REDUCING PEAK HOUR DEMAND WITH MSMT-MPR SPRINKLER NOZZLE RETROFITS

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Abstract: This presentation will outline the study results of a multi-stream multi-trajectory matched precipitation rate (MSMT-MPR) sprinkler nozzle retrofit study, including water conservation potential and water system optimization by reducing peak hour demand. The presentation will outline a brief overview of a preliminary study in 2008 and an explanation of the methods and procedures used in the 2009 study.

In the summer of 2009 Eugene Water & Electric Board created a study to measure the potential for MSMT-MPR nozzles to mitigate peak hour demand. A previous sample study in 2008 indicated a 40% reduction in flow and a 10% increase in distribution uniformity when retrofitting spray nozzle systems to MSMT-MPR style nozzles. In 2009 EWEB collected sufficient data for a statistically valid sample of site retrofits. This presentation will outline the study parameters used and detail the water savings after 3 years of data collection. The presentation will also show results of whether customers continued to water outside the peak hour watering window provided them and if the equipment installed stayed in the ground for the duration of the study.

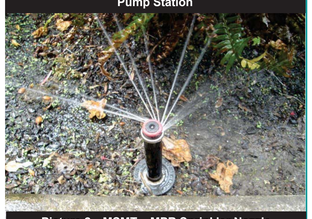
Based on the results from this study EWEB has now created an ongoing MSMT-MPR rebate to customers in our water service area.

Introduction

In the Eugene Water and Electric Board (EWEB) water service area there are a number of neighborhoods supplied with potable water from continuously running pump stations. A majority of new homes in the area have automated sprinkler systems. In 2005, water meter recordings demonstrated that water usage spiked in the summer because of landscape irrigation systems, with most systems running between 5:00 a.m. and 7:00 a.m. Due to high demand during this time period, the pump stations (see picture 1) were exceeding their capacity, causing the fire flow pumps to be used to meet the demand of landscape irrigation. To reduce the costly demand on the fire flow pumps and to increase the reliability of the water service in the area, an extensive education campaign was implemented to encourage customers to shift their landscape water usage away from the 5:00 a.m. to 7:00 a.m. time period.

Picture 1—Pumps inside continuous drive Pump Station

The highest demand for water during one hour of the day is referred to as peak hour demand. As part of the targeted neighborhood education program, Multi-Stream Multi-Trajectory Matched Precipitation Rate sprinkler (MSMT-MPR) nozzles (see picture 2) were offered as a method of reducing the peak hour demand because of the low flow rates posted in published literature by the nozzle manufacturer.



Picture 2—MSMT – MPR Sprinkler Nozzle

Flow measurements were taken both before and after each retrofit in 2009. Water meter recordings were performed again in 2010 to determine if customers kept the watering schedule provided after the retrofit was completed. In addition, data has been collected on total water savings to each customer, as a side note to EWEB's primary interest in flattening peak hour demand during the 5:00 a.m. to 7:00 a.m. time period. Data has been analyzed for 2010 and 2011. Data collection for 2012 will be complete at the end of October.

The data demonstrates, on average, more than a 40% reduction in gallons per minute (gpm) flow for each retrofitted sprinkler zone. Preliminary data also indicates significant reduction in water use by customers who received MSMT-MPR nozzle retrofits. Final results of the three year evaluation will be available in February of 2013

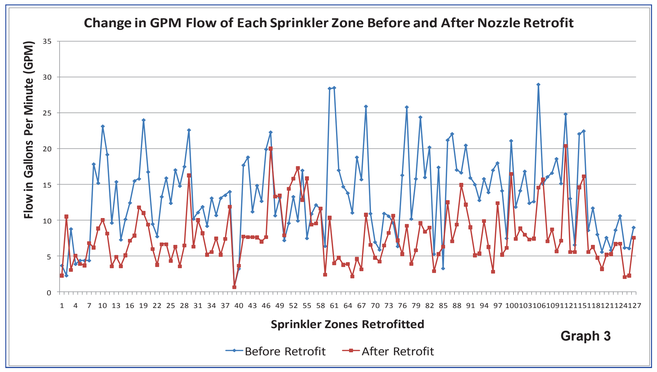
Pilot Year: 2008

In 2008, a small sample of both residential and commercial landscapes (see Picture 3) were retrofitted with the MSMT-MPR nozzles. The data were inconsistent and discrepancies were evident between residential and commercial landscapes. Additionally, the small sample size made the data statistically insignificant. It was evident that a more extensive study was needed. Study parameters were developed for recruiting EWEB customers and contractors into the program in 2009.

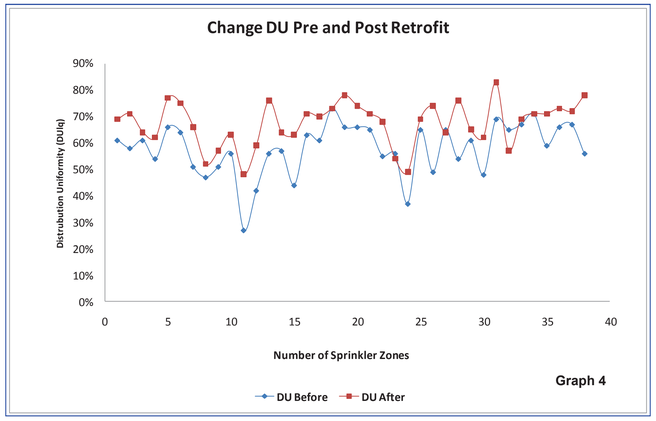
Study Year: 2009

Study Parameters for Participation

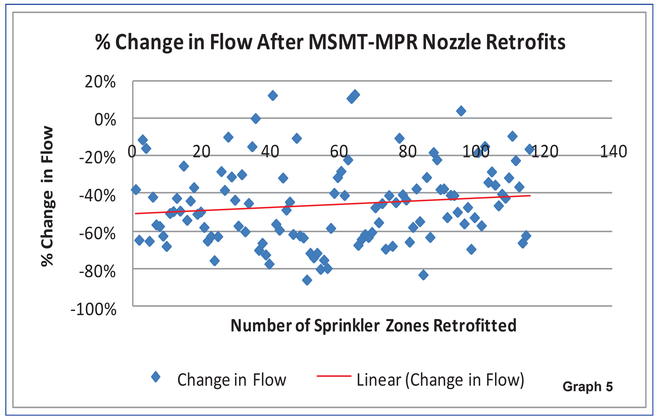
1. Customers contacted EWEB to apply for the study.
2. EWEB staff installed water meter recording equipment to measure the gpm flow to each landscape irrigation zone.
3. Customers received an information packet with information for a landscape contractor willing to perform a pre retrofit catch-can audit.
4. Customers scheduled with the landscape contractor to perform the catch can audit per Irrigation Association (IA) auditing procedures. (Audits were performed on turf zones only.)
5. Contractor purchased and installed the MSMT-MPR sprinkler nozzles.
6. Contractor submitted invoice for labor and materials to EWEB.
7. EWEB contacted customers to schedule a post retrofit catch-can audit and inspection, conducted by EWEB summer interns.
8. EWEB summer intern staff assisted customers in continuously running pump areas with reprogramming sprinkler-timers to water outside the 5:00 a.m.to 7:00 a.m. time period.
9. EWEB reimbursed the landscape contractor for their labor and MSMT-MPR nozzle costs.



Graph 3



Graph 4



Graph 5

Implementation Year: 2009 (continued)

During the summer of 2009, and following the study parameters, 131 landscape sprinkler zones were retrofitted with MSMT-MPR nozzles. Seventeen residential and 6 commercial customers received nozzles. These 23 addresses are referred to in the data as "sites." The pie charts (Graphs 1 and 2) show the cost per retrofitted site—both audited and non-audited. In both cases, the majority of the cost was for the labor to audit the sites and install the MSMT-MPR nozzles

Graphs 3 and 4 clearly demonstrate the difference in zones both before and after the retrofit. Graph 3 shows the difference in gpm for every retrofitted zone. This decreased gpm flow averages a 43% reduction. Graph 4 shows a 10% increase in distribution uniformity (DU) for the retrofitted zones that could be audited. In every case, significant water reduction was realized. Graph 5 shows the variability in the percentage change in gpm flow as a result of installing MSMT-MPR nozzles.

Study Years: 2010-2012

In 2010, water meters were recorded at the retrofitted sites to determine if the sprinkler zones showed continued reduction in gpm flow. Sprinkler controller schedules were also monitored to confirm whether customers were continuing to water outside the 5:00 a.m.-7:00 a.m. time period. Water meter recordings were taken and the gpm flow rates were nearly 100% consistent with 2009 recordings. Of the retrofit sites located in continuously running pumping zones, 7 of the 8 sprinkler timers *watered outside* the 5:00 a.m.-7:00 a.m. watering period. Although not a statistically valid sample, the data does indicate when MSMT-MPR nozzles are installed and sprinkler controllers reprogrammed, they are rarely changed back to previous hardware or watering schedules.

Water Savings

Of secondary interest was if customers received water savings from their new sprinkler nozzles. Customer water use data was collected in 2010 and 2011. The baseline in each graph is an average from 2006-2008 for evapotranspiration (ET_o–cool season grass) and Kgal usage. At initial glance, Graph 6 indicates water consumption reduced by 31% in 2010 and 25% in 2011 compared to the baseline average. Looking at Graphs 7 and 8, however tell a more complex story. Eugene experienced wetter than normal weather in 2010 and 2011. ET_o for Eugene, OR actually *decreased* by 101% in 2010 and 74% in 2011 compared to the baseline 3 year average.

Picture 3—Retrofitting existing sprinklers with MSMT-MPR Nozzles

Though the retrofit sites did reduce water use in total gallons, they used *more* water than was needed compared to the low evapotranspiration rates from those years. In 2010 water use compared to ETo increased by 25% and in 2011 water use increased by 12% compared to ETo. The data for 2012 is still being collected.

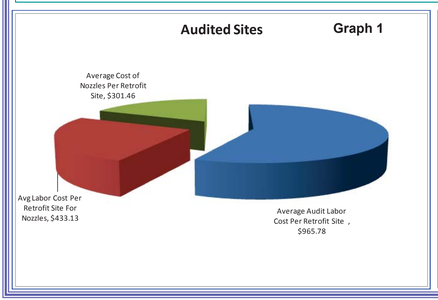
Conclusions

Data demonstrates that MSMT-MPR nozzles consistently and significantly reduce the gallon per minute flow in automated sprinklers. This finding is useful for water utilities seeking to reduce peak hour water use in targeted neighborhoods during summer months. For utilities seeking to reduce water use in general, these findings are also significant. The sprinklers have potential to ease customer budgets and extend valuable resources. However, there is a cautionary tale. The MSMT-MPR nozzles alone will not maximize water reduction without careful customer education regarding weather patterns and corresponding sprinkler timer schedules.

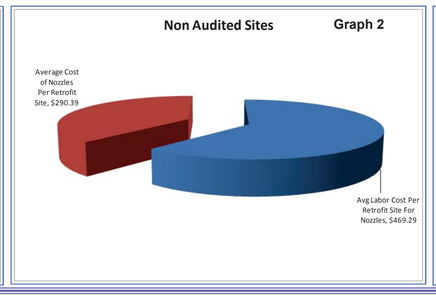
Next Steps

EWEB has used the findings regarding gpm flow to reduce hourly peak in neighborhoods by offering rebates to customers in areas served by continuously running pump stations. Rebates for MSMT-MPR nozzles have the potential to reduce hourly peak and costs to our pump stations. The data shows customers who install MSMT-MPR nozzles need to have sprinkler timer schedules programmed to follow the weather. Programs like EWEB's Green Grass Gauge (see Picture 4) program can help customers water to the weather and maximize the water savings potential of the MSMT-MPR nozzles.

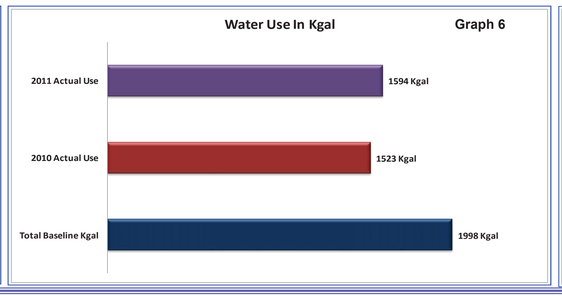
Picture 4—Green Grass Gauge—used to measure sprinkler output



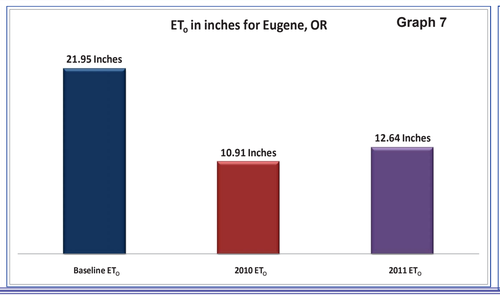
Graph 1



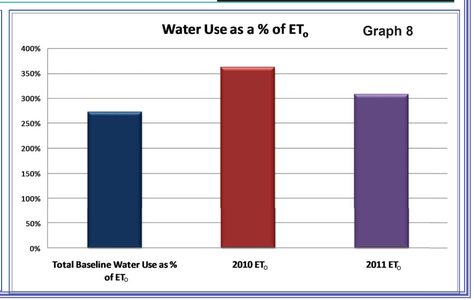
Graph 2



Graph 6



Graph 7



Graph 8