Shifting Baselines in Water Utility Management:

Using customer-level analysis to understand the interplay between utility policy, pricing, and household demand

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The EFC at UNC is dedicated to enhancing the ability of governments to provide environmental programs and services in fair, effective, and financially sustainable ways.

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Abstract

Studying customer behavior has become an essential financial management and research component for most commercial enterprises. Currently, most water utilities could better use the extensive database of customer metering and billing records to study the implications of their pricing and policies, as well as factors outside utility control, like weather. Customer-level analysis can reveal overall trends in usage and billing practices over time that a utility can use to minimize negative revenue impacts and improve utility operations. Customer-level analysis can also be used to study the specific behavior of individual customers, like irrigation, to target communication and even pricing to individual customers. In addition to the benefit to individual utilities to understand and scrutinize their customers, an investigation into customer consumption behavior within the context of pricing, socioeconomic, housing, and drought response can produce larger lessons for other utilities. This report seeks to tell some these stories using customer level analysis, supplemented with financial information.

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I. Introduction

Studying customer behavior has become an essential financial management and research component for most commercial enterprises. Businesses track purchases through customer records and use that data to make decisions regarding marketing, pricing, and policy. Likewise, water utilities track customers through their metering and billing records—a database that could be better used by most utilities to understand the implications of their pricing and policies, as well as factors outside utility control, like weather. By looking at customer behavior in the context of a changing operating environment, water utilities can make more informed decisions that can ensure financial and resource security.

Over the past five years, each of the North Carolina Urban Water Consortium (UWC) members has implemented changes to its water and wastewater pricing and policies. Whether prompted by water resource conditions, financial necessity, and/or changing customer demands, the seven utilities included in this analysis changed policies ranging from billing frequency and rate structure to pricing and connection policies. These changes were made around the time of a record regional drought during 2007 and 2008. The occurrence of this drought further intensified the challenge of balancing water conservation and revenue stability.

Given the changing nature of water and wastewater utility management, the Environmental Finance Center designed a *Water Customer Sales Profile* to examine how customers' water use patterns have shifted in response to a number of utility changes instituted over the study period. Specifically, this study sought to:

- Establish post-transition baseline usage and revenue analyses for seven UWC utilities in the format of *Water Customer Sales Profiles*. Since the conclusion of the last drought's conservation programs, utilities have noticed that water use did not immediately return to pre-drought levels. Each utility received a profile that provided descriptive statistics of customer behavior and revenue before and after the drought. Members of the research team met with each utility to review and verify the analysis.

- Minimize negative revenue impacts and improve the new operating environment by strengthening each utility's ability to identify and predict customer usage and behavioral patterns at the conclusion of an operational transition (i.e. billing frequency transition, rates changes, new meter rollout).

- Compare analyses across utilities undergoing similar operational transitions and document 'lessons learned' to inform future UWC operational transition implementation.

II. Project Background

Since 2007, the Environmental Finance Center has analyzed the billing data for all 12 Urban Water Consortium members for varying lengths of time, ranging from 30 to 60 month study periods. The majority of these profiles began in Fiscal Year (FY) 2007 (July 2006 – June 2007) and continued through the drought, ending in either FY 2008 or FY 2010. By the completion of this series of analyses, EFC will have analyzed, in total, over 839 thousand residential customer accounts and 15.2 million customer billing records throughout the state of North Carolina, from as far west as Charlotte and as far east as Wilmington (Cape Fear Public Utility Authority) (Table 1).

In this most recent analysis of seven UWC utilities, we used customer billing data from between FY07 and FY10 and focused on assessing how customer water use and revenue shifted from the pre-drought period (FY07) to the post-drought period (FY10) (Table 2). We analyzed post-drought policy customer behavior in these seven consortium utilities to help identify a new baseline for customer water use behavior, given changes in rate and conservation policies.

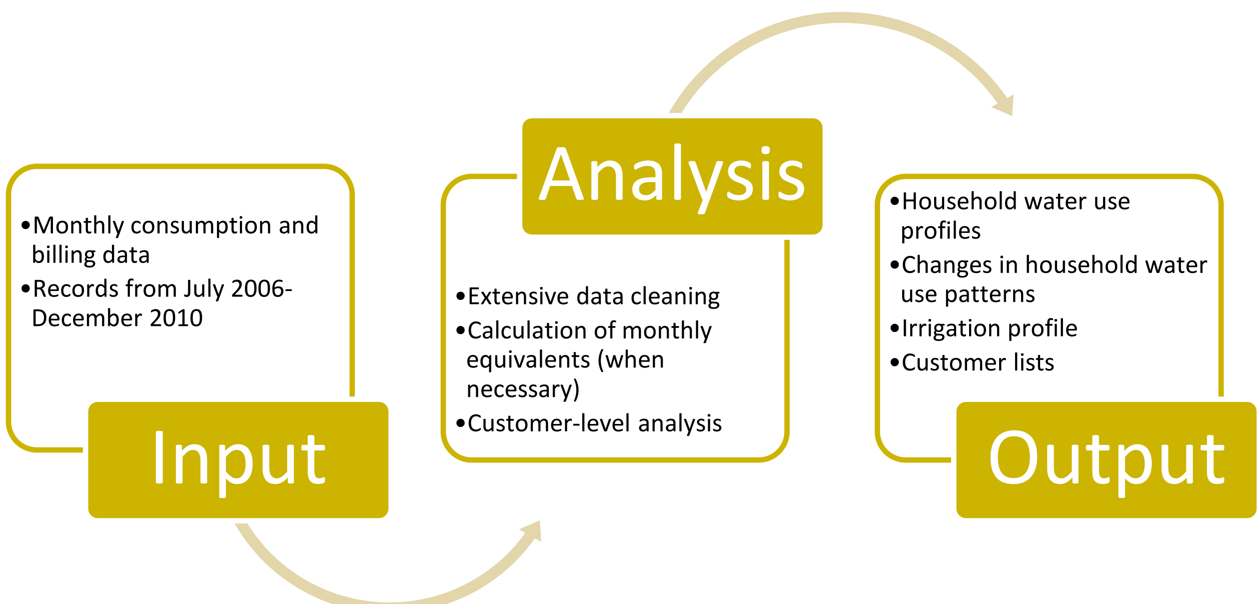
Table 1: Summary of UWC Members' Billing Records Analyzed

Utility	Approx. # of residential accounts	Billing frequency	Billing data period	Months
Fayetteville PWC	74,684	Monthly	July 2006-June 2007	30
			July 2007- December 2008	
Greenville UC	26,782	Monthly	July 2006-June 2007	30
			July 2007- December 2008	
High Point	36,222	Monthly	July 2006-June 2007	30
			July 2007- December 2008	
OWASA	17,426	Monthly	January 2006 – December 2008	36
CMUD	222,936	Monthly	July 2006 – December 2008	30
Raleigh Utilities	95,224	Bi-Monthly	July 2006-October 2010	52
Cary	46,157	Monthly	July 2006 – June 2011	60
Cape Fear PUA	57,900	Bi-Monthly	July 2008 – December 2010	30
Winston-Salem/Forsyth County UC	100,045	Bi-Monthly	July 2006 – June 2011	60
Durham Water	74,831	Bi-Monthly	July 2006 – June 2011	60
Greensboro	69,910	Quarterly – Monthly	July 2006 – December 2010	54
Burlington	17,383	Monthly	July 2008 – June 2011	36

III. Methodology[1]

This research was conducted using customer billing records from Cape Fear Public Utilities Authority, City of Greensboro Department of Water Resources, City of Durham Department of Water Management, Burlington Water Resources Department, Winston Salem/Forsyth County Utility Commission, City of Raleigh Public Utilities, and the Town of Cary Water Resources Department. For most of the utilities, the records covered the time frame from July 2006 through December 2010 (a 54-month study period). These seven utilities were the last of the 12 UWC members to receive a *Customer Water Sales Profile* from the EFC through UWC funding. Their analysis was deferred because of the peculiarities in the data associated with each of the seven that made analysis and standardization more difficult. Such features include bi-monthly and quarterly data, a utility merger, and several billing software transitions.

Figure 1: Process for Creating Customer Water Profiles



Each participating utility provided a database of every billing transaction record (Figure 1, Input), along with premise identification numbers.

[1] More on the methodology used for customer level billing analysis can be found in:
Boyle, C., S. Eskaf, M.W. Tiger & J. Hughes. Mining Water Billing Data to Inform Policy and Communication Strategies. Journal AWWA, 103:11, November 2012.

At minimum, data included the billing month, account and rate structure classifications, meter sizes and types, usage through each meter, and billed amounts. Some utilities also provided information on zip codes, penalties, and cutoffs.

One of the key elements of this research is being able to track each customer's consumption over time. Utilities often track various meters that belong to the same house or lot under one premise number, but using several account numbers. For example, a household might have a different account number for their irrigation meter than their standard domestic meter. In this case, the premise would include two water meters. Our analysis combined these two meters for an overall premise (or household)-level consumption.

Using account classifications, rate schedules applied, meter sizes, and number of dwelling units per premise, the individually-metered households and single family dwelling units were identified. These residential premises have standard meters ¾" in size or less[2] and did not have more than one dwelling unit per premise. Hence, master-metered apartment complexes or multifamily housing units and commercial, industrial, institutional, and wholesale customers are not included in this analysis.

Utilities typically assign unique premise numbers when a new house is first constructed, which, unlike account numbers, usually never change over time. Premise-level analysis does not track the individuals that live the homes; it tracks the water and wastewater consumption assigned to the homes. For ease of discussion, the premises are referred to as households, and do not necessarily indicate a constant group of people resided at the premise for the duration of the study.

Due to the variation of billing software, the datasets produced were in different formats, using different units, and rounding at different levels. Extensive and customized data cleaning was necessary for each dataset, with the goal of producing a final dataset of accurate data that are consistent across the seven utilities. Records were aggregated to produce only one record per address (or premise) per bill. Premises that received wastewater service only, but not water service, were identified and excluded, leaving only water-using premises.

In order to make trans-utility comparisons, the EFC converted bi-monthly and quarterly billing records into monthly equivalent volumes. Rather than simply dividing a bi-monthly bill's consumption by two and assigning each half to a month, the EFC divided each bi-monthly bill's consumption across the two months proportionately based on the previous billing period. To do this, the EFC assumed

[2] Some utilities have residential customers with 1" meters. For those utilities, we included customers coded as residential with 1" meters.

linear changes between billing periods. The same method was applied to quarterly billing to estimate "monthly-equivalent" bills' consumption point.

The data cleaning process is extensive, critical, and an actual deliverable to the utilities. As a result of our cleaning, we were able to provide utilities with a list of customers whose particular water use patterns indicate potential problems. These customers might include those that may be misclassified or have highly irregular billing and usage patterns. In our analysis, we did our best to identify and keep the good data, to understand and improve the questionable data, and, if necessary in rare cases, to remove the bad data to protect the integrity of the analysis. For each utility, we excluded the bills that we estimated to be due to leaks and/or were for customers that were actually non-residential.

IV. Capabilities and Opportunities of Customer Level Analysis

Although most utilities run analytics on their customers, they are analyzing water use from a billing perspective. The reports they generate are billing reports: how many bills are sent for different levels of consumption on a monthly basis. Most billing systems do not make it easy for utility staff to pull reports on the behavior of individual customers. Using a customer-level analytical approach has many benefits over the typical billing-level analysis. A few advantages of customer level analytics include:

- ***Targeted customer-level communication:*** Because the EFC examines billing records on a customer level, we are able to draw conclusions about how certain households use water over time; subsequently, we are able to produce customer lists that can be used for targeted outreach. For example, rather than sending information to all customers about a smart irrigation incentive, the utility could target just those customers it believed to be irrigating. Some of these customers would be easy to identify by the fact that they have a separate irrigation meter, but we have found that all UWC utilities have households that are irrigating through their standard meter.

- ***Customer-level impact analysis:*** Policy decisions impact different groups of customers in different ways, and may also impact the same customer in a number of different ways depending on the nature of their demand. By combining a household's average water use with an analysis of their lowest and highest monthly water use, the EFC analysis provides valuable information about what charges various household types will face—and how policy changes will impact revenue for these groups. For example, we provide analytics to answer the questions, what percentages of households ever reach your highest tier? And how many households are disadvantaged by the highest tiers?

- ***Customer-specific rates (not just budget-based rates):*** Although most utilities in the Urban Water Consortium have shifted to an increasing block rate structure in order to promote conservation and help maintain affordability, there are equity concerns and financial risks associated with these types of rate structures. Some utilities across the country have adopted budget-based rate structures to address some of these concerns and risks. In short, budget-based rates are individualized increasing block rate structures, but there is more potential for “tailored rates” than what has been adopted by a handful of utilities across the country. The Environmental Finance Center is researching this potential using the type of customer-level analysis conducted for the UWC.

V. Accounts of Change: Water Use and Revenue Shifts in Seven North Carolina Water Utilities, 2007 to 2010

This section contains accounts of the major inter-utility findings produced from this latest round of UWC Water Customer Profiling and Analysis. The analytical framework focuses on comparing water use and revenues of household water users in fiscal years 2007 (July 2006-June 2007) and 2010 (July 2009-June 2010). In this way, we skip over the multitude of fluctuations that occurred during the late 2007, early 2008 drought, and we compare use and revenue trends in pre-and post-drought periods. The section below describes some of the trends that emerged from this snapshot of two years of customer water consumption.

Declines in Household Water Use

Across the country, utilities are facing declining residential water use patterns. Ultimately, this decline is attributed to the fact that households are able to meet their demands with less water through technology required by regulations[3]. Compounding this overall increase in water use efficiency, the State of North Carolina experienced a drought in 2007-08 that brought about mandatory restrictions, adjustments to rate structures, and public education campaigns designed to reduce water use through conservation (i.e. sacrifice), as well as efficiency. Even when rescinded, these efforts have the rumored potential to bring lasting declines in water use. (Addendum 1 to this report contains a more detailed analysis on "drought hangover" in North Carolina.)

A simple cursory look at average monthly household water use among UWC members confirms that, whether attributed to efficiency or conservation, residential water use is on the decline across the state (Table 2). On average across the five of the seven utilities in this round of analysis with FY07 and FY10 data, household average use declined by 8.6% between 2007 and 2010, with Raleigh experiencing the largest per household water decrease (-12.7% reduction). Burlington and Cape Fear were not able to provide FY07 and FY10 data. Nonetheless, Burlington saw an increase between FY09 and FY11, and Cape Fear saw a large decrease between FY09 and FY10.

[3] Rockaway, T., P. Coomes, J. Rivard & B. Kornstein Residential water use trends in North America. Journal AWWA 103:2, February 2011.

Table 2: Average household water use between FY07 & FY10 (unless otherwise noted)

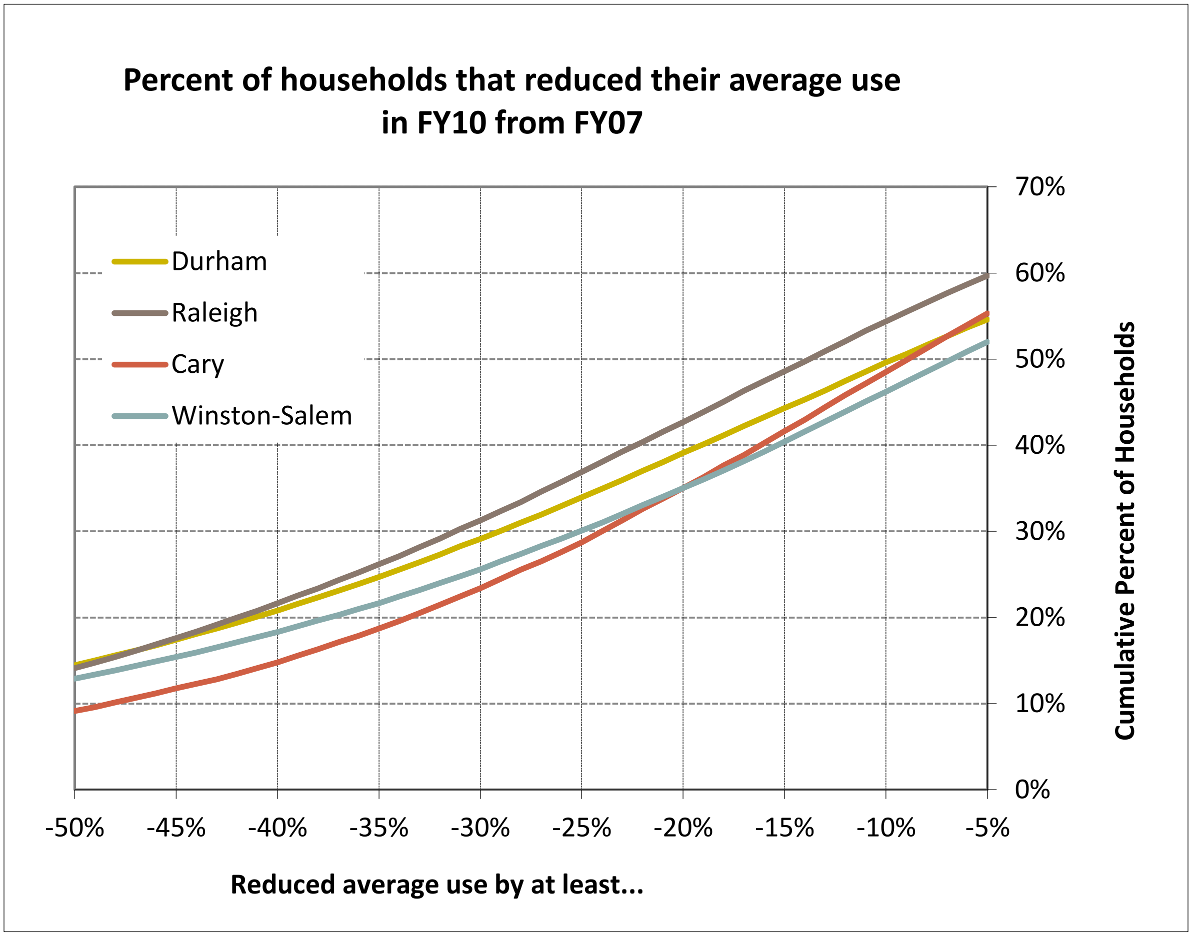
	Average monthly household water use (kgal)		Percent change	Median monthly household water use (kgal)		Percent change
	FY07	FY10		FY07	FY10	
Burlington (FY09 & FY11)	4,090	4,097	0.2	3,400	3,300	-2.9
Cape Fear (FY09 & FY10)	5,384	4,602	-14.5	4,000	3,740	-6.5
Cary	5,322	4,886	-8.2	4,310	3,940	-8.6
Durham	4,163	3,928	-5.6	3,437	3,112	-9.5
Greensboro	5,066	4,453	-12.1	41.57	3,740	-10.0
Raleigh	5,177	4,518	-12.7	4,001	3,740	-6.5
Winston-Salem/Forsyth	4,570	4,363	-4.5	3,748	3,640	-2.9

Extent of decline

Beyond average household water use, the customer-level perspective of this analysis allows us to ask the question: Who is conserving and by how much? Drilling down into individual consumption patterns helps utilities understand the nature of water use reductions in their utility, which is important for rate setting and financial planning.

Figure 2 shows the extent of water use reductions by individual households. For example, in Durham and Raleigh, around 14% of households reduced use by at least 50%. Cary had fewer big savers (with only 9% of households reducing average water use by at least 50%), but overall had the same percentage as Durham of customers that reduced average water use by at least 5%. Between 52% and 60% of customers in each of the utilities reduced their average water use by at least 5% in FY10. These four utilities were chosen for this figure because they provided data for FY07 and FY10 and had consistent billing frequency for the two fiscal years. As previously mentioned, Burlington and Cape Fear were not able to provide both FY07 and FY10 data. Greensboro transitioned from quarterly to monthly billing and comparing consumption levels is a non-relative exercise.

Figure 2: Reductions in customers' average use between FY07 & FY10

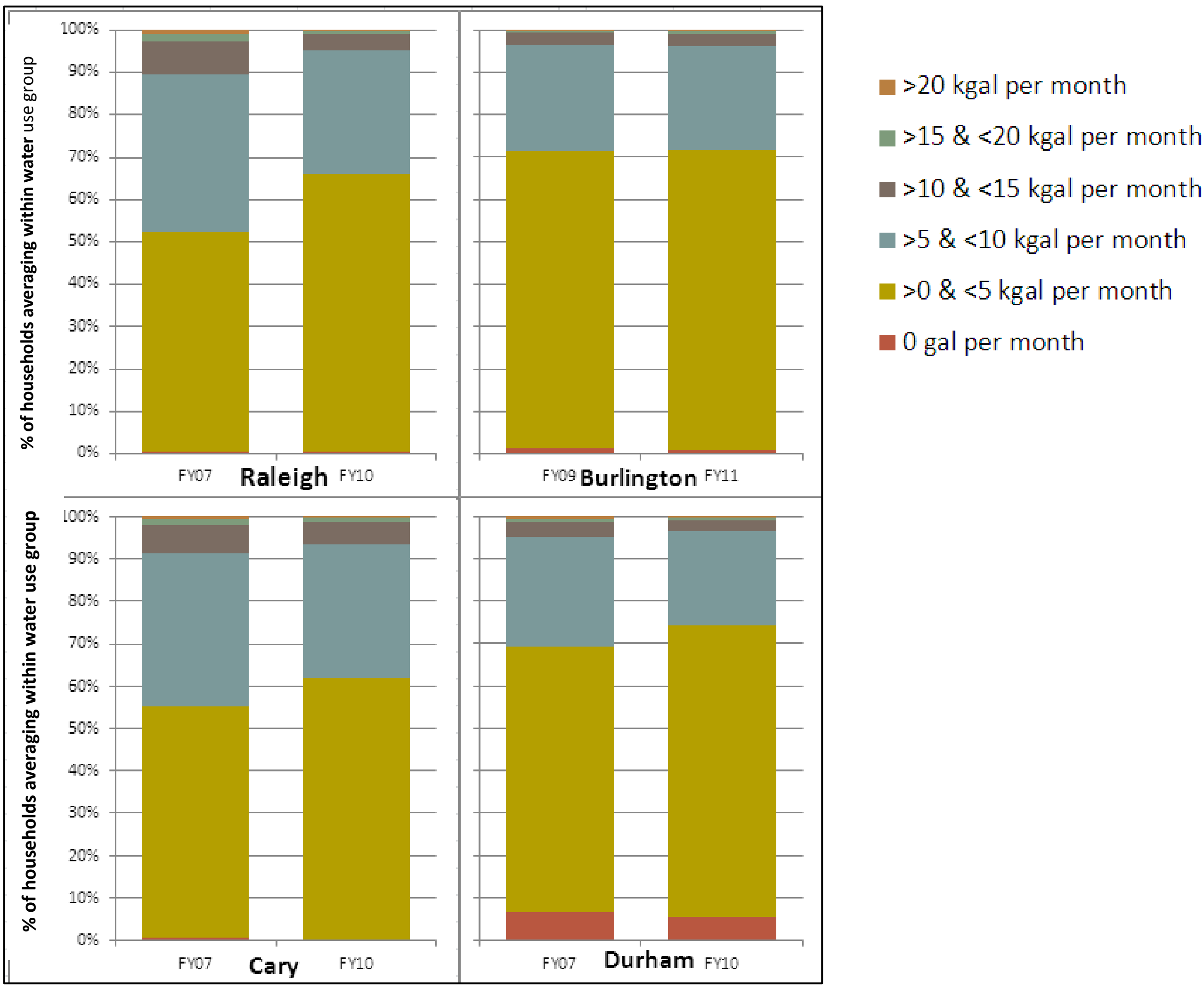


The analysis that the EFC did for each utility identified what type of customers were the "big savers" and what type of customers were "little savers." For the City of Raleigh, 44% of their "big savers" (with at least a 50% reduction in average household water use) averaged more than 10 ccf per month in FY 2007, while only 12% averaged less than 4 ccf in FY07. This trend of "big user" turned "big saver" was echoed in other utilities across the UWC.

Levels of Household Consumption

Viewing household consumption by each household's average monthly use provides insight on customers' typical monthly use, and the average bill customers face each month. Although a customer's use does vary throughout the year, understanding customers' average monthly use provides a framework for distinguishing different types of household use patterns.

Figure 3: Groups of average household water use for FY07 & FY10 (FY09 and FY11 for Burlington)



Across the UWC utilities, average use generally shifted downward between FY07 and FY10. Figure 3 compares the average monthly consumption changes between four of the seven utilities we studied. These four utilities currently bill on a monthly basis, so in our analysis we summarized consumption into monthly equivalents.

In FY07, over 10% of customers averaged over 15 kgal per month in Durham, whereas by FY10, under 5% of customers averaged over 15 kgal per month (Figure 3). Similar trends are seen in Cary and Raleigh. As we look at the lower use bins (0-5 kgal and 5-10 kgal), there is less of a blanket trend across utilities. The largest share of households in Durham used between 0-5 kgals per month in both FY07 (~41%) and FY10 (~50%). The largest portion of customers in Cary used between 5-10 kgals per month in both years (~47% in FY07 and ~44% in FY10).

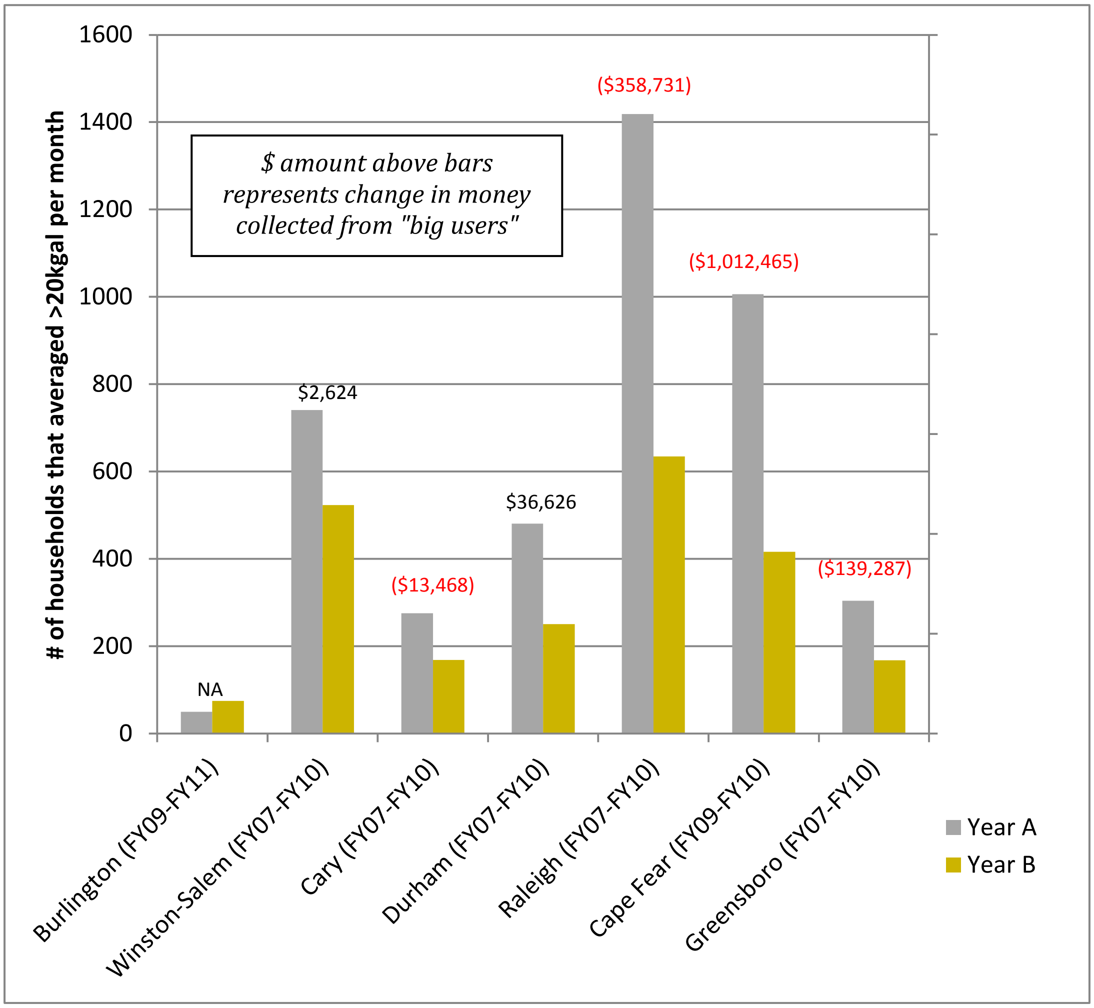
In another variation, the number of Raleigh customers averaging between 10-15 kgals per month decreased significantly (by 6 percentage points) and by FY10 virtually equal portions of customers fall into the 0-5 and 5-10 kgal per month bins (at 43% for each of these bins). Without factoring in rates and tier structures and other policy measures, it is difficult to pinpoint the drivers behind such shift; nevertheless, the similarities and differences among utilities point to the fact that there is no "one size fits all" strategy for operational and financial sustainability.

A drop in big users

Reductions in the number of large users are usually driven by decreased outdoor water use (water use that contributes to peak demand for most utilities) and can have both positive and negative impacts on utility operations and revenues. On one hand, reductions in seasonal peak aid in forecasting capacity needs and reduce uncertainty around seasonal use. However, drastic drops in water use among the large users directly impact utility revenues, especially when a tiered rate structure is applied, which results in substantial revenue drops for utilities that rely largely on volumetric charges for the bulk of revenue.

As mentioned above, much of the decline in average household water use between 2007 and 2010 appears to have been driven by reduction among utilities' large-water using households. Aside from Burlington, every utility saw a drop in the total number of customers using over 20,000 gallons per month (Figure 4). For four of the six utilities that saw a decline in big users, they also experienced a loss in revenue collected from them. Although changes in rates and rate structures can cushion the impact of such reduction, a reduction in "big users" was associated with a reduction in revenue for Cape Fear, the City of Greensboro, the City of Raleigh, and the Town of Cary.

Figure 4: Change in number of households and dollars collected from households averaging >20,000 gallons per month



A buffer to the revenue impacts of conservation is the share of the total charge allotted to volume versus base (or administrative charge). Although Durham and Winston Salem also saw a drop in large users, revenue impacts were less severe due to a large share of the charge coming from a fixed or base rate.

Demand Hardening

Average household water use alone does not speak to the changes in household consumption behavior in a given year. In order to reflect water use fluctuations, we profiled residential customers based on their "peaking" behavior. We defined a peaking household as one whose three months (or monthly equivalents) of highest use divided by their three months (or monthly equivalents) of lowest use was greater than two. In other words, for a quarter of the year, peaking households were using more than double of what they were using during another quarter of the year. This behavior suggests that these households have some discretionary water use, a significant portion of their demand that they can live without for at least three months out of the year. (They also could have had a fluctuation in the number of people in the home.)

We developed four mutually exclusive categories of customer peak behavior (defined below).

- **Low users, high peakers** are customers who average up to 4,000 gallons in their three lowest-use months but average more than double that in their three highest-use months.

- **High users, high peakers** are customers who average more than 4,000 gallons in their three lowest-use months and average more than double that in their three highest-use months.

- **Low users, low peakers** are customers who average up to 4,000 gallons in their three lowest-use months and average less than twice that amount in their three highest-use months.

- **High users, low peakers** are customers who average more than 4,000 gallons in their three lowest-use months but average less than twice that amount in their three highest-use months.

Of particular interest in this analysis of pre- and post-drought behavior were the low-using, low-peaking customers. This group of customers is one that has little room left to conserve. They have a low baseline (lowest three months) average and not a lot of discretionary water use. One utility characterized the increase of customers in this quadrant from FY07 to FY10 as "demand hardening." They felt like if they had more customers that were low using and low peaking, they would have less "slack" to cut in the drought years. In typical years, these customers would provide an advantage in capital planning and budgeting because their behavior would be conservative and relatively easy to predict, but in an atypical year, their low and steady water use could require more draconian (think inside water use) restrictions earlier in the drought.

Table 3 shows the percent of households that fell in Quadrant 3 in Year A versus Year B for each utility studied and whether there was an increase or decrease between the years. Those utilities that saw an increase between years may be on the way toward demand hardening, although more data points would be required to indicate an overall trend. Durham and Raleigh experienced the largest changes in the percentage of low-using, low-peaking households. More analysis could be done into why these geographically adjacent utilities experienced such divergent results.

Table 3: Change in low using and low peaking households

	Year A	Year B	Increase (+) / Decrease (-)
Burlington	44% (FY09)	42% (FY11)	-
Cape Fear	40% (FY09)	43% (FY10)	+
Cary	30% (FY07)	35% (FY10)	+
Durham	39% (FY07)	28% (FY10)	-
Greensboro	40% (FY07)	40% (FY10)	No change
Raleigh	21% (FY07)	39% (FY10)	+
Winston-Salem/Forsyth	50% (FY07)	42% (FY10)	-

Comparing Tiered Rate Structures

Although all of the seven utilities in this analysis have a tiered (block) rate structure, each utility's rate structure differs. This difference reflects a range of policy goals and priorities among the utilities. Of the seven utilities in this analysis, six have increasing block rates; only Burlington Water Department has a decreasing block structure. Tiered rate structures are rate structures where the unit price of water changes with each of several preset consumption blocks for each period. With an increasing block rate structure, the unit price increases[4]. With a decreasing block rate structure, it decreases.

The EFC examined household water use in FY10 as related to each water utility's current (FY12) rate structure. Therefore, the analysis does not show how an increasing block rate structure influences demand, but rather the intended and unintended policy implications of utility rate setting.

A striking difference among the six utilities with increasing block rates is the break point for the Tier 1 rate. For some utilities, the levels of consumption that fall within Tier 1 represent "lifeline" water use. "Lifeline" water use is typically water used for drinking, cooking and hygiene purposes. But that is not how every water utility uses the first tier of its rate structure, as made apparent in Table 4.

Column A in Table 4 shows the percentage of households whose water use never exceeded Tier 1 levels. In other words, these households "permanently" live in Tier 1 consumption levels. Looking at this column, the policy behind Cary and Cape Fear's Tier 1 rates seem to differ from that of the other utilities. The table shows that if consumption was the same in FY12 as it was in FY10, 58% of Cape Fear's customers would never encounter Tier 2 rates. In Cary, 40% of residential customers would never encounter Tier 2 rates.

Column C highlights the "lifeline" nature of each utility's Tier 1. Column C shows the percentage of residential customers whose three lowest month's average falls in Tier 1 levels of consumption. By averaging a household's three lowest months, our analysis reveals a household's "baseline" water use. This level of water use is the best way to estimate a household's non-discretionary water use.

Although the City of Raleigh's Tier 1 rates are set to only one ccf[5] higher than in Winston-Salem/Forsyth County rates (4 ccf, rather than 3), they appear to have more residential customers that could "live" with Tier 1 rates if they had to (65% rather than 40%).

Column B shows the percent of households whose average water use would fall in Tier 1 consumption levels. For the most part, these households consume (i.e. "live") at Tier 1 levels, but their consumption may "visit" other tiers throughout the year.

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[4] As defined by the AWWA Rates and Charges Committee:
http://www.awwa.org/Resources/topicspecific.cfm?ItemNumber=3649&navItemNumber=3650

[5] CCF stands for 100 cubic feet. 1 ccf = 748 galons.

Table 4: Tier 1 between utilities with increasing block rate structures

			A	B	C
Utility	Tier Range (FY12)	Tier 1 Volumetric Charges	Percent of households that never exceeded Tier 1 (FY10)	Percent of households whose average water use falls in Tier 1 (FY10)	Percent of households whose 3 lowest non-zero months' average falls in Tier 1 (FY10)
Cape Fear	0–8 ccf per month (0-12k gallons per bi-monthly bill)	$1.97/ccf ($2.64/ kgal)	58%	74%	92%
Cary	0-6.7 ccf per month (0-5k gallons per month)	$2.69/ccf ($3.60/ kgal)	40%	61%	91%
Durham	0-2 ccf per month	$1.73/ ccf	15%	12%	43%
Greensboro	0-3 ccf per month	$1.60/ ccf	15%	21%	49%
Raleigh	0-4 ccf per month	$2.53/ ccf	21%	32%	65%
Winston-Salem/ Forsyth	0-3 ccf per month (0-6 ccf per bi-monthly bill)	$1.62/ ccf	16%	22%	40%

Another way to analyze the policy implications of rate setting is to compare the steepness of utilities' increasing block rate structures. Among the UWC utilities, the strongest price signals, measured as the percent difference in rates between tiers (Table 5) are being sent by Raleigh, Durham and CFPUA between Tiers 1 and 2, and by Durham to users exceeding tier 4 (>15 ccf per month). It is also interesting to note that although Winston Salem and Durham distinguish use between Tiers 2 and 3, the marginal price difference between these tiers is small, and may not be enough to really discourage customers to keep use within Tier 2.

Table 5: Percent difference between tiered rates (as of April 2012)

	Cary	CFPUA	Raleigh	Durham	Winston Salem	Greensboro
% Difference between tier 1 and 2 rates	12.5	40.0	50.0	40.4	37.5	35.9
% Difference between tier 2 and 3 rates	34.7	28.6	28.6	9.2	1.7	23.1
% Difference between tier 3 and 4 rates	-	-	-	26.6	10.6	31.9
% Difference between tier 4 and 5 rates	-	-	-	39.9	-56.7 ★	-

★ Winston-Salem/Forsyth County apply the same rate to all inside retail customers. Although their rate structure has the appearance of a decreasing block between Tiers 4 and 5, Tier 5 is targeted toward large commercial customers.

Revenue Stability

Under the common residential water use pricing model, utilities face a tradeoff between reliance on a stable base charge (a fixed fee no matter what a customer uses) and dependence on a variable volumetric charge (a rate applied to customer water use). With a higher base charge, utilities have a relatively stable and predictable revenue stream (dependent only on the number of customers and payments made). However, when a utility collects more of its revenues from base charges, it diminishes one of its strongest ways to send a water conservation/efficiency message to its customers.

Various water conservation groups have recognized this tradeoff, and are promoting water utilities to build more of their cost recovery into their volumetric charges. In fact, the California Urban Water Conservation Council guides a group of 398 members to increase water use efficiency through the implementation of a series of Best Management Practices, one of which deems a utility's volumetric rates to be "sufficiently consistent with the definition of conservation pricing" when:

> *The percent of revenue collected through volumetric charges is greater than or equal to 70% of revenue (base and volumetric) collected from all retail customers*

The EFC was interested in how UWC members compared against this water conservation expectation and calculated the percent of revenue collected from residential volumetric charges over total residential charges. The analysis in Table 6 compares these percentages.

Table 6: Base charges as a percentage of all charges across the NC Triangle

	Cary	Durham	Raleigh
Fiscal Year	% of revenue collected from volumetric charges as a percent of all revenue collected from households (base & volumetric)		
‘07	91.4%	82.0%	76.3%
‘08	90.8%	82.2%	74.5%
‘09	90.4%	71.0%	74.7%
‘10	91.1%	73.5%	75.4%
‘11*	92.3%	72.1%	78.0%
*FY11 does not include all 12 months in any of the data sets			

The range and progression of reliance on volumetric charges throughout time and across the Triangle region of North Carolina reveals the diversity in utility pricing policy in regards to water conservation

The Town of Cary collected significantly more revenue from volumetric charges (approximately 90%) between FY07 and FY11 than it did base charges (approximately 10%). Even though the Town of Cary saw a median decrease in average household water use of 332 gallons per month between FY07 and FY10, it still collected $2.3 million more from its residential customers[6]. The Town of Cary's rate increases outpaced declines in water use. However, should Cary experience a sharp and unexpected decline in water use, more of their revenue is at stake, than was in FY07.

The City of Durham, on the other hand, has moved away from reliance on volumetric charges to reliance on base charges. In FY10, Durham collected 27.9% of its residential revenue from base charges. In FY09, Durham nearly doubled their base rate for water sewer and irrigation – and adopted an increasing block rate structure that increased the price of water at all levels –decreasing its reliance on volumetric charges.

Household Irrigation Water Use

Every utility in the Urban Water Consortium offers separate meters for irrigation purposes, and under North Carolina law, separate irrigation meters are required for all newly plotted land with an in-ground irrigation system. Despite this, irrigation meters are not capturing all of the water used for irrigation in each of these utilities. In fact, in some cases, they are not capturing the majority of water used for heavy irrigation.

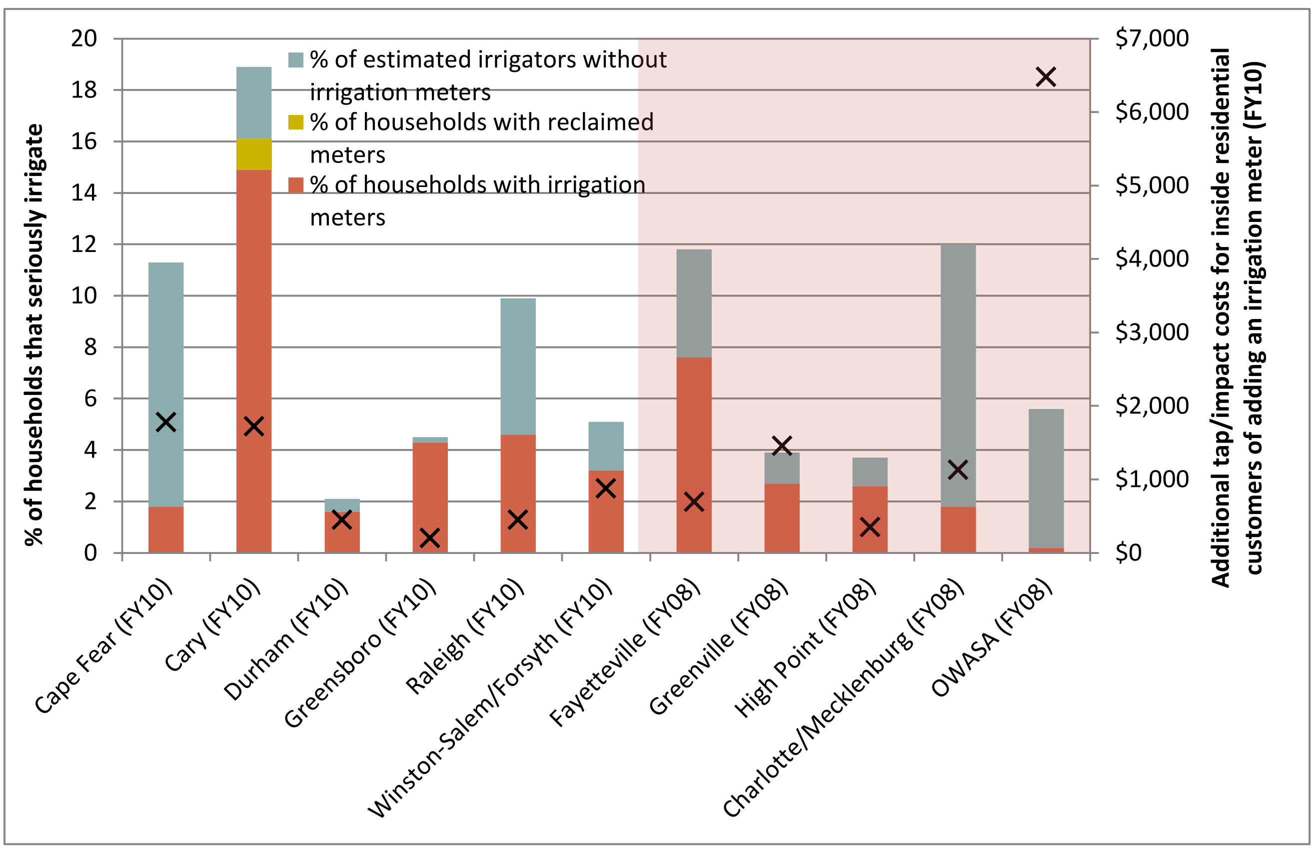
[6] The revenue collected from residential customers was calculated from 88% of Cary households that had at least 6 months of usage in each year.

The following analysis attempts to capture the number of customers and amount of water likely to be attributed to heavy irrigation (i.e. using in-ground irrigation systems, not simply hand watering). The EFC used billing records to estimate how many existing residential customers were using a standard meter to supply water to an in-ground irrigation system. This was done by looking at the water usage patterns for those households that did have irrigation meters and finding households without irrigation meters that had similar patterns.

Figure 5 shows the percent of customers that the Environmental Finance Center estimates to be irrigating through in-ground irrigation systems. As noted, they are taken from different years.

The red area represents the customers that are irrigating through an irrigation meter. This group of customers will continue to grow as a percentage of the whole as all newly plotted lands with in-ground irrigation systems will be required to separately meter their irrigation water use. The yellow area represents customers that irrigate with reclaimed water. Currently only the Town of Cary pipes and meters reclaimed water directly to residential customers (yellow band in Figure 5).

Figure 5: Household irrigation trends across 12 UWC utilities



The light blue area represents the group of customers that the EFC estimates to be irrigating through their standard meter. As the graph indicates, this group of customers varies significantly among the UWC members. The black "x" indicates one reason why this variance exists. This marker aligns with the additional costs to households to install a separate irrigation meter in FY10. For the utilities that fall under the shaded portion of the graph, the assumed irrigators were identified during a drought year, which may have resulted in an over- or under-representation of households irrigating from standard meters (depending on individual utility restrictions on outdoor water use). However, there are many other reasons why households were encouraged or discouraged to connect their irrigation system to a separate meter, including rate discrepancies and utility policies. The Environmental Finance Center recently published an article in Journal AWWA[7] exploring this issue.

These standard-metered irrigators have serious implications for utilities. For one, if they are indeed irrigating with an in-ground irrigation system, they should have a proper backflow prevention system installed and be conducting required maintenance of that system. In addition, it is important to know what water (and revenue) is at stake if the utility experiences a particularly wet or dry year that will influence irrigation demand.

Identifying Standard-Metered Irrigators: An Assessment

In order to identify estimated irrigators, the Environmental Finance Center uses the following three criteria:

1. Household does not have an irrigation meter.

2. Average household water use May through October is greater than 10,000 gallons per month.

3. Households that have an irrigation season to non-irrigation season water use ratio equal to at least 70% equivalent of the median ratio for households with irrigation meters (i.e. have similar use patterns to known irrigators in the same year). For the Town of Cary, the median ratio for irrigation-metered households was 1.88, with the 70% equivalent thus being 1.32.

The algorithm used to identify estimated irrigators is designed to be a conservative estimate. In other words, we anticipate that there are more households irrigating, whether via a hose or even an in-ground irrigation system, that the algorithm does not identify as irrigators.

[7] Tiger, M., S. Eskaf & J. Hughes. Implications of Residential Irrigation Metering for Customers' Expenditures and Demand. Journal AWWA, 103:12, December 2011.

Most utilities require backflow prevention devices to be installed and inspected on all irrigation systems connected to their system to protect water supplies from contamination or pollution. A study funded by and conducted for the UWC in 2010 found that UWC members rely on the private sector to install backflow prevention devices and provide annual inspections of the systems, with the exception of Fayetteville Public Works and the Town of Cary. This year, the Environmental Finance Center collected the list of customers for whom the Town of Cary provides annual backflow prevention inspections. After removing the customers that had irrigation meters, we cross-referenced the list with the list of customers that we identified as "estimated" irrigators; the results are reported in Figure 7. We used this analysis to help us assess the accuracy of our algorithm. This introspective analysis revealed the conservative nature of our estimate.

Table 7: EFC estimated irrigators cross-referenced with the Town of Cary backflow prevention customers

	Estimated irrigators identified by EFC	Not identified as an estimated irrigator
TOC backflow prevention customers	701	754
Not a TOC backflow prevention customer	630	

Quadrant 1 (n=701): These are customers that have been identified as standard-metered irrigators by the EFC and are also complying with the Town of Cary's backflow protection regulations. All customers in this quadrant meet the analysis' minimum threshold average household water use of 10,000 gallons or greater from May through October (Criteria #2) ***and*** a water use ratio of 1.32 or greater (Criteria #3). The median water usage was 13,595 gallons, and the mean was 14,536. The median water use ratio was 1.86, and the mean was 1.93.

Quadrant 2 (n= 754): The EFC did not identify these customers as irrigators, yet they have backflow prevention equipment. It is not surprising that there are just as many customers that have irrigation systems but that we do not identify as irrigators. In an effort to avoid false-positives, we have set the bar high to be considered an "estimated" irrigator. Most of the 754 were not identified as irrigators because their average water use was less than 10,000 gallons per month (only 46 had a water usage of 10,000 gallons or above). The median water usage was 7,463 gallons and the mean was 7,426. Given that the households in this data group, on average, only used about 7,500 gallons, significantly below EFC's threshold of 10,000 gallons, few data points met this criteria.

Quadrant 3 (n= 630): All customers in this quadrant met the report's minimum threshold average household water use of 10,000 gallons or greater from May through October ***and*** a water use ratio of 1.32 or greater. However, they are not coordinating with the Town of Cary on backflow prevention. These customers are (a) either breaking the Town of Cary's backflow prevention ordinances or (b) because Cary households with irrigation meters use almost as much inside their home as they do outside, they are getting flagged in Criteria 3 listed above. If the latter is true, these households could be manually irrigating through their hose bib and in compliance with Cary's ordinance that requires backflow prevention devices for automated, in-ground irrigation systems.

VI. Summary

No two utilities are exactly alike. Despite some similarities in monthly usage across the seven utilities, there were significant differences in customer consumption behavior between them. This indicates that policies that might work for one utility may be ineffective in another utility where customers behave differently. Nonetheless, there are some lessons that can be shared across utilities (see Addendums 2 and 3).

Although analyzing and understanding customer profiles can be difficult for water utilities given current billing technology and software, it should be an essential part of any large utility's management decision-making framework. At the very least, customer-level analysis provides a summary of usage patterns across years and can help utilities discover errors that can be easily corrected, such as using wrong rate structure classifications for specific customers.

Customer-level analysis can also provide a better understanding of customers by revealing trends in usage and bill paying practices over time and customer specific practices such as peaking and irrigation water use. Producing profiles based on customer water use history is a powerful tool in evaluating new utility-wide policy decisions affecting customers and allows utilities to better target specific marketing campaigns, as well as design tailored rate structures.

In addition to the benefit to individual utilities to understand and scrutinize their customers, an investigation into customer consumption behavior within the context of socioeconomic, housing, and drought response can produce larger lessons for other utilities. This report sought to tell some of the stories using customer level analysis, supplemented with financial information.

Addendum 1: Coping with the Drought Hangover in Southeast Water Utility Management: Addressing Mid-Term Financial Impacts of Water Conservation

PRELIMINARY RESULTS

Research project for NC Urban Water Consortium
By Shadi Eskaf, Casey Wichman, and Christine E. Boyle, PhD

Introduction

This project investigates the mid- and long- term water use demand reductions spurred by conservation measures undertaken during droughts. We examine how household water use changed in three utilities using household-level billing records before, during, and after the 2007-08 drought in North Carolina.

The premise for this research is the conundrum facing 21st century water utilities: they encourage customers to use water efficiently, but lose significant amounts of revenue when customers conserve on their water consumption. Utilities in the southeastern United States are now noticing that per household water use is on the decline, threatening their revenue stream. Exacerbating the situation is that customers coming out of a drought period (as experienced in the southeast in 2007-2008) continue to conserve and use water more efficiently than in the pre-drought period, lowering the revenue baseline for utilities for an unknown period post-drought. In order to ensure financial sustainability, utilities must be able to plan for reduced consumption and lower revenues both during the water shortage periods and for some time beyond.

Although utilities have improved their understanding of collective customers' reactions to different conservation initiatives, there are still gaps in understanding how individual customers or types of customers react to different initiatives. For example, a utility may be able to estimate that their conservation initiatives will lead to an overall 10% reduction in demand, but may not be able to identify the demand reduction of the small number of large users on whom the utility relies on for a disproportionately large amount of its revenues. This research aims first, to establish the length of time following a drought wherein customer water use returns to a permanent "new baseline" use level; and second, to estimate the percent reduction of this "new baseline" consumption level.

Methodology

Using water billing data from three utilities in North Carolina (Durham, Winston-Salem and Raleigh), we assess post-drought customer water consumption behavior in two ways. First, we establish the length of time after a drought before average water use settles into a stable level of consumption. To determine the change in behavior for water customers, we used the cumulative sum (CUSUM) change-point method by calculating the cumulative sum of differences between each household's bi-monthly water use relative to the mean consumption in the study period (July 2006 – December 2010), adjusting for seasonality. Then, by taking the maximum of the absolute value of the CUSUM trend, we were able to pinpoint the month in which consumption patterns changed for each utility. This is the time period we assigned to the beginning of "drought behavior". We then repeated this procedure for the months after drought behavior. For each utility, we found an additional change in mean consumption which we determine to be the end of drought behavior and, thus, the beginning of our "new baseline" period. This technique aims to measure the length of time that water consumption remains low post-drought once conservation initiatives are removed, in order to inform utilities about the potential magnitudes and impacts of the drought hangover on utility revenues.

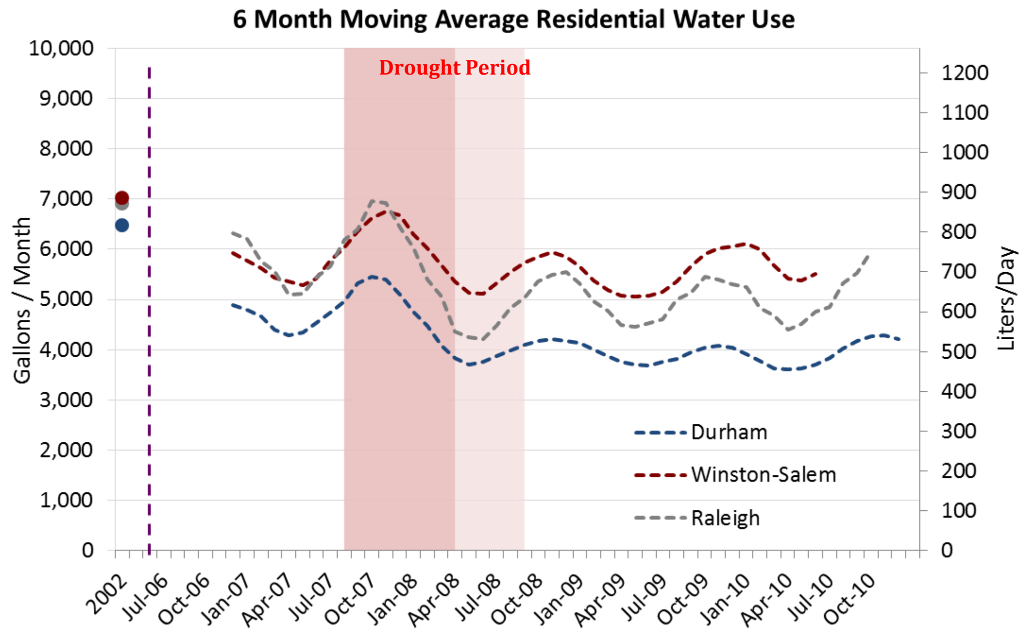
Second, in order to estimate the percent reduction in average household water use, we employ a fixed effect instrumental variables regression model to estimate the declines in average residential water use in the post-drought period, controlling for other time-varying factors that may affect residential water use, such as price, precipitation, temperature, season, implementation of additional conservation programs, and the state of the economy.

In the next phase of this research, we will develop several new business models simulations using the billing data to determine alternative pricing strategies that breaks down the aforementioned conundrum and provides improved financial stability, even in times of reduced water demand, while continuing to maintain a conservation incentive. This research contributes empirical evidence on conservation-based water utility revenue models and also assists in planning water conservation policies that ensure fiscal sustainability.

Summary of Findings

Looking the change in average monthly use before, during and after the 2007-08 drought, across the three utilities there is an overall downward shift in water use following the drought's end (see Figure 1). High season summer water use peaked for all utilities during the early months of the drought, indicated by the red areas in the timeline, but in the post-drought phase seasonal averages appear to be lower than pre-drought levels.

Figure 1 Residential Water Use: FY 2007 - FY 2010



Results from the CUSUM technique pinpoint the month in which consumption patterns changed for each of the three utilities. All three utilities have both of these change points, but the start point of the new baseline differs. Before getting into the utility-specific results, let us highlight two important points common to all three utilities. First, water use in the "new baseline" was lower than water use pre-drought in all three cities. Second, all three cities had drought hangover periods (of varying length) before stabilizing to a new monthly average. The results in this addendum are all *preliminary*, and further analysis will probably refine these estimates. Nevertheless, these preliminary results are indicative of the types of changes in water use that occurred in the three cities.

Durham

In Durham, approximately 11 months passed between the end of the drought and the establishment of a new baseline. The new baseline is lower than during the drought-behavior period. This suggests that the drought, and its affiliated conservation policies, marked a transition to a permanent decline in use, what we refer to as permanent behavioral and structural water use changes.

Table 2 Preliminary CUSUM change point analysis results

	Month where drought behavior begins:	Time until new baseline begins (# months from end of the drought):	Month
Durham	2007-11	11	2009-03
Raleigh	2007-11	20	2009-12
Winston-Salem	2007-12	16	2009-08

Raleigh and Winston Salem

The story for Raleigh and Winston Salem is different. In Raleigh 20 months passed between the drought's end until the establishment of a new baseline in consumption. In Winston Salem it took 16 months from end of drought to establish a new baseline. For Winston Salem and Raleigh, the new baseline is lower than pre--drought; but higher than the drought-behavior period use. This indicates that customer water use "BOUNCED BACK" immediately following the drought's end, and eventually settled into a new baseline (of stable use). This settling back in period however, took a long time, over a year in each case. In these two cities, the new baseline mean use, although lower than pre-drought, were in fact higher than the drought-behavior period mean use. This suggests smaller, yet still permanent declines in use as far as we can determine through this study period

To measure the percent reduction between pre- and post- drought consumption, we use regression to estimate the percent change in household's average water use for the three utilities. We interpret the results as the effect of being in the post-drought period on an average household. When we pool all three into a joint analysis, estimates indicate that average use dropped by about 23% per household in the post drought period, holding all other factors constant. This number is consistent with our summary statistics from the *Shifting Baselines Report* submitted to the Urban Water Consortium in May 2012.

Although these findings are only preliminary, and will be running in the final version in coming months, they nonetheless have large implications for utilities' operational and financial planning. If utilities do not account for permanent, or even temporary, changes in consumption following a drought, they run the risk of over-estimating use in months and years following a drought. Another potential planning problem is setting rates too low due to not accounting for permanent declines in use, and subsequent revenue drops. The risks of revenue shortfalls can be avoided once a utility has good information about the impacts and duration of drought-time curbs in water use.

Addendum 2: Benefit-Cost Analysis of Durham Transition from Monthly to Bi-Monthly Billing

Research project for NC Urban Water Consortium
By Casey Wichman

In order to quantify the utility savings and costs of switching from bi-monthly to monthly billing for the Durham Water Utility, the Environmental Finance Center performed a preliminary analysis on three-months of utility activities thought to be influenced by billing frequency. In particular, the EFC quantified the costs and savings associated with switching to monthly billing in October of 2011 from:

1. Total number of letters sent to customers (including friendly payment reminders, late notices, phone notices, and cut-off notices)
2. Number of adjustments to customer bills due to leaks
3. Number of adjustments to customer bills due to meters being read too high
4. Total amount of balances that were cut-off and never repaid
5. Number of service orders

We compared these activities for customer bills between December and February over a three-year period. In fiscal year 2009-2010 and 2010-2011, District 3 customers in Durham utility were billed bi-monthly whereas in fiscal year 2011-2012, the same customers were billed on a monthly basis. Comparing the average costs from the first two years under bi-monthly billing with the costs associated with monthly billing in the most recent period allows for a good approximation of what the utility should expect to occur when monthly billing is rolled out for all customers.

Overall, the results were mixed—some activities increased due to the transition to monthly billing, resulting in higher costs, while other activities resulted in increased savings for the utility.

The level of communication between the utility and customer was increased with more frequent billing. Particularly the amount of friendly reminders and late notices mailed to customers increased by 20 to 27%. Additionally, phone notices increased slightly, by 8%, but the number of cut-off notices decreased by 5%.

After monthly billing was initiated, the total number of leak adjustments increased by 68% and the dollar amount of leak adjustments increased by 105%. The average leak adjustment amount, however, decreased from fiscal year 2010-2011 to fiscal year 2011-2012. This result is likely due to customers suspecting smaller leaks more quickly as they receive more frequent information about their consumption habits each month.

The number of adjustments due to meters being read too high decreased substantially (84%) and the dollar amount of these adjustments dropped by over 90% after transitioning to monthly billing.

Monthly billing had a significant impact on the number of accounts that were cut-off due to non-payment. The number of accounts whose service was cut-off dropped by approximately 47% after monthly billing was initiated. Additionally, the dollar value of the cut-off accounts decreased by 49%. This result is likely driven by the increased level of communication between the utility and the customer, as well as the smaller payments required on more frequent bills.

Lastly, we tracked the number of service orders requested before and after monthly billing began. There was a slight increase (6%) in the number of service requests during the transition.

While this analysis provides a snapshot of what Durham Water Utility could expect from rolling out monthly billing in other districts of its service area, as well as what other utilities could expect from a transition to more frequent customer billing, it is not a comprehensive analysis. An improvement on this study would be to compare a full year's worth of utility activities before and after the transition in order to 1) take into account seasonal differences, 2) compare activities across multiple billing periods, and 3) better depict a utility's expected costs and savings at an annual level.

Table 1: Did Switching to Monthly Billing Increase Utility Costs or Revenue?

	Bi-monthly Billing (Dec-Feb)		Monthly Billing (Dec - Feb)	Net Effect of Monthly Billing Relative to Bi-Monthly Average	
Total Letters	**2009-2010**	**2010-2011**	**2011-2012**	**Difference**	**% Change**
Friendly Reminder	2396	2503	3107	**658**	**26.8%**
Late Notice	1230	1205	1472	**255**	**20.9%**
Phone Notice	841	849	914	**69**	**8.2%**
Cut-off Notice	185	289	224	**-13**	**-5.5%**
Total Leak Adjustments	**2009-2010**	**2010-2011**	**2011-2012**	**Difference**	**% Change**
Dollar Amt of Adjustments	-$6,955.63	-$15,133.72	-$22,647.50	**-$11,602.83**	**105.1%**
Number of Adjustments	33	29	52	**21**	**67.7%**
Mean Adjustment Amount	-$210.78	-$521.85	-$435.53		
Total Meter High Adjustments	**2009-2010**	**2010-2011**	**2011-2012**	**Difference**	**% Change**
Dollar Amt of Meter High Adjustments	N/A	-$9,254.44	-$793.42	**$8,461.02**	**-91.4%**
Number of Meter High Adjustments	N/A	19	3	**-16**	**-84.2%**
Mean Meter High Adjustment Amt	N/A	-$487.08	-$264.47		
Total Balances Cut-off	**2009-2010**	**2010-2011**	**2011-2012**	**Difference**	**% Change**
Dollar Amt of Cut-offs	$22,200.35	$22,837.79	$11,444.99	**-$11,074.08**	**-49.2%**
Number of Cut-offs	36	24	16	**-14**	**-46.7%**
Average Cut-off Amt	$616.68	$951.57	$715.31		
Total No. Service Orders	**2009-2010**	**2010-2011**	**2011-2012**	**Difference**	**% Change**
No. of Service Orders	314	421	389	**22**	**6.0%**

This table displays the number and dollar amount of letters sent to customers, leak adjustments, meter high adjustments, cut-off balances which were never repaid, and service orders for three-months (Dec-Feb) of bills between FY 2009-2010 and FY 2011-2012 for customers in District 3. The final two columns show the net effect of switching from bi-monthly to monthly billing for Durham's District 3 customers.

Addendum 3: Managing Transition: City of Raleigh Utility Employees Reflect on Billing Software Change

Research project for NC Urban Water Consortium
By Jon Breece

In November 2010, the City of Raleigh transitioned to a new utility billing software system – after a two-year process of scrutinizing the existing system and implementing a new system. While the shift was "not perfect," the transition went well with no billing hiccups, such as gross overcharges, according to utility billing division employees involved with the project.

The impetus for the shift in software packages was the March 2008 Raleigh City Council decision to transition to a tiered-rate structure for water pricing.[8] The existing system – Ventyx's Banner Customer Information Systems (CIS)[9] – did not allow for tiered-billing. Planning for the shift began in August 2008 with the City's release of a request for proposals (RFP) from software vendors.

After week-long demonstrations from the two finalists, the City selected Oracle's Customer Care and Billing (CC&B)[10] system to succeed CIS. In addition to allowing for tiered-rate billing, CC&B also allowed for monthly billing, mobile field solutions, online bill pay and consolidation of domestic water and irrigation bills into one bill for residential customers.

According to Raleigh utility billing division employees, the keys to a successful shift include:

1. Properly scoping the project and allocating staff
2. Working with an experienced partner
3. Rigorously testing software
4. Training and testing employees

[8] http://www.newsobserver.com/2008/03/05/69032/raleigh-oks-tiered-water-pricing.html
[9] http://www.ventyx.com/solutions/customer-information-systems.asp
[10] http://www.oracle.com/us/industries/utilities/046909.html

Do not underestimate the resources that the effort requires

Utility Billing Services Manager Susan Decker cautioned other utilities considering such a transition not to underestimate the resources needed to make a successful software switch. Preparation and execution of a shift require a loss of resources for day-to-day utility billing operations. The division reallocated the information technology and business units to perform shift-related tasks.

Decker also advised other utilities to have a solid plan for a "defect and enhancement resolution process." In order to meet a "go live" date, utility leadership must be willing to push non-mission critical features of a system to post-implementation, she said. Raleigh created a post-implementation team to handle system enhancements after the November 2010 switch brought the core functioning of the new system online.

The project also demanded the management of 13 separate digital environments for development, testing, training, and quality control. This necessity required a commitment of technical and human resources. The digital environment leads needed to coordinate developments with one another to synchronize project progress.

Properly scoping and staffing the project requires the project team to resist the temptation to underestimate the resources needed, Decker said. What may be perceived as "over-allocation" at the start of a project is preferred to pulling in additional participants late in the project. Pulling in additional employees on an ad-hoc basis is unfair to these participants, requires time to get new additions "caught up," and can create stress. Late in its transition, Raleigh had to add more employees for testing and validation.

Decker also recommended other utilities engage in rehearsal cut-overs as a way to gauge the effort needed to perform the "go live" cut-over and employee skill needed. Raleigh conducted three mock cut-overs prior to the "go live" weekend. During these weekend rehearsals, the utility timed the conversion tasks including manually reentering some non-converted accounts. Based on these dress rehearsals, the leadership could reconfigure work processes. The rehearsals also required employees to put-to-use the classroom instruction that they had received on the CC&B system.

Work with an experienced implementation partner

Decker credited the success of the transition to working with an experienced implementation partner – ProMark Solutions, Inc.[11], a Las Vegas-based company that Decker said had a firm grasp of the CC&B system and the City's legacy system. Decker said that ProMark scoped and staffed the project superbly and laid out a firm execution plan.

Raleigh reached out to ProMark after it became clear that the company originally hired to shepherd the move had over-promised on expertise, experience and staffing, Unfortunately, the initial partnership led to "wasted time" and delays in service roll-out,[12] said Decker. Decker stressed the importance of selecting a partner with a realistic assessment of their technical abilities and staffing capabilities.

The ProMark team's execution plan accounted for the time to migrate customer accounts and to identify and manually convert accounts that could not migrate. A week prior to the November 1, 2010 switch, the division shut down the CIS system and began to capture usage data in a Microsoft Access database. The shutdown was necessary because conversion programs do not allow data entry after the programs have started, according to Kevin Champion, Utility Billing Operations System Administrator.

During the days-long conversion process, the division converted approximately three years of data. Employees moved data into the new system from the Access database that had pooled customer and work order information into a shared environment while the conversion process went forward. After the cutover, the Banner CIS system was available for the utility to query.

ProMark team members remained in Raleigh until the end of June 2011 to provide additional support.

Engage in rigorous software testing

The transition was smoother than most, according to David Martin, a staff assistant with the Utility Billing Division and former private industry software developer who has been involved with more than 50 conversions.

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[11] http://www.promarksolutions.net/
[12] http://www.newsobserver.com/2009/11/06/177369/raleigh-botched-computer-upgrade.html

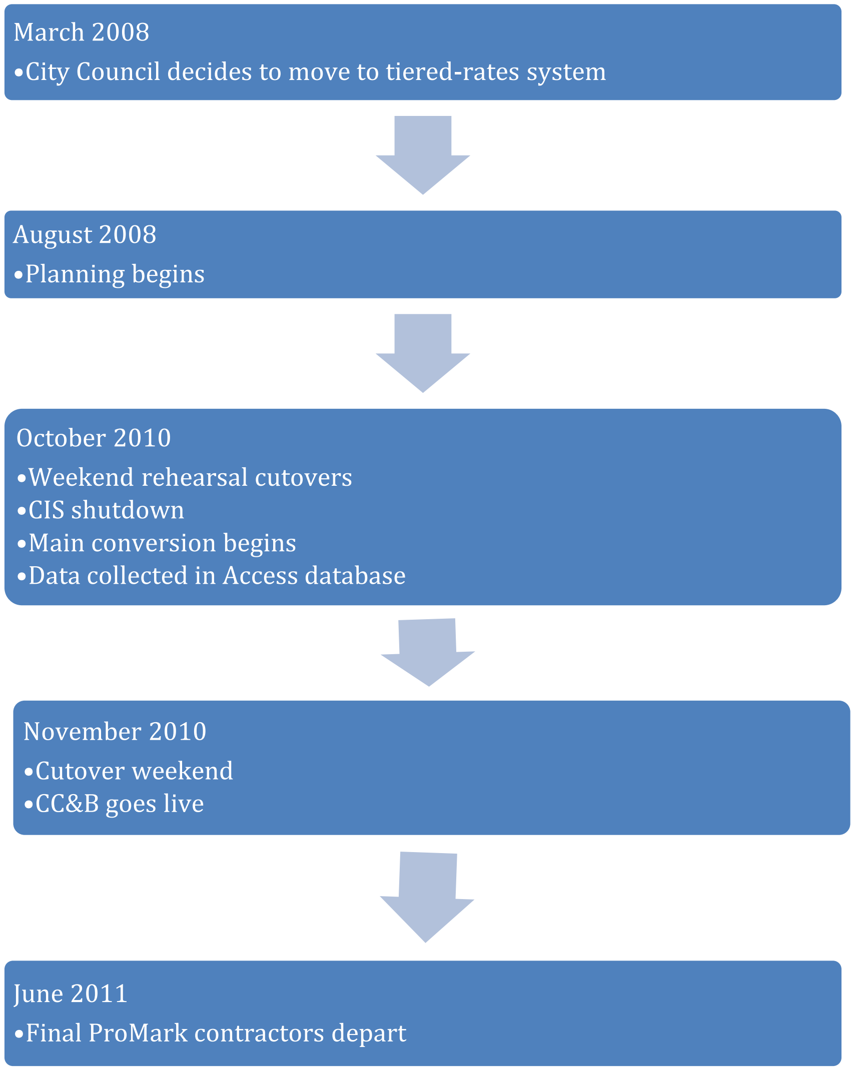
Martin said that the CC&B system was “tested, tested, [and] tested again” before going live and any subsequent changes to the system have been rigorously tested. Testing included doing daily balancing reports and comparing the results from the CIS and CC&B systems. “Day-in-the-life” testing evaluated the system’s ability to handle day-to-day tasks.

Train and test employees

To aid the transition, the division also cross-trained selected employees on the new system to create a large pool of “super-users” to train and assist others, Martin said. For two to four weeks after the cut-over, trained staff members served as “floor-walkers” to help employees adjust to the new system, Decker said.

This integration of employees into the planning and implementation process was also seen in the composition of task-based teams. All groups of employee associated with the legacy system were represented – including technicians, customer services representatives, accountants, and information technology employees.

Figure 1 Timeline of Raleigh's Transition



For more information:

Your New Utility Bill
http://www.raleighnc.gov/home/content/FinUtilityBilling/Articles/UtilityBillNew.html

A ProMark Touchdown at the City of Raleigh
http://www.promarksolutions.net/PDF/News4.pdf