Comments on WaterSense® Notice of Intent (NOI) to Develop a Draft Specification for Landscape Irrigation Sprinklers

November 19, 2015

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Commenter: Karen Guz
Affiliation: San Antonio Water System
Comment Date: September 18, 2014

Email Attachment: WaterSense NOI CommentSAWS.pdf

Dear Sir or Madam:

San Antonio Water System (SAWS) would like to thank EPA for the opportunity to comment on its *WaterSense Notice of Intent (NOI) to Develop a Draft Specification for Landscape Irrigation Sprinklers*. SAWS is a water and wastewater provider serving over 1.6 million customers in South Central Texas. SAWS has been an avid supporter of the EPA WaterSense program and has cited the program in San Antonio indoor efficiency codes that require EPA WaterSense fixtures in new construction.

Technology Retrofits Will Not Save Water Without Water Management Focus

While the EPA WaterSense approach to indoor technologies has been highly successful, we have concerns about a similar labeling process for irrigation technologies. The weather-based irrigation controllers that have already received a WaterSense label must be used extremely carefully with exceptionally high water users to deliver their potential savings. The 2013 Residential End Use Study (REUS), conducted in nine diverse locations, notes that if all study homes were brought up to the theoretical landscape budget by technology like a weather-based irrigation controller, the net effect would be a significant increase in water consumption. This is because the majority of homes, in fact 82 percent of the study homes in the nine cities, water less generously than the theoretical requirement built into the technology. The updated RUES illustrates how variations in personal habits associated with outdoor water use make it complex to achieve reductions. The number of toilet flushes, number of personal showers, and time using faucets are fairly predictable in most indoor settings. How much individuals believe is appropriate to add supplemental water to landscapes is not easy to predict.

The SAWS conservation department has a long history of working with residential and commercial customers to help them decrease their discretionary landscape water usage. The greatest savings we have achieved have not come from changing the irrigation technology used, but rather from increasing the personal management of the water use at the site. This usually has required enhanced personal understanding of the landscape and its needs combined with careful human monitoring of the irrigation system settings. We have also deployed a variety of technologies to achieve efficiency in how water is applied to landscapes. The results from these efforts has been erratic with extreme fluctuations in success or failure that appear to be dependent upon how carefully the site manager or home owner adheres to irrigation setting advice. It has been startling that in some retrofit circumstances, particularly in commercial settings, water use increases after the seemingly more efficient technology has been deployed. (A brief program review of a multi-stream nozzle retrofit rebate has been attached that provides a more detailed example.) Every review of landscape irrigation program data reminds us again that we cannot succeed in achieving long-term savings without a strong focus on

motivating someone to function as a water manager. Even technologies designed to aid in water management tracking fail if a person is not motivated to respond to the data from them.

Discretionary water used on landscapes accounts for 20 to 40 percent of the municipal water used in Texas and for similar percentages of water sold in other urban areas. Patterns in discretionary use are particularly concerning because increases in irrigation use in new homes often overwhelms the savings achieved through efficient indoor practices. While this is a growing problem, there is not an easy to way to achieve water-efficient landscaping practices and landscape designs. We applaud the EPA WaterSense program for engaging with this challenge and hope that the approaches will be more nuanced and that ample research will be conducted before any additional irrigation products receive labeling.

Community planners, water utilities and elected officials are looking for answers to the discretionary water use challenge. Systemic design and management is hard. A retrofit to a specific technology is easier to deploy and manage but may be completely ineffective. It is important that highly regarded programs like EPA WaterSense avoid distractions from real solutions by giving the impression that a simple change in technology will solve the problem. Integrated water management with site managers actively watching consumption patterns must be emphasized to achieve success.

What Does Work to Save Landscape Irrigation Water?

What SAWS has learned from our experiences is that there is no substitute for having a person concerned with the monthly water consumption and focused on how much water is flowing through the irrigation system. A technology retrofit sometimes seems to create a false sense of conservation success, which leads to increased water use. Even conversions to drip irrigation can go terribly wrong if there is not vigilant water management at a site. It is difficult to overstate the importance of water management follow-through post-retrofit in order to achieve landscape irrigation savings. We hope that the EPA WaterSense program can help emphasize water management as the most important tool as part of their education programs.

Updating Assumptions About Landscape Water Use

There is an unfortunate assumption in landscape water planning that all landscape plant material should be provided an ideal amount of water to optimize growth and health. The models used to calculate these ideal amounts are derived from crop sciences used to improve crop yields for food production. While the principles of the science are sound, the assumption that all site managers desire an optimized plant growth for an aesthetic landscape is flawed. Data does not support that most site managers apply these relatively generous water quantities to their aesthetic plants.

The updated 2012 REUS research makes it clear that the majority of homeowners do not water their landscapes to the theoretical landscape water budgets that are commonly deployed to predict landscape water usage. Over 80 percent of homeowners have consumption patterns significantly lower than the predicted amount and a very small percentage use more than the predicted amount. It is concerning that the majority who

are careful with their use are described as practicing “deficit irrigation.” This negative term implies that this practice is somehow flawed and perhaps should be corrected to increase water usage.

Perhaps instead of describing the more moderate discretionary usage a “deficit” it should be recognized as normal or sustainable.

The patterns of water use seem to indicate that many site managers and home owners are satisfied using quite moderate amounts of supplemental water. This is logical because many aesthetic landscape plants are capable of thriving and looking attractive without receiving the theoretical ideal amount of supplemental water. Studies on how to manage more landscapes with moderate amounts of water should be a focus. This is not to suggest that there should never be supplemental water application to aesthetic landscapes, but that perhaps it is time to reconsider some of the long-standing assumptions about landscape water use patterns.

What About Better Irrigation Technology?

The issues that SAWS has raised are not meant to imply that improved irrigation technology is unimportant. However, the technology alternatives need to be put into perspective with water management and have very careful vetting to ensure that they do achieve significant reductions when used by customers. Because education on water management often is (and should be) included with retrofit programs it is important to assess how much additional savings the technology achieves apart from the education. This requires a study with a control group receiving only the education on water management as well as a group receiving both the education and retrofit. We hope that a study on pressure controlled nozzles will be conducted because there does not yet seem to be compelling evidence that a retrofit to these nozzles will achieve savings. If a study can confirm savings apart from education, the data would be helpful as utilities consider incentive programs that are based on the quantity of water savings achieved.

Responses to Specific EPA Questions Within the NOI

1. *Is the proposal of labeling nozzles and bodies separately appropriate for this product category?*

If the EPA moves forward with this product labeling strategy, it is best to provide the label separately.

2. *Regarding the performance measure for high-efficiency nozzles, is the top-tier approach or increase-from-baseline approach more appropriate for identifying the performance threshold for DU?*

There is an inherent assumption in this question that improvement in DU will automatically yield lower water use at a site. In the early days of conservation programs aimed at efficiency for landscape, this assumption was built into many programs. In light of program evaluation and studies from the University of Florida, this assumption has been questioned. Aesthetic plants, particularly xeric ones, have extensive root systems capable of gathering water from a broad area. In addition water moves through soil

horizontally, as well as vertically after application. For this reason, being focused on perfectly uniform application is perhaps just one consideration in quality irrigation design but not the overall focus on achieving reductions at a site. This needs further study.

3. *Regarding pressure regulation, is a sprinkler's ability to maintain a constant outlet pressure over a range of inlet pressures an appropriate measure of performance for pressure-regulating spray bodies? Is it appropriate to include a performance measure that specifies the sprinkler body's ability to decrease flow when a nozzle is damaged or missing?*

One of the exciting aspects of many of the pressure control nozzles is their ability to reduce waste from missing nozzles on irrigation heads. After years of monitoring irrigation systems for waste, the staff at SAWS can confidently make this statement "irrigation systems break and need constant maintenance." This is not a surprise. Water flows through irrigation pipes with variable pressure, and lawn equipment is harsh if heads do not drop all the way down after an irrigation cycle. The "geysers" from broken or missing nozzles are a significant source of waste. It would be good to include some way to measure this savings as one of the reasons to suggest this is a better product than traditional ones.

4. *Is the required orifice flow rate of 1.5 gpm in the ASABE/ICC test method for pressure regulation adequate to characterize the performance of a family of sprinkler nozzles that covers a range of wetted radii and patterns?*

Irrigation heads have a different gallons per minute depending upon their radius of throw and other factors. It seems limiting to focus only on 1.5 gpm.

Conclusion

We urge the EPA WaterSense program to pause and engage in further research regarding what ways implementation of any irrigation technology is best accomplished to achieve savings. Theoretical models of what savings "should" occur are not sufficient no matter how firm the science seems. Retrofit studies that include education and monitoring, as well as some that do not are needed to separate the issue of how much taking "control of the controller" achieves savings versus the deployment of the technology. We cannot justify expensive retrofits as essentially loss leader efforts that help us get to the irrigation controller and the site manager. It is important to confirm how much savings come from each aspect of the effort.

Please contact me with any questions about these comments. SAWS appreciates the opportunity to engage with the EPA WaterSense program.

Karen Guz, Conservation Director, San Antonio Water System, (210) 233-3671

EMAIL ATTACHMENT: SAWSmultistreamnozzleprogramreview07052014.pdf

Program Review—Multi-Stream Nozzle Rebate

Program Description

Irrigation Design Rebate

The initial template for the Irrigation Design Rebate was modeled after an existing Landscape Rebate program that is no longer in practice. Participation in the program was limited to San Antonio Water System (SAWS) residential and commercial customers, and the total rebate disbursement was uniquely contingent upon whether the system consumption was less than the calculated watering recommendation at each site for the evaluation period of 12 months. Irrigation consultations conducted by SAWS licensed irrigators were required before implementing the multi-stream rotor retrofit in order to identify system consumption and to provide landscape irrigation management education.

As a performance-based rebate program, a specified percentage of the rebate amount was issued initially, while the remainder was issued upon completion of the requirements of the rebate program. These conditions were presented and agreed to by the program participants at the time of application. Initially, the rebate was set to disburse 25 percent upon completion of the retrofit, and 75 percent upon completion of the evaluation period and confirmation that the retrofit achieved an identifiable reduction in water consumption. This schedule was adjusted in 2013 to disburse 50 percent upfront, and 50 percent upon completion, in order to encourage greater participation in the program. The processes to determine rebate amount and program success are laid out below.

In order to maintain communication, and as a courtesy, monthly emails were sent to program participants for each site as a reminder of the calculated monthly water recommendation, and how those calculations compared to their actual usage during the month. The process for calculating the watering recommendation is outlined below.

Calculating a Monthly Water Recommendation

As a first step to measuring program success, a monthly landscape watering recommendation was calculated for each site using a modified Water Use Classifications of Landscape Species (WUCOLS) method. This method was chosen because it is more concise than other methods and does not require a large amount of detail. Potential evapotranspiration (ET_o), factors for species (k_s) and microclimate (k_{mc}) to calculate the landscape coefficient (K_L), and effective monthly rainfall amounts (ER) were required for calculation. The formulas used for calculating the water recommendation are as follows:

$$(1) \quad K_L = k_s \times k_{mc}$$

$$(2) \quad \text{Recommendation} = (ET_o \times K_L) - ER$$

There is a plant density factor (k_d) included in the WUCOLS calculation of landscape

coefficients, but it was concluded that the difference in plant densities is not a limiting factor in this region and therefore does not affect results.

Average potential evapotranspiration in inches per month was collected from the TexasET Network as a function of the Penman-Monteith equation using local weather station data. The species coefficient was assumed to be a standard 0.6 for warm season grasses as appropriate for the region. Seasonal coefficients were based on season and type of cover. For turf during most months of the year, 0.6 was used. For beds, a coefficient of 0.3 for woody perennials was used for all monthly calculations. The bed coefficient was determined by Mark Peterson of SAWS based on reviews of existing literature independent of the WUCOLS method. The effective rainfall range used is a minimum of 0.2 inches to a maximum of one inch. This is based on SAWS determination of local soil types and conditions, which is typically assumed to be six inches of clay loam soil at which anything over one inch of rainfall is assumed to saturate the soil, resulting in runoff and higher evaporative rates. According to the TexasET Network and as a result of the lack of user supplied effective rainfall estimates, the first one-tenth of an inch is assumed to be lost to evaporation, one-fifth to one inch is given full credit, and any amounts from one to two inches are likely lost to runoff or deep percolation.

Identifying Actual Usage

The second step in assuring the rebate requirements are met is determining actual irrigation consumption. Residential systems measure indoor and outdoor usage on the same meter, so the following calculation is used to get irrigation consumption:

$$\text{Outdoor Usage} = \text{Meter Reading} - \text{Indoor Usage} \quad (3)$$

Average indoor residential usage is assumed to be 6,000 gallons or 802 cubic feet, which is consistent with the SAWS winter average consumption. Commercial systems include separate meters for indoor and irrigation uses, so the actual irrigation meter reading is used for these sites.

Determination of Success

The monitoring period of 12 months was initiated following the irrigation consultation and site-specific retrofit installation date. For both residential and commercial properties, the same test was applied to determine if the property passed or failed the program requirements. The aggregate total outdoor water use was required to be less than the aggregate calculated water recommendation.

Savings Expectations

It is the expectation that rebate programs serve to incentivize customers to become engaged in conservation efforts, and they allow SAWS licensed irrigators to gain access to irrigation controllers, in the form of required consultations, to make sure schedules are set correctly, and systems are watering efficiently.

Upon development of this program, rebate amounts were determined to be 25 to 30 percent of industry standard costs for materials and labor. The rebate amount offered

was initially $50 per zone up to $400 for residential and $3,200 for commercial customers, but to attract additional participation, the rebate offer was increased in 2013 to $100 per zone, not to exceed $800 for residential and $6,000 for commercial customers.

Results of Water Recommendation Calculations Versus Actual Water Applied On Site

Residential customers were more successful at staying within the expected landscape water recommendation than commercial customers. While 77 percent of residential customers were awarded their full rebate at the end of the 12-month period, only 8.3 percent of commercial customers were awarded their full rebate. The water recommendation methodology considered variables such as weather, while a secondary analysis examined whether customers made net decreases in landscape irrigation use.

Post Retrofit Water Consumption Changes

The following figures illustrate the change in consumption from the 12-month periods prior to and following the multi-stream nozzle retrofit. There were 12 commercial and 16 residential properties evaluated. The blue lines show the amount of water in gallons that each commercial and residential property either reduced or increased their consumption.

In Figure 1, the red line shows the percentage reduction or increase in consumption amount as compared to the 12-month period prior to the retrofit with consultation at each site. The green line represents the average yearly savings for all sites evaluated following the multi-stream retrofit with consultation. On average, the commercial sites increased their usage by 81,855 gallons.

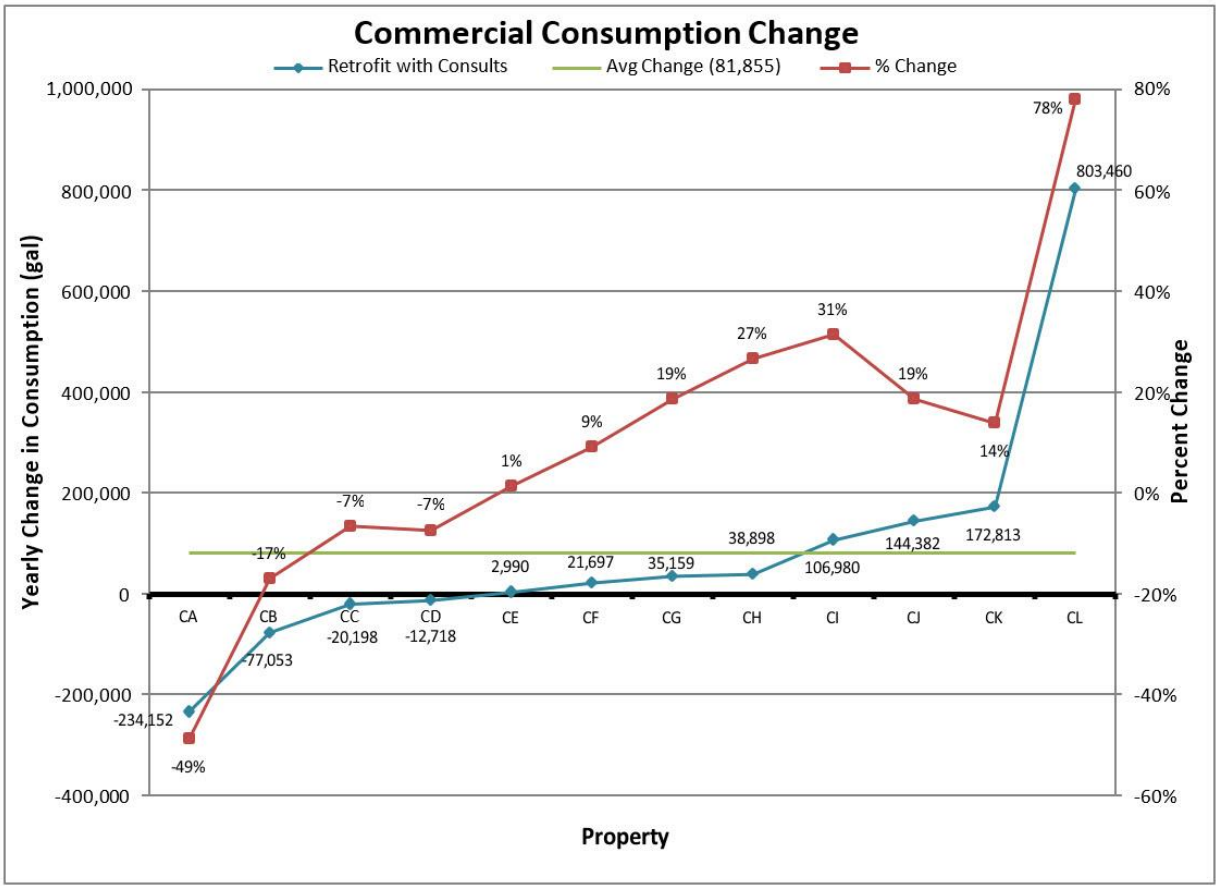

Figure 1. *Change in consumption as collected for 12 commercial customers who participated in the irrigation design rebate program for a multi-stream nozzle retrofit.*

Residential consumption was significantly reduced after the retrofit was completed. However, water use is typically reduced significantly as a result of residential conservation consultations that focus on irrigation system management. The red line in Figure 2 represents the average yearly water savings at a site where an irrigation consultation performed by a SAWS licensed irrigator was the sole conservation effort. This data is a department metric for residential sites only, and shows an average yearly savings of 24,000 gallons. The green line represents the average yearly water savings of 30,066 gallons for the 16 residential sites used for this evaluation. The difference in average savings of consultations only and multi-stream retrofit with a consultation is 6,066 gallons a year.

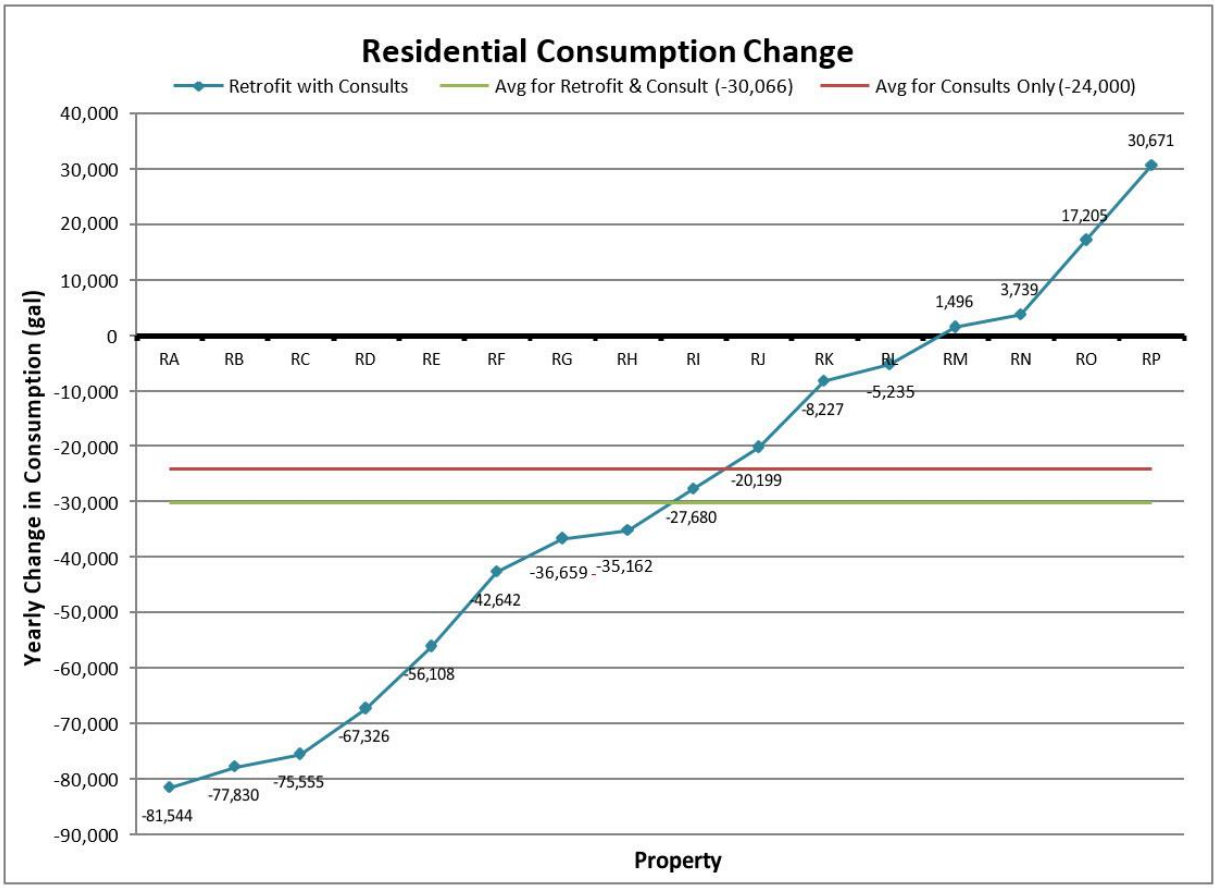

Figure 2. *Change in consumption as collected for 16 residential customers who participated in the irrigation design rebate program for a multi-stream nozzle retrofit.*

Comparison to Education Consultations

Using the average rebate amount per residential property ($288.28) and the difference in average yearly residential water savings over a 10-year life (60,660 gallons or 0.186 acre-feet), the cost per acre-foot of water saved is determined to be $1,549.

There was a net increase in commercial site water use following the retrofits and a fairly high rate of failure to meet water recommendation expectations. Additionally, independent variables at each commercial site prevented the determination of a relevant average savings for consultations only. For this reason, there is not a cost per acre-foot estimation for the commercial retrofits.

Preliminary Conclusion

Multi-stream nozzles reduce the rate at which water is applied to the irrigated area, so this change will require an increase in run time. The increase in run time should not increase the total consumption at a site because of improved distribution uniformity and reduced loss from evaporation. There should be a net decrease in water use. It is challenging to explain why this did not occur at commercial sites.

The significant increase in consumption at commercial properties may be attributed to the control of the irrigation systems relying solely on contracted licensed irrigators. In an attempt to increase the aesthetic value to a commercial property, it can be inferred that the contracted irrigators may be increasing run times even more than required by the retrofit alone. The irrigation settings for commercial sites were discussed with contracted irrigators for each site, but SAWS staff did not directly manage or change commercial irrigation controllers.

Residential participants were receptive to suggested irrigation controller settings provided by SAWS consultants and are usually pleased to have these settings put in place by SAWS staff. The residential customers may have succeeded in saving water because they did not change these settings.

It is important to note that the evaluation periods for commercial and residential sites were not the same. The large majority of commercial sites installed the retrofit in the fall of 2010, and extreme drought conditions in 2011 could have influenced the increase in consumption during the 12-month evaluation period. Of the residential sites evaluated, there were a few install dates in each year from 2010 to 2013. However, there were no distinct trends present for changes consumption at these sites when compared by year.

The cost of the additional water saved at residential properties due to the multi-stream retrofit, excluding the savings from consultations only, is very high at $1,549 per acre-foot. The approved rate of savings for peak water is $1,100 per acre-foot. The program was discontinued during review because there were not apparent savings at commercial sites and only modest savings at residential sites.

If the total savings per site (retrofit with consultation) is combined, then the cost per acre-foot improves. The cost of a consultation service is approximately $155 making the total cost $443.28 with the average rebate amount included. The cost per acre-foot for the combined retrofit with consultation is $480.78, which is well within the approved metric for programs. The question is whether or not the consultation service would have occurred without the retrofit since the cost per acre-foot for consultations alone is only $209. There is currently a strong waiting list for consultation services during summer months and marketing efforts for consultations are hampered by limits in scheduling. For these reasons, it does not appear to be necessary to offer a special rebate in order to

entice customers into a consultation service. The nozzle rebate will be reviewed to determine if outcomes can be improved.

Commenter: John Ossa
Affiliation: Rain Bird Corporation
Comment Date: July 25, 2014

Email Text:

From: Ossa, John MAIL TBA [mailto:JOssa@rainbird.com]
Sent: Friday, July 25, 2014 3:46 PM
To: Tanner, Stephanie
Cc: Ossa, John MAIL TBA
Subject: Rain Bird Position -- Sprinkler Standard NOI

Stephanie,
Rain Bird was happy to participate in the process that AWE initiated to provide WaterSense feedback on the Sprinkler Standard NOI.

We also felt it was appropriate to provide a direct response to WaterSense. Attached please find our position statement.

If you have any questions, please don't hesitate to contact me.

Regards,
John

John Ossa, CID, CLIA
Public Agency Account Manager

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EMAIL ATTACHMENT:

Date: July 25, 2014

To: Stephanie Tanner
From: John Ossa
Re: Rain Bird Response to EPA WaterSense Sprinkler Standard NOI

Rain Bird supports WaterSense initiatives that seek to “raise the bar” on landscape water use efficiency. We believe the industry and markets will be well served if all products delivered agreed upon thresholds of operating performance. Government mandates and guidelines, as well as locally derived standards and codes, can drive the change that is needed in products and behaviors associated with water waste.

Performance thresholds need science-based metrics that not only take into account individual component metrics, but also system metrics that encompass product capability and system management.

Irrigation system performance is the result of four elements. Proper irrigation design, conscientious installation, diligent system maintenance that supports the design intent and knowledgeable system management. Of the four elements, system management can have the most profoundly negative impact in terms of water waste, plant failure and site degradation. The mere presence of great hardware and technology does not guarantee anything.

In addition to developing specifications for irrigation hardware, we recommend WaterSense consider the following area of focus: *Encourage interactive partnerships between water purveyor, the green industry, and property owners for the purpose of developing and implementing science based water budgets for landscapes that ensure compliance with local water use mandates.*

Since Rain Bird’s beginnings in 1933, we have focused on developing products and technologies the enable the use of water in the most efficient manner possible. We communicate our history and commitment to a stewardship ethic, innovation and quality in the phrase The Intelligent Use of Water. Rain Bird developed in-head pressure regulation and check valves in the 1980’s. While we know that in-head pressure regulation as a single feature creates a significant opportunity to reduce water use, and only costs a small fraction more than the same device without that feature, to date there has not been a robust market for this technology.

Irrigation hardware and technology have evolved tremendously in recent years. An explosion of new technology, as well as invigoration of markets for existing water conserving hardware have been a direct consequence of market dynamics driven by water availability and escalating water pricing.

Rain Bird is aligned with the goals of the WaterSense NOI and will continue to lead a market transformation with products and technologies that preserve and protect water resources.

The WaterSense NOI to Develop a Draft Specification for Landscape Irrigation Sprinklers. Version 1.0 dated May 22, 2014, contains four specific questions. What follows is our response to those questions.

1. Is the proposal of labeling nozzles and bodies separately appropriate for this product category?

2. Regarding the performance measure for high-efficiency nozzles, is the top-tier approach or increase-from-baseline approach more appropriate for identifying the performance threshold for DU?
3. Regarding pressure regulation, is a sprinkler's ability to maintain a constant outlet pressure over a range of inlet pressures an appropriate measure of performance for pressure-regulating spray bodies? Is it appropriate to include a performance measure that specifies the sprinkler body's ability to decrease flow when a nozzle is damaged or missing?
4. Is the required orifice flow rate of 1.5 gpm in the ASABE/ICC test method for pressure regulation adequate to characterize the performance of a family of sprinkler nozzles that covers a range of wetted radii and patterns?

Rain Bird Response

1. Yes. Nozzles and pressure-regulating sprinkler bodies are two different technologies that should be considered separately.

Pressure and regulated pressure are key variables that drive nozzle performance. Establishing performance metrics, testing protocols, and accepted ranges of performance for pressure regulation is best done separate from developing nozzle criteria. Conducting simultaneous testing and specification development will undermine the ability to isolate variables and determine how they affect system performance.

2. A theoretical relationship does exist between DU and water savings. It is true that one should expect that as DU increases there could be potential water savings via less run time. However, other nozzle design factors can negate the potential water savings of improved DU. The top-tier and increase-from-baseline can help indicate some relative nozzle performance; however utilizing a single metric, DU alone—fails to capture all the nozzle characteristics that lead to overall system efficiency.

   Water savings are the sum of numerous variables being managed in a dynamic system. At minimum, key variables include operating pressure, spacing, wind, product age, water quality, soil-plant-water interaction, site maintenance, and perhaps most important—system management. The effects of poor system management (scheduling) easily undermine the potential for efficiency represented by optimized hardware and system design. Maintaining a constant and optimum outlet pressure is a desired objective in sprinkler and nozzle performance. Optimum pressure ensures the nozzle will deliver the highest uniformity of application possible for that device. Optimized uniformity combined with science based scheduling creates desired system efficiency.

   Crafting testing protocols to adequately address a great range of dynamic variables is complex. During system operation water pressures may spike, drop and rise again—all at frequencies and durations that may not repeat. Testing over a range of inlet pressures is most important.

   Including a performance measure that specifies a sprinkler's ability to decrease flow when a nozzle is damaged is a desirable objective. Clarifying the distinction between what constitutes "minor damage" and the conditions that would release the expectation of performance (destroyed) is critical.

The technology to decrease flow when a nozzle is missing is currently available as an option. The manufacturers that have this technology have not addressed the issue to an agreed upon specification, hence there are differences in the respective features and performance.

3. No. The flow rate of 1.5 gpm does encompass what is found in many sprinkler installations. It is unwise to conclude that data specific to a 1.5 gpm nozzle at a variety of patterns constitute the basis for an “adequate characterization” of performance of an entire product category. We recommend testing all flow rates and operating pressures for the nozzle range available to be used on the sprinkler. In addition, testing the regulator in both increasing and decreasing pressure environments is important due to hysteresis.

Commenter: John R. Farner, Jr.
Affiliation: Irrigation Association
Comment Date: July 28, 2014

Email Text:

Here are the IA comments. Please let me know if you have any questions!

John

_____
John R. Farner, Jr.
Government and Public Affairs Director
Irrigation Association

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Email Attachment:

July 28, 2014

Ms. Veronica Blette
Chief, WaterSense
United States Environmental Protection Agency

Dear Veronica:
Below are the comments from the Irrigation Association regarding the *Notice of Intent to Develop a Draft Specification or Landscape Irrigation Sprinklers*. We look forward to working with you throughout the development of this specification.

Thank you for all you do in promoting efficient irrigation in the marketplace. If you have any questions regarding our comments, please feel free to contact me at johnfarner@irrigation.org or 703.536.7080.

Sincerely,

John Farner
Government Affairs Director

- The Irrigation Association supports the intent of WaterSense to develop a specification to label landscape irrigation sprinklers. We applaud WaterSense for taking the initiative to promote water use efficiency through these vital technologies. If labeled, these efficient products will open up new opportunities for WaterSense to partner with the irrigation industry to conserve even more water in the landscape through efficient irrigation.

- Throughout the NOI, WaterSense references both SWAT testing methods and those developed through the ASABE/ICC 802-2014 *Landscape Irrigation Sprinkler and Emitter Standard.* The Irrigation Association supports the decision by WaterSense to adopting those set forth by the ASABE/ICC standard development process. These processes have been developed by a full standard setting process, with various interests participating (including the IA and WaterSense) and can withstand much more scrutiny because of this.

- Questions defined by WaterSense:

  Is the proposal of labeling nozzles and bodies separately appropriate for this product category?

  The IA supports the scope of the possible specification and feels that it is appropriate to include both labels for nozzles and pressure-regulating bodies of landscape irrigation sprinklers under one specification.

  Regarding the performance measure for high-efficiency nozzles, is the top-tier approach or increase-from-baseline approach more appropriate for identifying the performance threshold for DU?

  The Irrigation Association would like more data on how each of the performance threshold testing approaches would be conducted, before supporting one over the other. The IA feels that both methods have merit, if done properly.

  - Under the top-tier approach, how will the “wide range of products” be selected and how may will be tested to determine the top 20 percent of DU_{lq} results? How often will the top tier be updated as new nozzles are introduced?

  - In the “increase-from-baseline-approach,” how would WaterSense determine the baseline DU_{lq}?

  Regarding pressure regulation, is a sprinkler’s ability to maintain a constant outlet pressure over a range of inlet pressures an appropriate measure of performance for pressure-regulating spray bodies?

  The method described in the ASABE/ICC standard may not be adequate if the standard orifice of 1.5 gpm is not within the range of the sprinkler being tested. Additionally, the flow rate of the nozzle could influence the performance of the pressure regulating device. If so, that test should be conducted with a nozzle of the highest flow rate designed for the sprinkler along with a nozzle with a lower flow rate (but not less than for the quarter circle nozzle) to test performance over a range of inlet pressures and flow rates.

Is it appropriate to include a performance measure that specifies the sprinkler body's ability to decrease flow when a nozzle is damaged or missing?

No, while it is desirable to reduce flow if a nozzle is missing, it should not be a mandatory requirement. With the advent of flow sensing and many controllers being able to adjust irrigation if there are problems with a modified flow rate, the flow restrictions actually interfere with being able to capitalize on flow management capabilities of controllers.

Is the required orifice flow rate of 1.5 gpm in the ASABE/ICC test method for pressure regulation adequate to characterize the performance of a family of sprinkler nozzles that covers a range of wetted radii and patterns?

The IA feels that it would be better to choose nozzles that represent the highest and lowest flow rate designed for the sprinkler in question.

Finally, many sprinklers are sold with a "nozzle tree," meaning a variety of nozzles available so that the proper nozzle for the circumstance can be selected. If some nozzles on the nozzle tree "pass" a WaterSense label test and others not, how will this be handled? Additionally, nozzles are sold with either fixed or variable arcs for spray heads. There could be circumstances where one-half of circle nozzle passes, but the quarter circle nozzle does not. How will the label be applied?

Also, because the proposed DU will be modeled, all nozzles can have a "sweet spot" of performance but they may not have the same spacing requirement or operating pressure when combined with a number of nozzles and arcs as used in the field.

Will these nozzle families or nozzle trees be labeled and if so, how will they be treated?

Commenter: Seth Ostrowski
Affiliation: Sprinkler Flow Control
Comment Date: July 28, 2014

Email Text:

Peter,

Here is my revision. I think it focuses first on the specification recommendation then our solution.

RE: WaterSense® Notice of Intent (NOI) to Develop a Draft Specification for Landscape Irrigation Sprinklers

We recommend you include in your specifications for landscape irrigation sprinklers the following:

1. *Each sprinkler must be able to reduce pressure to the nozzle optimal design pressure range (generally 25-30PSI). This feature must either be part of the sprinkler body assembly or be added into the sprinkler riser or pipe immediately prior to the sprinkler body.*

REASON: Higher than optimal pressure results in higher sprinkler equipment failure rates, increased operation and maintenance costs and significant loss of water to from “misting” and evaporation.

The excess supply pressure causes "high pressure misting" and the designed wetted radii and patterns are negatively affected. Losses of up to 33 percent from over-pressurized misting can result.

2. *Each sprinkler should be able to reduce the amount of lost water by 70 percent due to a sprinkler failure.*

   REASON: Currently, if a sprinkler is broken, a geyser will result in almost complete loss of the water until the broken sprinkler is fixed. This broken condition may exist for days or weeks until discovered with the rest of the zone receiving no water causing possible vegetation failure, increased costs associated with plant replacement, and water waste. This would require each irrigation zone to be self-healing at each nozzle location and the reduction in water flow would still allow the other sprinklers in the same zone to function properly.

Our company’s solution to both issues:

Sprinkler Flow Control has a device that accomplishes at least two important results: 1. it reduces the inlet pressure to the sprinkler nozzle and the gpm, thereby reducing water loss due to "overpressurization"/high pressure misting and improving uniformity of water distribution; and 2. it decreases the flow when a nozzle is damaged or missing by as much as 90 percent. The disc is also removable and can be reinstalled.

The Sprinkler Flow Control device is a concave stainless steel disc with radial cuts and a center orifice. In the case of a RainBird Professional 1800 Series sprinkler body, the disc is inserted into the bottom of the sprinkler body at the inlet. It is installed by removing the top cover/seal assembly, then pushing the disc down into place using an install tool. Other sprinkler applications require that the disc be inserted into the riser.

Depending on the disc orifice and supply pressure, the disc will allow between .75 gpm to 5.0 gpm to pass. The standard range for most fan type sprinkler nozzles is between .29 gpm and 4.0 gpm. The disc orifice is matched to the needs of the sprinkler nozzle. Depending on the supply line size and pressure, 16 gpm or more will be supplied to the sprinkler during normal conditions prior to the disc installation.

Our testing shows that the municipal supply pressures at the irrigations zones do not vary much and the correct match of disc orifice and sprinkler nozzle will provide for a consistent supply pressure to the nozzle.

We feel that modifications to existing sprinkler bodies should be considered when developing specifications for landscape irrigation sprinklers. Our disc is a good example of taking existing sprinklers and modifying them to perform better given certain conditions. Because the modification may be less expensive to install and maintain, there is a greater likelihood and probability that the end user will install water saving devices.

My contact information is: Peter Maksymec, Sprinkler Flow Control, 9107 West Russell Road, Las Vegas, Nevada 89148. Office 702-551-SAVE (7283), cell 702-493-8450, and email Peter@SprinklerFlow.com. Our website is www.SprinklerFlow.com. We would like to stay involved in the draft of the specifications.

Seth Ostrowski
Operations Manager
Sprinkler Flow Control
9107 W. Russell Rd.
Las Vegas, NV 89148
702-630-3136

Save Water, Save Time, Save Money

Commenter: Adam Carpenter
Affiliation: American Water Works Association
Comment Date: July 28, 2014

Email Text:

Dear Sir or Madam:

Please find comments from the American Water Works Association on EPA's *WaterSense Notice of Intent to Develop a Draft Specification for Landscape Irrigation Sprinklers* dated May 22, 2014 attached. Please do not hesitate to contact us with any questions or feedback you may have.

Sincerely,

Adam T. Carpenter, ENV SP, DTM
Regulatory Analyst, American Water Works Association
202-326-6126 – Office
acarpenter@awwa.org

Email Attachment:

U.S. Environmental Protection Agency
Office of Wastewater Management (OWM)
1200 Pennsylvania Ave, N.W.
Mail code 4201M
Washington, DC 20460

Re: Notice of Intent to Develop a Draft Specification for Landscape Irrigation Sprinklers

Dear Sir or Madam:

The American Water Works Association (AWWA) would like to thank EPA for the opportunity to comment on its *WaterSense Notice of Intent (NOI) to Develop a Draft Specification for Landscape Irrigation Sprinklers*. AWWA is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes over 3,900 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our nearly 50,000 total memberships represent the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.

Support for WaterSense and Water-Efficient Landscaping

AWWA supports the WaterSense program as a valuable tool for both consumers and water utilities. WaterSense gives consumers choices for high-efficiency products. It also assists water utilities in implementing conservation programs where locally relevant by providing them with products appropriate to promote and incentivize because they can be certain that installing those products will reduce water demand compared to traditional products.

Given that a substantial portion of residential and commercial water use in many areas goes to lawn and landscaping irrigation, highly efficient options are needed and AWWA appreciates that WaterSense is working on identifying efficient irrigation options. AWWA supports the development of WaterSense labeling for products that will use water more efficiently when placed into actual use, and where that efficiency can be demonstrated in actual conditions. However, we do not believe, based upon the NOI, that all of the building blocks necessary to meet these intents of WaterSense labeling of irrigation sprinklers have been put into place at this time. We recommend that additional research be completed before pursuing labeling this product category, or at least delaying the completion of a draft specification until this additional research has been completed. If a poorly preforming labeling system were to be put into place, even with the best of intentions, both consumers and water utilities could suffer poor performance and receive a false sense of expected water savings.

Potential for Adverse Consequences and Need for More Research

It is important to remember that improved technology or increased product performance alone does not automatically translate into water savings. We believe that additional research and field data is needed to address a first question that EPA should be asking itself and the stakeholder community. Specifically, whether irrigation sprinklers *should or should not* be available for WaterSense labeling, prior to asking *how* they should be labeled. In order for WaterSense to remain relevant to the water utility community and other stakeholders, it must be clear that WaterSense labeled products actually reduce water use compared to other reasonable alternatives. In the instance of irrigation products (for residential and commercial applications) that are inherently discretionary uses, determining savings much more difficult than for non-discretionary water uses such as toilets.

For example, in designing a new home or performing landscape upgrades, the homeowner, builder, and/or landscaper (“users”) have several options to reduce outdoor water use.

Developers and homeowners choosing to install a low water use landscape, such as xeriscaping and other climate-appropriate landscaping, could reduce the needed area for irrigation or possibly eliminate it entirely. Other landscaping techniques such as drip irrigation for plants and shrubs are also much more efficient than sprinklers. If WaterSense labeled products existed only for sprinklers and not for other, more structurally efficient options, the user could end up in a situation where the choices are to (1) install WaterSense approved equipment or (2) design the system to be more water efficient using other landscaping designs that may not have the associated consumer

education and recognition that a WaterSense label delivers. A user may then choose to install WaterSense equipment to be able to market/promote the labeling or because the labeling system misleads the user into thinking the sprinklers are more efficient than the alternatives, because no labeling existed for those alternatives. EPA should carefully consider ways to prevent this sort of unintended adverse consequence, such as providing WaterSense labeling or alternative consumer education and recognition for low-water-use landscapes that do not use irrigation devices or use devices other than sprinklers. The ultimate goal of WaterSense is to provide choices that reduce water use through more efficient options, and labeling one or a few more efficient landscaping options without recognition of others could undermine this effort and reduce consumer and utility confidence in the WaterSense program.

Additionally, it is unclear whether the proposed methods in the NOI would actually reduce water use. Methods to reduce flow may be useful for proving water savings in a controlled laboratory environment, but are built upon the assumption that consumers will either no modify their behavior as a result of new technology or modify it in an anticipated manner. For example, if it appears that less water is being applied per minute of irrigation to their lawns, some consumers may simply increase the number of minutes of irrigation, resulting in smaller savings or even greater overall use. Additionally, there is little empirical data that high distribution uniformity (DU) actually reduces water use, given that topography, behavior, vegetation type, and other factors are all also important. Systems with different levels of DU should be studied in various field conditions to develop an actual relationship before using DU as a measurement towards labeling. DU also does not measure how much of the water leaving the sprinkler actually is applied to the intended irrigated area. We recommend that EPA examine additional factors, such as studying actual customer use and product category performance in the field, prior to offering WaterSense labeling for irrigation sprinklers or progressing far into specifications development.

These issues do not automatically suggest that EPA should not pursue WaterSense standards for irrigation sprinklers. However, they do suggest that EPA should study them more thoroughly and should explicitly address each of the potential unintended consequences throughout specifications development for this product category. For example, EPA may wish to consider labeling only in situations where the technology has been demonstrated to save water, and provide alternative labeling and recognition for alternative efficiency options that require little or no irrigation (thus, going further towards reducing water use). Such a system could reduce the potential adverse consequences of labeling in this product category. However, these alternatives must be studied with care to identify how savings will occur and which conditions those savings would apply to and to fit into other aspects of the WaterSense program. That way, users can make more informed decisions and utilities can choose to incentivize this product category (where locally appropriate) only if the correct conditions are met to result in water savings. This information is necessary for utilities and consumers to make wise investments in demand reduction where appropriate.

Finally, it is also essential that thorough educational materials be developed to help inform developers and consumers of these product or system limitations to help them use these products efficiently to further help avoid these unintended consequences. Any

WaterSense program for this category would benefit greatly if the above identified issues were both studied and clearly addressed.

Responses to Specific EPA Questions Within the NOI

3. *Is the proposal of labeling nozzles and bodies separately appropriate for this product category?*

We believe that it is appropriate to label nozzles and bodies separately. However, we have some reservations about the product category as a whole because of potential adverse outcomes and lack of demonstrated water savings in real-world situations. More research is needed to make sure all the components come together correctly. Additionally, any product labeling program would be well served by a robust marketing and education effort that clearly presents irrigation system complexities and how intended water savings can best be achieved.

4. *Regarding the performance measure for high-efficiency nozzles, is the top-tier approach or increase-from-baseline approach more appropriate for identifying the performance threshold for DU?*

We believe that additional research is needed before pursuing either one of these approaches. At present, there is insufficient data to conclusively show that changing the DU reduces water use outside of controlled laboratory settings. Not all irrigated areas require the same amount of water because of different vegetation types, topography, exposure to sunlight, and other factors. Additionally, an increase in DU does not mean that consumers will use the system any more efficiently than if there had been a low DU. Different products with a identical DUs could have differing efficiencies and evaporative losses. This does not mean that DU is not a useful measure for other product performance purposes, but for water use efficiency we do not agree with the assumption that scoring high on DU automatically results in water savings worthy of WaterSense labeling. It is possible that consumer satisfaction may be higher with higher DU products, and that higher DU products help to reduce runoff, but these co-benefits would be applicable to WaterSense only if higher DU can be proven to also reduce water use. Therefore, we feel these issues need further study before using either approach.

5. *Regarding pressure regulation, is a sprinkler's ability to maintain a constant outlet pressure over a range of inlet pressures an appropriate measure of performance for pressure-regulating spray bodies? Is it appropriate to include a performance measure that specifies the sprinkler body's ability to decrease flow when a nozzle is damaged or missing?*

We recognize that varying inlet pressures based on utility services coupled with poor irrigation system design can result in poor system performance and increased water use. It is important to measure both inlet and outlet pressure and flow rate to determine how a system is operating. Products that deliver a more constant outlet pressure and flow rate improve sprinkler performance which can contribute toward water efficiency. In many products, a constant outlet pressure may mean that the flow rate is also constant, but this should not be assumed for all products.

For damaged or missing sprinklers, we believe that a device that would reduce flow or shut the sprinkler off entirely would save water over the short term compared to the "geyser" that could potentially occur for a damaged or missing sprinkler. However, there are several issues to be addressed in such a design:

- First, what constitutes damaged or missing? Clear definitions are absolutely essential to be able to objectively measure this phenomenon. If the sprinkler was missing, would the device that regulates the flow also be missing?
- Second, does the reduced flow mask the fact that the sprinkler is damaged or missing? In this case, users may not perform needed repairs that would reduce water use because they are unaware of the problem, and may even increase watering times when they notice that less water is being applied to certain irrigated areas. Preferably, any such design would also include a component that would help inform users of the problem and the need for repairs.
- Also, no device to shut off or reduce flow will work if that device is also damaged or missing, and it is therefore unclear how such a device would be tested.

6. *Is the required orifice flow rate of 1.5 gpm in the ASABE/ICC test method for pressure regulation adequate to characterize the performance of a family of sprinkler nozzles that covers a range of wetted radii and patterns?*

We believe that 1.5 gpm may not be the correct rate in all situations. Given the wide variety of nozzles with different spray patterns, coverage arcs, etc. a different flow rate may be required for some products. It is important to use a realistic flow rate for a given product because failing to do so may falsely show savings when in real-world applications none exist.

Conclusion

Thank you for the opportunity to comment on this important notice of intent. It is our sincere hope that additional research and development in the areas discussed throughout these comments will help WaterSense identify potential barriers to implementing a specification in this category and allow EPA to address each of the roadblocks early in development. If you have any questions regarding this correspondence or if AWWA can be of assistance in some other way, please contact me or Adam Carpenter at (202) 326-6126 or acarpenter@awwa.org.

Respectfully,

Thomas W. Curtis
Deputy Executive Director American Water Works Association
CC: Peter Grevatt, EPA OGWDW
Andrew Sawyers, EPA OWM
Veronica Blette, EPA OWM

Commenter: Jeffrey Hughes/Mary Ann Dickinson
Affiliation: Alliance for Water Efficiency
Comment Date: July 28, 2014

Email Text:

Please accept the attached as public comment on the EPA *WaterSense Notice of Intent to Develop a Draft Specification for Landscape Irrigation Sprinklers*. Thank you for the opportunity. Please acknowledge receipt.

Mary Ann Dickinson
President and CEO
Alliance for Water Efficiency
300 W. Adams Street, Suite 601
Chicago, Illinois 60606
www.a4we.org

Email Attachment:

Delivered via E-mail to: watersense-products@erg.com
July 28, 2014

WaterSense, U.S. Environmental Protection Agency Office of Wastewater Management (4204M) 1200 Pennsylvania Avenue, N.W. Washington, D.C. 20460

RE: COMMENTS ON EPA WATERSENSE NOTICE OF INTENT TO DEVELOP A DRAFT SPECIFICATION FOR LANDSCAPE IRRIGATION SPRINKLERS

The Alliance for Water Efficiency is pleased to submit the attached comments in response to EPA WaterSense's request for comments or suggestions on the NOI to develop a draft specification for landscape irrigation sprinklers.

The Alliance for Water Efficiency is a nonprofit organization dedicated to the efficient and sustainable use of water. We represent a broad coalition of stakeholders which include water suppliers, business and industry, government agencies, energy and environmental advocates, and academia.

We appreciate your consideration of our comments and recommendations. Please let us know if you have any questions.

Sincerely,

Mary Ann Dickinson
President and CEO
ALLIANCE FOR WATER EFFICIENCY

Comments on EPA WaterSense Notice of Intent to Develop a Draft Specification for Landscape Irrigation Sprinklers

JULY 28, 2014

Our discussion group has many more questions that we believe should be addressed in addition to the questions posed by WaterSense. In order to respect the WaterSense NOI process we have included our preliminary answers to the questions in Section V. of the NOI. Our own list of questions concludes the notes from our conference call.

Section V. Outstanding Questions

WaterSense welcomes feedback on all aspects presented in this NOI but is seeking specific input on the following outstanding questions:

1. Is the proposal of labeling nozzles and bodies separately appropriate for this product category?
    a. Yes. Some AWE stakeholders assert that if you were to do nothing more than require pressure-regulating sprinkler body there would be measurable savings. Please note that savings potential is greatest when pressure is higher than optimum due to system supply pressure or elevation changes in the irrigation system.

    b. WaterSense might be better advised to focus on pressure-regulating labeling before attempting to label nozzles at this time. Given that pressure-regulating sprinkler bodies are more likely to deliver repeatable results a quicker roll-out schedule is likely.

    c. The efficient nozzles and pressure-regulating sprinkler bodies are two different technologies that should be considered separately. Conducting simultaneous testing and specification development is likely to result in confusion regarding the difference in each of the technologies (i.e., test only one variable at a time). Our stakeholders' recommended strategy for study and roll out is to begin the labeling process for pressure-regulating sprinkler bodies as soon as possible.

2. Regarding the performance measure for high-efficiency nozzles, is the top-tier approach or increase-from-baseline approach more appropriate for identifying the performance threshold for DU?
    a. There is some indication in the literature that variability in catch can data does not adequately represent soil moisture variability (Dukes, Haley, & Hanks, 2006). These data indicate that this is not an appropriate question because this question is based upon an assumption that there is a direct relationship between DU and water savings. It is the experience of the AWE stakeholders that there is not yet an established basis for assuming that this is the case.

    b. WaterSense research for high-efficiency nozzles should quantify whether

there is a reliably direct connection between DU and water savings or whether there is another lab test that can more reliably determine if high-efficiency nozzles can deliver water savings on a level that merits WaterSense labeling.

3a. Regarding pressure regulation, is a sprinkler's ability to maintain a constant outlet pressure over a range of inlet pressures an appropriate measure of performance for pressure-regulating spray bodies?

a. It is the opinion of the AWE stakeholders that the best way to test pressure regulation for sprinkler bodies is to determine if the product can maintain a relatively constant flow rate over a range of inlet pressures. For example, testing for quarter circle, half circle, and full circle flow rates at step increased and decreased pressures.

3b. Is it appropriate to include a performance measure that specifies the sprinkler body's ability to decrease flow when a nozzle is damaged or missing?

a. Yes. The "geyser" of a broken sprinkler is a common occurrence and minimizing water wasted in these instances could result in significant savings. However, a "geyser" can only be managed by pressure regulation if the feature is not damaged when the nozzle is damaged or missing.

b. Managing water loss from geysers is a desirable feature. It is the opinion of the AWE stakeholders that it is appropriate to include a performance measure that requires the sprinkler body to decrease flow by a specified percentage or to a specified maximum flow rate when a nozzle is damaged or missing.

c. In order to be clear about claims of water savings a clear definition of damaged or missing nozzle should to be developed.

4. Is the required orifice flow rate of 1.5 gpm in the ASABE/ICC test method for pressure regulation adequate to characterize the performance of a family of sprinkler nozzles that covers a range of wetted radii and patterns?

a. While a flow rate 1.5 gpm matches the ½ circle nozzle, which represents about 60 percent of sprinkler installations, it is the opinion of the AWE stakeholders that there should be research conducted at higher flow rates (typical of full circle) and at lower flow rates (typical of ¼ circle) in the high-efficiency nozzle testing protocol before accepting 1.5 gpm as a representative of performance for all sprinklers.

Additional AWE Stakeholder Comments

Many AWE stakeholders question the savings consistency of WaterSense labeled irrigation sprinkler bodies and nozzles because irrigation usage varies based on a number of variables including, type of system, cost of water, socio-economic variables, plant type, horticultural practices, etc. While it is true that other WaterSense products, such as showerheads, faucets, and toilets, use water, none of these products have a

spatial installation requirement in order to perform efficiently. In addition, irrigation installations are subject to a different level of degradation in performance due to the nature of outdoor installations. Sprinklers are prone to much more damage (e.g., from mowing and vandalism) than indoor plumbing fixtures. Therefore, performance beyond the day of installation should be taken into account when determining water savings potential of sprinkler components.

The AWE stakeholders agreed that it is important that AWE participate fully in this NOI process. Therefore, we focused our conversation on what we have discovered in our own research and what data gaps WaterSense would need to fill in order to label high-efficiency nozzles and pressure regulating sprinkler bodies with a high degree of confidence that water saved would reliably meet the 20 percent threshold for WaterSense labeling.

To our knowledge, none of the pilot studies to date have been peer reviewed, though some have enough participants to be considered statistically valid. One or more peer reviewed studies from representative regions of the country would be advisable before implementing WaterSense labeling.

The three utility studies represented on the call tested for DU before and after installation. All three studies provided modified watering schedules based on changes in DU. Participants were trained on how to change schedules based on weather or time of year. Water use evaluation was indexed to changes in ET. None of the three studies identified any measurable water savings from retrofitting with high-efficiency sprinkler nozzles.

One utility found that high-performing systems can degrade when retrofitted with high-efficiency sprinkler nozzles. Surprisingly, there does not seem to be a strong relationship between DU and total water used by an irrigation system. University studies have also found no direct relationship between improvements in DU and improved appearance of the landscape.

AWE stakeholders have several questions that we recommend be answered through further research:

- The studies to date have all been conducted as retrofits of existing installations. What is the water saving potential in a new construction situation?
- Most of the known studies are pilot studies where the majority of participants are “early adopters” and, since early adopters are often very efficient irrigators, there is only a limited opportunity to achieve water savings without compromising plant health and landscape aesthetics. As such, the inclusion of early adopters in these pilot studies might be partially responsible for the low or no water savings results. The more important question is—what is the water-saving potential of using this technology in the general population?
- Many of the known studies have concluded that any water savings realized were the result of education about controller programming and not necessarily attributable to changes in technology. How can further research discover the water saving potential

associated with the technology alone, without the inclusion of an education component to find out what really might happen when the physical equipment is labeled and released?

- Is the management of the system more important to achieving water savings than the sprinkler technology?
- Known studies have found that DU quickly degrades, sometime significantly decreasing within one year. Changes in DU may not be technology related however there is a concern about longevity of savings. Further research about how the technologies perform over time is recommended. Are there changes (degradation) in DU attributable to the technology or to installation challenges? Regardless of the cause of the degradation in DU, are water savings significant enough after degradation to meet the WaterSense threshold of 20 percent savings? Is pressure regulation sustained over time? Are changes in pressure regulation product related or installation related? Regardless of the cause of the degradation in pressure regulation, are water savings significant enough after degradation to meet the WaterSense threshold of 20 percent savings?
- Are there differences in how the technologies are likely to be adopted by sectors (Commercial vs. Residential vs. Industrial)?
- How can data logging/AMR/AMI be used in the research so researchers can get information without having to approach the customer, which might change results because of behavior changes due to awareness that the customer is being studied (Hawthorne effect)?
- Standards address specification and safety of the product, not water savings. How will the WaterSense specification ensure water savings?
- Are these technologies useful in specific landscape configurations but not necessarily appropriate for general use?
- Is there a regional difference in water savings potential? Running parallel studies in several climate zones seems wise because savings could be regionally different.
- Is there a difference in water savings potential due to soil types? Running parallel studies that specifically identify soil conditions and characteristics seems wise because the purpose of irrigation is to fill the soil reservoir from which the plants draw water over time.

One of the stated reasons for early release of the NOI for sprinklers is because the EPA is using the NOI process to seek existing studies. Several organizations have conducted literature reviews regarding outdoor water efficient technology studies. Though some studies have combined measures, those studies that have studies these technologies in isolation are of particular interest.

A comprehensive list links to resources are listed below:

- CUWCC PBMP Report on Rotating Sprinkler Nozzles

  - http://www.cuwcc.org/Portals/0/Document%20Library/Committees/Programmatic%20Committees/Research%20and%20Evaluation/Meeting%20Documents/2013/October%2030,%202013/RN%20PBMP%20Report%20Draft.pdf?timestamp=1401729034336

- Dr. Michael Dukes Studies

  - http://abe.ufl.edu/mdukes/publications/
  - http://abe.ufl.edu/people/directory/faculty-profiles/dukes-mike.shtml
  - http://abe.ufl.edu/mdukes/

- AWE Literature Review Due in Two Months Bibliography

Dukes, M. D., Haley, M. B., & Hanks, S. A. (2006). *Sprinkler Irrigation and Soil Moisture Uniformity.* Falls Church, VA: Irrigation Association.

Commenter: Sue McGuire
Affiliation: Unaffiliated
Comment Date: July 28, 2014

Email Text:

As a resident of Nevada County, California, and pursuant to Article X of the United States Constitution, I dispute the federal government's claimed authority to regulate my water usage.

Pursuant to the limitations on federal authority under Article X, I do not believe the federal government or its regulatory agencies have such jurisdiction or authority to regulate my personal water usage, that of my business, that of Nevada County, or that of the State of California. I do not relinquish my personal rights, my rights as a citizen of Nevada County, or as a citizen of the State of California to the federal government or its regulatory agency, the EPA.

This is demand that the federal government's EPA withdraw any alleged claim of jurisdiction to regulate water usage by me personally or my business and to withdraw EPA's presence in Nevada County and in California.

SUE McGUIRE
P. O. Box 1715
Nevada City, CA 95959
(530) 913-3906

"In the beginning of change, the patriot is a scarce man,
and brave and hated and scorned. When his cause
succeeds, the timid join him, for then it costs nothing
to be a patriot." *Mark Twain, 1904*

Commenter: James Canyon
Affiliation: Digital Spring, LLC
Comment Date: June 11, 2014

Email Text:

Re: ECCO Soil moisture system
To whom it may concern.
Our company is bringing a novel turf soil moisture product to the consumer market this calendar year. I am writing to introduce Digital Spring, to inform you about our ECCO wireless soil moisture stakes, and to request to be kept in the loop as soon as the standard is adopted as it is our intention to ensure our product carries the WaterSense label.

Digital Spring, LLC is a Startup company located in San Diego, CA, and we have spent the past 2 years developing a new type of soil moisture sensor. Our sensor is fully encapsulated inside plastic and, like TDR measurements measures dielectric constant of soil however our sensor uses a new type of transducer to do so. Performance of our sensors is currently being measured and verified by CSU Fresno CIT. Today we are focusing on bringing our sensor technology to market in a variety of markets including commercial farming, commercial turf, consumer turf, and consumer potted plants and shrubs.

Last March, Digital Spring won Metropolitan Water District's 2013 Innovative conservation program grant to study the performance of our new ECCO soil moisture system installed as a retrofit to existing residential sprinkler systems in three cities in CA/NV/AZ. ECCO soil moisture system is a bypass technology which consists of lawn stakes inserted by the homeowner into the turf in each watering zone controlled by a timer based sprinkler controller. ECCO Soil Moisture Stakes wirelessly communicate with what we call a smart switch which is mounted onto the sprinkler valve. The ECCO smart switch learns the homeowners watering patterns then interrupts the watering based on the lawn demand as measured by the sensors. Each sensor contains a stand-alone computer which allow our sensors to measure soil moisture 24 hours per day and instructs the switch located at the valve how much to water each day based on the sensor program. A schematic can be seen at www.eccosoil.com.

It is our intent to have our sensors and system pass the WaterSense testing and proudly display the WaterSense logo on the packaging. As I said earlier, we are working with Cal State Fresno to perform our testing and hope we will be able to get certified in their lab. Please keep us in the loop regarding testing requirements and please feel free to contact us if you have any questions.

Thanks
Sincerely,
James Canyon, CEO/Founder Digital Spring, LLC
www.digitalspringnet.com
www.eccosoil.com
+1858-204-9422

Commenter: Sandra Cannon
Affiliation: U.S. Department of Energy Sustainable Acquisition Program
Comment Date: June 3, 2014

Email Text:

Dear WaterSense Team

I strongly recommend that the Landscape Irrigation Sprinkler Specification go well beyond commercial code and be either focused on Federal facilities or have two sets of specifications--one for Federal facilities and commercial entities AND one for home owners.

The above is to preclude the situation we presently have with faucets where the WaterSense specification does not meet commercial code and therefore is not applicable for Federal facilities. ---Sandra

Sandra Cannon, Technical Support
U.S. Department of Energy Sustainable Acquisition Program
Tel. 509-529-1535

Avoid Waste, Purchase $mart - EcoPurchasing

Commenter: Antonio Fernandez
Affiliation: Harvard School Dental Medicine
Comment Date: May 30, 2014

Email Text:

To whom this may concern,

My name is Antonio Fernandez and I'm a first time home buyer that is trying to go as green, at the same time I'm green to the complete green home system like water, electricity etc. the reason I write is that I received a rebate add at my home for my toilet and washer and as I was reading over the specs/all information I see the landscape irrigation sprinkler tab. Can you explain a bit more how the (LIS) will benefit me and the environment in the long run. Also the cost of it?

Thank you,
Antonio

HARVARD
School of Dental Medicine
Antonio Fernandez
Purchasing Assistant
Harvard School Dental Medicine
188 Longwood Ave. Rm B010
Boston, Mass 02119
Office: 617-432-6626|**Mobile:** 857-492-1748
Fax: 617-432-2161
antonio_fernandez@hsdm.harvard.edu

Commenter: Jorge Manuel Mustonen Morel
Affiliation: Unaffiliated
Comment Date: May 27, 2014

Email Text:

APRECIADA GENTE DE WATERSENSE¨

MUCHAS GRACIAS POR INFORMARME SOBRE LA ACTIVIDAD DE ASPERSORES DE RIEGO DE PAISAJE.

ME GUSTARIA MUCHO RECIBIR LAS MEMORIAS DE ESA ACTIVIDAD, SI ES POSIBLE TRADUCIDAS AL ESPAÑOL. MUCHAS GRACIAS,

Commenter: Tom Reynolds
Affiliation: Water Balance
Comment Date: May 23, 2014

Email Text:

Since 2008, never got one handshake from EPA. I don't need it to know I have presence in irrigation. You'll finally handshake, or I'll continue to move on, opening opportunities, that have zero relationship with you.

Oh yeah. Get out of the business of supporting tax-payer-funded, typically municipal and extension "conservation." It clearly has no basis, no more that full and complete governmental health care. Those landscapes are alive, stupid! You clearly have no clue about consumer-adviser intimacy and confidence.

Tom A. Reynolds

Tempe, AZ
602-463-5072
www.waterbalance.net

Commenter: Edward Norum
Affiliation: CSU Fresca, Center for Irrigation Technology
Comment Date: May 27, 2014

Email Text:

We are working on the technical aspects of this specification. We offer to share our progress with your project leader if you will provide the contact information.

Regards: Ed Norum

Commenter: Kinzea Thompson
Affiliation: Unaffiliated
Comment Date: May 26, 2014

Email Text:

Once again the federal government is stepping far beyond its constitutionally granted obligations. If you cannot or will not uphold your oath to protect and defend the constitution, please by all means self-terminate. This country will never dig its way out of this economic recession until you parasites stop thinking up new shit to make everything more expensive, if your ideas were economically viable you would be in the private sector providing for your families. Do you understand COMRADE?

Commenter: Brian Shiffman
Affiliation: Unaffiliated
Comment Date: May 25, 2014

Email Text:

The landscape irrigation sprinklers that are available today are the most efficient sprinklers ever developed with respect to water output. Their water output can be easily determined by the information already supplied by the manufacturer and when supplemented with the dealer's knowledge, make the determination of the water savings readily available. In my area, we have seen a tremendous water savings by using these new sprinklers. The industry has done a good job responding to the needs of the landscape market both commercial and residential. I don't see the need for this additional cost to incorporate "WaterSense" into the production of irrigation sprinklers. I also don't see where the authorization is for the EPA to become involved in this activity.

Sincerely,

Brian Shiffman

Commenter: John Texeira
Affiliation: Unaffiliated
Comment Date: May 25, 2014

Email Text:

This is America, the Constitution and my right to life, liberty and the pursuit of happiness gives me the God given right to water my grass and garden.

Big Government needs to stay out of my life and my business.

John Texeira

Commenter: Keith Murr
Affiliation: Unaffiliated
Comment Date: May 25, 2014

Email Text:

EPA Get out of our lives.

Commenter: Angelo N. Ververis
Affiliation: Unaffiliated
Comment Date: May 25, 2014

Email Text:

This intent is ridiculous. It is a waste of our tax dollars. The EPA is out of line engaging in this. States should address these issues on a local case by case basis.

Angelo N Ververis

Concerned Citizen

Commenter: Greg Walsh
Affiliation: Unaffiliated
Comment Date: May 25, 2014

Email Text:

please stay out of our lives, we do not need or care for our Agenda

TAKE A HIKE

Commenter: Mary Crocker
Affiliation: Unaffiliated
Comment Date: May 24, 2014

Email Text:

Greetings,

I'm a homeowner, not an irrigation specialist. However, I am very concerned about using water resources wisely. I have 2 rain barrels in operation to water my small vegetable gardens. I also collect the drip from my central air conditioner for when the rains don't come, which is happening a lot lately in Texas. In fact, for several years. Texas is not the only state with serious drought conditions. More use of rain barrels would help. And learning about using native plants for your community which don't require more water.

I have heard about using grey water for landscape irrigation and I would love to use it. However, my local government officials think that can only be used if you build the new neighborhood with that system. Education is needed, perhaps at municipal government statewide conferences.

I remember that my grandmother and her sister had cisterns under their houses which were build on pier and beam. They preferred that water for gardens and washing hair. Why did we neglect that technology and knowledge?

Peace and Joy,
Mary C

Commenter: Ken Mauser
Affiliation: Aquatrols Corporation
Comment Date: May 24, 2014

Email Text:

I can understand your desire to get a more effective and more efficient sprinkler for the application of the water. On the surface. But what happens to that water after it leaves the sprinkler and lands on the soil? Water is lost every time a sprinkler or emitter is turned on and water comes out because water doesn't go where we want it to. Water will always follow a path of least resistance. And that is where the loss of water, in the soil, begins. If you people are going to finally move outdoors and start to work on water conservation and water use efficiency in the landscape then you better work on the whole process and not just the application system. Irrigation systems deliver water from point A to point B. And then they distribute that water as uniformly as possible. But once that water is out of the irrigation system it is not controlled and can be lost in staggering amounts. I have seen irrigation system distribution uniformity percentages of 80 and 85% drop to the 60% area when it comes to water use efficiency % because the water wouldn't or couldn't get into the soil effectively. Let's do the whole job and not just part so we can get maximum water use efficiency and max water conservation.

Aquatrols has been helping the turf and landscape industry save water for over 50 years. We have more experience helping turf managers and landscapers manage water more effectively and efficiently than anyone in the industry. We are here to help. Ask us.

Ken Mauser
Territory Manager/Territory Agronomist
Aquatrols Corporation
805-402-4863

Commenter: James Johnson
Affiliation: Healthy Efficient Homes LLC
Comment Date: May 24, 2014

Email Text:

Why does WaterSense have a program for sprinklers when we should be banning sprinklers. In the next few years with water being a valuable resource we will need to stop using all sprinkler systems and let grass go brown in the summer as it should.

Jim Johnson
Healthy Efficient Homes LLC
100 Western St
PO Box 261
Worthing SD 57077
Cell 605-940-2738605-940-2738

Commenter: Kerry Frost
Affiliation: Unaffiliated
Comment Date: May 24, 2014

Email Text:

Hi

I have a new product for the domestic home owner to save water and drip feed irrigate the garden. The first of a range of product for this problem is on sale at www.wateringpipe.co.uk. Besides this the technology is design to change the way water is stored and managed in numerous settings. Such as gray water irrigation systems and integrated in structures for maximum efficiency of space.

Please consider this advance in the market whilst changing specifications etc.

Yours K. Frost

Commenter: Doris Wright
Affiliation: Unaffiliated
Comment Date: May 23, 2014

Email Text:

I received an email asking for input regarding specifications for saving landscape water.

1. Don't water grass. It goes dormant but recovers when it rains. This should include golf courses. Also sports fields.
2. In gardens lawn can be replaced with low water use plants that can be mulched to conserve even more water, or by vegetables and fruits, also mulched.
3. Or if the lawn owner does not like to take care of plants he can cover the area with mulch or gravel or some other permeable material.
4. Gray water is good for plants. But probably water from aquifers near fracking sites is bad for plants as well as animals including us.
5. The irrigation system should be on a separate water line from the house line, and one that can be shut off until the moisture level is below a certain level under all that mulch. This could probably be automated with moisture sensors.

Any more questions?

DW

Commenter: John Mitchell
Affiliation: Siphonaid/Siphon Priming Device
Comment Date: May 23, 2014

Email Text:

Have you considered grey water for landscape irrigation? www.siphonaid.com is an inexpensive, easy to use tool for many (not all) households. this is water re-use - and not just reduction of use - but re-use.

Do you have any feedback? Do you do anything w/ grey water?

thank you
John Mitchell

Commenter: Greg Chick
Affiliation: Green Plumbers
Comment Date: May 23, 2014

Email Text:

It is my opinion thru decades of contracting that spray areas less than 8' in area are not ideal for containing spray or even distribution.

Could this comment be put on the table?

Greg Chick, LEED AP. CWM, ARCSA AP, CLIA Current Plumbing contractor, former irrigation contractor. ASABE TG member, water geek.
greg@ramonasplumber.com

Commenter: Lucas Mouttet
Affiliation: Fort Collins Utilities
Comment Date: May 23, 2014

Email Text:

Hi there –

Thanks for the email about the Notice of Intent on landscape sprinklers – very interesting!

We have been rebating these items for a few years now, and were able for the first time this year determine statistical savings from customers who received a rebate – analysis from the consultant attached – please let me know if you need more explanation on it. The nozzles we rebate are listed on our website here - http://www.fcgov.com/utilities/residential/conserve/water-efficiency/water-efficient-sprinkler-systems/sprinkler-equipment-rebates/qualifying-sprinkler-equipment

Please let us know if we can be of any other assistance in this process with collaborations or data – we're happy to help.

We are certainly excited for you guys to certify nozzles and heads, it will only help us promote our current program!

Lucas

Lucas Mouttet
Water Conservation Coordinator
Fort Collins Utilities
970-224-6123 – office
970-962-9138 - mobile

Efficiency Works!

Email Attachment:

To: Lucas Mouttet
From: Tim Hillman
Date: May 8, 2014"

RE: 2013 Indoor/Outdoor Water Savings Summary by Rebate Measure

This document provides a summary of the indoor, outdoor and total water savings from Fort Collins Utilities' (FCU) water rebate programs. This analysis is an update to the "2013 Indoor/Outdoor Water Savings Summary by Rebate Measure" (delivered September, 2013) that includes data through the end of 2013 and is meant to provide FCU with another snapshot of the water use impacts observed among these customers.

As more customers participate and the analysis is further refined, FCU should be able to rely on these metrics of program performance through the ongoing use of the Strategic Intelligence Management System (SIMS). The remainder of this document contains a description of the scope of this analysis and the methodology use to calculate indoor, outdoor and total water use changes from each of the measures as well as a summary of the results.

Methodology and Scope

At the time of this analysis, six of FCU's individual rebates and the sprinkler audit program that are being tracked by FCU's Tracking Nexus on Sharepoint and are similarly being tracked by the SIMS, are included in this analysis. The methodology and analysis deriving the indoor/outdoor water use splits were outlined in detail in the following reports: "Fort Collins Indoor and Outdoor Water Use Summary: 2005 – 2011" (delivered 3/1/12).

In an attempt to better understand the impacts of particular measures, this analysis evaluates program participants that only installed the rebated measure of interest (i.e., they are not known to have installed another rebated water measure at the property). Caution should be used, however, when trying to infer actual savings attributable to the measures from these results as there are a number of exogenous factors that affect water use. Despite this, these results provide a valuable snapshot of water use changes among these customers that can aid in the assessment of the impacts of these rebate programs. Table 1 provides a summary of the measures and whether the indoor or outdoor water use component was included in this assessment.

Table 1 Summary of measures include in this analysis

Measures with Indoor and Total Use Analyzed	Measures with Outdoor and Total Use Analyzed
Clothes Washer, Dishwasher, Toilet	Irrigation Controller, Irrigation Nozzles & Heads, Rain Sensor, Sprinkler Audit

The water savings associated with each of the rebated measures is calculated from billing consumption data that is totaled on an annual basis to yield the normalized annual consumption (NAC). The NAC is simply the sum of the consumption for a consecutive 12 month period and does not represent weather normalized consumption, but in this case consumption that is normalized to a full 12 month calendar period. The NAC approach used in this analysis evaluated changes in total water use for all measures and either indoor water use or outdoor water use changes depending on whether the measure affected indoor or outdoor water use.

The difference of the NAC prior to measure install and the NAC after the measure install is quantified to yield savings (gross program impacts):

$$Unadjusted\ Program\ Savings = \sum_{i=0}^{n} \Delta NAC = \sum_{i=0}^{n} NACpre - NACpost_i$$

where: NACpre = Constant pre-enrollment NAC value for 1 month prior

to enrollment NACpost = Rolling month post-enrollment NAC starting 1 month after enrollment

Water use exhibits substantial variation across seasons and years and to attempt to normalize for these impacts, our evaluation is based on the net program savings. Net program savings are calculated by adjusting the gross savings observed among program participants (the "unadjusted program savings" outlined above) against the water savings observed among a control group composed of a random sample of non-program participants.

The adjusted (or net) program savings are computed as:

$$Adjusted\ Savings = \left|(C_{adj} * NACpre) - NACpost_i\right|_{Program\ Participants}$$

where the control adjustment factor (Cadj) is computed as:

$$Control_{adj} = \left|\frac{NACpost_i}{NACpre}\right|_{Control}$$

A control adjustment factor is calculated and applied for every NACpre and NACpost period associated with a unique measure install date. A control adjustment factor greater than 1.0 signifies that consumption increased among the control group customers over the two years surrounding the measure install date.

Results

Three result sets are presented below: 1) a summary of the indoor water savings for the measures that affect indoor water use (clothes washer, dishwasher and toilet); 2) a summary of the outdoor water savings for the measures that affect outdoor water use (irrigation controller, irrigation nozzle/head, rain sensor and sprinkler audit); and 3) a summary of the total water use changes observed across program participants for all measures. The number of meters, the median and average control adjusted annual water savings (gal/year) and the 95% confidence interval on the average savings observed on an indoor water use, outdoor water use or total water use basis are summarized in Table 2, Table 3 or Table 4, respectively.

Table 2 Summary of control adjusted indoor water use savings by measure

Program/Measure	Annual Indoor Water Savings per Program Participant			Confidence Interval for Average Savings[1]		
	Number of Meters	Median (gal)	Average (gal)	Absolute (+/- gal)	Relative (+/-%)[2]	Standard Deviation (gal)
Clothes Washer	1,825	4,280	5,200	530	10%	11,490
Dishwasher	1,186	970	1,350	530	40%	9,350

Toilet	588	3,880	5,550	860	16%	10,600

1. **Confidence interval defined for a 95% confidence level.**
2. **Relative confidence interval calculated as the absolute confidence level divided by the mean.**

Table 3 Summary of control adjusted outdoor water use savings by measure

Program/Measure	Annual Outdoor Water Savings per Program Participant			Confidence Interval for Average Change[1]		
	Number of Meters	Median (gal)	Average (gal)	Absolute (+/- gal)	Relative (+/- %)[2]	Standard Deviation (gal)
Irrigation Controller	32	13,450	23,470	21,100	90%	58,970
Irrigation Nozzle/Head	66	13,850	20,130	8,580	43%	35,810
Rain Sensor[3]	11	4,520	9,810	10,640	109%	18,010
Sprinkler Audit	748	8,670	13,840	2,190	16%	30,390

1. **Confidence interval defined for a 95% confidence level.**
2. **Relative confidence interval calculated as the absolute confidence level divided by the mean.**
3. **Too small a sample to provide any statistical significance and should not be the basis for any policy decision.**

Table 4 Summary of control adjusted total water use changes by measure (a positive number signifies a reduction in use)

Program/Measure	Annual Total Use Change per Program Participant			Confidence Interval for Average Change[1]		
	Number of Meters	Median (gal)	Average (gal)	Absolute (+/- gal)	Relative (+/- %)[2]	Standard Deviation (gal)
Clothes Washer	1,825	7,720	8,430	1,040	12%	22,590
Dishwasher	1,186	2,690	4,140	1,310	32%	22,920
Toilet	588	6,850	8,920	1,900	21%	23,560
Irrigation Controller	32	12,260	22,560	26,450	117%	76,320
Irrigation Nozzle/Head	66	4,260	6,440	5,590	87%	23,160
Rain Sensor[3]	11	-3,640	2,520	8,690	345%	14,700
Sprinkler Audit	748	2,750	4,190	1,710	41%	23,910

1. **Confidence interval defined for a 95% confidence level.**
2. **Relative confidence interval calculated as the absolute confidence level divided by the mean.**
3. **Too small a sample to provide any statistical significance and should not be the basis for any policy decision.**