.019		
	MFR - H.E. Washers	MFR - H.E. Washers	$53,903	$53,903	0.029	0.029	0.003		
		MFR - Smart Meter Program		$ -		0.12			
Commercial, Institutional, & Industrial	CII - Audit Program Rebate		$510,314		0.017		-	**0.43**	**0.723**
		CII - Tech Assistance & Incentive Program		$547,411		0.13			
	CII - Urinal Rebate	CII - Urinal Rebate	$121,282	$121,282	0.043	0.043	0.005		
	CII - H.E. Toilets Rebate	CII - H.E. Toilets Rebate	$303,135	$303,135	0.258	0.258	0.029		
	CII - Spray Rinse Valve /Rebate	CII - Spray Rinse Valve /Rebate	$53,903	$53,903	0.07	0.07	0.008		
		CII - Smart Meter Program		$ -		0.18			
		Totals	**$4,791,071**	**$5,787,434**	**0.677**	**1.861**	**0.367**	**1.044**	**2.228**
		Cost-Effectiveness (Dollars per MGD)	**$7,076,914**	**$3,109,652**					

6.3 INCENTIVE STRUCTURE

AIQUEOUS recommends that the Commission adopt an incentive mechanism for SWNY, as an investor-owned water utility, similar to the structure implemented in the Commission's Energy Efficiency Portfolio Standard (Case 07-M-0548). This would include the following elements:

(1) Establish publicly-reviewed avoided costs by service area – while the $12 million per MGD avoided cost number is appropriate where additional groundwater wells could be brought online, it is possible that other areas lack groundwater availability for this type of solution. The currently-proposed studies by SWNY should also establish appropriate avoided costs by service territory.

(2) Establish NRW and Water Conservation Goals – taking into account testimony and publicly-available data, the Commission should adopt formal NRW and Water Conservation Goals for SWNY. These should include a target NRW %, real water loss reductions, and conservation program savings.

(3) Create a structure of incentives and penalties – as the PSC did in Case 07-M-0548, the Commission should establish an incentive mechanism to provide SWNY with a portion of the avoided cost benefits delivered by its real water loss and water conservation programs, provided that goals are achieved or exceeded. Similarly, the Commission should establish negative adjustments should program performance fall below performance goals set by the PSC.

(4) Independent, Third Party Review of Results – as in its Energy Efficiency Portfolio Standard, the Commission should require third-party validation of real water loss and water conservation program performance and net benefit performance. AIQUEOUS recommends the use of the Utility Cost Test to determine net benefits.

(5) Re-filing of Plans Every Three Years – finally, the Commission should adopt a real water loss and water conservation program filing schedule on an every-three-year basis, similar to its EEPS schedule. While the five-year plan establishes a long-term, approach, waiting until then to assess lessons learned and make adjustments is too long and inconsistent with energy efficiency industry practices.

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