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**Date:** October 26, 2018

**From:** Dr. Mehdi Nemati, Assistant Professor and Water Resources Cooperative Extension Specialist

**To:** Robb Barnitt, CEO, Dropcountr

**Re:** Report for the Effect of Dropcountr (DC) on Water Consumption in the Austin Water Utility (AWU)

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Dear Mr. Barnitt:

Please find a summary report related to the *Effect of Dropcountr (DC) on Water Consumption in the Austin Water Utility (AWU)* enclosed. This report estimates the percentage reduction of household water consumption due to enrollment in DC services. We have reported the percentage reduction according to the baseline water consumption before enrollment in DC, and the aggregate percentage reduction in water-use for program participants. Also, we converted the percentage reductions into actual volumetric units conserved as a result of DC. Our findings suggest that DC has a statistically and economically significant conservation effect on water consumption. We find that the introduction of DC services for the population of households participating in DC causes an aggregate treatment effect of 15.42 percent reduction in water usage. There is significant variation in the effects across households' dependent on baseline consumption quintile. Households in the highest quintile of baseline consumption reduce consumption by an estimated 19.89 percent in response to DC services.

Sincerely,

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**Summary Report: Analysis of DC Pilot Program for Austin Water Utility**

***Executive Summary***

This report estimates the percentage reduction of household water consumption due to enrollment in DC services. We report the percentage reduction according to baseline water consumption prior to enrollment in DC, and we report the aggregate percentage reduction in water-use for program participants. In addition, we convert percentage reductions into actual volumetric units conserved as a result of DC. The data used in this analysis includes 36 months of historical usage along with approximately 38 months of data under the DC pilot program (over 11 million observations). For this analysis, households who participated in the DC services at any point during the study period will be referred to "*Enrolled*" households, while those who do not are "Never-Enrolled" households. The first full month after which a household has received their first DC report is considered the first treatment month. Therefore, June 2015 is the first possible treatment month. We do this to avoid mismeasurement in the timing of program initiation since the statistical analysis occurs at the monthly level. Progression of DC enrollment over the treatment period in the AWU service area is presented in Figure 1. All the analysis in this study is based on data that has been cleaned up to eliminate possible errors and outliers in the observations. Table 1 presents summary statistics after data cleaning of the number of households and also a number of observations before and after DC start date in each group. In September 2018, summary statistics indicate that in the AWU service area 22,323 households enrolled in the DC program.

To preview results, this report suggests that DC has a statistically and economically significant conservation effect on water consumption. We find that the introduction of DC services for the population of households participating in DC causes an aggregate treatment effect of 15.42 percent reduction in water usage. There is significant variation in the effect across households' dependent on baseline consumption quintile. Households in the highest quintile of baseline consumption reduce consumption by an estimated 19.89 percent in response to DC services.

***Statistical Analysis of DC Program Effect on Water Consumption***

The subsequent analysis estimates the effect of DC on household water consumption while considering several factors affecting consumption. Some of these factors include seasonality, annual fluctuations in weather (e.g., drought), and some household specific factors such as house size, lot size, outdoor landscape, etc. For regression analysis purposes we organized a panel dataset of household-level monthly water consumption in the AWU service area which tracks water-use of individual households over time. This panel data began in May 2012 and ended in September 2018, which includes the period the DC service began (July 2015). This allows us to examine household changes in consumption in response to the DC service. The control group for this analysis is households who did not enroll in DC services in order to account for seasonal and annual trends in water consumption, possible other conservation programs that are available in the AWU service area (e.g., rebate programs), and conservation policies in the AWU service area. Overall, this statistical analysis measures the effect of DC taking into account household

characteristics that also affect consumption (e.g., lot size) as well any seasonal or year-specific effects on consumption. In summary, the effect of DC enrollment on water consumption is estimated by defining two groups; households who enrolled in DC (Enrolled group) and households who did not enroll in DC (Never-Enrolled households).

General results are given in Table 2. In this analysis, a log of monthly water consumption at household-level is the dependent variable which allows us to interpret the estimated coefficients reported in Table 2 as percentage responses. We explore the variation of DC enrollment effect by average summer baseline pre-DC water consumption. For each household, we calculate the mean summer pre-DC water consumption. Next, we create indicator variables for whether that mean summer pre-DC water consumption is in the first, second, third, fourth, or fifth quintile of the whole sample summer pre-DC consumption (i.e., Q.1, Q.2, etc.). Then we interact these indicators with enrolled household and time variable indicators. We defined baseline consumption quintiles as 20% and lower, between 20% and 40%, between 40% and 60%, between 60% and 80%, and higher than 80% percentiles. Quintile thresholds, in average gallons per month, are 3,200 and lower as the first quintile, between 3,200 and 5,300 as the second, between 5,300 and 8,100 as the third, between 8,100 and 12,900 as the fourth, and higher than 12,900 as the fifth quintile.

We find that the DC effect is monotonically increasing in baseline consumption level--the largest effect is observed for the group with the highest baseline consumption. Our analysis suggests that households in the highest quintile of baseline consumption reduce consumption by an estimated 19.89% in response to the DC service. This makes sense since household with higher baseline water consumption likely have more discretionary water-use, and thus, can more easily reduce their water consumption, especially with regular feedback on their water consumption patterns. There appears to be an increase in usage in monthly consumption for those households in the lower quintiles of the baseline consumption. This response is referred to as a "boomerang effect," where customers who learn that they are using less than their neighbors or other like-households increase their demand. To put these conservation figures into perspective, households in quintile one increased their consumption by 2.69 gallons per day, households in quintile two, three, four, and five decreased water consumption by 8.39, 23.19, 41.65, and 80.51 gallons per day.

The last row in Table 2 summarizes aggregate reduction in consumption resulting from DC for households that participated in this program. In summary, regarding the overall impact of DC, the object of interest is the aggregate treatment effect, which we estimate to be -15.42% for the population of households participating in DC. Table 3 summarizes reductions in water usage in levels rather than percentage reductions (also taking into account timing of enrollment) due to DC for households who participated in the program. The total reduction in water consumption due to DC is 348.11 million gallons from June 2015 to September 2018 (inclusive). DC caused 103 and 181 million gallons reduction in water usage for enrolled households in the fourth and fifth quintile of consumption, respectively.

## Appendix

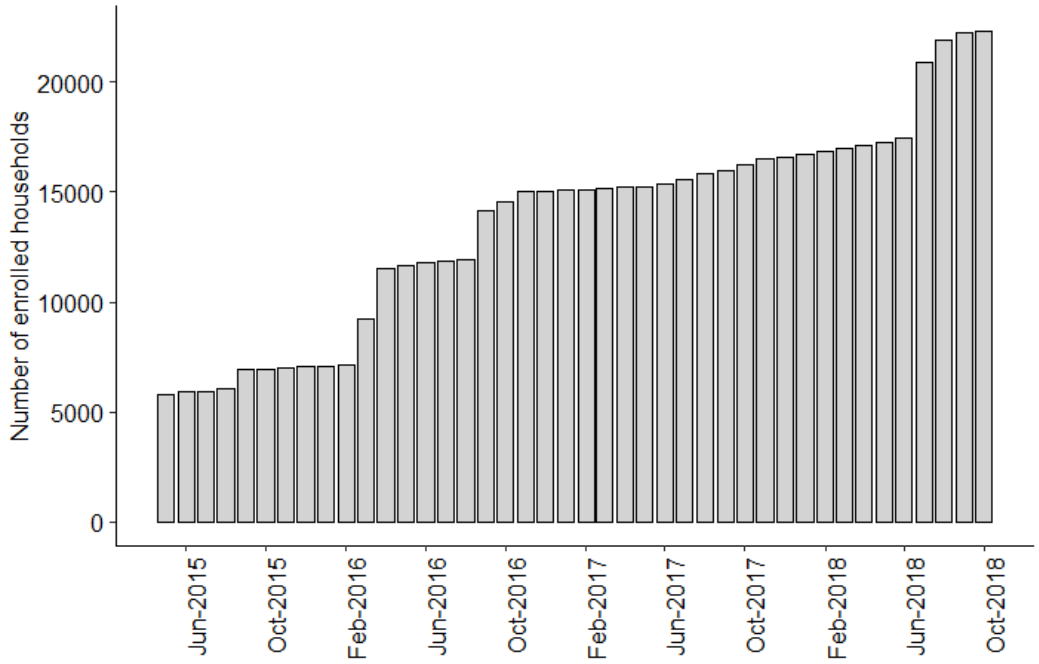


Figure 1: Progression of Dropcountr enrollment over the treatment period. A total number of enrolled households by the end of September-2018 was 22,323.

Table 1: Summary Statistics of Data Availability for Analysis. Monthly consumption values in Gallons for the baseline period

| | All accounts | Control group | Treatment group |
|---|---|---|---|
| Number of accounts | 310,420 | 288,097 | 22,323 |
| Pre-period observations | 5,618,397 | 5,191,227 | 427,170 |
| Treatment period observations | 8,275,918 | 7,537,683 | 738,235 |
| Average Consumption (Baseline) | 6,568 | 6,540 | 6,909 |

Notes: Baseline period is May 2012 through June 2015. Dropcountr is still active.

Table 2: Dropcountr effect on daily water consumption (gallons/month) in the Austin Water Utility service area.

| | Estimated Effect Size | |
|---|---|---|
| Enrolled in Dropcountr and quintile 1 | 3.73% | |
| | (0.29) | |
| Enrolled in Dropcountr and quintile 2 | -6.72% | |
| | (0.27) | |
| Enrolled in Dropcountr and quintile 1 | -13.26% | |
| | (0.26) | |
| Enrolled in Dropcountr and quintile 1 | -16.96% | |
| | (0.24) | |
| Enrolled in Dropcountr and quintile 1 | -19.89% | |
| | (0.24) | |
| Dropcountr Aggregate Effect | | **-15.42%** |
| Month by Year Effects | YES | |
| Household by Month Fixed Effects | YES | |
| Observations | 11,830,480 | |

Notes: Quantiles of consumption are defined based on the average baseline summer usage. Quantiles threshold in average gallons per month is 3,200 and lower as the first quintile, between 3,200 and 5,300 as the second, between 5,300 and 8,100 as the third, between 8,100 and 12,900 as the fourth, and higher than 12,900 as the fifth quintile. The Dropcountr aggregate effect is calculated for the population of households participating in Dropcountr. Estimation results are statistically significant at the 1% significance level. Standard errors are reported in the parenthesis.

Table 3: Cumulative water savings in absolute terms for households who participate in Dropcountr program by September-2018 (All of the consumption numbers are in thousand gallons)

| Quintile | Number of households | consumption after enrollment | Dropcountr Effect | consumption if not enrolled | savings |
|---|---|---|---|---|---|
| 1 | 2501 | 173,061 | 0.0373 | 179,516 | -6,455 |
| 2 | 2739 | 283,580 | -0.0672 | 264,524 | 19,057 |
| 3 | 2909 | 384,888 | -0.133 | 333,698 | 51,190 |
| 4 | 3470 | 609,125 | -0.169 | 506,183 | 102,942 |
| 5 | 3298 | 911456 | -0.199 | 730,076 | 181,380 |
| Total | 14917 | 2,362,111 | - | 2,013,997 | **348,113** |

Notes: All of the consumption numbers are in thousand gallons. Overall, we estimate Dropcountr reduced aggregate water consumption by 348 million gallons for program participants between enrollment up to September 2018.