Comments on the *WaterSense®* *Draft Specification for Soil Moisture-Based Irrigation Control Technologies*

February 6, 2020

Table of Contents

The comments provided below are replicated in their entirety as submitted by each stakeholder. The only changes made were of a typographical nature or for clarity, as indicated by items in brackets. Any parenthetical items, emphasis through capitalization, or grammar that is inconsistent with WaterSense style was provided by the commenters.

Commenter: Brian Koblenz
Affiliation: Irricloud
Comment Date: November 25, 2019

Email Text:

I have both read your specification and participated in your webinar.

Most of my response is targeted to make sure that this process does not inhibit or reduce innovative ideas that may improve water savings now and in the future. My concern is that approving a specification like this IMPLIES that SMS [soil moisture sensor] systems that do not meet this specification are likely inferior in terms of water savings and, that should not be the implication.

FWIW [for what it's worth], I believe my company's products can meet all of your specifications, however the lack of definition of "Irrigation Event" and what it means to stop an "Irrigation Event" gives me some concern. (More on this later.)

You state systems that enable and disable irrigation events are "in-scope" yet you exclude from your scope "On-demand SMS" which are precisely those systems that enable and disable irrigation based on SMS data.

What I believe you are doing in actuality is ONLY including those systems that "disable" pre-defined irrigation events and the absence of "disabling" the event allows the event to move forward. In other words, the base controller "clock" enables the event and the sensor can "disable" the event. In this scenario, SMS are given high thresholds above which they must "disable" irrigation events. (I suspect most of the add-on SMS systems rely on this scenario but they will struggle with the requirement to "notify" the base controller that the SMS is not operating properly but I will leave it to those vendors to make their case.)

One could imagine a different (better?) system where a clock has an "irrigation event" program with a set of zones to run but no specified start time. Then the SMS could interact with the clock to "enable" that program that would then run to completion. In this scenario, the SMS are given a low threshold below which an irrigation event must be "enabled". There are many things to recommend this style and it can work in the context of "restricted watering days", but that restricted day framework may itself not lead to the most efficient watering scenarios and may change over time.

One could also imagine yet another system where the "irrigation event" program is based on a combination of clock information and SMS data where both starting and stopping (enabling/disabling) the irrigation event is controlled by the SMS.

All of the above scenarios are practical, useful, and efficient; supporting one to the exclusion of the others is inappropriate.

What is an "irrigation event"? Most irrigation controllers today work with the notion of a program and even within that term, different companies do things differently. A program might:

a) run 1 zone for some time

b) run multiple zones concurrently for some time

c) run a set of zones in sequence where each zone has a run time

d) might mix b) and c)

e) might "water and soak" any of a), b), c), d) so that the watering repeats some number of times (usually within a day) at some interval

f) let your imagination roam

My point is that I think you want to be tolerant of many different ways of skinning the cat and your specification is insufficiently tolerant. In any case, I believe it is necessary to clearly define irrigation event.

I don't want to set your process back too far, but maybe there is a way to be both simpler and more tolerant.

You already have a test methodology for WBIC [weather-based irrigation controllers]. How about creating your engineered boxes with a pre-defined moisture content and place them in your test area where they are exposed to the weather and can control an irrigation valve. Place the SMS in the box, connect it to the base controller which can enable the valve and log the amount of watering that occurs. (Ensure the base controller does not have access to the weather data or program it to be at some very different location.) Keeping with the WBIC model, if, after a month (and assuming at least 4 days of .1 inches of rain etc), the amount of watering is "good", then we have a WaterSense approved system. You can still do the freeze test or any other stress you want to create on the SMS but you are not limiting the way the base controller and SMS interact.

I am sure the above could have been written more eloquently and I am happy to answer any questions or discuss and clarify via email or phone.

-brian
brian.koblenz@irricloud.com

Commenter: Peter Lackner
Affiliation: Toro Irrigation Division
Comment Date: December 13, 2019

Email Text:

We would like to request that a fourth moisture level, 100% (field capacity), be added to the test protocol, at least for testing the Toro® Precision™ Soil Sensor, model PSS-KIT. Per the instruction manual, this is required for the sensor's calibration procedure, as well as for it to change states from allowing irrigation to blocking it while in operation.

Given that a) the testing facility will already have all required materials on-hand to make this accommodation (water, soil, salt solution, and the tools required to calibrate to any given percentage of moisture depletion), b) the test is only conducted once for any given model of sensor, c) the manufacturer is paying for the test, and d) the dual-threshold "checkbook" method of irrigating, which the Precision Soil Sensor uses, is an accepted practice per the IA's [Irrigation Association's] handbook (see *Irrigation 6th Edition*, Ch. 13 "Irrigation Scheduling"), we feel this is a reasonable request.

In other words, the sensor does not operate incorrectly or inaccurately, it simply operates differently from the other manufacturers that have been tested. As such, creating the test such that it is designed to fail any existing product that already operates in this manner might be considered unfair "restraint of trade" or undue burden on the manufacturer to change its product.

Regards,

Peter Lackner
Product Marketing Manager
Toro Irrigation Division

Commenter: Bernard Cardenas-Lailhacar
Affiliation: University of Florida
Comment Date: December 20, 2019

Email Text:

Hi All,

From the Public Meeting Summary comments, seems that some stakeholders are really confused with the term "irrigation event" (there are two comments/questions on page 3 and two comments on page 4 regarding this concept). Sometimes seem that they are referring to only one zone running and sometimes to all the zones that could potentially run. I suggest changing the language to "irrigation cycle", and define this as "all the irrigation zones that are programed to run sequentially after the first zone starts".

This definition encompass[es] the "on-demand" SMSs models that could start an irrigation cycle at any time (not necessarily after a scheduled start time).

Regards,

Bernard Cardenas-Lailhacar | Research Associate |

234 Frazier Rogers Hall | Gainesville, FL 32611 |
irrigation.ifas.ufl.edu |☎ : 352-392-1864 ext 234

Commenter: Celine Benoit
Affiliation: Metropolitan North Georgia Water Planning District
Comment Date: January 7, 2020

Email Text:

Hello,

Please find attached the Metropolitan North Georgia Water Planning District's comments for the WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies.

Feel free to reach out with any questions or comments.

Thank you for your consideration.

Best,

Celine Benoit
Water Efficiency Planner & GIS Analyst
Metropolitan North Georgia Water Planning District

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Email Attachment

See page 8.

Metropolitan North Georgia Water Planning District
International Tower | 229 Peachtree St., NE | Suite 100 | Atlanta, GA 30303

WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies: Comments

The Metropolitan North Georgia Water Planning District (The District) is committed to continuing to support water efficiency not only on a regional scale within the Metro Atlanta area, but nationwide. Our planning efforts and the implementation of water-saving technology throughout our region has demonstrated positive impacts for our communities. We continue to promote the use of WaterSense products in our planning efforts and are pleased to see the inclusion of irrigation products such as soil moisture-based controllers.

Please find below our comments regards the WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies:

Under 3.0 Supplemental Capability Requirements

3.1 Is there a time frame established for how long content should be preserved within the product giving a loss of power?

3.3 Are there further specification as to the equipment surrounding the notification system to indicate when the system is not receiving sensor mechanism input? Does this include notification via an app or on the physical system itself?

3.4 We support the requirement of ensuring the products capability of functioning with a rainfall device, given that our Georgia Code (12-5-6) mandates irrigation systems installed after 2005 using public water sources, be equipped with a rain sensor shut-off switch.

3.5.2 and 3.5.3 Requiring day interval schedule is also supported by the District. Our current Drought Response requires adopting an interval irrigation scheduling during times of drought, with complete cessation at times of high drought response.

We look forward to the finalization of these requirements as they develop, and are glad to contribute in further discussions. Thank you for considering our comments.

Thank you,

Celine Benoit
Water Efficiency Planner & GIS Analyst
Metropolitan North Georgia Water Planning District

Commenter: Bob Beers
Affiliation: HydroPoint
Comment Date: January 15, 2020

Email Text:

Good afternoon,

I hope you all had a great holiday season and new years.

We attended the EPA session at the IA Show in [Las] Vegas regarding the moisture sensor testing process and specification terms. You all have done a great job with everything...we were very impressed!

One question we had as we left is related to verbiage around how a moisture sensor is "connected to" or "communicates with" a smart irrigation controller. It sounded as though the specification would require a moisture sensor to be directly wired to a smart irrigation controller for it to qualify. With our Baseline Irrigation products we can support a moisture sensor that is wired to a gateway device (we call it a SubStation) which wirelessly networks back to the smart irrigation controller. So, the moisture sensor still delivers all of the real-time moisture data back to the controller which can act on the moisture data with no measurable difference in reaction time versus a wired device.

We are hoping for some clarification around that scenario. It's the same moisture sensor product and the same smart controller product...we just add in a wireless gateway so we can manage a moisture sensor anywhere on the site.

Thanks!

Bob Beers
Product Manager, Irrigation Technology
o 208-639-8738 **m** 208-703-7141

HydroPoint 360º Smart Water Management
hydropoint.com | baselinesystems.com

Commenter: Sean Steffensen
Affiliation: California Energy Commission
Comment Date: January 21, 2020

Email Text:

The California Energy Commission provides comments in the enclosed letter.

Thanks,
SEAN STEFFENSEN, P.E. | MECHANICAL ENGINEER
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Email Attachment

See pages 11 through 15.

January 21, 2020

Ms. Stephanie Tanner
U.S. Environmental Protection Agency
Office of Water
WaterSense Program
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460

Dear Ms. Tanner:

The California Energy Commission (CEC) appreciates the opportunity to provide comments on the U.S. EPA's (EPA) proposed specification for Soil Moisture-Based Irrigation Control Technologies (SMBICT). The CEC is the primary energy policy and planning agency of the State of California. One of the chief mandates of the CEC is to reduce the wasteful, uneconomic, inefficient, and unnecessary consumption of energy and water in the state by prescribing standards for minimum levels of operating efficiency for appliances that consume a significant amount of energy or water on a statewide basis. We recognize the importance of working closely with the EPA to lead efficiency efforts that will incentivize energy and water efficient technologies that will reduce the wasteful consumption of energy and water.

The CEC appreciates the EPA's efforts to establish a new voluntary WaterSense specification for SMBICT, especially as the state recovers from severe drought conditions and continues to focus on ways to conserve its limited water supply. The CEC is pleased that the EPA's specification proposes to address inefficient irrigation scheduling – applying water when not needed. The SMBICT will measure soil moisture content and prevent the wasteful application of water. The specification has the potential to encourage consumers to choose products that will automate irrigation and save what the EPA estimates to be hundreds of billions of gallons of water across the country.

The CEC supports the EPA's proposed modifications to the American Society of Agricultural and Biological Engineers (ASABE) X633 Testing Protocol for Landscape Soil Moisture-Based Control Technologies to reduce the test time while maintaining the repeatability and reliability of the test procedure.

energy.ca.gov
1516 9th Street, Sacramento, CA 95814

Specifically, the CEC supports the EPA's proposal to modify the test procedure:

- Soil moisture testing only in moderately coarse media and saline water,
- Freeze testing only in moderately coarse media and saline water at 40 percent water depletion,
- Clarification to connect add-on and plug-in devices to a base controller during testing as specified by the manufacturer.

The CEC encourages careful review of the calculation methods and performance levels selected by the EPA. The CEC recommends some modifications to ensure repeatability and clarity. The CEC provides this information and recommended changes to the specification language in the appendix to this letter.

The CEC appreciates the opportunity to comment on this draft specification. If there are any questions about the attached comments, please contact Sean Steffensen at (916) 651-2908 or at Sean.Steffensen@energy.ca.gov.

Sincerely,

DAVID HOCHSCHILD
Chair

Appendix

Topic 1: Clarify the calculation of relative average deviation (RAD) as shown on slide 35 of webinar presentation and section 2.2.1.2 of the draft specification.

The draft specification says that the RAD will be averaged across all water depletion levels. The WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies (November 20, 2019) webinar slide 35 shows that the RAD should be calculated at each water depletion level (20 percent, 40 percent, and 60 percent). The webinar and the draft specification seem to be inconsistent.

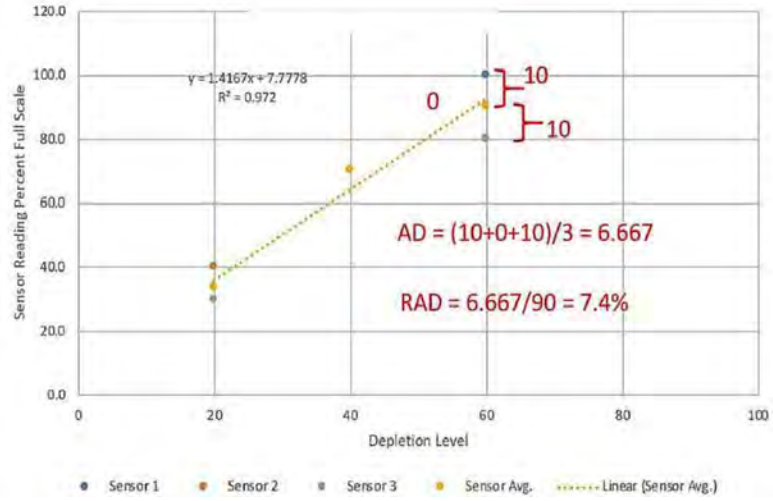
The calculation of the average RAD across all water depletion levels could be made clearer by adding Equation (3) to the specification.

The draft specification must also define the units of the performance criteria. The webinar suggests the units are "sensor reading percent full scale."

Equation (3): $RAD_{avg}=(RAD_{20}+RAD_{40}+RAD_{60})/3$

Where RAD_{20} is the relative avg deviation at 20 percent water depletion
RAD_{40} is the relative avg deviation at 40 percent water depletion
RAD_{60} is the relative avg deviation at 60 percent water depletion

Figure: Plot Showing Calculation of Relative Average Deviation



Source: U.S. EPA WaterSense Webinar, November 20, 2019, Slide 35

Section 2.2.1.2 is included below for reference.

> "2.2.1.2 The relative average deviation (RAD) of the readings at which the replicate SMSs enable and disable irrigation, calculated in accordance with Equations 1 and 2 below, when averaged across all water depletion level readings, shall be less than or equal to 10 percent."

Equation (1) $$Relative\ Avg\ Deviation = \frac{Avg\ Deviation}{\bar{x}}$$

Where: $\bar{x}$ is the mean

Equation (2) $$Avg\ Deviation = \frac{\sum_{i=1}^{n}|\bar{x}-x_i|}{n}$$

Where: $\bar{x}$ is the mean

x_i *is the observation*

n is the number of observations

Topic 2: Clarify Equation 2 in section 2.2.1.2 to show that the calculation is at a single water depletion level.

The test procedure requires three observations per each water depletion level. Therefore "n" in equation 2 will always be three. Equation 2 could be made clearer by replacing n with three in Equation 2.

Clarity also could be added by rewriting Equation 2 as a simple sum as shown below.

Suggested Equation (2) Average Deviation = $[(\bar{x}-x_1)+(\bar{x}-x_2)+(\bar{x}-x_3)]/3$

Where: $\bar{x}$ is $(x_1+x_2+x_3)/3$
x_1 is the first observation
x_2 is the second observation
x_3 is the third observation

Topic 3: The sensor readings and calculation methods in section 2.2.1.3 need to be identified.

The draft specification provides this instruction to find the slope as a verification of the device performance. The draft does not identify the readings or describe how the three readings at each of the three water depletion levels are used to calculate the slope.

> Section 2.2.1.3 "The absolute value of the slope of the line generated by plotting irrigation enable readings for all three replicates across all three depletion levels and the absolute value of the slope of the line generated by plotting irrigation disable readings for all three replicates across all three depletion levels shall both be greater than zero when rounded to two significant digits (i.e., ≥ 0.01)."

The EPA must identify the irrigation enable and irrigation disable readings to remove ambiguity. Are the readings a sensor value presented as a percentage of full scale? Is the reading a resistance, a current or voltage? What units are used to record the reading? If the reading varies among the soil moisture sensing technologies, then the specification must define the differences.

The calculation result is sensitive to the units of the readings' measurement. The performance criteria should be expressed in the desired units. If the readings are in ohms then the criteria would be expressed as >0.01 ohms per percent water depletion.

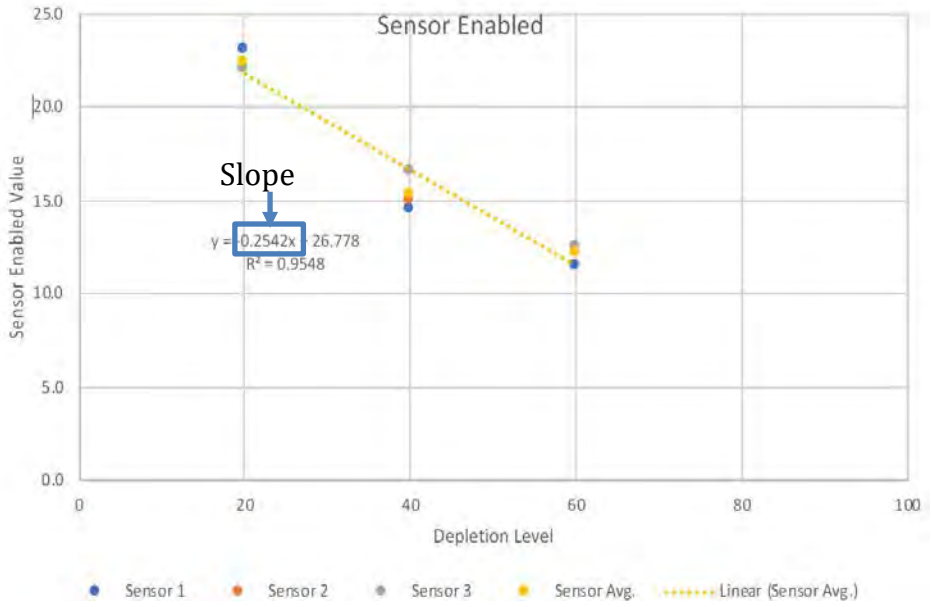
If units of measure vary among the soil moisture sensing technologies, then the specification must define the units of the performance criteria for each technology.

The draft specification must define the vertical axis as the sensor reading and the horizontal axis as the water depletion level so the slope can be calculated consistently.

The draft specification must define how the depletion level percentage is represented when the calculation is performed. For example would “20” or “0.2” be used to represent 20 percent when the slope is calculated?

The draft specification does not provide a calculation method for the slope of the line. Slide 37 of the webinar presentation shows a Microsoft Excel plot where the slope is observed as the coefficient of the “x” value of the linear least squares fit of the data. The draft specification must identify the linear least squares fit as the calculation method to ensure consistency.

Figure: Plot Showing Slope of Sensor Readings



Source: U.S. EPA WaterSense Webinar, November 20, 2019, Slide 37

Commenter: Mary Ann Dickinson
Affiliation: Alliance for Water Efficiency
Comment Date: January 29, 2020

Email Text:

Hello:

Please find attached our comments on the draft specification. Let me know if we need to file our comments in any other way.

Mary Ann

Mary Ann Dickinson
President and CEO
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Email Attachment

See pages 17 through 19.

Public Comment Submission on WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies, Version 1.0

Commenter Name: Mary Ann Dickinson

Commenter Affiliation: Alliance for Water Efficiency

Date of Comment Submission: February ____, 2020

Note: Underscore is suggested added language, ~~strikethrough~~ is suggested deletions

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Topic: Scope and Objective, Sensor mechanism definition

Comment: AWE has concerns about SMS's failing and causing unnecessary irrigation runs. When SMS's fail, they often fail to signal the controller that the soil moisture is adequate and that there is no need to irrigate. The common conductivity type SMS's slowly decay over time. The pressure type sensors have a shorter history use, and thus some uncertainty exists about lifespan and failures.

The SMS's must be part of a controller that also operates on time schedules, preferably based on weather data. The SMS's should not be the sole indicator when to initiate or cease irrigation.

AWE suggests that initially WaterSense should only allow the sensors to delay or disable irrigation events when the sensors detect adequate water is available. Our concern is the sensor, if allowed to initiate irrigation, might cause the irrigation system to run only because the SMS is faulty and not detecting water or sending the accurate signal to the controller. It is important to note that many plants will not have a noticeable appearance of distress when over irrigated.

Rationale: The conductivity SMS's have a history of failures, and the history of the use of pressure sensors in residential irrigation is very limited. WaterSense should proceed with caution in this new endeavor.

Suggested Change (or Language): Soil moisture-based irrigation control technology—a sensor mechanism and interface device that ~~enables or~~ disables an irrigation event at preset or selected soil water content values.

Topic: Scope and Objective, Sensor mechanism definition

Comment: It is not clear what is meant by "or potential". WaterSense should include a definition of "potential", as used in this document.

Rationale: Users may not be familiar with irrigation industry terminology.

Suggested Change (or Language): Sensor mechanism—the portion of the device that is in contact~~s~~ with the soil of the irrigated landscape and that measures physical properties (conductivity or pressure) that are related to the water content of the soil or potential water.

Topic: Controller Requirements

2.1.1 For add-on or plug-in devices, the interface device shall be connected to a base controller, as described in Appendix A.

Comment: Appendix A has few specifications regarding performance and capabilities. Most of the criteria are in Section 3. Thus Section 3 should be referenced also.

Rationale: Improve clarity to users

Suggested Change (or Language): 2.1.1 For add-on or plug-in devices, the interface device shall be connected to a base controller, as described in Section 3 and Appendix A.

Topic: 2.1.2 Soil test medium type

Comment: It seems odd that the test is to be conducted only in a "moderately coarse test medium." Given the wide range of soils, AWE has concerns that this will not adequately represent the real-world conditions where the devices are expected to perform.

Rationale: Users may question if the sensors are appropriate for the local soil types, especially clay loam and sandy loam.

Suggested Change (or Language): WaterSense should provide justification for why there is only one soil type used in testing.

Topic: 2.2 Performance criteria

Comment: AWE has concerns about the effect of soil alkalinity on SMS's. The growing use of reclaimed water for landscape irrigation can raise the pH of soils to higher levels than in the past. In addition, some landscape irrigators are supplementing irrigation with brackish ground water for turf that can tolerate higher pH levels. It is known the SMS's that use conductivity can send false readings, as pH can affect conductivity. Does the ASABE S633 Standard include testing under variable pH conditions?

Rationale: Real world conditions should be represented in laboratory tests to garner user confidence in the technology.

Suggested Change (or Language): N/A

Topic: 2.2 Performance criteria

Comment: In the past, SMS's have been known to perform well when first installed, but fail after a few years. Does the ASABE S633 Standard include accelerated ageing tests?

Rationale: The residential market is known for less than stellar maintenance of irrigation equipment. Consumers cannot be relied upon to regularly verify that their equipment is operating properly.

Suggested Change (or Language): Inform the user of the type of aging tests required by the ABASE S633 Standard.

Topic: 3.0 Supplemental Capability Requirements

Comment: It is unclear what a "program" is.

Rationale: N/A

Suggested Change (or Language): Add a definition of "program" to improve clarity for the user. It would be helpful to explain the difference between program, station and zone.

Topic: 3.0 Supplemental Capability Requirements

Comment: Controllers should have a means to cease irrigation in rain events. Better language would improve clarity for the user.

Rationale: The proper term is rainfall *detection* device.

Suggested Change (or Language): 3.4 Be capable of interfacing with a rainfall <u>detection</u> device.

Topic: 3.0 Supplemental Capability Requirements

Comment: Controllers can only do something, or do nothing – they cannot "avoid".

Rationale: Local ordinances sometimes ban watering at specified times.

Suggested Change (or Language): 3.5.3 The ability to set irrigation runtimes to ~~avoid~~ <u>prevent</u> watering during a prohibited time of day (e.g., between 9:00 a.m. and 9:00 p.m.).

Topic: 3.0 Supplemental Capability Requirements

Comment: This is highly problematic when the sensors are faulty. In addition, this wording is problematic in that it allows manufacturers to determine the WaterSense specification. If WaterSense chooses to include this requirement, WaterSense should specify the maximum elapsed time before the controller switches to sensor mode.

Rationale: AWE prefers that the controller *not* automatically switch to sensor modes in the event that the sensors are no longer operating accurately. There should be some means to properly operate the system when the sensors are malfunctioning.

Suggested Change (or Language): ~~3.8 Be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to soil moisture mode within some period of time as designated by the manufacturer, even if the switch is still positioned for manual operation.~~

Commenter: Tom Penning
Affiliation: IRROMETER Company, Inc.
Comment Date: January 31, 2020

Email Text:

I would like to thank the EPA and ERG for their many years of effort working toward a labeling program to include soil moisture based management devices that improve water use efficiency for landscape irrigation. Comments for submission are attached for your consideration.

Best Regards,

Tom Penning
President

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TomP@irrometer.com

IRROMETER®
Optimizing Irrigation · Maximizing Conservation · Since 1951

Email Attachment

See pages 21 through 23.

Public Comment Submission on WaterSense Documents

Commenter Name: Tom Penning, Diganta Adhikari and Brian Bourbonnais

Commenter Affiliation: Irrometer Co., Inc.

Date of Comment Submission: 1/31/2020

Topic: Appendix A

Comment: Requiring a “base controller” with features that may not be available on existing controllers, precludes the millions of homes that could be saving water by simply attaching an inexpensive SMS add-on type device to their existing controller. Many homeowners will not want to spend the additional funds nor incur the additional aggravation of having to change out the controller also.

Rationale: Forcing the consumer to purchase a new controller in order to take advantage of an SMS add-on device causes an undue burden for both the consumer and the manufacturers offering these devices.

When a consumer who is interested in such a product, and learns that it is WaterSense labeled, they will go to the retailer and then discover the cost of the SMS device plus the cost of a new compatible controller may be more than the cost of a “competitive technology” controller. In such an instance, the consumer will most likely select the lower cost option.

Likely they may have preferred to purchase the lowest cost option of only buying the SMS add-on device to upgrade their existing controller. Offering a simple and inexpensive way for customers to upgrade their existing controllers with a WaterSense labeled device, will increase water savings to millions of customers who would have not done so under the proposed specification.

While the desire to remove as many old style controllers from use may be well-intentioned, it should not happen at the expense of the consumer nor the manufacturers offering affordable and simple solutions to help the consumer save water. WaterSense should not label products that favor “one technology over another,” when they both have been proven to serve the program mission by improving “… water efficiency to conserve water resources for future generations and reduce water and wastewater infrastructure costs.”

The WaterSense label should serve to motivate consumers who may be paying for efficiency improvements out of their own pocket and not just those that may be obtaining an incentive rebate from a utility.

The section 7.0 definitions reference such devices are used with “standard clock-timer controllers” and not those only with specific feature sets. This is the premise under which this specification should be based. If an existing controller is not compatible with local regulations, then it is a local compliance issue and not one of using a WaterSense labeled product to force updating equipment.

Suggested Change (or Language): Remove Appendix A requirement to label devices only with a compatible controller and all references to it in the document.

Topic: 2.1.1

Comment: The add-on and plug-in devices can be tested without having to use a controller

Rationale: If an Appendix A base controller is not to be used then this step is unnecessary.

Suggested Change (or Language): For add-on and plug-in devices, the interface device shall be connected to a compatible power supply and offer a means to test the switched output.

Topic: 3.0, 3.1, 3.2, 3.5, 3.6, 3.7 & 3.8

Comment: Beginning sentence can be shortened and referenced steps can be eliminated.

Rationale: If an Appendix A base controller is not to be used then the wording “configured for testing in accordance with Appendix A” is unnecessary in the beginning sentence. The other steps relate to controllers only and are not relevant for add-on and plug-in devices.

Suggested Change (or Language): Create separate 3.0 requirements for add-on and plug-in devices from stand-alone controllers.

Topic: 4.2

Comment: WaterSense Labeling should be on the device itself and not dependent on being in combination with a base controller.

Rationale: If an Appendix A base controller is not to be used then most of this section is not relevant. Manufacturers should provide guidelines of the types of controllers their devices are compatible with.

Suggested Change (or Language): Add-on and plug-in devices shall not be packaged nor marked to encourage operation of the irrigation system without them being enabled.

Topic: 7.0

Comment: These definitions are good as proposed.

Rationale: All definitions of SMS devices refer to their use with a “standard clock-timer controller” being the base controller the devices are to operate with. These definitions are good and should remain. They do not state the base controller must include all the features listed in 3.0 and Appendix A.

Suggested Change (or Language): no change

Topic: Appendix B, 3.1 & 3.2

Comment: Labeling should be on the tested device only and not be applicable solely when used in combination with a list of specific controllers.

Rationale: The use of SMS devices will save water when used with any type of controller and their adoption and labeling should not be restricted in an effort to update consumers existing irrigation hardware.

Suggested Change (or Language): 3.1: Soil moisture sensor devices certified to meet the requirements of this specification may bear the WaterSense label. 3.2 can be stricken.

Topic: 2.2

Comment: This methodology as proposed is good. This statistical analysis suitably compares devices of differing types. It should be equally suitable for potential other sensor types that may be submitted in the future.

Rationale: Sensors types that may be tested will vary in their technology, output format, scale and units of measurement. The details of which should be irrelevant to the process and analysis, while still being able to be comparable in their performance.

Suggested Change (or Language): n/a

Commenter: Michael Temple
Affiliation: Irrigation Association
Comment Date: February 1, 2020

Email Text:

Please find attached my comments on the stated draft specification.

Thank you,
Michael Temple
CID, CIC, CLWM, CLIA, CGIA, LEED AP
Technical Program Director
Irrigation Association
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miketemple@irrigation.org | www.irrigation.org
LinkedIn | Facebook | Twitter | Instagram

Email Attachment

See pages 25 through 27.

PUBLIC COMMENT SUBMISSION ON EPA WATERSENSE® DRAFT SPECIFICATION FOR SOIL MOISTURE-BASED IRRIGATION CONTROL TECHNOLOGIES

Commenter Name:
Michael Temple, Technical Program Director

Commenter Affiliation:
Irrigation Association

Date of Comment Submission:
February 1, 2020

Topic:
All references to the ASABE S633 Testing Protocol

Comment:
The reference is stated incorrectly.

Rationale:
The reference needs to be changed to prevent confusion and ensure the correct protocol is utilized.

Suggested Change (or Language):
All references to the "ASABE S633 protocol" should be changed to read "ASABE x633 protocol."

Topic: Section 3.0 Supplemental Capability Requirements

Comment:
This section should be removed. It does nothing to improve the water savings of a soil moisture sensor and has requirements that nearly all landscape irrigation controllers currently on the market cannot meet. Furthermore, it automatically excludes add-on devices as they do not control station programming and operating times. An add-on sensor only determines if the irrigation will run based on the soil moisture when the base controller calls for irrigation. An add-on device can provide substantial water savings at a much reduced cost to the owner than a plug-in device or stand along controller.

Rationale:
This section excludes a substantial part of the soil moisture sensor market and would impose undue cost on the irrigation system owner to obtain a WaterSense labeled soil moisture sensor based irrigation control system.

Suggested Change (or Language):
Delete Section 3.0.

Topic: Section 4.2 Add-on and Plug-in Devices

Comment:
The requirement of providing a list of compatible base controllers will put undue burden on manufacturers of add-on soil moisture sensors due to the large number of potentially compatible base controllers available on the market that will have to be tested under this requirement. Tying the WaterSense labeling to this list will be problematic. The device itself should be labeled, not conditional on to which controller it is connected.

Rationale:
This requirement places undue burden on the manufacturers thus reducing the number of devices that could be approved without this requirement. Labeling should apply to the device, not conditionally on a combination of products. This conditional labeling will lead to confusion in the marketplace.

Suggested Change (or Language):
Delete the requirement to provide a list of compatible controllers for add-on sensors but require that the method of interaction with the base controller be listed (i.e. common wire interruption or controller sensor terminal connection).

Topic: Appendix A: Testing Configuration and Compatible Base Controller Determination Section 1.0 Initial Configuration for Testing

Comment:
Reference to Section 3.0 should be removed for reasons stated above.

Rationale:
See above comments.

Suggested Change (or Language):
The manufacturer shall specify a base controller model with which the add-on or plug-in device shall be connected and tested. Together, the unit shall be capable of meeting the requirements of this specification~~, including the supplemental capability requirements specified in Section 3.0~~.

Topic: Appendix A: Testing Configuration and Compatible Base Controller Determination Section 2.0 Determining Additional Compatible Base Controllers

Comment:
Reference to Section 3.0 should be removed for reasons stated above.

Rationale:
See above comments.

Suggested Change (or Language):
If desired, additional base controller models with which the add-on or plug-in device can be paired, and that together as a unit meet the requirements of this specification, ~~including the supplemental capability requirements specified in Section 3.0,~~ can be identified.

Commenter: Daniela Urigwe
Affiliation: Energy Solutions
Comment Date: February 1, 2020

Email Text:

Hello,

Please find attached comments from the California Investor-Owned Utility (Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison) Codes and Standards Enhancement Team, in response to the U.S. EPA WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies.

Thank you for the opportunity to participate in this process.

Regards,

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Email Attachment

See pages 29 through 34.

California Investor-Owned Utility Codes and Standards Enhancement Team Comments on WaterSense® Draft Specification for Soil Moisture-Based Irrigation Control Technologies

Commenter Name: California Investor-Owned Utility Codes and Standards Enhancement Team

Commenter Affiliation: California Investor-Owned Utilities, comprised of Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE)

Date of Comment Submission: February 1, 2020

This letter comprises the comments of the Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE), collectively referred to herein as the California Investor-Owned Utilities (CA IOUs) in response to the United States (U.S.) Environmental Protection Agency (EPA) WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies. The CA IOUs represent some of the largest utility companies in the Western U.S., serving over 32 million customers.

The CA IOUs support U.S. EPA's efforts to develop a WaterSense specification for soil moisture-based irrigation control technologies. A WaterSense specification for this product would provide consistency across the market for the testing and sale of these products, and increased product uptake would result in significant water savings as well as utility bill cost savings to consumers. The CA IOUs commend the effort made to put forth this proposal and urge U.S. EPA to revise and finalize this specification in a timely manner.

The CA IOUs appreciate the opportunity to provide the following recommendations on the draft proposal and encourage U.S. EPA to consider them carefully.

Topic: 1.0 Scope and Objective

Comment: The draft specification states that it does not apply to on-demand soil moisture sensor (SMS) controllers that automatically adjust irrigation schedules based on soil water values. We suggest considering the inclusion of on-demand SMS in this specification or under a future revision to this specification.

The test report from the University of Florida[1] indicated that it was not possible for one SMS brand to be tested under the proposed test procedure, but a slight adjustment to the test procedure could be made to accommodate this brand. The product was not identified, so it is not known exactly why it did not meet the test criteria. The CA IOUs recommend expanding the test to include this product.

Rationale: In the case of on-demand SMS controllers, the American Society of Agricultural and Biological Engineers (ASABE) X633 testing protocol that forms the basis for this draft WaterSense specification could still be used to ensure that the SMS disables and allows watering under specified soil moisture conditions. To determine whether the controller is

[1] https://www.epa.gov/sites/production/files/2019-11/documents/ws-products-outdoor-sms-controller-test-report.pdf

optimally watering, a specification could rely on criteria such as those used in the WaterSense specification for weather-based irrigation controllers.

For the product that could not be tested, the University of Florida test report states that "a slight adjustment to the test procedure" could be made to accommodate the brand. If the anticipated performance and water-saving potential of this product is similar to the other tested products, this test procedure adjustment should be considered so that the product can be tested and labeled under this WaterSense specification. Otherwise, the product that could not be tested would be at a disadvantage if it is not eligible for the WaterSense label while other similar products are eligible.

Suggested Change (or Language): Modify the scope so that on-demand SMS are included in a current or future revision. Modify the test procedure to accommodate the additional SMS brand that could not be tested previously.

Topic: 2.1.2

Comment: The CA IOUs agree with testing moderately coarse media with 3.0 deciSiemens/meter (dS/m) (i.e., saline) applied water. This test condition is important since it represents sandy loam soil, which is common across the U.S., and it represents the higher salinity test condition that users are most concerned about. However, we recommend additionally testing moderately fine media with 3.0 dS/m applied water.

Rationale: In the test data from the University of Florida, results showed that the moderately fine media in saline water had a lower coefficient of determination for both the irrigation-enable and irrigation-disable tests compared to the other test conditions (coarse media-freshwater, fine media-freshwater, and coarse media-saline water). This test condition additionally showed a different pattern in the absolute value of the slope of the regression line across water depletion levels than the other conditions did, and it reported the highest relative average deviation reading of any in the test for one brand sampled, exceeding the ten percent threshold proposed by this draft specification. Therefore, since this test condition showed differences from the other test conditions, we recommend including it in the test along with the coarse media-saline water condition. Additionally, the moderately fine media represents clay loam soil. Although across the U.S., clay loam soil is less common than sandy loam soil, this soil type is prevalent in Texas and parts of California,[2] two of the nation's largest irrigation markets. Testing this soil type in a saline condition in addition to testing the coarse media-saline water condition will help the test be more representative while still reducing test burden relative to the full ASABE test with all four test conditions.

Suggested Change (or Language):

2.1.2 SMSs shall only be tested under two conditions, as defined in ASABE X633:

1) The moderately coarse test medium and water with an electrical conductivity (EC) of 3.0 dS/m.
2) The moderately fine test medium and water with an electrical conductivity (EC) of 3.0 dS/m.

Topic: 2.2.1.1

[2] https://ldas.gsfc.nasa.gov/nldas/soils

Comment: The CA IOUs recommend language to clarify that the SMS devices currently covered by the draft specification do not enable irrigation on demand by creating a schedule; rather, they allow a pre-existing watering schedule to start or continue.

Rationale: This change would clarify language that is intended to apply specifically to SMS controllers that stop or allow watering based on preset or selected soil water values.

Suggested Change (or Language):

2.2.1.1 To evaluate the function of the SMS, for test media at each of the three depletion levels, the SMS evaluated shall successfully disable and allow irrigation in response to changes in the interface device settings.

Topic: 2.2.1.2

Comment: The equations listed in Section 2.2.1.2 should be revised for clarity. The CA IOUs support the recommendations put forth by the California Energy Commission[3] in their recent comments on this topic.

Rationale: The order of the equations does not naturally flow as a user would execute them. The desired units of measurement are not clearly indicated. In some cases, the clarity of the equations could be improved.

Suggested Change (or Language):

- 2.2.1.2 The relative average deviation (RAD_{avg}) of the readings at which the replicate SMSs disable and allow irrigation, calculated in accordance with the below equations, shall be less than or equal to 10 percent when averaged across all water depletion levels.
- Revise the order of the equations in the text. Since Average Deviation must first be calculated to determine Relative Average Deviation, the equation for Average Deviation should be listed as Equation 1 and the Equation for Relative Average Deviation should be listed as Equation 2.
- Clarify the equation for Average Deviation to show that the calculation is performed at each water depletion level, and simplify the equation in line with the California Energy Commission's suggestions. Additionally, clarify that since three sensor samples are required in the test, n (the number of observations) equals three.
    - Equation (1): Average Deviation = $[|\bar{x}-x_1| + |\bar{x}-x_2| + |\bar{x}-x_3|] / 3$
      Where: $\bar{x}$ is $(x_1+x_2+x_3) / 3$, the mean sensor reading across the three sensor samples at a given water depletion level
        - x_1 is the first sensor reading observation
        - x_2 is the second sensor reading observation
        - x_3 is the third sensor reading observation
- Clarify the equation for Relative Average Deviation to indicate that $\bar{x}$ is the mean sensor reading across the three sensor samples at a given water depletion level.
    - Equation (2): Relative Average Deviation = Average Deviation / $\bar{x}$
      Where: $\bar{x}$ is $(x_1+x_2+x_3) / 3$, the mean sensor reading across the three sensor samples at a given water depletion level

[3] https://www.epa.gov/sites/production/files/2020-01/documents/ws-products-outdoor-sms-prelim-public-comments.pdf

- Clarify that the average across water depletion levels should be performed after Relative Average Deviation (RAD) is calculated for each water depletion level. Add an equation in line with the California Energy Commission's suggestion to clarify this calculation:
    - Equation (3): $RAD_{avg} = (RAD_{20}+RAD_{40}+RAD_{60}) / 3$
      Where:
        - RAD_{20} is the RAD at 20 percent water depletion
        - RAD_{40} is the RAD at 40 percent water depletion
        - RAD_{60} is the RAD at 60 percent water depletion
- Clarify the unit of measurement for sensor readings within these equations to align with the units presented in the WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies webinar presentation[4] in which sensor readings are in units of "Sensor Reading Percent Full Scale."

Topic: 2.2.1.3

Comment: Section 2.2.1.3 states that:

"The absolute value of the slope of the line generated by plotting irrigation enable readings for all three replicates across all three depletion levels and the absolute value of the slope of the line generated by plotting irrigation disable readings for all three replicates across all three depletion levels shall both be greater than zero when rounded to two significant digits (i.e., ≥ 0.01)."

The description of this performance criterion is not adequately clear to ensure repeatability for all users of the WaterSense test procedure. This performance criterion could be clarified or simplified for users.

Rationale: As written, the test does not clarify the units of the vertical axis of the plot or the plotting mechanism to determine the relationship across the readings at which a sensor disables or allows irrigation at varying water depletion levels. The units of the vertical axis and the line fitting methodology could both affect the slope of the line generated and may impact the results reported under this criterion.

Suggested Change (or Language): If sensor-enable and sensor-disable readings are to be plotted, we recommend standardizing the units of the vertical axis on which the readings are plotted (the horizontal axis is assumed to be the water depletion level). If the vertical axis values vary across technologies, we recommend specifying the values relevant for each technology type. Additionally, we recommend outlining a specific methodology for fitting a line through the plotted points, such as a linear least squares approximation, to ensure a standardized methodology is followed by all users of the specification. Data reported in this way would be more easily comparable than data created based on varying user methodologies.

Due to the complexity of the proposed criterion, we suggest using an alternative performance criterion that does not rely on plotting and fitting a line through data measurements. For example, a simpler performance criterion that does not rely on this method follows:

[4] https://www.epa.gov/sites/production/files/2019-11/documents/ws-outdoor-sms-draft-spec-public-meeting.pdf

- The average values at which the sensor disables or allows irrigation must monotonically increase or monotonically decrease from a depletion level of 20% to a depletion level of 60%.
- To determine this, for sensor-enable or sensor-disable readings, take $\bar{y}$, the mean sensor reading across the three sensor samples at a given water depletion level.
    - Then, $\bar{y}_{20} > \bar{y}_{40} > \bar{y}_{60}$ or $\bar{y}_{20} < \bar{y}_{40} < \bar{y}_{60}$

      Where:
        - $\bar{y}_{20}$ is the average sensor-enabled/disabled value at 20 percent water depletion, rounded to two significant digits
        - $\bar{y}_{40}$ is the average sensor-enabled/disabled value at 40 percent water depletion, rounded to two significant digits
        - $\bar{y}_{60}$ is the average sensor-enabled/disabled value at 60 percent water depletion, rounded to two significant digits

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Topic: 3.4

Comment: For stand-alone SMS controllers, reconsider the requirement that the controller must be capable of interfacing with a rainfall device.

Rationale: Rainfall shut-off devices can be a useful addition to weather-based controllers and base controllers that can be used with a variety of add-on or plug-in devices. However, for stand-alone SMS controllers, this requirement may not be relevant. Soil moisture sensors may connect to the base irrigation controller using the same port that a rain shut-off sensor would use. Additionally, soil moisture sensor capability could supersede the need for a rainfall device since SMSs would disrupt irrigation based on actual soil moisture during a rainfall event.

Suggested Change (or Language):

3.4 Base controllers must be capable of interfacing with a rainfall device. This capability is optional for stand-alone SMS controllers.

Topic: 3.8

Comment: Clarify time period to return to SMS mode after manual operation.

Rationale: Manufacturers may vary in the amount of time they allow the device to operate in manual mode before defaulting to SMS mode operation. To standardize expectations for consumers across products, WaterSense should propose an allowable period of time by which products must revert to SMS operation mode.

Suggested Change (or Language):

3.8 Be capable of allowing for a manual operation troubleshooting test cycle and shall automatically return to soil moisture mode within ***X hours***, even if the switch is still positioned for manual operation.

Topic: 4.0

Comment: Section 2.2.2 of the draft specification does not require recording RAD after the freeze test. Only the disabling or the allowing of irrigation is tested. Therefore, as part of the product documentation, we recommend a requirement that product literature include educational text explaining that users should recondition the sensor after each season.

Rationale: Test data from the University of Florida showed that in some cases, RAD increased after the freeze test to values in excess of the ten percent limit proposed under this specification. For WaterSense certification, products should include instructions that users are to recondition soil moisture sensors after each season. This instruction will help ensure the persistence of savings and product longevity for customers, since without this recalibration products may operate in a less precise manner after exposure to freezing temperatures.

Suggested Change (or Language):

4.3 All SMSs shall be packaged with documentation indicating that products should be reconditioned after each season, as well as instructions on how to recondition products.

Topic: 4.2

Comment: The specification states that product documentation for the add-on and plug-in devices shall list each compatible base controller model capable of being paired with the device. The CA IOUs recommend additionally including weblinks (via text, Quick Response/QR code, or other easily accessible mechanism) in the product literature to the manufacturer webpage or WaterSense webpage so that a full, up-to-date compatibility list can be accessed after product literature is printed.

Rationale: Especially in the case of add-on devices meant to work with many base controllers, listing every possible base controller the product could work with may be cumbersome, and the product literature could quickly become out of date as new base controllers become available. Links to dynamically updated webpages will help consumers have access to updated information as it becomes available.

Suggested Change (or Language):

4.2 The product documentation for the add-on and plug-in devices shall additionally include links to webpages with a full, updated list of each compatible base controller model.

Topic: General

Comment: The CA IOUs encourage U.S. EPA to research and consider irrigation controller standby power use as part of this WaterSense specification.

Rationale: Although water-efficient landscape irrigation controllers will reduce the amount of irrigation water used nationwide, the additional features of these products may require more power draw in standby mode than traditional timers. For example, products may ping sensors or connect to the internet, and this activity may require more power than irrigation controllers without these features.

Suggested Change (or Language): Consider irrigation controller standby power use as part of this specification or in a future revision.