Rain Sensor Installation

Submitted to:
Southwest Florida Water Management District

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Background

During the time it took the United States population to double, water use has increased eightfold.[1] Americans use an average of 101 gallons of water per day per person, far exceeding the 20.5 gallons per day minimum estimated to maintain life, food production and hygiene.[2] Most of the water used by homeowners is not used within the home for such purposes as bathing, laundering and toilet flushing — it is expended outdoors.[3] In aggregate, residential lawns cover 21 million acres of land in the United States, an area over 17 times the size of the Grand Canyon.[4] Outdoor water use is responsible for up to 50% of all household water use in dry months.[5] And for some regions of the United States, there are more dry than moist months.

A lawn only requires one inch of water per week, either naturally and/or by irrigation.[6] And according to a study conducted in Durham Region, Ontario, 90% of householders do not measure the amount of water used on their lawns.[7] Techniques to counter the amount of water wasted through lawn watering include watering restrictions and the installation of devices, such as rain shutoff sensors. Rain shutoff sensors override automatic irrigation systems by communicating to the sprinkler system that the lawn has received sufficient water, usually from a natural water source, such as rain.[8] Rain sensor devices prevent sprinklers from spraying water needlessly when there has been sufficient rainfall.

For an average lawn of 5,000 square feet, an underground irrigation system will cost $4–$10 USD every time it is used.[9] Other estimates of average lawn size are significantly higher, around one-third of an acre, or 14,375 square feet,[10] which indicates that water consumption and associated costs will be substantially greater. In year-round arid climates, such as Southwest USA, the bulk of a household's water usage can be accounted for by landscape irrigation.[11] Installing a rain sensor can save 5%–10% of water used outdoors,[12] or an estimated 3,245 gallons of water per year,[13] thus potentially saving the homeowner money from reduced water utility bills. The water savings provided by such devices can recover upfront costs in a relatively short period of time.[14] On a larger scale, these devices have the potential to save a community millions of dollars on water infrastructure by avoiding costs for the creation of new water resources.[15]

Barriers and Benefits

A barrier that may be overlooked by some rain sensor giveaway, rebate or retrofit programs is that certain rain sensors may not be effective. In an irrigation system retrofit project conducted in Kelowna, BC, it was discovered that mini-click rain sensors did not decrease, but actually increased, residents' water use by 15% from June 2000 to June 2001.[16] Water use decreased by 31% in July, after residents received notices about above-average water consumption in June.[17] Residents expected the rain sensors to work and, therefore, did not turn off their sprinklers manually in the rain, as they would have done prior to installing the rain sensor.[18] To overcome this barrier, Kelowna's water

conservation program experimented with soil moisture sensors, which were found to be more effective than mini-click sensors.[19]

Cost is another potential barrier to the installation of rain sensors. Rain sensor shutoff devices range in price from $20–$80 USD, depending on the sophistication of the technology.[20] [21] In addition, installation may take an hour of a plumber's time. Offering an incentive to homeowners for the installation of a rain sensor on their sprinkling system may offset the cost of purchasing and installing, as well as motivate residents. However, cost was not found to be a barrier in affluent Kelowna, BC, where many homeowners are interested in investing money into water-saving technologies that they never expect to recover from reduced water bills.[22] Therefore, researching the financial status of a target group will help determine if cost is a barrier. Free retrofit programs may best be targeted to lower-income groups.

Lack of knowledge regarding the benefits of rain sensors and which rain sensors are the best to purchase is another potential barrier to their adoption by residents. Programs that assist residents with installation, overcome the barriers of purchasing and installing rain sensors. Programs that include an educational component about the benefits of rain sensors are also valuable for motivating homeowners to take action.

There are a number of benefits to retrofitting irrigation systems with rain sensors. First, rain sensors can lead to cost savings. While there is an upfront cost for purchasing and installing rain sensors, many municipalities offer rebate programs to offset this cost. Further, according to a rain sensor rebate program brochure from Sioux Falls, South Dakota, depending on rainfall amount, a rain sensor can save a household up to $100 USD annually from reduced water utility bills.[23] In addition, a rain sensor can help reduce wear on an irrigation system by decreasing the amount of time the system is in operation and can also prevent lawn and landscape damage due to overwatering.[24] At the community level, rain sensors can conserve drinking water supplies and reduce runoff of lawn chemicals into groundwater and surface water supplies.[25]

Summaries of Programs

St. Petersburg's Rain Sensor Giveaway Program[26]

St. Petersburg offers free rain sensors to all residents of St. Petersburg. In order to be eligible for the offer, water customers must bring a water utility bill to the Water Resources Department and fill out a form prior to picking up the rain sensor and installation instructions.[27] In order for residents to avoid a charge on their utility bills, an Installation Verification Form is to be sent to the Water Resources Department after the installation is complete.[28]

Also as part of irrigation system upgrading, the Water Resources Department and the Pinellas-Anclote River Basin Board of the Southwest Florida Water Management District offer free audits to customers with sprinkler systems.[29] Included in the audit is the installation of a rain sensor, if one is not already present.[30] To be eligible, water

customers must be using well, potable or reclaimed water with a working in-ground sprinkler system.[31]

Austin's Water Conservation Program, TX[32]

Through Austin's Water Conservation Program, free rain sensors are given to residents who stop by the Water Conservation office or who pay $3 USD to the office for shipping and handling to have the shutoff device mailed.[33] There is also an irrigation system rebate program, which can offset the costs for purchasing and installing rain sensors by up to $25 USD.[34] Free irrigation system audits are offered to residents who use more than 25,000 gallons of water per month in the summer.[35] As part of the survey, the auditor will check the system for leaks, determine water application rates and sufficient coverage, help to determine an efficient watering schedule and recommend replacements of system components.[36]

From FY2004–2005, 67 rain sensors were distributed.[37] With water savings from the sprinklers at an estimated 3,245 gallons per year per rain sensor retrofit, this works out to a modest annual savings of 217,415 gallons of water per year overall. Irrigators were reluctant to continue this program because they felt that many customers were not likely to install the devices on their own after having received them, but there was no follow-up inspection to verify if this was indeed the case.[38] This program would benefit from the addition of an installation verification form, such as was used in St. Petersburg to verify installations of rain sensors. There have been no 2005 or 2006 evaluations of the program.

Tampa Water Department, Tampa Bay, FL[39]

Tampa's Water Department uses a number of measures to help residents conserve water. For outdoor water use, irrigation is limited to one day per week and is banned between 8 a.m. and 10 p.m.[40] Further, since 1991, by Florida law, all new irrigation systems must have rain sensors.[41] Tampa Bay offers free 'Sensible Sprinkling' irrigation audits and distributes free rain sensors to residents.[42] For the audits, if retrofit suggestions are completed, Tampa Water will rebate the homeowner up to $3,500 USD.[43] The Sensible Sprinkling irrigation evaluation program and delivery of free rain sensors resulted in a 25% decrease in water consumption for those households who participated.[44]

Rain Sensor Rebate Programs

While the programs described above overcome a greater number of barriers to purchasing and installing rain sensors for sprinkler systems, it is more common for municipalities to offer rebate programs. Two examples of rebate programs are provided below:

Sioux Falls, South Dakota's Office of Public Works[45]

The Sioux Falls program offers up to a $50 USD rebate for the first purchase and installation of a rain sensor device and up to $32 USD for additional sensors if the irrigation system requires more.[46] The program began in 2005 and is still operating.[47] The program is promoted by lawn irrigation contractors.[48] Program organizers have met

with contractors in 2005 and in 2006 and will continue yearly meetings as long as the program continues.[49] In 2005, 123 rain sensors were installed in residential sites and an additional 175 rain sensors have been installed so far in 2006, for a total of just under 300.[50] If the estimated amount of annual water savings from installing a rain sensor is indeed 3,425 gallons, the installation of 300 rain sensors would have already resulted in a decrease of 973,500 gallons of water a year for Sioux Falls.

Longboat Key, Florida[51]
Longboat Key also runs a rebate program, offering to cover 50% of the cost for the purchase and installation of a rain sensor device for up to $50 USD.[52] Longboat Key has a rain sensor ordinance requiring all automated irrigation systems to be equipped with a rain sensor shutoff device, effective as of May 1, 2006.[53] Other states besides Florida that either have statewide rain sensor mandate or a mandate within various municipalities include New Jersey, North and South Carolina, Texas, Georgia, Minnesota and Connecticut.[54]

Rain Sensor Pilot

Not surprisingly, a program that involves directly installing rain sensors for homeowners will obtain the highest levels of participation. Such a program is likely to be more successful, as it addresses the barriers to both obtaining a sensor and installing it. It is suggested that governmental agencies hire contractors to canvas neighborhoods and install rain sensors and other water-saving devices.[1]

A successful rain sensor program would make use of canvassers who go door-to-door explaining the program to residents and scheduling appointments with plumbers who are trailing behind them (e.g., the plumbers are doing installations in homes that have already been canvassed in the neighborhood). As suggested in the low-flow showerhead report, the vehicles for the canvassers and the plumbers can be utilized to advertise and legitimize the program. Since these programs have already been found to not only be cost-effective and have high participation rates for the installation of low-flow showerheads, it is suggested that they be used as the basis for a rain sensor pilot. As with the low-flow showerhead pilot, the suggestions below are meant to improve upon already successful programs.

Soliciting Participation: In addition to explaining the importance of reducing water consumption to the resident, it is also important to emphasize the money lost as a result of inaction rather than the savings that accrue from acting. People are more likely to act to avoid a loss of money than they are to save the same amount of money.[55] Further, indicating the percentage of households who have already installed rain sensors, along

[1] Given the similarity in the barriers for low-flow showerheads and rain sensors, the pilot suggested here closely parallels and paraphrases the approach suggested for the low-flow showerhead report. Note also that it is likely that a program targeting the installation of rain sensors can also simultaneously target low-flow showerheads. Combining these two behaviors would not only substantially reduce household water use, but also program delivery costs.

with providing personal anecdotes of these installations, can enhance the perceived social appropriateness of installing sensors.

Social Diffusion: When a homeowner elects to install a rain sensor, his or her actions are invisible to others. As a result of this lack of visibility, there is little likelihood that others will engage in the same action as a consequence of social diffusion. It is recommended, therefore, that homeowners be asked if a decal could be placed on the side of their recycling container indicating that they have reduced their water use by installing water-saving devices. Residents should not be asked to install the sticker themselves, but rather simply for permission to have the sticker placed on their recycling container the next time it is put out. Past programs have shown that having the stickers affixed by the contractors on set-out dates will dramatically increase the number of recycling containers with stickers over what would occur if the residents placed the stickers on the containers themselves.

Expanding Reach: It is suggested that homeowners be provided with the opportunity to pay for the rain sensor and its installation out of their water savings. This approach allows a household to benefit immediately from obtaining the cost-saving device while not having to cover the upfront costs of purchasing and installing the device. The cost for the installation, and the devices themselves, are simply paid for out of the cost savings to the household on their water bill. Once these costs have been recovered, the household's water bills are reduced accordingly. This suggestion provides two advantages. First, it allows communities who cannot afford to front the costs of a free installation program to nonetheless offer the service. Second, it allows more costly renovations, such as the installation of low-flow toilets, to be included in a program.

Providing Feedback: Given the low cost of water, it will be important to provide feedback to households on the amount of water they personally saved as well as the amount of water the community saved by installing rain sensors. Bill stuffers can be placed in utility bills, but bill stuffers are rarely read. It would be more effective to place what appears to be a handwritten note in red ink directly over the top of the bill indicating their annual water savings for them personally and for the larger community.

Strategy 1: The first strategy involves providing no up-front costs for the installation of rain sensors.

Strategy 2: The second strategy is identical to the first, except that the methods set out above regarding social diffusion and feedback are added to the second strategy.

Pilot Evaluation

The effectiveness of the two strategies is evaluated by randomly assigning two neighborhoods into either Strategy 1 or 2. Since Strategy 2 involves social diffusion, these neighborhoods need to be geographically distant from one another, such as different communities of a city. In total, it is suggested that 100 contiguous homes be selected for each strategy. Past water data for two years prior to the introduction of the

strategies would be compared to the same data following the introduction of the strategies with seasonal variations in temperature and rainfall partialed out. It is suggested that water data for a minimum of two years should be examined following the introduction of the strategies. Further, the percentage of homes agreeing to participate in the two strategies should also be assessed.

Endnotes

[1] City of Norman, Oklahoma, Water Trivia Facts; Barlow, M. (2002). The commodification of the world's water; Cited in: Rain Bird Corporation. (2006). Pg.1. A homeowner's guide to water-efficient landscapes. http://www.rainbird.com/pdf/iuow/IUOW_HomeownerWhitepaper.pdf
[2] Vickers, 2002. Handbook of water use and conservation. Cited in: Ibid. pg.1
[3] Tampa Bay Water. (2006). Residential outdoor conservation: Lawn maintenance. http://www.tampabaywater.org/conservation/residentialoutdoor.aspx
[4] National Audubon Society. (2003). Rethink your lawn. http://www.audubon.org/bird/at_home/ rethink_lawn.html
[5] Tampa Bay Water. (2006).
[6] Soroczan, C. (2001). Research highlights: Peak day irrigation demand reduction monitoring. Canada Mortgage and Housing Corporation. http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/01-114-e.htm
[7] Samulski, A. Consultant. (2002). Pg.35. Water efficient Durham: Outdoor water conservation project. Taken from McKenzie-Mohr and Associates, cbsm.com. http://www.cbsm.com/Reports/DurhamReport.doc
[8] Tampa Bay Water. (2006).
[9] Tampa Bay Water. (2006).
[10] National Audubon Society. (2003).
[11] Wojcik, D. (2002). Pg.40. Water use efficiency: State-of-the-art. Smart Water Report, Western Resources Advocates. http://www.westernresourceadvocates.org/water/smartwater.php#top
[12] Vickers, 2001. The Handbook for water use and conservation . Cited in: Arboleda, G. & Goldman, M. (2002). Overview of retrofit strategies: A guide for apartment owners and managers. Water Resources Engineering, Inc., San Francisco, CA. http://www.huduser.org/publications/ pdf/Book1.pdf
[13] Arboleda, G. & Goldman, M. (2002).
[14] Wojcik, D. (2002). Pg.40.
[15] Samulski, A. Consultant. (2002). Pg.17.
[16] Klassen, N. (2003). Kelowna, BC: Water smart efficiency program. Canada Mortgage and Housing Corporation. http://www.cmhc-schl.gc.ca/en/inpr/su/ waco/onrecast/onrecast_002.cfm
[17] Ibid.
[18] Klassen, N. (2006, September 13). Personal Communication. E-mail: nklassen@direct.ca
[19] Ibid.
[20] Town of Longboat Key Public Works. (Undated). Rain sensor compliance and rebate program. http://www.longboatkey.org/Departments/PWK/RainSensor/ RainSensorComplianceandRebate.htm
[21] Vickers, 2001. The Handbook for water use and conservation . Cited in: Arboleda, G. & Goldman, M. (2002).
[22] Klassen, N. (2006, Sept. 13). Personal Communication.
[23] City of Sioux Fall Public Works. (2005). Be water-wise: Rain sensor rebate program. Rain Sensor Retrofit Information. http://siouxfalls.org/PublicWorks/ water_conservation/rebates/sensor_retrofit_brochure.aspx
[24] Ibid.
[25] Ibid.

[26] **Program Contact:** City of St. Petersburg, P.O. Box 2842, St. Petersburg, FL 33731. (Phone) (797) 892-5018, (Email) WRDCustomerService@stpete.org, (Web site) http://cms.stpete.org/default.asp?page=1525.
[27] St. Petersburg the Sunshine City. St. Petersburg's current water conservation programs: Rain sensor giveaway. http://cms.stpete.org/default.asp?page=1525
[28] Ibid.
[29] Ibid.
[30] Ibid.
[31] Ibid.
[32] **Program Contact:** Amanda Dewees, Conservation Specialist. Austin Water Utility. P.O. Box 1088, Austin, TX 78767.
(Phone) (512)-974-3514, (Email) Amanda.Dewees@ci.austin.tx.us, (Web site) www.waterwiseaustin.org/research.htm.
[33] Austin Water Utility. (2005). Water conservation biennial report FY 2004—FY 2005. www.waterwiseaustin.org/research.htm.
[34] Water Conservation Division, Austin Water Utility. (2005). Water conservation plan. http://www.waterwiseaustin.org/research.htm
[35] Ibid.
[36] Ibid.
[37] Austin Water Utility. (2005) Water conservation biennial report FY 2004—FY 2005.
[38] Dewees, Amanda. (2006, September 28). Personal Communication by email: Amanda.Dewees@ci.austin.tx.us.
[39] **Program Contact:** Sandra E. Anderson, Consumer Affairs Manager, Tampa Water Department. 306 E. Jackson St., Tampa, FL 33602, (Phone) (813) 274-8653, (Fax) (813) 274-7435, (E-mail) Sandra.anderson@tampagov.net.
[40] EPA. (2002). Pg.42. Cases in water conservation: How efficiency programs help water utilities save water and avoid costs. Tampa, Florida: Growth and water management. http://www.epa.gov/watersense/ docs/utilityconservation_508.pdf.
[41] Ibid. pg.42.
[42] Arboleda, G. & Goldman, M. (2002).
[43] Ibid.
[44] EPA. (2002). Pg.43.
[45] **Program Contact:** Rick McKee, City of Sioux Falls Public Works, 224 West Ninth Street, P.O. Box 7402, Sioux Falls, SD 57117-7402. (Phone) (605) 367-8698, (Email) rmckee@siouxfalls.org, (Web site) www.siouxfalls.org.
46 City of Sioux Fall Public Works. (2005).
[47] McKee, Rick. (2006, September 25). Personal Communication by email: rmckee@siouxfalls.com.
[48] Ibid.
[49] Ibid.
[50] Ibid.
[51] Program Contact: John J. Florensa, Public Works Director. 600 General Harris, Longboat Key, FL 34228. (Phone) (941) 316-1988, (Web site) http://www.longboatkey.org/.
[52] Town of Longboat Key. (2005). Rain sensor compliance and rebate program. http://www. longboatkey.org/Departments/ PWK/RainSensor/RainSensorComplianceandRebate.htm
[53] Ibid.
[54] Rain Bird Corporation. (2006). Pg.12
[55] McKenzie-Mohr & Smith, 1999