Response to Public Comments Received on November 2019 *WaterSense® Draft Specification for Soil Moisture-Based Irrigation Control Technologies*

February 2021

Background

This document provides the U.S. Environmental Protection Agency's (EPA's) responses to public comments received on the *WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies*. The title of the final specification has been changed to the *WaterSense Specification for Soil Moisture-Based Irrigation Controllers* to more closely align with the *WaterSense Specification for Weather-Based Irrigation Controllers*. For purposes of this document, the comments are summarized. The verbatim comments can be viewed in their entirety on the WaterSense website.

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I.   Comments on Section 1.0: Scope and Objective

I.1   Include On-Demand Soil Moisture Sensors in Scope

a. One commenter said that the draft specification does not apply to on-demand soil moisture sensor (SMS) controllers that automatically adjust irrigation schedules based on soil water values. They suggested that WaterSense consider including this type of SMS in the current specification or a future revision.

    If on-demand SMSs were to be included, the commenter stated that the American Society of Agricultural and Biological Engineers (ASABE) X633 testing protocol could still be used to ensure that the SMS enables and disables irrigation. The specification could use criteria from the *WaterSense Specification for Weather-Based Irrigation Controllers* to assess whether the controller is watering optimally.

b. One commenter expressed concern that SMS systems that do not meet the *WaterSense Specification for Soil Moisture-Based Irrigation Controllers* would be perceived as providing less water savings than those that do meet the specification.

    The commenter did not agree with WaterSense's definition of an "irrigation event" and its description of the conditions required to stop an irrigation event. The specification applies to SMS systems that enable and disable irrigation events. The commenter said that although "on-demand SMS" meet that definition, WaterSense has excluded them from the scope of the specification.

    The commenter said that the specification includes only SMS systems that must actively disable programmed irrigation events to prevent irrigation, excluding those products that enable irrigation based on the soil moisture level in the landscape. The commenter suggested that a preferable SMS system would be one that initiates irrigation events for specific zones without a specified start time. The commenter said that this SMS configuration would be compatible with restricted watering days. They noted that the structure of restricted watering days might not be conducive for maximum water efficiency and that the schedule associated with it could vary.

    The commenter proposed an alternative SMS system with a clock and SMS data, and said the SMS would control whether to enable or disable an irrigation event.

    The commenter said that all SMS systems were practical, useful, and efficient and that WaterSense should not preferentially support one type of SMS system.

The commenter also suggested that WaterSense define the term "irrigation event." Most SMS manufacturers use the term "program" when discussing irrigation, and different manufacturers use a variety of irrigation patterns as part of their program.

The commenter said that they did not want to delay the process of finalizing the specification. They suggested that it might be possible for WaterSense to develop a simpler and more tolerant specification, possibly based on the test protocol described in the *WaterSense Specification for Weather-Based Irrigation Controllers*. The test could use engineered soil with known moisture content. An SMS could be connected to a base controller, which could then enable an irrigation valve and record the amount of water used for irrigation. The commenter noted that this base controller should not have access to weather data or should be set to a different location. The SMS could be placed in boxes filled with engineered soil and exposed to ambient weather. After one month of testing, the SMS system would pass if it initiated an appropriate amount of watering. The commenter added that WaterSense could still freeze the SMS or incorporate another type of stress test, but that the proposed method would not limit the interaction between the base controller and the SMS itself.

Response: EPA understands the desire to include on-demand type SMSs in this specification. EPA's specification development philosophy is to cast a wide net to include innovative technologies; however, there is unfortunately no test method currently available for on-demand products or any other type of SMS that is not based on enabling and disabling irrigation based on a preset moisture level(s). The scope of the current test method (i.e., bypass type SMSs only) is a result of SMS manufacturers separating from the committee that was tasked to develop the American National Standards Institute (ANSI)/ASABE S627 Weather-based Landscape Irrigation Control System in 2013 and forming a separate committee to develop a test method solely aimed at measuring performance for bypass SMSs (which has resulted in publication of ANSI/ASABE S633 Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies). At that time, committee members intended for an on-demand test method to be included in ANSI/ASABE S627. That did not occur, as the ASABE S627 committee focused on developing a test method solely for weather-based irrigation controllers. Additionally, WaterSense has not identified water savings data for on-demand SMSs to demonstrate these products save water. If a test method, as well as water savings and performance data, become available for these products, WaterSense can consider including them in future revisions to this specification.

To clarify the type of product EPA means when using the term "on-demand," EPA revised the description in Section 1.0: Scope and Objective of the final specification as follows:

"On-demand SMSs, or those that ~~automatically adjust irrigation schedules based on soil water values~~ initiate irrigation at a lower preset moisture level and terminate irrigation at an upper preset soil moisture level."

Regarding the comment about defining an irrigation event, EPA defined this term in the final specification (see the response in Section I.6).

I.2 Request to Include a Product That Was Not Able to Be Tested

One commenter referenced a statement from the SMS test report—published by the University of Florida, Agricultural and Biological Engineering Department under the direction of Dr. Michael Dukes—that one product developed by an unidentified manufacturer could not be tested under the proposed test procedure, but that the test procedure could have been adjusted to accommodate it. The test report did not explain why the product did not meet the testing criteria. The commenter said their organization recommended adjusting the test procedure to include the product.

Response: Please see the related response in Section II.3.

I.3 Elaborate on Mode of Communication Between SMS and Controller

One commenter wanted to clarify the terminology describing the connection between the SMS and the smart irrigation controller. In their opinion, the specification sounded like the SMS needed to be directly wired to the smart irrigation controller for the product to qualify for WaterSense certification. The commenter explained that their company manufactures a product that connects to a gateway device via a wire. The gateway device wirelessly sends data back to the smart controller. The commenter pointed out that the device delivers data from the sensor to the controller in the same amount of time as a wired device. The commenter requested clarification on their product's wireless mode of connection—and, in particular, whether it would be eligible for the WaterSense label.

Response: EPA has revised the final specification and supporting statement to reflect this suggestion.

EPA has updated the definition of a base controller in Section 7.0 of the final specification as follows:

"The irrigation controller with which the add-on or plug-in device ~~is connected for full operation~~ communicates, through a wired or wireless connection, for full operation. Mostly commonly, a base controller is a standard clock-timer controller, but may also be a weather-based controller that uses weather data as a basis for irrigation scheduling."

This revision changes the language from "connected" to "communicates" and also reiterates that the base controller may be a weather-based irrigation

controller. EPA also revised language throughout Appendix A of the final specification to indicate that a wireless connection is permissible.

In the supporting statement, EPA updated multiple references to the text regarding the connection between the add-on or plug-in device and the base controller. The supporting statement now indicates that the add-on or plug-in device communicates with, rather than is connected to, the base controller. In some cases, the updated language specifies that the communication is wired or wireless.

I.4   Modify Definition of Soil Moisture Sensor

One commenter expressed concern that soil moisture sensors could fail and result in unnecessary irrigation. The commenter explained that soil moisture sensors that function by sensing conductivity slowly degrade over time. Sensors that operate based on pressure readings are a newer technology, so there is less information available about their durability.

The commenter indicated that controllers should not exclusively rely on SMSs to initiate irrigation but should be connected to a controller that uses time schedules, preferably based on weather data.

Furthermore, the commenter said that the WaterSense specification should only permit SMSs to delay or disable irrigation if the sensors detect sufficient water. If the sensors were permitted to initiate irrigation, a sensor might not do so because it is not accurately measuring water or because it is not providing accurate signals to the controller.

The commenter recommended that the specification be amended as follows: "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."

Response: EPA acknowledges the concern that irrigation would be allowed if an SMS failed. While product deterioration was an issue for SMS products on the market decades ago, EPA has no indication that SMS products currently on the market rapidly deteriorate over time. However, EPA addressed this concern in the specification by requiring a labeled SMS (as configured in Appendix A of the specification) to indicate to the user when it is not receiving sensor mechanism input and is not adjusting irrigation based on soil moisture content in the landscape (see Section 3.3 of the specification).

Additionally, EPA is clarifying in this comment response document and in the specification that bypass SMSs (those included in the scope of the specification) do not "initiate" irrigation. They enable or allow and disable or prevent/interrupt an irrigation event based on a preset or selected soil water value(s). EPA revised the language in Section 1.0: Scope and Objective of the final specification to clarify this function:

> "Soil moisture-based irrigation control technology—a sensor mechanism
> and interface device that enables (allows) or disables
> (prevents/interrupts) an irrigation event at preset or selected soil water
> values. These products are commonly known as, and for the purpose of
> this specification shall be referred to as, soil moisture sensors (SMSs)."

EPA would like to clarify that on-demand SMSs are products that "initiate"
irrigation and are excluded from the specification at this time. Per Section I.1
of this document, EPA clarified the definition for on-demand SMSs in the
specification.

I.5   Modify Definition of Sensor Mechanism

One commenter stated that the use of the phrase, "or potential," in the
specification is unclear. The commenter suggested that this may be
terminology unique to the irrigation industry and suggested that WaterSense
provide a definition for the word "potential" as it is used in the document.

The commenter recommended that the specification be amended as follows:

> "Sensor mechanism—the portion of the device that is in contacts 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."

Response: EPA revised the definition of "sensor mechanism" to alleviate
confusion around the terms "potential" and "content" sensors. These terms
describe the two types of SMS technologies intended to be included in the
scope of the ANSI/ASABE S633 and are further described in that standard.
EPA revised the definition of "sensor mechanism" in Section 1.0 of the final
specification to be more general with respect to the mechanism:

> "Sensor mechanism—the portion of the device that contacts the soil and
> measures physical properties that are related to water content or potential
> the amount of moisture in the soil."

I.6   Define "Irrigation Event"

One commenter stated that, based on the comments reported in the
*WaterSense Draft Specification for Soil Moisture-Based Irrigation Control
Technologies Public Meeting Summary*, stakeholders appear to be confused
by the term "irrigation event," which was interpreted as irrigation that occurred
in one or all zones. The commenter suggested that WaterSense revise the
language to "irrigation cycle," and define it as, "all the irrigation zones that are
programmed to run sequentially after the first zone starts." The commenter
pointed out that this definition would still include on-demand SMS models that
could start irrigation at any time (not necessarily after a scheduled start time).

Response: EPA agrees and has included a definition for "irrigation event" in Section 1.0 of the final specification based on ANSI/ASABE S633:

"Irrigation event is defined as landscape watering beginning at a pre-determined start time(s) and run times(s) for one or more watering zones (ANSI/ASABE S633)."

II.   Comments on Section 2.0: Performance Criteria

II.1   General Support for Adopting ASABE X633 Test Procedures

a. One commenter expressed their support for EPA's proposed modification to the ASABE X633 test procedure. In particular, the commenter supported the following three changes:

1) Conducting soil moisture testing in moderately coarse media and saline water;

2) Requiring freeze testing only in moderately coarse media and saline water at 40 percent water depletion; and

3) Adding a clarification to connect add-on and plug-in devices to a base controller during testing as specified by the manufacturer.

b. One commenter indicated their support for the proposed ASABE X633 test procedure. They noted that the statistical analysis is sufficient to compare different types of devices and should be applicable to other types of sensors that could be submitted for testing for the WaterSense label in the future.

The commenter noted that the types of sensors that could be tested would have different technology, output format, scale, and units of measurement. The commenter said that WaterSense was correct to design the test procedure to focus on SMS performance, rather than on minor differences in their design details.

*Response***:** EPA thanks the commenters for their support.

II.2   Include Reference to Aging Tests

One commenter stated that SMSs may perform well when first installed but fail after a few years of operation. They added that residential consumers typically do not maintain irrigation equipment or regularly check for proper operation. The commenter asked whether the ASABE X633 test procedure included accelerated aging tests.

Response: Neither ANSI/ASABE S633 nor the final specification includes aging tests. EPA understands the commenter's concern over product failure

based on SMSs that were used decades ago. However, SMS technology has improved significantly in recent years, and EPA has seen no evidence of product failure for products that underwent performance testing. Specifically, there were no sensor mechanism failures during performance testing at the University of Florida. Additionally, the University of Florida published an unrelated report on SMSs examining water savings over a 2.5-year time period. Failures were rare and typically occurred straight out of the box. Researchers continued monitoring for five years with few issues. The associated report is located at https://www.waterrf.org/research/projects/smart-irrigation-controller-demonstration-and-evaluation-orange-county-florida. The University of Florida has conducted other research involving plot studies that are ongoing (2+ years) and has seen little evidence of product failure.

Regarding maintenance, EPA intends to promote proper maintenance in marketing and technical materials that will be published in the future. Additionally, the specification protects against catastrophic failure by requiring that a labeled SMS is capable of notifying the user when it is not receiving sensor mechanism input and is not adjusting irrigation based on soil moisture content in the landscape (see Section 3.3 of the specification).

Lastly, EPA notes that the average warranty for products currently on the market is around five years, whereas the payback period is less than two years, as determined in the *WaterSense Specification for Soil Moisture-Based Irrigation Controllers Supporting Statement.* Supporting materials that EPA intends to develop will encourage replacement of SMSs within the warranty period.

II.3   Add a Moisture Level to the Test Protocol

One commenter suggested that WaterSense add a fourth moisture level to the test procedure, at least for testing the product manufactured by their company. The additional moisture level would be 100 percent of field capacity. The commenter indicated that their product requires this moisture level for proper calibration and for the SMS to switch from allowing to preventing irrigation.

The commenter provided justification for their request. They observed that, since it was testing other soil moisture sensors, the testing facility would have all the materials to add a fourth moisture level. The commenter also pointed out that the test is conducted a single time for each sensor model and that the manufacturer is paying for the test.

Furthermore, the commenter stated that the dual threshold "checkbook" irrigation method is part of the Irrigation Association's handbook. Their company's soil moisture sensor operates in a different—not incorrect or inaccurate—way from other SMS models on the market. The commenter

indicated that the test procedure should be revised to be able to evaluate their product to avoid "restraint of trade" and reduce their company's obligation to change their product.

Response: EPA directed the commenter to the ASABE S633 Committee, as it is the body responsible for test method modifications, rather than WaterSense. The committee discussed the request and responded with the following statement: "It is the committee's opinion that the [product brand, model number], can be tested using the standard as it is written. [Product manufacturer]'s request to include an additional step of creating another test container with a test medium mixture of a defined moisture level to be used for initial calibration of their sensor mechanism falls under the provision of Section 5.1 of the standard whereby 'Each manufacturer should provide instructions detailing any variances from the described procedures and recommend changes to accommodate their sensor's characteristics.'"

II.4   Add Reference to Section 3 in Testing Modifications

One commenter observed that most criteria for performance and capabilities are included in Section 3 of the test procedure, rather than in Appendix A as referenced in the specification. The commenter recommended changing the language to read,

> "2.1.1 For add-on or plug-in devices, the interface device shall be connected to a base controller, as described in <u>Section 3 and</u> Appendix A."

Response: EPA has not made the suggested change. Section 3 of the specification provides criteria that add-on and plug-in devices, as well as stand-alone controllers, must meet to earn the WaterSense label. Appendix A, on the other hand, discusses how add-on or plug-in devices must interface with a base controller in order to be tested to the specification criteria.

II.5   Remove Stipulation to Use Base Controller

One commenter stated that add-on and plug-in devices can be tested without using a controller. The commenter suggested that the language be changed to the following:

> "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."

Response: Please see response in Section III.1 related to this issue.

II.6   Add Soil Media Type for Testing

a. One commenter questioned why the specification required testing only in a moderately coarse test medium. The commenter stated that there are a variety of soil types throughout the country, and that the chosen medium within the test method may not be the same as the local soil type. The commenter was concerned that the testing conditions may not reflect real-world situations and asked WaterSense to justify the selection of a single soil type for testing.

b. One commenter agreed that it was appropriate to conduct the test in moderately coarse media with saline water measuring 3.0 deciSiemens/meter (dS/m). They observed that the media is representative of sandy loam soil, which is common in the United States. The commenter recommended that WaterSense add one condition to the test procedure: moderately fine media with 3.0 dS/m water.

The commenter observed that the University of Florida test results reported a lower coefficient of determination for moderately fine media in saline water for the irrigation-enable and irrigation-disable tests compared to other test conditions. They added that there were differences in the absolute value of the slope of the regression line across water depletion levels for this test condition compared to others. For one brand, the moderately fine media in saline water had the highest relative average deviation. The commenter recommended including the test condition in the test procedure due to these distinctions. Furthermore, the commenter explained that moderately fine media represents clay loam soil, which is common in the large irrigation markets of Texas and California. The commenter said that adding the moderately fine media would reduce the burden of testing and increase representativeness.

The commenter recommended changing the language to the following:

> "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."

Response: EPA examined results from performance data on a variety of soil and salinity combinations (see *WaterSense Specification for Soil Moisture-Based Irrigation Controllers Supporting Statement*). Further, EPA understands the perception of a significant difference in test results when viewing graphs in the University of Florida's *Soil Moisture-Based Irrigation*

Controller Final Test Report. Therefore, EPA conducted the following additional statistical analyses (t-tests)[1]:

- T-test comparing R^2 of sensor enable at 24 hours for coarse versus fine soil (Figure 7 of the final rest report). This resulted in P = 0.71, indicating there is no statistically significant difference at the 95 percent confidence interval between the irrigation enable coarse and fine R^2 values.

- T-test comparing R^2 sensor disable at 24 hours for coarse versus fine soil (Figure 8 of the final rest report). This resulted in P = 0.97, indicating there is no statistically significant difference at the 95 percent confidence interval between the irrigation disable coarse and fine R^2 values.

- T-test comparing R^2 sensor enable at 3 dS/m at 24 hours for coarse versus fine soil (Figure 7 of the final rest report). This resulted in P = 0.07, indicating there is no statistically significant difference at the 95 percent confidence interval between the saline irrigation enable coarse and fine R^2 values.

- T-test comparing R^2 sensor disable at 3 dS/m at 24 hours for coarse versus fine soil (Figure 8 of the final rest report). This resulted in P = 0.06, indicating there is no statistically significant difference at the 95 percent confidence interval between the saline irrigation disable coarse and fine R^2 values.

- T-test comparing absolute value of the slope, enable at 24 hours (coarse versus fine soil), saline and freshwater results combined (Figure 9 of the final rest report). This resulted in P = 0.18, indicating there is no statistically significant difference between the irrigation enable coarse and fine absolute value of the slopes.

- T-test comparing absolute value of the slope, disable at 24 hours (coarse versus fine soil), saline and freshwater results combined (Figure 10 of the final rest report). This resulted in P = 0.20, indicating there is no statistically significant difference between the irrigation disable coarse and fine absolute value of the slopes.

- T-test comparing absolute value of the slope, enable at 24 hours (coarse versus fine soil), saline water only (Figure 9 of the final rest report). This resulted in P = 0.44, indicating there is no statistically significant difference between the saline irrigation enable coarse and fine absolute value of slopes.

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[1] P-values can be used to determine whether one group of data are statistically different from another group of data. Typically, P-values exceeding 0.05 indicate there is no statistical difference between the two groups of data.

- T-test comparing absolute value of the slope, disable at 24 hours (coarse versus fine soil), saline water only (Figure 10 of the final rest report). This resulted in P = 0.46, indicating there is no statistically significant difference between the saline irrigation disable coarse and fine absolute value of slopes.

Based on these results, EPA did not add an additional soil/salinity combination. However, this does not prevent other agencies or organizations from requiring an additional combination if they feel it is necessary to ensure performance in differing soil types.

II.7   Address Influence of Soil Alkalinity

One commenter expressed concern about the influence of soil alkalinity on SMSs. They noted that reclaimed water, which is increasingly used in irrigation, can raise soil pH. Irrigation design professionals may also be using brackish groundwater to supplement water sources used for irrigation. The commenter stated that SMSs that depend on conductivity can register false readings under these conditions, since pH can affect conductivity. The commenter asked whether the ASABE S633 standard included testing under variable pH conditions. The test procedure should represent real-world conditions to increase confidence in the products.

Response: ANSI/ASABE S633 specifies that the pH of the test media shall be between 8 and 9. EPA is not concerned about the impact of pH on test results, as the pH of the test media used during the University of Florida's SMS performance testing ranged between 8 and 9 and all products performed well. This range of pH is higher than typical reclaimed water, with a pH of around 7.5.[2]

II.8   Update Language About Enabling Irrigation

One commenter recommended that the specification be updated to indicate that SMSs eligible for the WaterSense label do not enable irrigation on demand by creating a schedule; rather, they allow a pre-existing watering schedule to start or continue. The commenter said that this change would clarify parts of the specification that are intended to apply to SMS controllers that stop or allow watering based on pre-set or pre-selected soil moisture values.

The commenter recommended the language in the specification be updated to the following:

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[2] Kent, Douglas. 2017. California Friendly Maintenance: Your Field Guide. Chapter 5: Irrigation with Recycled Water. http://bewaterwise.com/assets/ca-friendly-maintenance-book.pdf

"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."

Response: EPA understands the desire to clarify the function of SMSs, as recommended by the commenter. Although EPA has not made the specific change proposed by the commenter, EPA has updated language in Section 1.0 of the final specification to address this concern:

"Soil moisture-based irrigation control technology—a sensor mechanism and interface device that enables (allows) or disables (prevents/interrupts) an irrigation event at preset or selected soil water values."

Additionally, EPA revised the description of "on-demand" SMSs to clarify the exclusion of those that create a schedule. See Section I.1.

II.9   Clarify Calculations in 2.2.1.2

a. One commenter requested that the specification clarify the equation used to calculate relative average deviation (RAD). The commenter noted that the *WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies* states that the RAD will be averaged across all water depletion levels, whereas the webinar about the draft specification reports that the RAD will be calculated at set levels of water depletion (20, 40, and 60 percent). The commenter stated that the draft specification and what was reported during the webinar did not appear to be consistent.

The commenter suggested that WaterSense add an equation to calculate the average RAD to the specification.

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

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

Another commenter agreed with these suggestions and recommended that the specification indicate that the average across water depletion levels should be calculated after calculating RAD for each water depletion level. The commenter recommended adding the same Equation 3 shown above.

b. One commenter submitted three suggestions for clarifying Equation 2 in Section 2.2.1.2 of the draft specification. First, the commenter requested that WaterSense clarify the equation to indicate that the calculation is made at a single water depletion level.

Secondly, the commenter suggested placing "n" in Equation 2 with "three," since there will always be three observations at each water depletion level.

Third, two commenters suggested that Equation 2 could be rewritten as a sum. One of these commenters also requested that the equation for RAD be clarified to indicate that $\bar{x}$ is the mean sensor reading across the three sensor samples at a given water depletion value. Both commenters recommended the following changes to Equation 2:

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

One commenter also suggested reordering the equations in the order in which they will be used, i.e., calculating average deviation first, and then calculating RAD.

The commenter recommended that the following equation be added:

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

Two commenters suggested that the equations should clearly indicate the units used for performance criteria, noting that in the webinar about the *WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies*, the units were presented as "sensor reading percent full scale."

Response: EPA agrees with the commenters' suggestions and has revised the equations in Section 2.2 of the final specification to be more detailed and transparent.

II.10   Clarify Details of Calculating Slope of Sensor Readings

a. One commenter stated that the sensor readings and calculation methods in Section 2.2.1.3 should be identified. Although the specification provides instructions for calculating slope, it does not identify the readings in question or describe how the readings at each of the three water depletion levels are used to calculate the slope.

The commenter stated that WaterSense should identify the irrigation enable and disable readings. The specification does not clearly identify the units of the readings and the methods used to obtain them. The commenter stated that the result of the calculation is sensitive to the units of measurement, and that the performance criteria should be expressed in terms of the desired units. If different types of SMSs use different units, the specification should define the units of the performance criteria for each type.

Regarding Figure 1 copied below (included as Figure 3 in the *WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies Supporting Statement*), the commenter said that the x- and y-axes should be identified as the water depletion level and sensor reading, respectively. This would enable slope to be calculated consistently.

The specification should also identify the format for the depletion level percentage as used in calculations. The commenter asked, for example, whether "20" or "0.2" would be used to represent 20 percent to calculate slope. The commenter said that the specification should identify the linear least squares fit as the preferred method of calculating slope to ensure consistency.
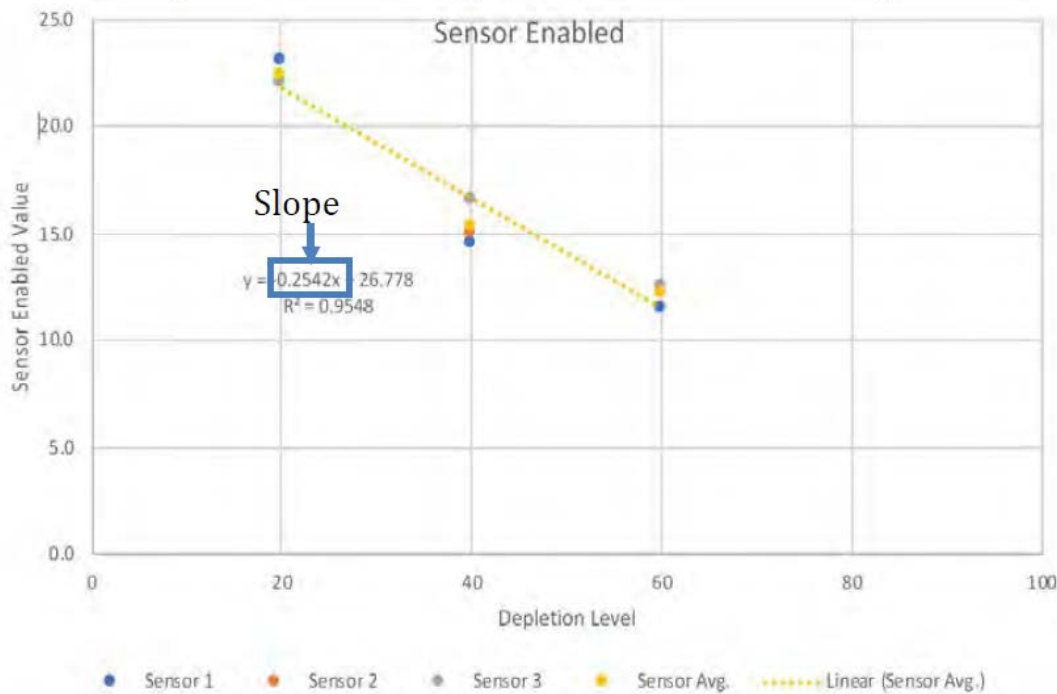

Figure 1. The commenter's marked-up version of Figure 3 from the *WaterSense Draft Specification for Soil Moisture-Based Irrigation Control Technologies Supporting Statement.*

b. One commenter agreed with comment (a) directly above. In addition, the commenter recommended an alternative performance criterion that does not depend on plotting and fitting a line to measured data. They suggested the following criterion:

- "The average values at which the sensor disables or allows irrigation must monotonically increase or monotonically decrease from a depletion level of 20 percent to a depletion level of 60 percent.
- To determine this, for sensor-enable or sensor-disable readings, take ȳ, 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"

Response: EPA is clarifying that units are normalized because readings are converted to percent of full scale, removing the concern of different units for different product readings. EPA also used the least square regression to calculate slope. It should be noted that along with the specification, EPA will provide a test method spreadsheet to its licensed certifying bodies to assist with product testing. The test method spreadsheet completes all necessary calculations to ensure criteria are met, including the calculations related to the slope of sensor readings. In response to these comments, EPA revised the language in Section 2.2.1.3 to clarify how the calculations should be conducted.

> "~~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).~~
>
> 2.2.1.3 The absolute value of the slope across three depletion levels of the line generated using a least square regression plot of irrigation enable readings (expressed as a percent of full scale) for each replicate shall be greater than zero when rounded to two significant digits (i.e., ≥ 0.01).
>
> The absolute value of the slope across three depletion levels of the line generated using a least square regression plot of irrigation disable

readings (expressed as a percent of full scale) for each replicate shall be greater than zero when rounded to two significant digits (i.e., ≥ 0.01)."

EPA did not adopt the alternative method proposed by the commenter, because the current method using slope provides a sufficient indicator of change in readings with a change in soil moisture.

III. Comments on Section 3.0: Supplemental Capability Requirements

III.1 Include Separate Requirements for Add-on and Plug-in Devices and Stand-Alone Controllers

One commenter stated that the first few sentences of this section should be shortened and referenced steps that could be eliminated. They explained that, if a base controller identified in Appendix A was not to be used, it was unnecessary to say that the controller should be "configured for testing in accordance with Appendix A." The other procedures in this section pertain to controllers only. The commenter suggested that Section 3.0 of the draft specification should establish distinct requirements for 1) add-on and plug-in devices; and 2) stand-alone controllers.

Response: EPA disagrees with the commenter that add-on and plug-in devices should not be required to meet the supplemental capabilities in Section 3.0 of the specification. All types of controllers (stand-alone controllers, and add-on and plug-in devices), as configured for testing as described in Appendix A of the specification, are held to the same standard with respect to additional features that contribute to the products' water saving capabilities. The goal of this section is not only to promote water savings, but to also stay consistent with the supplemental capability requirements included in the *WaterSense Specification for Weather-Based Irrigation Controllers*. The list of supplemental capability requirements was initially developed by water utility stakeholders who indicated that weather-based controllers should have certain features (in addition to meeting performance criteria) to promote greater long-term water savings. EPA developed the list of supplemental capability requirements that are currently included in Section 4.0 of the *WaterSense Specification for Weather-Based Irrigation Controllers* in coordination with a working group consisting of utility and manufacturer representatives. EPA reviewed the *WaterSense Specification for Weather-Based Irrigation Controllers* for possible revision in 2019. During that process, WaterSense gathered public comments on that specification. Stakeholders were generally very positive about the supplemental capability requirements and did not request any changes. Though weather-based irrigation controllers and SMSs function differently, both product types aim to address irrigation scheduling inefficiencies. As such, EPA intends to promote the products together as "WaterSense labeled

irrigation controllers." Therefore, EPA has retained all of the supplemental features for all types of SMSs (i.e., add-on and plug-in devices and stand-alone SMSs) to ensure an equal level of performance for this product category.

III.2   Eliminate Section 3.0

One commenter suggested that Section 3.0 of the draft specification should be removed from the final specification. They stated that the contents of the section do not improve the water savings associated with SMSs. The commenter stated that most controllers on the market do not meet the requirements outlined in Section 3.0.

The commenter said that Section 3.0 excludes add-on devices from eligibility for the WaterSense label, since these devices 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. The commenter stated that add-on devices could provide notable water savings at a lower cost to consumers than a plug-in device or standalone controller.

In summary, the commenter stated that Section 3.0 has the effect of excluding segments of the SMS market and added that it imposes a cost on consumers by requiring them to obtain a controller compatible with WaterSense labeled SMSs.

Response: EPA is clarifying that, while plug-in and add-on devices may not include all supplemental capability requirements included in Section 3.0 of the specification, allowing them to be paired with a compatible base controller for testing and listing allows the products (when in communication with a base controller) to be included in the scope of the specification, not excluded. Regarding the importance of the features included in Section 3.0 of the specification, please see the response Section III.1 of this document.

Note that EPA provides a list of compatible base controllers for each plug-in and add-on device so that consumers can easily identify whether their existing clock-timer is compatible with a WaterSense labeled device. If so, then the consumer can purchase only a labeled plug-in or add-on device and does not need to replace their existing controller.

III.3   Define Irrigation Program

One commenter stated that WaterSense should define the word "program" in the specification. They also suggested that the specification explain the difference between a program, station, and zone.

Response: EPA has revised the following language in Section 3.1 of the final specification:

"Be capable of preserving the contents of the ~~irrigation program~~ programmed irrigation settings and sensor mechanism settings when the power source is lost and without relying on an external battery backup."

EPA intends that this updated language will clarify the word "program" as used in the draft specification.

III.4   Inquiry About Duration of Preserving Contents During Power Loss

One commenter asked whether controllers are required to preserve data for a prescribed amount of time following a power outage.

Response: EPA did not require that base controllers preserve data for a prescribed amount of time following a power outage in the final specification. EPA made this decision to avoid being overly prescriptive.

III.5   Inquiry About Notification System Requirements

One commenter asked if there are further requirements pertaining to the notification system that informs the consumer when the controller is not receiving input from the SMS. The commenter asked whether these requirements require notifications to be displayed on the controller or in a smartphone application.

Response: EPA did not require specific mechanisms regarding the notification system in the final specification. EPA made this decision to avoid being overly prescriptive and to encourage innovation in the market.

III.6   Comments on Whether the Rainfall Device Capability Should Be Included

One commenter suggested that, for stand-alone SMS controllers, WaterSense reconsider the requirement that the controller must be capable of interfacing with a rainfall device. The commenter stated that it could be useful to add rainfall shut-off devices to weather-based irrigation controllers and base controllers, since they can be used with a variety of add-on or plug-in devices. However, this requirement may not be relevant for stand-alone SMS controllers. SMSs may be able to connect to a base controller using the same connection port as a rainfall device. Furthermore, SMSs can disrupt irrigation based on soil moisture content during a rainfall event, which could preclude the need for a rain sensor.

The commenter suggested changing the language to the following:

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

Response: EPA did not revise the requirement based on this comment. While EPA agrees that SMSs may serve as a more effective technology with respect to bypassing irrigation if the landscape is sufficiently watered (by either rain or irrigation), EPA has retained this requirement to ensure SMSs on the market are able to communicate with a rainfall device, as these devices are an important component of an efficient irrigation system in many climate regions, and many states require them by law. However, EPA clarified in Section 4.4 of the *WaterSense Specification for Weather-Based Irrigation Controllers* to allow weather-based irrigation controllers to be capable of interfacing with a rainfall device *or* SMS, acknowledging that either product aims to accomplish the goal of bypassing irrigation when the moisture is a sufficient level in the soil as a result of rainfall.

EPA agrees with the commenter's concern that SMSs and rainfall devices may be connected to the same port, especially in the instance of an SMS add-on or plug-in device, where the SMS is connected to the sensor port along with rainfall device. EPA has added language to Section III of the *WaterSense Specification for Soil Moisture-Based Irrigation Controllers Supporting Statement* to address this concern, "However, if a rainfall device and soil moisture sensor are both connected to the same port, the devices must be wired in series so that either device may interrupt or bypass scheduled irrigation events. If incorrectly connected in parallel, both devices must disable irrigation, in order for an irrigation event to be bypassed." EPA plans to include additional detail in technical and marketing materials regarding this potential issue.

III.7 Change Language Regarding Rainfall Devices

One commenter said that controllers should have a way to disable irrigation during rain events, and that more accurate language would make this clear to consumers. They suggested that the term "rainfall detection device" be used, as shown in the following suggested change:

"3.4 Be capable of interfacing with a rainfall <u>detection</u> device."

Response: EPA continued using the term "rainfall device" in the final specification. EPA selected and defined this term during development of the *WaterSense Specification for Weather-Based Irrigation Controllers* to be inclusive of rain sensors and rain measurement devices, such as rainfall interrupt devices and tipping rain buckets. To remain consistent with that specification and the reasoning behind the use of the term, EPA has decided to retain the term "rainfall device" in the *WaterSense Specification for Soil Moisture-Based Irrigation Controllers*.

Support for Day Interval Schedule Requirement

One commenter expressed their support for the fact that the specification required a schedule based on intervals of days. The commenter works for a

water district that requires residents to use an interval irrigation schedule during droughts and possibly to cease watering entirely during extreme drought.

Response: EPA thanks the commenter for their support.

III.8   Rephrase Verbiage for SMS Controllers

One commenter said that controllers can irrigate or not irrigate, but they cannot "avoid" irrigation. They recommended changing the language to the following:

> "3.5.3 The ability to set irrigation runtimes to ~~avoid~~ prevent watering during a prohibited time of day (e.g., between 9:00 a.m. and 9:00 p.m.)."

Response: EPA agrees with the commenter and has made the following change to Section 3.5.3 of the final specification:

> "The ability to set irrigation runtimes to ~~avoid~~ prevent watering during a prohibited time of day (e.g., between 9:00 a.m. and 9:00 p.m.)."

EPA intends for the change to clarify the language identified by the commenter.

III.9   Comments on Automatically Returning to SMS Mode After Manual Operation

One commenter stated that it is problematic to allow SMSs to return to soil moisture mode after manual operation, because the sensors may be faulty. The commenter said that there should be a way to properly operate the system when the sensors are malfunctioning.

Two commenters recommended that WaterSense should not allow manufacturers to determine the maximum time that can elapse before the controller switches to sensor mode. One commenter recommended that WaterSense specify the maximum time allowable before the device returns to soil moisture mode. The other commenter recommended deleting the following language from Section 3.8 of the specification:

> "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."

Response: Regarding the concern over faulty sensors, Section 3.3 of the draft specification required that labeled SMSs are capable of indicating to the user when they are not receiving sensor mechanism input and are not adjusting irrigation based on soil moisture content in the landscape.

Therefore, if sensors are faulty, the user will be notified. EPA is also clarifying that there are means to properly operate the system if sensors are malfunctioning. A manual operation mode is available on all products for troubleshooting. The intent of the requirement included in Section 3.8 of the draft specification is that the controller will automatically return to soil moisture mode (so scheduling is once again based upon the moisture in the soil) if a manual cycle is run for troubleshooting means and is not turned back to soil moisture mode.

However, in further evaluating this requirement, EPA determined that the language included in Section 3.8 of the specification referencing a physical switch is a relic of the language included in the *WaterSense Specification for Weather-Based Irrigation Controllers*. EPA issued a clarification to the weather-based irrigation controller specification in June 2020 to remove the language related to the physical switch and also removed the language in the final *WaterSense Specification for Soil Moisture-Based Irrigation Controllers* as follows:

> "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~~."

Regarding the request to specify the amount of time allowed to pass before a product return to soil moisture mode, EPA did not make this change, to avoid being overly prescriptive in its requirements.

IV.   Comments on Section 4.0: Packaging and Product Documentation Requirements

IV.1   WaterSense Label Should Be on SMS

One commenter said that the WaterSense label should apply to the SMS itself, rather than the combination SMS and base controller. They said that, if the base controller is not listed in Appendix A to the specification, the majority of Section 4.0 is not relevant. The commenter suggested that manufacturers of SMSs should provide guidelines for compatible controllers. The commenter suggested that the following language be added:

> "Add-on and plug-in devices shall not be packaged nor marked to encourage operation of the irrigation system without them being enabled."

Response: EPA did not make this suggested change, as base controllers are required to test add-on and plug-in devices to ensure that together they meet the performance and supplemental capability requirements in the specification. Please see the responses to related comments for the reasoning behind this decision in Section III.1 and Section VII.1.

IV.2 Remove Requirement to List Compatible Base Controllers

One commenter said that requiring manufacturers of SMSs to list compatible base controllers is an undue burden. Manufacturers will have to conduct extensive testing, since there are many controllers on the market that could be compatible with their products. This could result in fewer SMSs receiving the WaterSense label. It could also lead to confusion in the marketplace. The commenter stated that the WaterSense label should apply to the soil moisture sensor itself, regardless of the controller to which it is connected. The commenter recommended deleting this requirement from the specification and requiring manufacturers to list the method of interaction with the base controller (such as common wire interruption or controller sensor terminal connection).

Response: As stated in the response in Section III.1, it is EPA's desire that all labeled SMSs (stand-alone, add-on, and plug-in devices) include supplemental capability requirements in addition to meeting performance requirements included in Section 2.0 of the specification. Additionally, plug-in and add-on devices are allowed to bear the WaterSense label and include a list (or access to a list) of compatible base controllers (see response in Section VII.1). EPA is not aware of a significant burden placed on manufacturers as this is the current scheme that applies to add-on and plug-in devices under the *WaterSense Specification for Weather-Based Irrigation Controllers* and has been successful in the marketplace for nearly a decade. WaterSense has not received complaints from weather-based irrigation controller manufacturers regarding the compatibility listing requirement, neither formally during the specification review process EPA conducted in 2019, or informally through the WaterSense Helpline or other channels.

IV.3 Modify Requirement to List Compatible Base Controllers

One commenter said that WaterSense should modify the requirement for manufacturers to list compatible base controllers for add-on and plug-in devices. They suggested that the manufacturer could include links to an online list of compatible controllers in their product literature. Links could be provided as text, Quick Response (QR) code, or other mechanisms that would be easily accessible.

Some add-on devices could work with many controllers, leading to a cumbersome list of compatible controllers. The list could also become outdated as new controllers are available. By maintaining the list online, consumers would have access to the most up-to-date information.

The commenter suggested making the following changes to the language in Section 4.2 of the specification:

"…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."

Response: EPA shares the commenter's concern about compatibility lists becoming outdated. Therefore, EPA clarified the language in Section 4.2 of the final specification to allow for manufacturers to provide access to a current list of compatible base controllers.

"…the product documentation for the add-on and plug-in devices shall list (or provide access to a list of) each compatible base controller model."

EPA did not require specific mechanisms for list access, so as to not be overly prescriptive.

IV.4 Require Documentation About Seasonally Reconditioning Products

a. One commenter stated that the specification does not require RAD to be recorded after the freeze test. According to data from the University of Florida tests, RAD sometimes increased beyond 10 percent after the freeze test. The commenter recommended that the product literature accompanying WaterSense labeled SMSs should include educational text explaining that users should recondition the SMS after each season. Since SMSs may be less precise after exposure to freezing temperatures, recalibration helps ensure that the product continues to save water and extends the longevity of the product.

The commenter recommended that WaterSense add the following 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."

Response: EPA did not include this requirement in the final specification. Based on EPA research on products currently available in the marketplace, manufacturer manuals for SMSs include information about product reconditioning with details specific to the product model. It is therefore unnecessary for EPA to require such documentation.

V. Comments on Section 7.0: Definitions

V.1 General Support for Definitions

One commenter expressed their support for the definitions in Section 7.0. Specifically, the commenter agreed with the definition of soil moisture sensor devices including the fact that they should be used with a "standard clock-timer controller" as the base controller. Further, the commenter noted that the

definitions do not state that the base controller must include all features listed in Section 3.0 and Appendix A of the specification.

Response: EPA is clarifying that the definitions are included to describe the three types of SMSs included in the scope of the specification (stand-alone controllers, and plug-in and add-on devices), as well as the term "base controller" as a base controller is required for testing plug-in and add-on devices and shall be listed as compatible with an SMS plug-in or add-on device. The definitions are not intended to conflict with Section 3.0 and Appendix A, which require add-on and plug-in devices to be tested with a base controller, and together meet the requirements in Section 3.0.

VI. Comments on Appendix A: Testing Configuration and Compatible Base Controller Determination

VI.1   Remove Requirement to Specify a Compatible Base Controller

a. One commenter suggested that WaterSense remove the requirement that SMSs be paired with a compatible base controller. They explained that this requirement could present an undue burden for consumers and manufacturers.

The commenter said that it would be preferable for consumers to attach an add-on device to their existing controller, but that doing so would not comply with the WaterSense specification. Homeowners may not want to spend extra money and go through the process of replacing their existing controller. The commenter suggested that consumers would likely prefer the less expensive option of purchasing a WaterSense labeled add-on device that worked with their existing controller. However, since that is not possible, the commenter speculated that the consumer would likely purchase a cheaper "'competitive technology' controller" rather than purchase a WaterSense labeled soil moisture sensor and a compatible controller.

The commenter said that the goal of saving water should not supersede the goal of offering consumers simple and affordable ways to save water. They said that WaterSense should not label products that favor a certain technology, and that WaterSense labeled products should be affordable to consumers who are not receiving a rebate incentive from a utility.

The commenter said that Section 7.0 defines soil moisture sensors as devices used with "standard clock-timer controllers," rather than controllers with specific features. Accordingly, the specification should not be contingent upon using certain controllers. Furthermore, the commenter suggested that WaterSense may be encouraging homeowners to update their controllers through this stipulation. The commenter stated that if outdated equipment is an issue, that is a matter of local compliance, rather than something that should be addressed by WaterSense.

The commenter recommended that WaterSense remove the requirement in Appendix A about labeling devices that have a compatible controller and delete all references to that requirement in the specification.

b. Another commenter stated that WaterSense change the following sentence to remove the reference to Section 3.0, as follows:

> "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~~."

Additionally, the commenter requested that WaterSense change the following sentence to remove the reference to Section 3.0, as follows:

> "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."

Response: EPA reiterates its desire that WaterSense labeled SMSs (stand-alone controllers and plug-in and add-on devices when in communication with a compatible base controller) meet all requirements included in the specification, including performance requirements in Section 2.0 and supplemental capability requirements in Section 3.0 (see response in Section III.1). Additionally, this requirement is identical to the requirement included in the *WaterSense Specification for Weather-Based Irrigation Controllers* and has proven successful for that sector for nearly a decade. EPA also reiterates that plug-in and add-on devices may be packaged separately from base controllers and include the WaterSense label on product packaging, though a list (or access to a list) of compatible base controllers is required along with the associated language indicating that the add-on or plug-in device is only WaterSense labeled when used in combination with the base controller(s) listed in product documentation as described in Section 4.0 of the specification.

VII. Comments on Appendix B: Informative Annex for WaterSense Labeling

VII.1 Label the SMS Plug-in or Add-on Device Alone, Not Based on Supplemental Capability Requirements When Paired With Base Controller

One commenter stated that only the tested device should receive the WaterSense label; the device should not need to be combined with a list of approved controllers to be eligible for the WaterSense label. The commenter

stated that SMSs will save water when used in combination with any controller. Under the requirements of the draft specification, consumers will need to purchase a new controller if their current one is incompatible with a WaterSense labeled SMS.

The commenter suggested that WaterSense eliminate Section 3.2 of Appendix B of the specification. Additionally, they suggested the following changes to the language in Section 3.1 of Appendix B:

> "3.1: Soil moisture sensor devices certified to meet the requirements of this specification may bear the WaterSense label."

Response: EPA did not revise the specification to remove Section 3.2 of Appendix B of the specification, nor revise the language in Section 3.1 of Appendix B. As stated in the response in Section III.1, EPA believes all labeled SMSs (stand-alone SMSs, and add-on and plug-in devices when connected to a base controller) should include the supplemental capability requirements included in Section 3.0 of the specification. Because many of the features included in Section 3.0 are not integral to the plug-in or add-on device but features of the base controller, a base controller is required for product testing and is required to be listed as compatible for WaterSense certification. Note that WaterSense labeled plug-in and add-on devices may be sold without a base controller.

VIII. General Comments on the Specification

VIII.1 General Specification Support

a. One commenter stated that their employer, a water district, is committed to supporting water efficiency both regionally and nationally. They indicated that their community has benefited from the implementation of water-saving technologies in their region. The commenter expressed their intention to continue promoting WaterSense labeled products and noted particular enthusiasm for the inclusion of irrigation products such as SMSs.

b. One commenter shared that they had attended EPA's session at an Irrigation Association conference in Las Vegas. During this presentation, they learned about the SMS testing process and the details of the specification. The commenter indicated that they were pleased with WaterSense's work.

c. One commenter indicated that their organization appreciates EPA's efforts to establish a WaterSense specification for soil moisture-based irrigation control technologies. Their state is recovering from severe drought and is focused on identifying strategies to conserve limited water resources. The commenter expressed support that the specification addresses inefficient irrigation scheduling by preventing unnecessary watering. In their opinion, the specification could encourage consumers to select products that automate

irrigation and save an estimated hundreds of billions of gallons of water across the United States.

d. One commenter expressed their appreciation for EPA's continued efforts to develop a WaterSense specification for soil moisture-based irrigation control technologies that can improve water efficiency in irrigation.

e. One commenter expressed their support for EPA's efforts to develop a WaterSense specification for soil moisture-based irrigation control technologies. The commenter stated that this specification had the potential to provide consistency in the market for the testing and sale of SMSs, and that higher sales of these products are expected to save water and lower consumers' utility bills. The commenter encouraged EPA to revise and finalize the specification promptly.

Response: EPA thanks the commenters for their support.

VIII.2 Modify Reference to ASABE Protocol

One commenter stated that the specification incorrectly references the ASABE standard. They recommended changing "ASABE S633 protocol" to "ASABE x633 protocol."

Response: The final specification appropriately cites the final standard, ANSI/ASABE S633 *Testing Protocol for Landscape Irrigation Soil Moisture-Based Control Technologies*.

VIII.3 Research and Consider Irrigation Controller Standby Power

One commenter encouraged EPA to consider including irrigation controller standby power in the specification or a future revision. The commenter stated that the additional features on irrigation controllers can draw more power in standby mode than traditional irrigation timers. Modern irrigation controllers may communicate with sensors or connect to the internet, and these capabilities may require more power.

Response: EPA thanks the commenter for this suggestion but has not included requirements pertaining to irrigation controller standby power in the final specification. EPA does not currently have data about power use of irrigation controllers in standby mode that would inform such a requirement. EPA encourages stakeholders to submit such data if available for consideration in a future revision of the specification.