



# **WeatherAccess™**

## **User Manual**

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## Introduction

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You can conserve water by operating your Baseline irrigation controller in a "smart" mode rather than in a timed mode. Unlike traditional irrigation controllers that operate on a timed schedule, a smart controller actively adjusts its watering schedule based on input from sensors. Smart controllers save water by applying the least amount of water possible to keep the soil moisture content in the root zone at the appropriate levels.

Baseline recommends watering smart with our biSensor soil moisture sensors because the sensors measure soil moisture levels where it matters, in the root zone of your plants. Baseline biSensors automatically adapt to the effects of evapotranspiration in real-time.

Baseline's irrigation controllers can also be programmed to use WeatherAccess™, a weather-based watering mode. WeatherAccess applies real-time weather data from a weather station in your area (available in Weather Underground's weather station network), and configurable zone properties to a standardized evapotranspiration (ET) equation. This calculation estimates the loss of moisture from the root zone, and then the irrigation controller uses the calculated value to adjust the runtime in order to apply just enough water to replace that lost moisture.

In WeatherAccess mode, Baseline irrigation controllers attempt to calculate the loss of moisture from the root zone and adjust the watering schedule accordingly. The controller's ability to accurately adjust runtimes depends on the quality of the weather data and how accurately the following properties are configured for each hydrozone in your landscape:

- A specific plant type's water needs (known as the "crop coefficient")
- Root zone depth
- The plant's microclimate (ranging from full sun to total shade)
- The application rate of the irrigation method used (spray, rotor, drip, or bubbler)
- Type of soil at the site (clay, sand, or loam)
- Slope of landscape (ranging from slight to extreme)

Having a good working knowledge of horticulture, water management, and an understanding of the science behind weather-based watering will help you be successful with WeatherAccess.

**IMPORTANT!** In order to connect to a weather station and access the configuration fields for WeatherAccess, the BaseStation 1000 and BaseStation 3200 irrigation controller must be connected to Baseline's BaseManager central control platform, and you must have a BaseManager Plus account set up.

Refer to the BaseStation 1000 or BaseStation 3200 user manual for controller specifications and general configuration information.

## Overview of Setting Up WeatherAccess

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If you are a new Baseline customer and you want to configure WeatherAccess with the initial setup of your irrigation controller, you'll need to perform all the steps in the following list.

If you already have your Baseline irrigation controller set up and your BaseManager Plus account activated and configured, and you want to convert to WeatherAccess, you'll need to perform the steps in the following list starting at Step 9.

- Step 1: Install your controller and connect all your devices (Refer to your controller's user manual)
- Step 2: Make sure your controller is running the most current firmware version (Refer to your controller's user manual)
- Step 3: Search for and assign devices (Refer to your controller's user manual)
- Step 4: Set up basic programs (Refer to your controller's user manual)
- Step 5: Install your communication equipment (Refer to the installation guide that came with your communication equipment)
- Step 6: Connect your controller to BaseManager (Refer to the BaseManager Quick Start Guide)
- Step 7: Call Baseline to activate your BaseManager Plus account (Call 866-294-5847)
- Step 8: Set up your BaseManager Plus account (Refer to the topics under Setting Up Your BaseManager Account in the BaseManager online help)
- Step 9: Connect a weather station to BaseManager (Refer to page 2 of this guide)
- Step 10: Assign the weather station to your controller (Refer to page 7 of this guide)
- Step 11: Configure the hydrozone settings (Refer to page 8 of this guide)
- Step 12: Enable the controller to use WeatherAccess  
For BaseStation 1000 controllers, refer to page 11 of this guide  
For BaseStation 3200 controllers, refer to page 12 of this guide

## Connecting a Weather Station to BaseManager


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Baseline's WeatherAccess uses real-time weather data from a weather station in your area. Our BaseManager central control platform connects to Weather Underground's weather station network, which enables you to select weather stations close to your irrigation controller locations.

Weather Underground's weather station network includes thousands of personal weather stations as well as National Weather Service and public stations.

**Note:** Baseline assumes no responsibility for the ongoing availability of weather stations in Weather Underground's weather station network.


You can connect to multiple weather stations in BaseManager, but you can only assign one weather station to an irrigation controller.

1. After you have logged into BaseManager, click the **Menu** icon  in the upper-left corner of the page.
2. In the menu, click **Administration**.
3. In the next menu, click **Manage Weather Stations**.
4. In the Weather Station table, click **Add Weather Station**.
5. In the **Weather Station ID** field, type or paste Weather Underground's ID for the weather station that you want to connect to. If you don't know the ID of the weather station, click **Find Weather Station** in the upper-right corner of the page. Refer to the topic on Finding a Weather Station in Your Area on page 3.
6. Click **Save** at the bottom of the page. BaseManager verifies that a valid station ID was entered and verifies that the Weather Station is collecting the following data points that are required for ET calculations.
  - Temperature
  - Dew point
  - Wind speed
  - Atmospheric pressure
  - Precipitation
  - Solar radiation (If the weather station does not provide this value, Baseline's system will estimate it.)

**Note:** After you connect the weather station to BaseManager, you need to assign it to a specific irrigation controller as a device. Refer to Assigning a Weather Station to an Irrigation Controller on page 7.

## Finding a Weather Station in Your Area

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1. After you have logged into BaseManager, click the **Menu** icon  in the upper-left corner of the page.
2. In the menu, click **Administration**.
3. In the next menu, click **Manage Weather Stations**.
4. Click the **Find a Weather Station** link on the Edit Weather Station page in BaseManager. The Weather Underground web site opens in a new browser tab.
5. In the **Search Locations** field, type the name of the area where your irrigation controller is located, and then click the search button at the right end of the field.
6. When the page for the location displays, click the **Change Station** link under the location name. A map displays to show icons for the weather stations in the area. To the right of the map, the nearby weather stations are shown in a list.
7. Zoom in and position the map view to find the location of the irrigation controller that you are setting up WeatherAccess on.

8. Position the cursor on a nearby weather station icon on the map. The name of the weather station is highlighted in the list on the right. The weather station ID is in parentheses. Write down the ID of the weather station that you want to use paying close attention to the case of the letters and the distinction between numbers and letters.


**Note:** You can copy the weather station ID in Weather Underground.

9. Return to the **Add Weather Station** page in BaseManager.
10. Type or paste the weather station ID in the field, and then click **Save** in the lower-right corner of the page.

**Note:** After you connect the weather station to BaseManager, you need to assign it to a specific irrigation controller as a device. Refer to Assigning a Weather Station to an Irrigation Controller on page 7.

## Deleting a Weather Station from BaseManager



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1. After you have logged into BaseManager, click the **Menu** icon  in the upper-left corner of the page.
2. In the menu, click **Administration**.
3. In the next menu, click **Manage Weather Stations**. The list shows the weather stations that are connected to BaseManager.
4. In the Weather Station table, find the row for the weather station that you want to delete.
5. Click the > at the end of the row. The Edit Weather Station page displays.
6. Click the **X** at the end of the row.


**Note:** If the weather station that you deleted was assigned to an irrigation controller, it will be removed from the controller.

## Verifying Communication with a Weather Station

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1. After you have logged into BaseManager, click the **Menu** icon  in the upper-left corner of the page.
2. In the menu, click **Administration**.
3. In the next menu, click **Manage Weather Stations**. The list shows the weather stations that are connected to BaseManager.
4. In the Weather Station table, find the row for the weather station that you want to test.
5. Click the > at the end of the row. The Edit Weather Station page displays.
6. Click the **Test** icon . BaseManager verifies communication with the weather station and then displays the status next to the weather station ID.



If the weather station is assigned to a controller, you can check the status of the connection between the weather station and BaseManager on the **Devices** tab in BaseManager. Click the **Weather Station** option on the Devices menu, and then click the **Test** icon .

**Note:** If the connection between the weather station and BaseManager is lost, BaseManager will use the last collected weather data to calculate the runtime for any watering events.

## Downloading a List of Connected Weather Stations

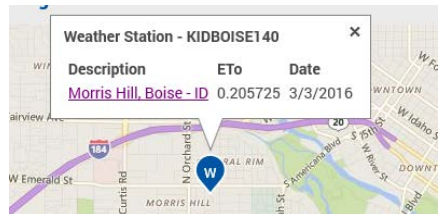
1. After you have logged into BaseManager, click the **Menu** icon  in the upper-left corner of the page.
2. In the menu, click **Administration**.
3. In the next menu, click **Manage Weather Stations**. The list shows the weather stations that are connected to BaseManager.
4. Click the **CSV** icon  in the upper-right corner of the page. A dialog box displays to prompt you to open the file with Microsoft Excel or save the file.
5. Select your preferred option, and then click **OK**. The list displays as illustrated below.

	A	B	C	D	E	F
1	Weather Station Report for Baseline Documentation					
2	Report Date: 3/3/16					
3						
4	Name	ID	Date Added	Data Capture Time	Latitude	Longitude
5	Clover Meadows, Boise, Idaho	KIDBOISE91	3/1/2016	12:30 AM	43.6232	-116.332
6	Lewis and Clark, Boise, Idaho	KIDBOISE146	2/11/2016	12:30 AM	43.6347	-116.335
7	Morris Hill, Boise - ID	KIDBOISE140	2/2/2016	12:30 AM	43.6106	-116.24
8	Yonkers Ave, Boise, Idaho	KIDBOISE144	2/11/2016	12:30 AM	43.6228	-116.297
9	Legend Ridge	KIDIDAHO30	12/14/2015	12:30 AM	43.5405	-116.148
10						

## Displaying Weather Station Information from the Map

1. In the main BaseManager interface, click the **Maps** tab, and then navigate to the Site level. Markers for the weather stations that you have added to BaseManager automatically display on the map.
2. Click on the weather station marker. The weather station pop-up box displays.
3. Review the information in the pop-up box.

**Description:** The weather station that the controller is connected to. If you want to see details about the weather station in Weather Underground, click the weather station name.




**ETo:** This field shows the calculated amount of water (in inches) needed to replace the moisture lost to evapotranspiration (ET). This value is calculated daily.

**Last Data Captured:** This field shows the most recent date and time when BaseManager captured data from the weather station to use in the ET calculations. The time in this field is relative to the weather station's time zone.

4. Close the pop-up box by clicking the **X** in the upper-right corner.

## Viewing Weather Station Information in Quick View

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1. Make sure the controller that the weather station is assigned to is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click Sites and Controllers. Continue drilling down until you can select the desired controller.
2. Click the **Quick View** tab. The Quick View page displays.
3. Scroll down to the **Weather Station** heading.
4. Click the **^** or **v** in the heading to expand or collapse the section.

Quick View shows the following information:


**Description:** The weather station that the controller is connected to. If you want to see details about the weather station in Weather Underground, click the weather station name.

**ETo:** This field shows the calculated amount of water (in inches) needed to replace the moisture lost to evapotranspiration (ET). This value is calculated daily.

**Last Data Captured:** This field shows the most recent date and time when BaseManager captured data from the weather station to use in the ET calculations. The time in this field is relative to the weather station's time zone.

## Checking the Calculated ETo Amount

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1. Make sure the controller that the weather station is assigned to is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click Sites and Controllers. Continue drilling down until you can select the desired controller.
2. Click the **Quick View** tab. The Quick View page displays.
3. Scroll down to the **Weather Station** heading.
4. Click the **^** or **v** in the heading to expand or collapse the section.
5. Review the number in the **ETo** column. This field shows the last calculated amount of water (in inches) needed to replace the moisture lost to evapotranspiration (ET). This value is calculated daily.


## Assigning a Weather Station to an Irrigation Controller

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You can connect to multiple weather stations in BaseManager, but you can only assign one weather station to an irrigation controller.

Before you can assign a weather station to an irrigation controller, the weather station must be connected to BaseManager. Refer to Connecting a Weather Station to BaseManager on page 2.

Make sure you know the name and ID of the weather station that you want to assign to an irrigation controller.

1. Make sure that the controller that you want to assign a weather station to is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click **Sites and Controllers**. Continue drilling down until you can select the desired controller.
2. Position the cursor on the **Devices** tab, and then click **Weather Station** in the menu that displays. The Weather Station page displays.
3. Click the **Assign Weather Stations** button at the top of the page.
4. Click the drop-down arrow in the **Weather Station** field, and then in the list that displays, click the ID of the weather station that you want to assign to the controller.
5. In the **Notes** field, type any information about the weather station.
6. Click **Save** at the bottom of the page. The controller is assigned to the weather station.


## Reassigning a Controller to a Different Weather Station

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**Note:** You must already have controller(s) assigned to a weather station. Refer to Assigning a Weather Station to an Irrigation Controller on page 7.


Before you can assign a weather station to an irrigation controller, the weather station must be connected to BaseManager. Refer to Connecting a Weather Station to BaseManager on page 2.

You must also know the ID of the new weather station that you want to assign.

1. Make sure that the controller that you want to assign a different weather station to is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click **Sites and Controllers**. Continue drilling down until you can select the desired controller.
2. Position the cursor on the **Devices** tab, and then click **Weather Station** in the menu that displays. The Weather Station page displays.
3. Click the **Assign Weather Stations** button at the top of the page.
4. Click the drop-down arrow in the **Weather Station** field, and then in the list that displays, click the ID of the new weather station that you want to assign to the controller.
5. In the **Notes** field, type any information about the weather station.
6. Click **Save** at the bottom of the page. The controller is assigned to the new weather station.

## Configuring Zone Settings for WeatherAccess

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1. Make sure that the controller that you want to configure zone settings for is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click **Sites and Controllers**. Continue drilling down until you can select the desired controller.
2. Position the cursor on the **Devices** tab, and then click **Zones** in the menu that displays.
3. In the list of zones, find the row for the zone that you want to change the settings for, and then click the > at the end of the row. The Zone Properties page displays.
4. Click **Edit** in the lower-right corner of the page.
5. Perform any of the following tasks:
  - Update the zone description - Click in the **Description** field and type a new description.  
**Note:** Limit the number of characters in the Description to 32 characters (BaseStation 1000) or 42 characters (BaseStation 3200). If you enter a longer description, the controller will automatically shorten it, and then pass the new version back to BaseManager.
  - Enable or Disable the zone - A check mark in the box means that the zone is enabled. Click in the box to set the check mark or remove the check mark.
  - Update the Design Flow - Type the number of gallons per minute that is expected for this zone based on the physical components and topology used in construction.
6. Click the > to expand the **Additional Zone Properties**.  
**Note:** If you are planning to use Baseline's smart watering technology, you need to complete all fields in the Additional Zone Properties. The irrigation controller uses this data to perform calculations and provide the runtimes, cycle times, and soak times for your zones.
7. Update the following fields in the **Irrigation Information** section:  
**Sprinkler Type:** Click the drop-down arrow in the field and from the list that displays, click the type of device used in this zone for distributing water in this zone.  
**Note:** Click the Info button next to the Sprinkler Type field to review the list of sprinkler types along with their precipitation rates and distribution uniformity percentages.  
If the list does not include the exact device used in this zone, choose **Custom**, and then change the number in the **Application Rate** field to indicate the rate (in inches per hour) at which water is applied to this zone by the sprinkler type. For a Custom entry, you can also change the number in the **Distribution Uniformity** field if needed.
8. Update the following fields in the **Landscape Information** section:  
**Use Basic Plant Information:** Select this option to use the root depth, crop coefficient, and sun exposure for your zone runtime calculations.

**Use Detailed Plant Information:** Select this option to include the species factor, root depth, density factor, and micro climate factor in your zone runtime calculations. To get the best results from these settings, we suggest that you have a working knowledge of weather-based watering science.

**Use Monthly Values:** Select this option to enter values for each month in specific fields based on your selection of Basic or Detailed Plant Information.

**Species Factor (displays when Use Detailed Plant Information is selected):** The Species Factor ( $K_s$ ) is a value used to adjust reference evapotranspiration to reflect a specific plant species. The Species Factor is a component of the Landscape Coefficient ( $K_L$ ).

Enter a high value for plant material that needs a lot of water or a low value for those species that need little water.

Species factor lists have been developed for some regions. Try searching on the Internet to find a list for your region. A general example of the settings is given below.

	High	Moderate	Low	Very Low
Species Factor	0.7 – 0.9	0.4 – 0.6	0.1 – 0.3	<0.1

**Root Depth:** Root Depth refers to the length of the section of a plant's dense roots, which draw most of its water and nutrients. Increasing the root depth increases the amount of water that can be applied during one watering event.

**Density Factor (displays when Use Detailed Plant Information is selected):** The Density Factor ( $K_d$ ) refers to the amount of leaf area in the planting in this irrigation zone. More leaf area typically means greater water loss for the planting. This factor changes as the landscape matures. The Density Factor is a component of the Landscape Coefficient ( $K_L$ ).

	High	Moderate	Low
Density Factor	1.1 – 1.3	1.0	0.5 – 0.9

**Micro Climate Factor (displays when Use Detailed Plant Information is selected):** The Micro Climate Factor ( $K_{mc}$ ) is a value used to adjust reference evapotranspiration to reflect the specific climate of an area. Use this factor to indicate whether the area is cool, shady, and protected or hot, sunny and windy or an average area that is somewhere in between. The Micro Climate Factor is a component of the Landscape Coefficient ( $K_L$ ).

Enter a high value for areas that are exposed to direct sun (or reflective heat) and high winds. Enter a low value for areas in shade and/or areas that are protected from the wind.

	High	Moderate	Low
Micro Climate Factor	1.1 – 1.4	1.0	0.5 – 0.9

**Crop Coefficient (displays when Use Basic Plant Information is selected):** The Crop Coefficient is a value used to modify reference evapotranspiration (ET<sub>o</sub>) to reflect the water use of a particular plant or group of plants. If you increase the Crop Coefficient value, the irrigation system will water longer.

**Sun Exposure (displays when Use Basic Plant Information is selected):** Select the amount of sun this zone receives during the day.

9. Update the following fields in the **Soil Information** section:

**Soil Type:** Select the soil type that matches the soil in this zone. The soil type you choose directly affects cycle time. Each soil type in the drop-down list has a default intake rate.

**Note:** Click the Info button next to the Soil Type field to review the list of soils along with their intake rates. This list is taken from the 8th Draft Testing Protocol Rev. 3 – September 2008 © 2008 Irrigation Association.

**Allowable Depletion:** When the soil moisture content reaches the Allowable Depletion level, irrigation needs to start. In most cases, the maximum allowable depletion level is just before the plants begin to show visible signs of stress.

**Slope:** Select the option that represents the angle of the slope in this zone.

10. Review the values in the **Suggested Irrigation Schedule for this Zone**.

**Calculated Cycle Time:** Uses the zone properties to determine how long you can water before there will be runoff.



**Calculated Soak Time:** Uses the zone properties to determine how long the applied water needs to soak into the soil before more water can be applied.

11. (Optional) Enter any additional information about the zone in the **Notes** box.
12. Click **Save** at the bottom of the page.

## Configuring a Program to Use WeatherAccess (BaseStation 1000)

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If you have not added any programs on your BaseStation 1000, refer to Adding a Program in the BaseManager online help, or refer to Setting Up Programs in the BaseStation 1000 user manual.


1. Perform one of the following options:
  - If you have a new BaseStation 1000 irrigation controller, skip to step 2.
  - If you are converting an installed BaseStation 1000 irrigation controller to WeatherAccess, update your controller to the latest firmware version. Refer to Updating the Firmware through BaseManager in the BaseManager online help or in the BaseStation 1000 user manual.
2. In BaseManager, make sure that the BaseStation 1000 controller on which you want to configure a program is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click **Sites and Controllers**. Continue drilling down until you can select the desired controller.
3. Make sure that you have a weather-station assigned to this controller. Refer to Assigning a Weather Station to an Irrigation Controller on page 7.
4. Click the **Programs** tab. The programs on the controller are shown in the list.
5. Click the program that you want to configure for WeatherAccess. The Program details page displays.
6. Click **Edit** in the lower-right corner of the page.
7. Click the **Enable Weather-based Watering** box to add a check mark. Notice that the weather icon  displays in the Runtime column and the field is grey and no longer allows user input. The runtime is a calculated value based on the zone settings and the weather station data.

**Note:** To learn more about the possible values that display in the Runtime field, refer to the Conditions that Affect the Runtime for WeatherAccess on page 13.
8. If you want to use calculated cycle and soak time values based on the hydrozone settings, click the drop-down arrow in the **Cycle Type** field and select **Zone Soak Cycles**. In the rows for the zones, click the icon add the calculated cycle and soak time values into the fields.

**Note:** When you enable WeatherAccess in BaseManager, you will see that the Enable/Disable ET option is selected (enabled) in the Program Setup menu on the BaseStation 1000 controller.
9. Click **Save** at the bottom of the page.

## Enabling a Zone to Use WeatherAccess (BaseStation 3200)

When you configure a zone to use WeatherAccess, you do not enter minutes in the Water Time field in the Zone Setup screen on the controller. Instead, the time is calculated based on the zone settings, weather, and rainfall data received from BaseManager for the previous day. The calculation is performed for each zone that is enabled for WeatherAccess.


1. Perform one of the following options:
  - If you have a new BaseStation 3200 irrigation controller, skip to step 2.
  - If you are converting an installed BaseStation 3200 irrigation controller to WeatherAccess, update your controller to the latest firmware version. Refer to Updating the Firmware through BaseManager in the BaseManager online help or in the BaseStation 3200 user manual.
2. Make sure that the controller that you want to configure a zone to use WeatherAccess on is displayed in the BaseManager footer. To select a different controller, click the **Menu** icon  in the upper-left corner of the BaseManager page, and then click **Sites and Controllers**. Continue drilling down until you can select the desired controller.
3. Make sure that you have a weather-station assigned to this controller. Refer to Assigning a Weather Station to an Irrigation Controller on page 7.
4. Click the **Programs** tab. The programs on the controller are shown in the list.

**Note:** If you have not added any programs on your BaseStation 3200, refer to Adding a Program in the BaseManager online help or Setting Up Programs in the BaseStation 3200 user manual.

5. Click the program that you want to configure for WeatherAccess. The Program details page displays.
6. Click **Edit** in the lower-right corner of the page. The Program Edit page displays.
7. Add zones to the program.
8. Configure the following zone settings:

**Mode:** Set the mode to Timed, Primary or Linked. For more information about Primary and Linked zones, refer to Setting Up a Primary Zone and Linking Zones in the BaseStation 3200 user manual.

**Note:** When you set the zone mode to Primary, the row expands to show additional fields. For weather-based Primary zones, set the Strategy to Timed. You can also assign a soil moisture sensor to the zone, which will enable you to keep track of soil moisture readings and create graphs for the zone.

**Enable Weather Based Watering:** Click in the box to add a checkmark. Notice that the weather icon  displays in the Runtime column and the field no longer allows user input. The runtime is a calculated value.

**Note:** To learn more about the possible values that display in the Runtime field, refer to the Conditions that Affect the Runtime for WeatherAccess on page 13.



**Note:** When you enable WeatherAccess in BaseManager, you will see that the Use ET Deficit Water Times field is set to YES in the Zone Setup screen on the BaseStation 3200 controller.

**Calculate Cycle and Soak Time:** Click the icon add the calculated cycle and soak time values into the fields for this zone.

9. Set up the start times and water windows for the program.

**Note:** Weather data used for these calculations is collected by BaseManager between 12:30AM and 12:55AM for the previous day.

10. Click **Save** at the bottom of the page.

## Conditions that Affect the Runtime for WeatherAccess

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- If the calculated runtime is less than 4 minutes, the zone will not water. The Water Time field in the Zone Setup screen on the BaseStation 3200 controller, and Zone Runtimes screen on the BaseStation 100 controller, as well as the Runtime field on the Programs tab in BaseManager will display zeroes.
- If a Primary zone on a BaseStation 3200 has a calculated runtime of less than four minutes, all of its linked zones will have their times set to zero also, even with a 200% tracking ratio (or greater).
- The seasonal adjustment for the program will be applied to this runtime. If the resulting runtime is less than four minutes, the zone will not be watered.
- The minimum cycle time is four minutes. If a zone has a cycle time of less than four minutes, and is then made into a WeatherAccess zone, the cycle time will be increased to four minutes. If the last cycle time for a zone is less than four minutes, it will not run. The zone will be set to done, and the remaining time will be added to the next run.

## Glossary of Terms

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application rate	The rate at which water is applied to an area within the landscape by an irrigation system. In order to determine proper duration of watering, it is essential that you know the application rate for each watering zone. Also known as precipitation rate.
biSensor™	Baseline's patented digital Time Domain Transmission (TDT) soil moisture sensor
crop coefficient (K <sub>c</sub> )	A value for specific crops that can be used to calculate ETC when field data is not available
crop evapotranspiration (ETc)	Specific crop moisture requirements as determined by lysimeter studies or calculated by formulas
density factor (K <sub>d</sub> )	A value that represents the amount of leaf area in the hydrozone. An area of dense planting will typically lose more water than an area of sparse planting.
distribution	The precipitation rate for different areas of the landscape based on head types, spacing, layout topology, pressure, etc. Having a uniform distribution is very important.
distribution uniformity (DU)	A measure of how evenly a sprinkler system applies water to any specific zone or area. High distribution uniformity means that the measured precipitation rate at any point in a zone will be roughly the same. Low distribution uniformity means that some areas get much more water per minute of water time than others.
ET-based watering	See weather-based watering
ET <sub>o</sub>	See reference evapotranspiration
evaporation	Loss of water as vapor from the soil surface or from moisture on the surface of a leaf. Differs from transpiration in that the water does not pass through the plant parts.
evapotranspiration (ET)	The process of transferring moisture from the earth to the atmosphere by evaporation of water and transpiration from plants.
field capacity	This is the maximum water holding capacity of the soil. In other words, the level of soil moisture left in the soil after drainage of the gravitational water. Irrigation to levels above field capacity will result in runoff or drainage as gravitational water.
hydrozone	A grouping of plants that have similar water requirements and can be watered the same
infiltration	The process by which water passes through soil – the liquid permeates the soil by passing through the pores in the soil

landscape coefficient ( $K_L$ )	A formula that uses the values for species factor ( $K_s$ ), density factor ( $K_d$ ) and microclimate factor ( $K_{mc}$ ) to estimate the crop coefficient
linked zone	Within a zone group, there is one primary zone and all other zones are then "linked" to the primary and will get their programming information from the primary (water time, program, schedule, etc.)
maximum allowed depletion (MAD)	When the soil moisture content reaches this level, irrigation needs to start. In most cases, the maximum allowed depletion level is just before the plants begin to show visible signs of stress.
microclimate	The climate of a specific location within a landscape. Variations in climate are influenced by subtle differences in temperature, humidity, and wind exposure. Microclimates can have a significant impact on plant water needs.
microclimate factor ( $K_{mc}$ )	A value used to represent the microclimate in a particular hydrozone. If the area is open and not subject to extraordinary winds or reflected heat, the microclimate factor is "average." A hydrozone that is shaded for most of the day and protected from wind is "low." A hydrozone that is surrounded by heat absorbing or reflective surfaces, or exposed to windy conditions is "high."
permanent wilting point	When soil moisture content reaches this level, plants can no longer get water from the soil, and they will wilt and die
precipitation rate	See application rate
primary zone	The zone within a scheduling group that all other linked zones are linked to. Changing the programming on this zone will adjust the programming on all linked zones, resulting in saved time and consistency. If you are using a biSensor, the primary zone is the zone that the sensor is connected to.
program	A program is a controller programming concept used to organize watering events. Each program can have different schedules, water days, watering strategies, master valves, etc.
reference evapotranspiration (ET <sub>o</sub> )	Reference ET applies weather and crop data to accepted formulas in order to estimate evapotranspiration for a range of vegetation and surface conditions.
runoff	When the soil moisture content is at the saturation level, any excess water from rain, snow melt, or irrigation drains to a low point in the landscape
saturation	When the soil moisture content is at this level, nearly all of the spaces between soil particles are filled with water. After a soil has reached saturation, it does not become more saturated; although, in some situations where water is trapped, it can become flooded.

scheduling group	A group of one or more zones that have been linked together for irrigation scheduling. A scheduling group must have one primary zone, and may have one or more linked zones. Irrigation for all zones in a scheduling group will follow the watering strategy of the primary zone, but actual water times and soak/cycle behavior will scale as programmed relative to the primary zone.
soak cycle	When a zone waters using soak cycles, the total water time includes periods of watering interspersed with periods of non-watering times (soak times).
soil-moisture content	The ratio of the volume of contained water in a soil compared with the entire soil volume
soil-moisture deficit	When soil dries (for example, by evaporation), the measurable shortage of water in the soil is known as the soil-moisture deficit. It also refers to the amount of water needed to return to field-capacity moisture content.
species factor ( $K_s$ )	A value that represents the water needs of a particular plant species. The values are based on water use studies for landscape species and on agricultural data
time domain transmission (TDT)	A measurement of how much the electrical signals in the soil are slowed down by the presence of water
timed zone	Any zone programmed to water on a time/day schedule, rather than on a smart irrigation schedule
transpiration	The loss of water vapor from parts of plants. Water is lost primarily from the pores on the leaves but also from stems, flowers, and roots
valve	A device that opens to allow water to flow to the sprinkler heads or emitters in a zone. It closes to halt watering for that zone.
water window	The time available for watering through an irrigation system. Typically, all days and times would be available for watering unless there are watering restrictions or you need to set aside a time for mowing.
WeatherAccess™	Baseline's implementation of weather-based watering
weather-based watering	A watering methodology that uses the principles of evapotranspiration to water when needed rather than on an established schedule. Also called ET-based watering.
zone	A designated area of landscaping that is watered by a specific valve

## Appendix

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The following examples show the how the six zones for the EPA SWAT test would be configured in BaseManager.

### Example Zone 1 (Using Basic Plant Information)

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Custom
<b>Application Rate:</b>	1.6 in/hr
<b>Distribution Uniformity:</b>	55%
<b>Landscape Information</b>	
<b>Use Basic Plant Info:</b>	Yes
<b>Use Monthly Values</b>	Yes (copy from K <sub>c</sub> table below)
<b>Root Depth:</b>	10 in
<b>Plant Type:</b>	Cool Season Turf Grass (Fescue)
<b>Sun Exposure:</b>	Shade Most of the Day
<b>Soil Information</b>	
<b>Soil Type:</b>	Loam
<b>Allowable Depletion:</b>	50%
<b>Slope:</b>	6%

### Example Zone 2 (Using Basic Plant Information)

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Popup Spray Heads
<b>Application Rate:</b>	1.6 in/hr
<b>Distribution Uniformity:</b>	60%
<b>Landscape Information</b>	
<b>Use Basic Plant Info:</b>	Yes
<b>Use Monthly Values:</b>	Yes (copy from K <sub>c</sub> table below)
<b>Root Depth:</b>	8.1 in
<b>Plant Type:</b>	Warm Season Turf Grass (Bermuda)
<b>Sun Exposure:</b>	Sunny All Day
<b>Soil Information</b>	
<b>Soil Type:</b>	Silty Clay
<b>Allowable Depletion:</b>	40%
<b>Slope:</b>	10%

**Example Zone 3 (Using Detailed Plant Information)**

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Custom
<b>Application Rate:</b>	1.4 in/hr
<b>Distribution Uniformity:</b>	70%
<b>Landscape Information</b>	
<b>Use Detailed Plant Info:</b>	Yes
<b>Use Monthly Values:</b>	No
<b>Species Factor:</b>	0.5 (ground cover)
<b>Root Depth:</b>	20 in
<b>Density Factor:</b>	1.0
<b>Micro Climate Factor:</b>	1.1
<b>Soil Information</b>	
<b>Soil Type:</b>	Loamy Sand
<b>Allowable Depletion:</b>	50%
<b>Slope:</b>	8%

**Example Zone 4 (Using Detailed Plant Information)**

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Custom
<b>Application Rate:</b>	1.4 in/hr
<b>Distribution Uniformity:</b>	75%
<b>Landscape Information</b>	
<b>Use Detailed Plant Info:</b>	Yes
<b>Use Monthly Values:</b>	No
<b>Species Factor:</b>	0.5 (woody shrubs)
<b>Root Depth:</b>	28 in
<b>Density Factor:</b>	1.0
<b>Micro Climate Factor:</b>	0.8
<b>Soil Information</b>	
<b>Soil Type:</b>	Sandy Loam
<b>Allowable Depletion:</b>	55%
<b>Slope:</b>	12%

**Example Zone 5 (Using Detailed Plant Information)**

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Surface Drip
<b>Application Rate:</b>	0.2 in/hr
<b>Distribution Uniformity:</b>	80%
<b>Landscape Information</b>	
<b>Use Detailed Plant Info:</b>	Yes
<b>Use Monthly Values:</b>	No
<b>Species Factor:</b>	0.5 (trees)
<b>Root Depth:</b>	25 in
<b>Density Factor:</b>	1.1
<b>Micro Climate Factor:</b>	1.1
<b>Soil Information</b>	
<b>Soil Type:</b>	Clay Loam
<b>Allowable Depletion:</b>	50%
<b>Slope:</b>	2%

**Example Zone 6 (Using Basic Plant Information)**

<b>Irrigation Information</b>	
<b>Sprinkler Type:</b>	Rotors
<b>Application Rate:</b>	0.35 in/hr
<b>Distribution Uniformity:</b>	65%
<b>Landscape Information</b>	
<b>Use Basic Plant Info:</b>	Yes
<b>Use Monthly Values:</b>	Yes (copy from K <sub>c</sub> table below)
<b>Root Depth:</b>	9.2 in
<b>Plant Type:</b>	Warm Season Turf Grass (Bermuda)
<b>Sun Exposure:</b>	Sunny All Day
<b>Soil Information</b>	
<b>Soil Type:</b>	Clay
<b>Allowable Depletion:</b>	35%
<b>Slope:</b>	20%

**Crop (Turf) Coefficients (Kc)**

Month	Full Sun		75% Shade	
	Fescue	Bermuda	Fescue	Bermuda
January	0.61	0.52	0.41	0.35
February	0.69	0.64	0.46	0.43
March	0.77	0.70	0.52	0.47
April	0.84	0.73	0.56	0.49
May	0.90	0.73	0.60	0.49
June	0.93	0.71	0.62	0.48
July	0.93	0.69	0.62	0.46
August	0.89	0.67	0.60	0.45
September	0.83	0.64	0.56	0.43
October	0.75	0.60	0.50	0.40
November	0.67	0.57	0.45	0.38
December	0.59	0.53	0.40	0.36
Zones	1*	2 & 6	-	-