Module 4 – Irrigation. This presentation will provide an overview of irrigation systems and the effects of irrigation on volatilization, leaching, runoff, excessive withdrawal and water quality issues.

In addition, cultural practices that affect over or under irrigation on plants and fertilizer needs; effects of irrigation water quality and reclaimed water issues.

Last, we demonstrate troubleshooting irrigation systems and discuss the importance of proper repair to maintain distribution uniformity to prevent spot leaching and runoff of fertilizers resulting in more fertilizer use and more pollution.

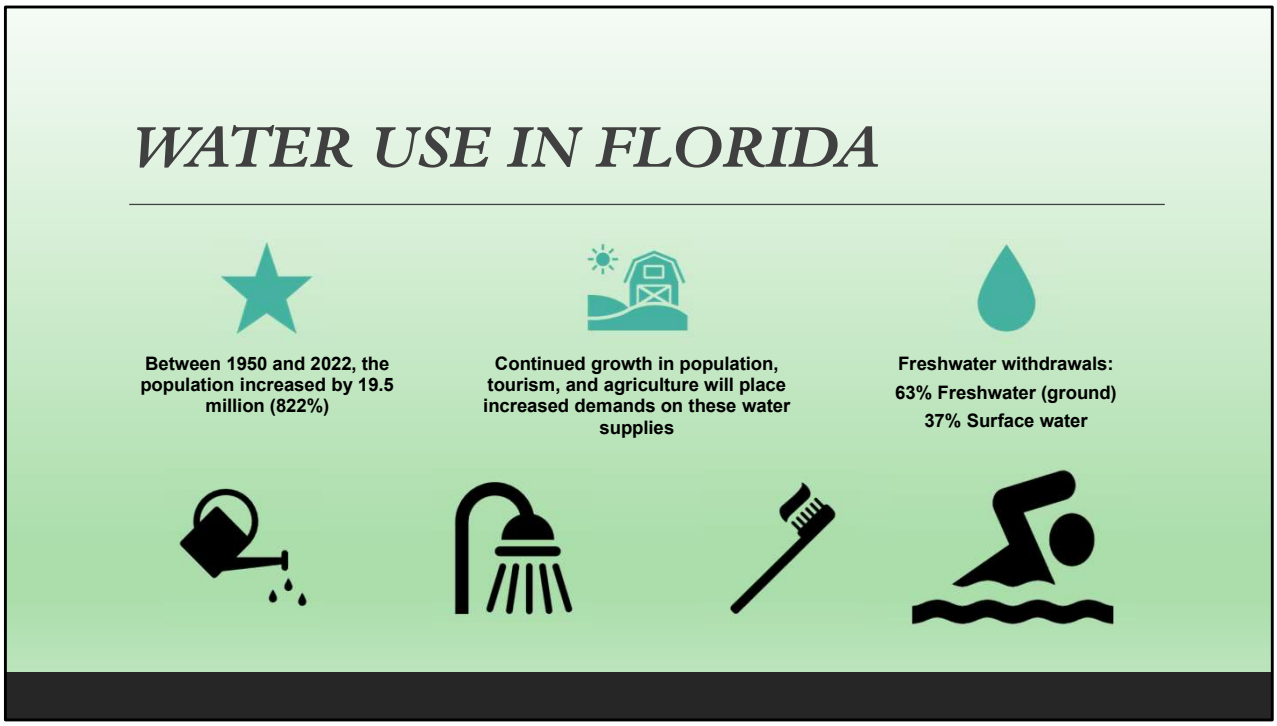
At the end of this module you will be able to:

- Explain how Florida laws regarding irrigation systems affect landscape professionals
- Describe the components of an irrigation system.
- Explain irrigation effects on fertilizing practices
- Identify irrigation equipment maintenance needs
- Identify irrigation BMPs to avoid nonpoint source pollution

Irrigation may not be your job, but it can have a big effect on it!

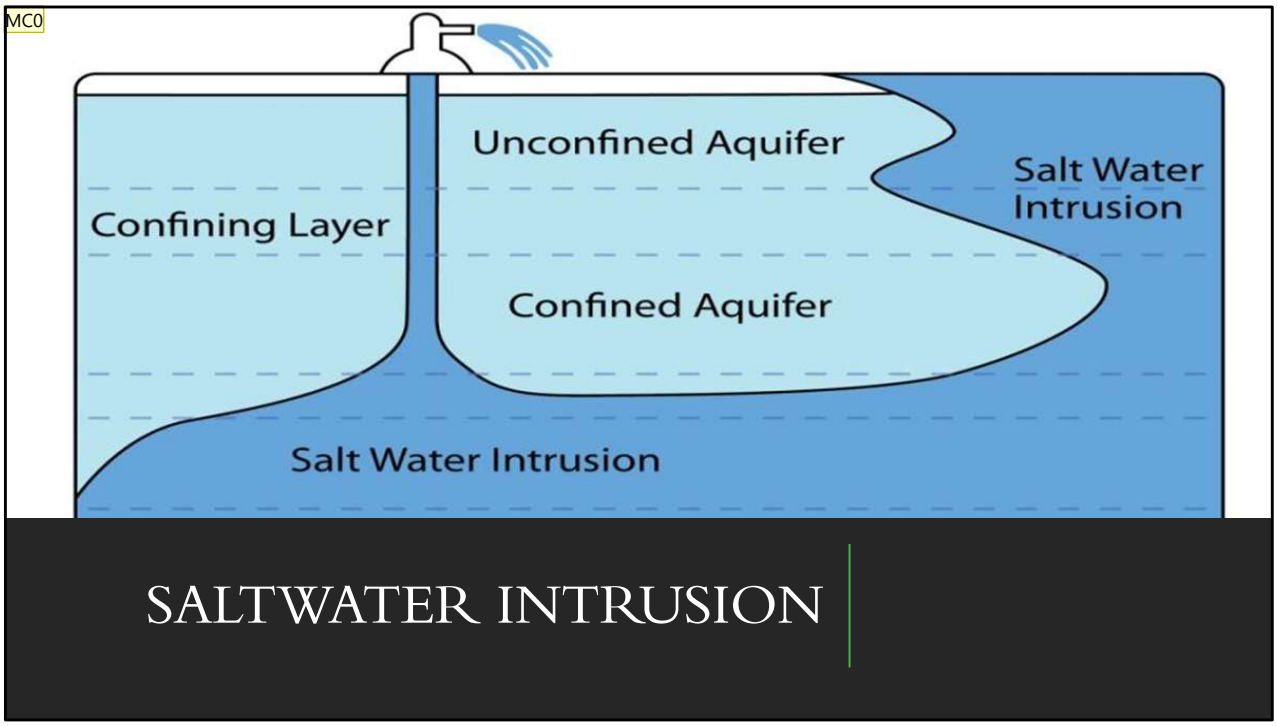
"Irrigation may not be your job, but it can have a big effect on it!" Today, water conservation is becoming an important part of Florida's overall water management program. Saltwater intrusion and pollutants threaten Florida's limited water resources, and increasing urbanization and periodic drought are placing greater demands on water supplies. For these reasons, nursery growers, landscapers, and homeowners should be conscious of water use and should strive to minimize waste and consumption of water. One of the best means of conserving water is to design or modify the landscape to reduce its water requirements.

Good water conservation includes performing a regular maintenance schedule, and monthly schedule adjustment. Irrigation maintenance includes inspection, adjustment, and cleaning equipment.



Water is among Florida's most valued resources. The State has more than 1,700 streams and rivers, 7,800 freshwater lakes, 700 springs, 11 million acres of wetlands, and underlying aquifers yielding quantities of freshwater necessary for both human and environmental needs (Fernald and Purdum, 1998). Although renewable, these water resources are finite, and continued growth in population, tourism, and agriculture will place increased demands on these water supplies.

Between 1950 and 2005, the population of Florida increased by 19.5 million (822 percent). Ground water accounted for nearly 63 percent of freshwater withdrawals, and surface water accounted for the remaining 37 percent of the freshwater in 2015.



Aquifer depletion is a serious problem in Florida and the United States. Coastal communities in the state are often affected as our increasing population demands more water. As more fresh water is pumped and its supply is depleted, salt water from the ocean is drawn into the wells, resulting in contamination.

Also, the depletion of deeper aquifers may be permanent where the weight of overlying sediments causes the aquifer to compress as the water is pumped out. The aquifer would therefore never again be fully recharged even if pumping ceased, because its capacity to store water has been reduced.

Salt water intrusion occurs in areas of high water demand such as large municipalities and agricultural operations that require heavy irrigation.

RESPONSIBLE IRRIGATION MANAGEMENT

- **Saves water**
- **Improves plant health and water quality**
- **Reduces need for fertilizers and/or chemical treatments**
- **Protects your client's investment**

Responsible irrigation management:

- Saves water
- Improves plant health and water quality
- Reduces need for fertilizers and/or chemical treatments
- Protects your client's investment

IRRIGATION MANAGEMENT BMPS

- **Be familiar with the system**
- **Know the water needs of plants**
- **Recognize irrigation problems**
- **Act to correct problems**

Irrigation management, knowing when and how much to irrigate is the cornerstone of water conservation and reducing nonpoint source pollution. It encompasses the amount of water applied and the frequency of application. To prevent excess water use that could lead to chemical leaching and runoff, fungal infestation, and disease; irrigation scheduling should take into account plant water requirements, recent rainfall, recent temperature extremes, and soil characteristics.

Visually observe site problems associated with irrigation (i.e., wet, dry spots, excessive weeds in specific location) or damaged system components (leaks, broken equipment), which should be reported to the client.

Repair any irrigation devices broken while servicing a site. Replacement parts should have the same characteristics as the original components.

LANDSCAPE IRRIGATION LAW

Florida Statute 373.62

FUNCTIONING RAIN SHUTOFF DEVICE :

- **Rain Sensor Switches or other devices, regardless of the age of the system, are required by law to be maintained and operational.**
- **Must install new ones or repair the existing ones.**
- **Confirm proper operating conditions.**

Landscape Irrigation Law: A licensed contractor who installs or performs work on an automatic landscape irrigation system must test for the correct operation of each inhibiting or interrupting device or switch on that system. If such devices or switches are not installed in the system or are not in proper operating condition, the contractor must install new ones or repair the existing ones and confirm that each device or switch is in proper operating condition before completing other work on the system.

Florida statute 373.62 (the old rain sensor law) has been revised to require "---properly installed, maintained and operated technology that interrupts the operation of an automatic landscape irrigation system during periods of sufficient moisture".

Irrigation systems are required to have rain shut-off devices which disengage automatic irrigation after an adequate rain event.
Rain Sensor Switches or other devices, regardless of the age of the system, are required by law to be maintained and operational.

IRRIGATION SYSTEM

MAIN COMPONENTS:

1. WATER SUPPLY
2. WATER CONVEYANCE
3. DISTRIBUTION DEVICE

Irrigation system design is complex and should be performed by trained professionals. An irrigation system consists of three main components: water supply, water conveyance (piping) and a distribution device. The proper design and installation of these components optimizes their use and decreases any off-site impacts. The design must also account for different site characteristics and topography.

An irrigation system needs to be designed to meet a site's peak water requirements. In addition, to prevent irrigation runoff, a system's application rate must not exceed the ability of the soil to absorb and retain the water applied during any one application. The irrigation system should also have enough flexibility to adapt to various water demands and local restrictions.

SYSTEM DESIGN IRRIGATION BMPS

- **Design operating pressure must not exceed the source pressure.**
- **Use devices designed for optimum uniform coverage**
- **Should not irrigate non-targeted areas**

Design operating pressure must not exceed the source pressure. The design operating pressure should account for low pressure during periods of high use (i.e., mornings) and for project build out when all of a development's landscaping is in place.

The distribution devices should be designed for optimum uniform coverage. Attention should be given to the direction and application of the distribution device; it should not include the irrigation of non-planted areas (such as driveways, parking lots, roads, sidewalks, underneath roof overhangs, and natural buffer zones).

WATER SUPPLY

- Potable water
- Groundwater
- Reclaimed water
- Surface water

It is important to know the source of your irrigation water supply. Potable water is safe for human consumption, and considered higher quality water. Most of Florida's potable water comes from well water that is pumped from deep underground aquifers.

Water from wastewater treatment plants is known as reclaimed wastewater; it is disinfected, but may contain high levels of sodium chloride, nitrogen and phosphorus. Water collected in or held in stormwater detention/retention reservoirs is commonly referred to as surface water, and public health issues and filtration may become an issue for use.

RECLAIMED WATER SUPPLY

Purple pipes

"Do Not Drink This Water"

- Monitor nutrient content
- Avoid over-irrigation
- Monitor salinity
- Maintain filtration
- Cross-connections and backflow devices

The Florida Legislature has found that reclaimed water provided by domestic wastewater treatment plants is safe for use in the landscape only. So, in an effort to promote and encourage water conservation, Water Management Districts now permit the use of reclaimed water. More and more counties and cities are accessing reclaimed water supplies for use on commercial property, athletic fields and residential landscapes. There are several precautions that come with the use of reclaimed water.

Reclaimed water piping, heads, valves, fixtures, etc. are required by law to be color-coded purple, and labeled "Do not drink this water."
Routinely monitor nutrient content for phosphorus and nitrogen. Nutrients may be highly variable, so confirm nutrient levels with the wastewater treatment plant manager. Advise caution to clients and other users: over-irrigation or off target spray may be a direct discharge to surface water as well as leaching both the included nutrients and any fertilizers or pesticides in the soil.

In addition, monitor salinity levels to prevent plant injury, emitter clogging and

premature wearing of irrigation components. Application of freshwater may be needed to flush accumulated salt from affected soils.

Irrigation managers should also pay close attention to all cross-connection controls and backflow prevention devices. Cross connection is a connection or potential connection between the drinking water system and any other system that may contain reclaimed water or other harmful substances that could enter the drinking water supply. A cross connection requires a backflow device to prevent undesirable reverse of water flow into the drinking water supply.

BACKFLOW DEVICE:

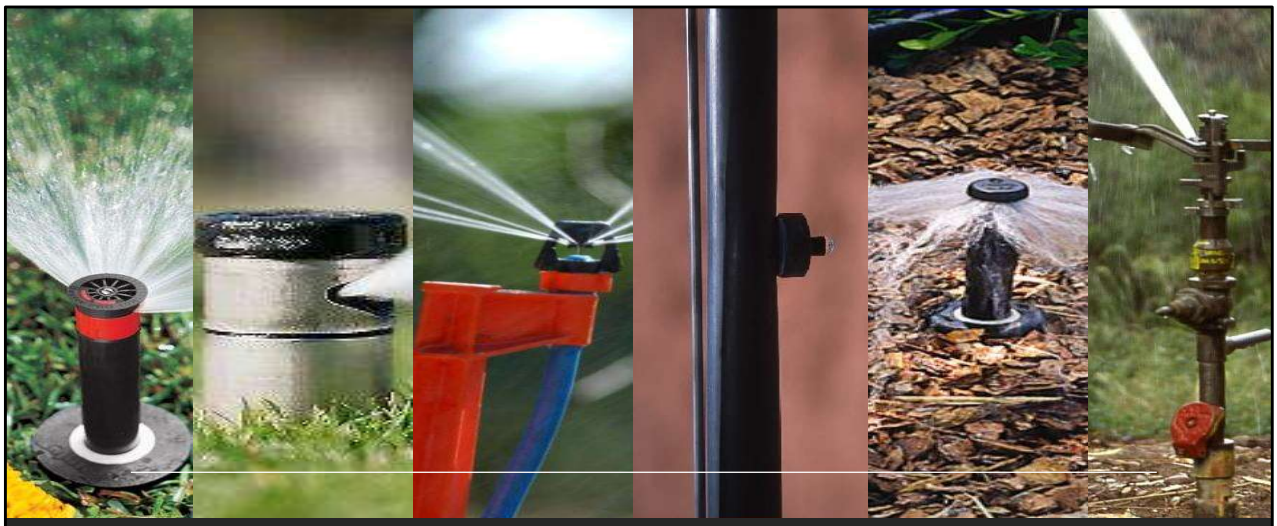
- **Prevents contamination**
- **Metered systems**
- **Annual inspection**
- **Check local codes**

Backflow devices are required on all metered systems. Backflow devices must be installed to prevent nutrients and pesticides from draining back into the water source. The backflow device is a mandatory device and must function unfailingly at all times. Annual inspection and maintenance by a certified backflow technician is essential to the performance and safety provided by this device. Check with your local codes; it differs even within states.



ELECTRIC VALVES

The term "valve" applies to a variety of devices for controlling the flow of liquid. Various valves allow for on-off control, modulation of the flow rate through the system, and prevention of back flow. They can also be used for pressure relief or as a safety device. In general, valves can vary from simple manual on-off devices to sophisticated control equipment which acts as metering instruments and delivers predetermined amounts of water to the system.



DISTRIBUTION DEVICES:

How many can you identify?

Let's take a moment to identify the following left to right:

pause

Spray (Pop-up)

Pause

Turfgrass Rotor

Pause

micro-spray

Pause

Drip

Pause

Bubbler

Pause

Impact Rotor

MICRO IRRIGATION EMITTERS

Drip Tubing

- Ideal when precision is desired or for narrow plantings
- Minimal lateral water movement
- Clogging or leaks may not be apparent
- Check filters if inadequate watering is suspected

With drip emitters, water moves laterally in sand only 10 to 12 inches from the emitter. Drip emitters are ideal when such precision is desirable or for narrow strip plantings, such as along hedge rows. Because drip emitters are sometimes placed under mulch or buried in the soil, clogging may occur that is difficult to detect. Check filters if inadequate watering is suspected on a system that worked well in the past. Because the action of drip emitters is not readily apparent, it is also hard to know whether the system is irrigating excessively due to a hole in the tubing or some other problem. Regular inspection is required to make sure that the drip emitters and the overall system are functioning as they should.

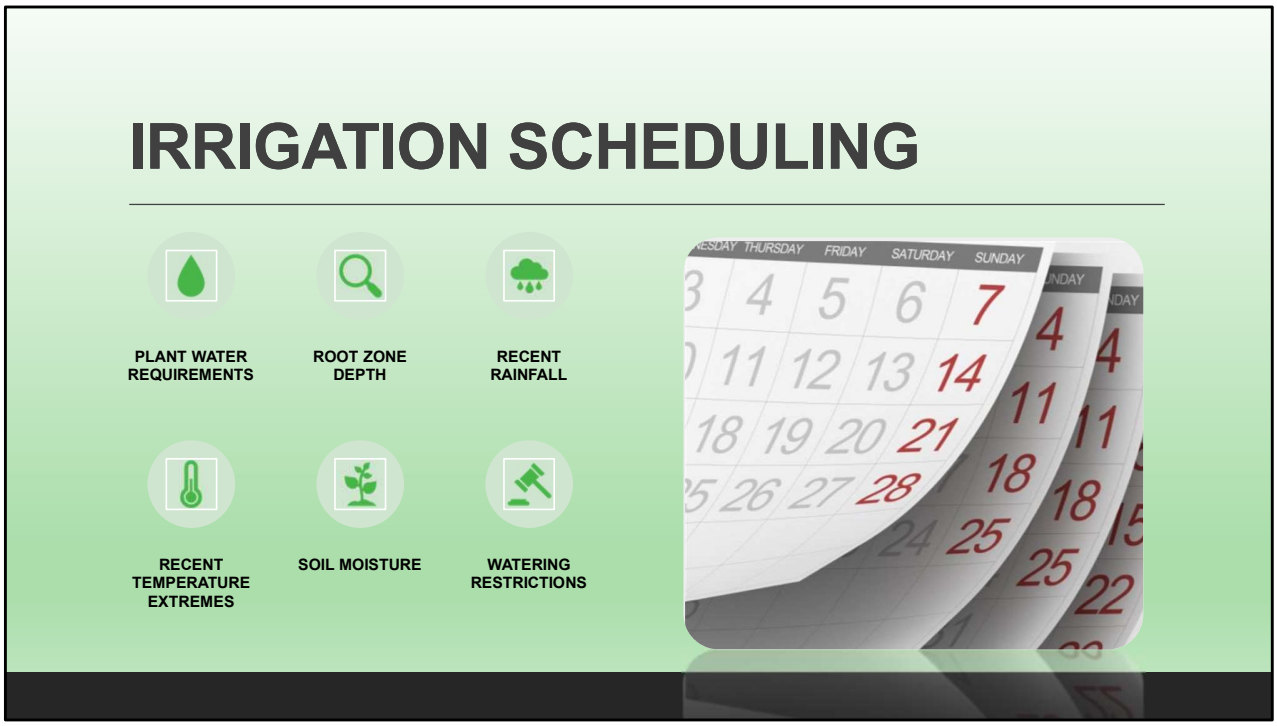
MICROSPRAYS/BUBBLERS

For more information, please visit: https://edis.ifas.ufl.edu/publication/AE524

IRRIGATION SCHEDULING

WHEN TO IRRIGATE AND HOW MUCH TO IRRIGATE

Transition Slide: Next we will discuss irrigation scheduling, knowing when and how much to irrigate.



Irrigation scheduling is based on the water needs of particular plants in the landscape, as influenced by the environment and other site-specific factors such as soil, root zone depth and local weather conditions.

Plant irrigation requirements will differ based on a plant's ability to extract soil moisture in relation to root zone depth and its physiological ability to deal with reduced availability of moisture. Plants require more water during seed, flower, and fruit production, but will not require very much when they are dormant. During the colder months, or those with shorter periods of daylight, most turfgrasses and landscape plants are not actively growing, thus use less soil moisture and may not require irrigation.

Be sure to adjust irrigation scheduling to comply with water management district and government restrictions.

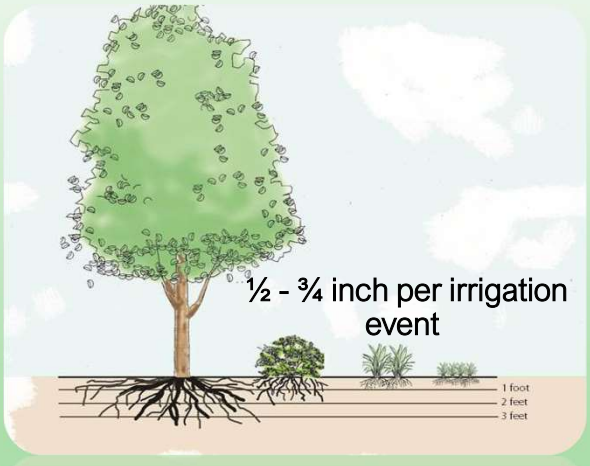
PLANT WATER REQUIREMENTS

EFFECTIVE RAINFALL

- Total rainfall minus runoff, evaporation, and deep percolation
- Contact with the plant roots

NATIVE FLORIDA SOILS

- Low water holding capacity
- 1 inch of rainfall or irrigation applied wets approximately 12 inches of sandy soil.



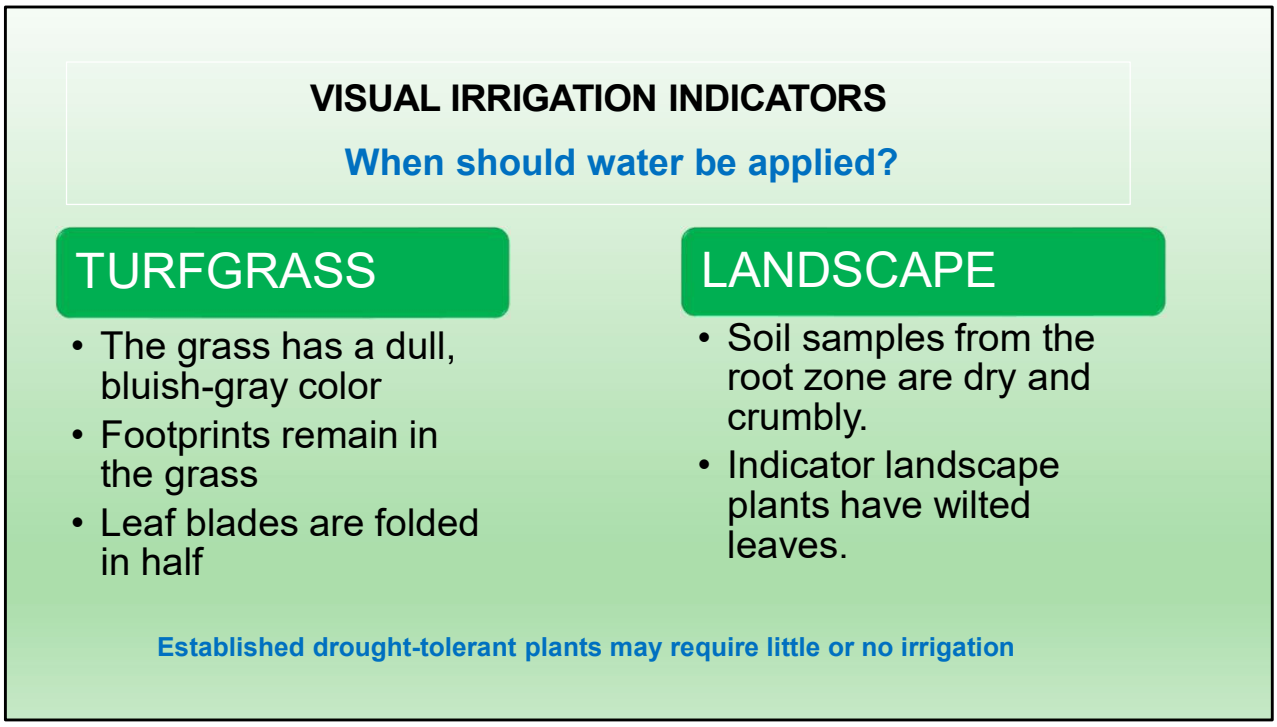
Total rainfall is not the same as effective rainfall. Effective rainfall is the total rainfall minus runoff, evaporation, and deep percolation; only the water retained in the root zone can be used by the plants, and represents what is called the effective part of the rainwater. The term effective rainfall is used to define this fraction of the total amount of rainwater useful for meeting the water need of the plant.

Florida soils generally have low water holding capacity, so a two-inch rain may have little more effect on reducing landscape irrigation than a typical irrigation event in any given month. Only water that is in contact with the roots can be absorbed by the plant.

A well-managed turf system will develop most of its roots in the first 12 inches of the soil. 1 inch of rainfall or irrigation applied will wet approximately 12 inches of sandy soil. Therefore, no more than 1/2 to 3/4 inch of water should be applied for a single irrigation event.

The exact amount of irrigation needed for each event will depend on a plant's

needs for growth, fruiting, and dormancy. Using an irrigation schedule with rain and/or soil moisture sensors can help prevent wasteful over-irrigation and the leaching of fertilizers or pesticides, as well as promote root development for drought conditions.



When mechanical or electronic devices are not available, visual indicators can be used as guidelines to determine the need for irrigation. It is important to note: established drought-tolerant plants may require little or no irrigation.

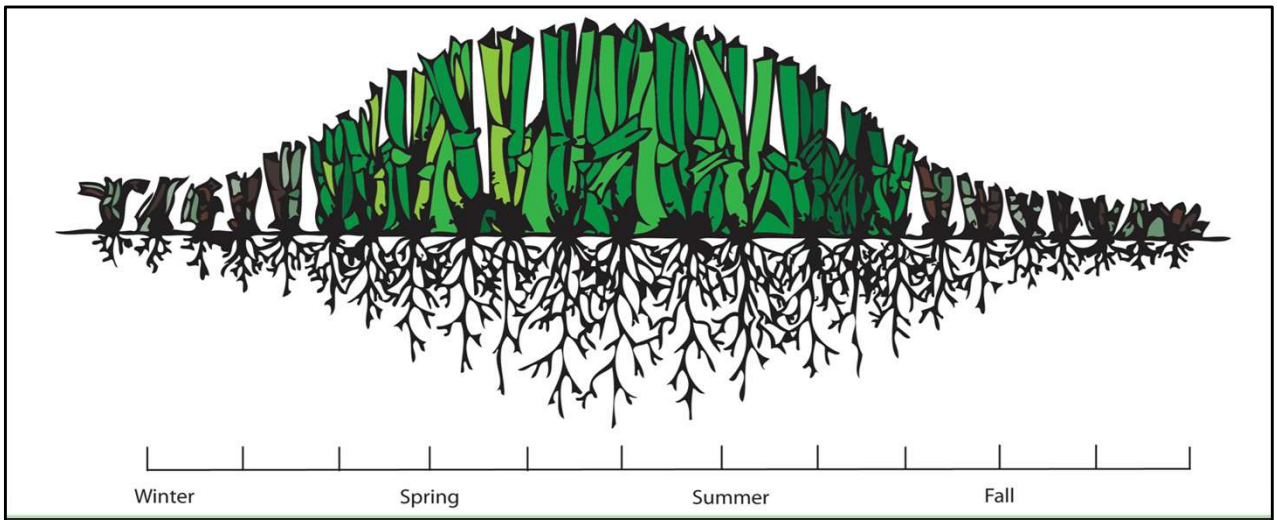
The following visual indicators should be used as guidelines to determine the need for irrigation.

For turfgrass:

- The grass has a dull, bluish-gray coloring.
- Foot tracks remain in the grass.
- Leaf blades are folded in half on at least one-third of the site. UF/IFAS recommends watering when 30–50 percent of turfgrass wilts.

For established landscape plants:

- Soil samples from the root zone are dry and crumbly.
- Indicator landscape plants (such as impatiens and azaleas) have drooping leaves.



PLANT GROWTH / WATER DEMAND

EVAPOTRANSPIRATION

Most roots grow in the top 6-12 inches of soil, and 1/2 to 3/4 of an inch of irrigation water may be needed for replenishment of moisture every 2 to 3 days during warm periods of active growth, and every 10 to 14 days during less active growth periods.

Under ideal conditions, the water required for a plant is equal to the water used during plant growth. This water goes to soil evaporation and plant transpiration. Typically, both processes are combined and called evapotranspiration (ET) potential. A plant's water requirements (ET) vary with its growth cycle and climatic conditions. The limiting ET factors are the amount of soil moisture to be transpired by the plant, solar energy reaching the plant (affected by latitude, season, cloud cover, and shade), the temperature and relative humidity of the air, and wind speed.

When possible, the timing of an irrigation event should be planned to increase irrigation efficiency, by reducing evaporative losses due to climatic conditions (for example, high temperature, low humidity, windy conditions) and by maintaining high irrigation uniformity.

WHEN CAN I WATER?

Scheduling Criteria:

- **Water source**
- **Location* – WMD, water purveyor**
- **House number**
- **Time of day**
- **Time of year**
- **Conservation measures**
- **Water morning hours**

**Some areas of the state differ*

STATEWIDE:

10 am-4 pm

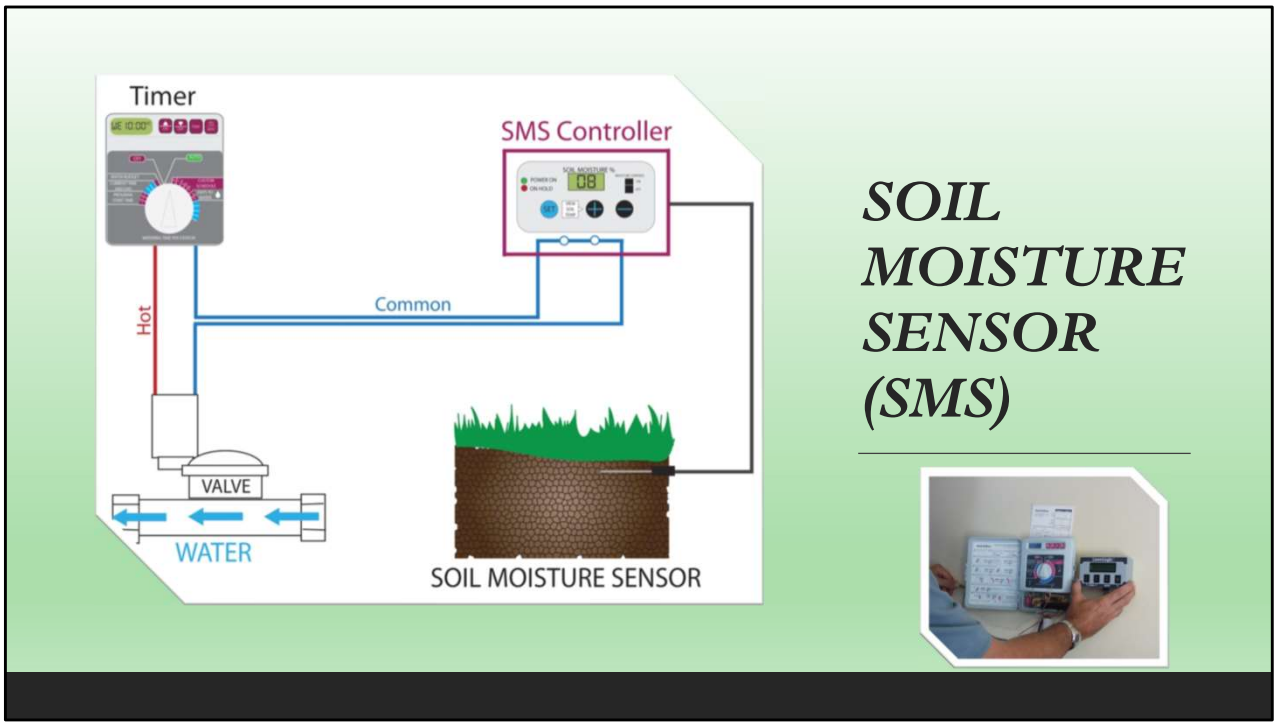
To prevent potential fines, it is important to identify and abide by all regulatory requirements. Besides water use permits, some water management districts have special year-round water conservation measures and drought/water shortage restrictions that govern the amount and timing of irrigation.

Be sure you know the restrictions for a site and set timers and controllers to those conditions. Since water shortage restrictions change with the severity of a drought, it is important to be aware of and to abide by current restrictions. Note: Statewide water restrictions prohibit watering between 10 a.m. and 4 p.m. However, some water management districts, counties and municipalities may have more limited restrictions. Water during the cooler, calm morning hours to minimize evaporation and disruption of sprinkler pattern.

RAIN SENSORS

Rain sensors—also called rain shut-off devices—are designed to interrupt the cycle of an automatic irrigation system controller when a specific amount of rainfall has occurred. These small wired or wireless devices are connect to the irrigation system controller. The sensor is mounted in an open area where they are exposed to rainfall.

Rain sensors operate by one of two methods. The first method is to either measure or weigh collected rainwater. These devices that collect water operate on two basic principles: water weight or electrical conductivity of water. Shut-off devices using the second method measure proportional expansion of water-sensitive materials, such as cork disks.



According to UF Specialists, one of the most effective and efficient methods of irrigation control is the use of properly installed and maintained soil moisture sensors with a specialized controller. There are two basic types of systems, direct control and bypass control. With direct control systems, the soil moisture sensors actually call for irrigation. In a bypass control system, regularly scheduled irrigations are bypassed if sufficient moisture is present.

Direct control systems are more expensive and require considerable management expertise, such as may be present at a golf course. Bypass systems are much less expensive and easier to install. Most bypass systems work with the existing controller.

EVAPOTRANSPIRATION CONTROLLERS

Climate based controllers are also known as evapotranspiration, or ET, controllers. Generally, ET is the process of transpiration by plants combined with evaporation that occurs from plant and soil surfaces.

There are generally three types of ET controllers:

- **Signal Based:** Weather data are either collected from publicly available sources or from agreements with weather station networks. The ET value is calculated for a hypothetical grass surface for that site. The ET controller adjusts the irrigation run times or watering days according to the climate throughout the year.

- **Historical ET:** This approach for ET controllers uses a pre-programmed plant water use curve for different regions. The curve may be modified by a sensor such as a temperature or solar radiation sensor that measures on-site weather conditions.

- **On-site Weather Measurement:** This is the system represented in the

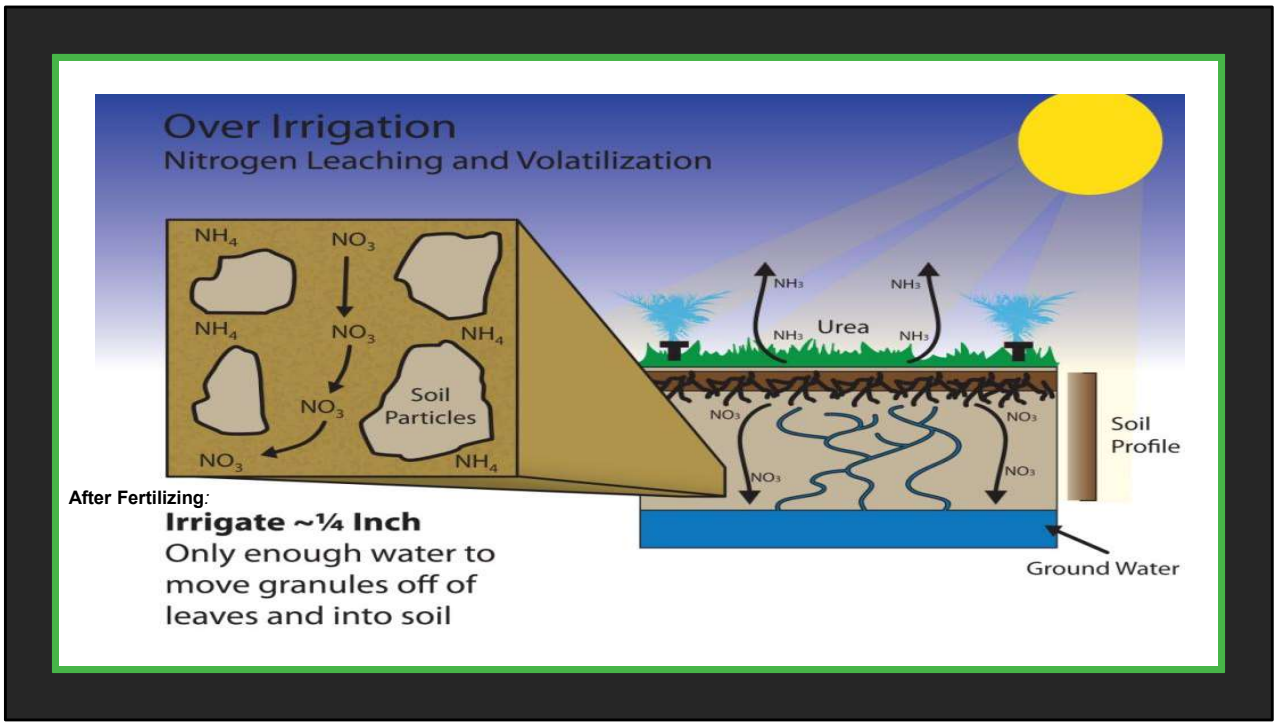
slide. This approach uses measured weather data at the controller to calculate ET continuously and adjust the irrigation times according to weather conditions. However, installing weather stations at every home is not practical or economically feasible; therefore, simplified ET estimation methods are typically used.

OVERIRRIGATION:

- **Increased plant disease**
- **Higher population of plant pests**
- **Weak and shallow roots**
- **Nutrient leaching and/or runoff**
- **Wasted water**

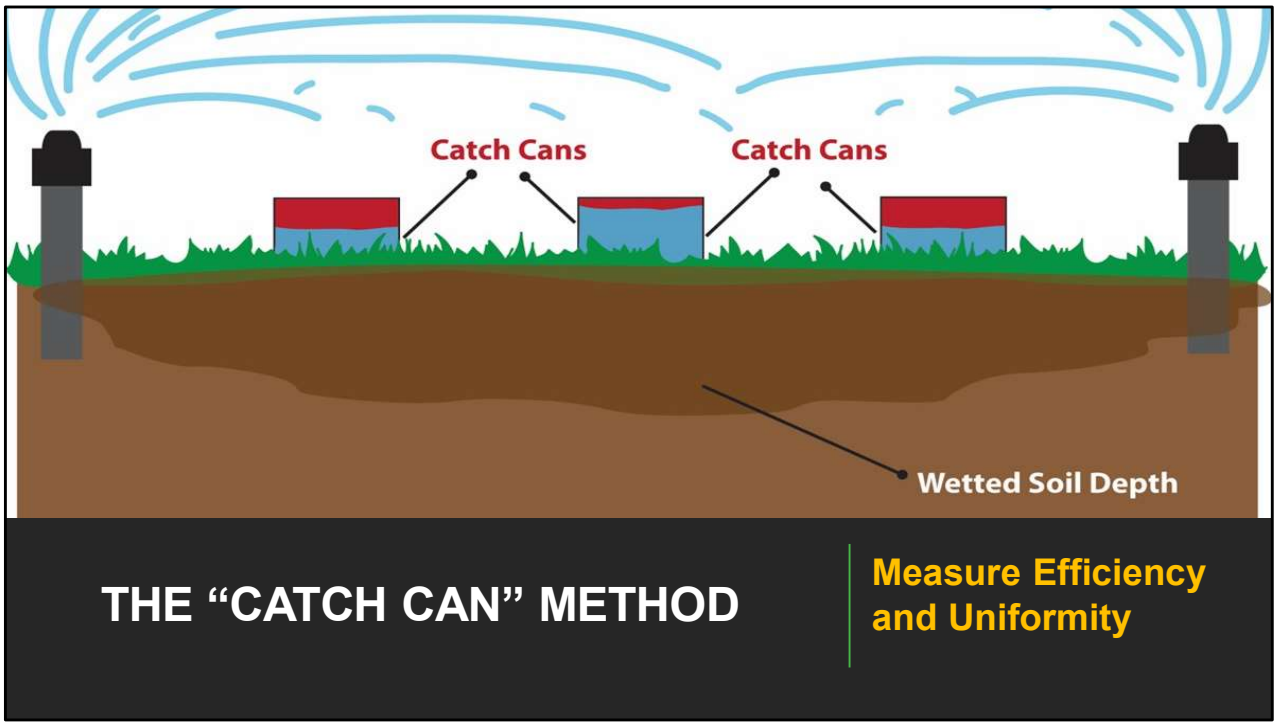
Routinely inspect irrigation systems and report inappropriate practices to prevent excess water use and waste. Overwatering can lead to these negative effects:

- Increased plant disease
- Higher population of plant pests
- Weak and shallow roots
- Nutrient leaching and/or runoff
- Wasted water



Ammonium Nitrate (AN) and Ammonium Sulfate (AS) are two soluble, quick-release N sources commonly used by professional lawn-care services. Urea and ammonium based fertilizers may lose up to 70% of N to volatilization. Volatilization is the loss of ammonia nitrogen to the atmosphere as a gas. Therefore, it is imperative that the proper quantity of water be applied following the application of urea fertilizer, unless rainfall is anticipated within 8 to 12 hours. Application of 1/4 inch of water should be sufficient to solubilize most of the urea and move it into the turfgrass root zone. Too much water can lead to runoff or leaching of nitrate into ground and surface waters.

It is also important to avoid applications over seasonally high water tables (standing water), which will result in movement of nutrients and pesticides off target areas.



Use the "Catch Can" method to measure how much water you are putting out. Place half a dozen containers out in a zone and run the irrigation for 15 minutes. If you measure the amount of water depth and multiply that by four, it will give you the amount of water in inches per hour. The University of Florida recommendation for turf irrigation is ½ - ¾ inch of water per application zone for lawns.

Distribution Uniformity is a measurement of how evenly water is distributed over a given area and should be considered when managing irrigation. This measurement is an indication of the system’s hydraulic performance and can be used to identify deep percolation/leaching.

Water Application Efficiency is a component of irrigation system efficiency and indicates how well a system is providing water to the plant’s root system. A system's application rate must not exceed the ability of the soil to absorb and retain the water applied during any one application. The irrigation system should be designed to have an application rate that is less than the infiltration capacity of the soil so that no surface pooling occurs or water percolates with

maximum efficiency.

Water until the irrigated area reaches field capacity. The maximum amount of water a soil may hold before draining. Imagine the root zone of your lawn like a sponge filled with water…pouring more in will not keep it full any longer.

EFFICIENCY AND UNIFORMITY

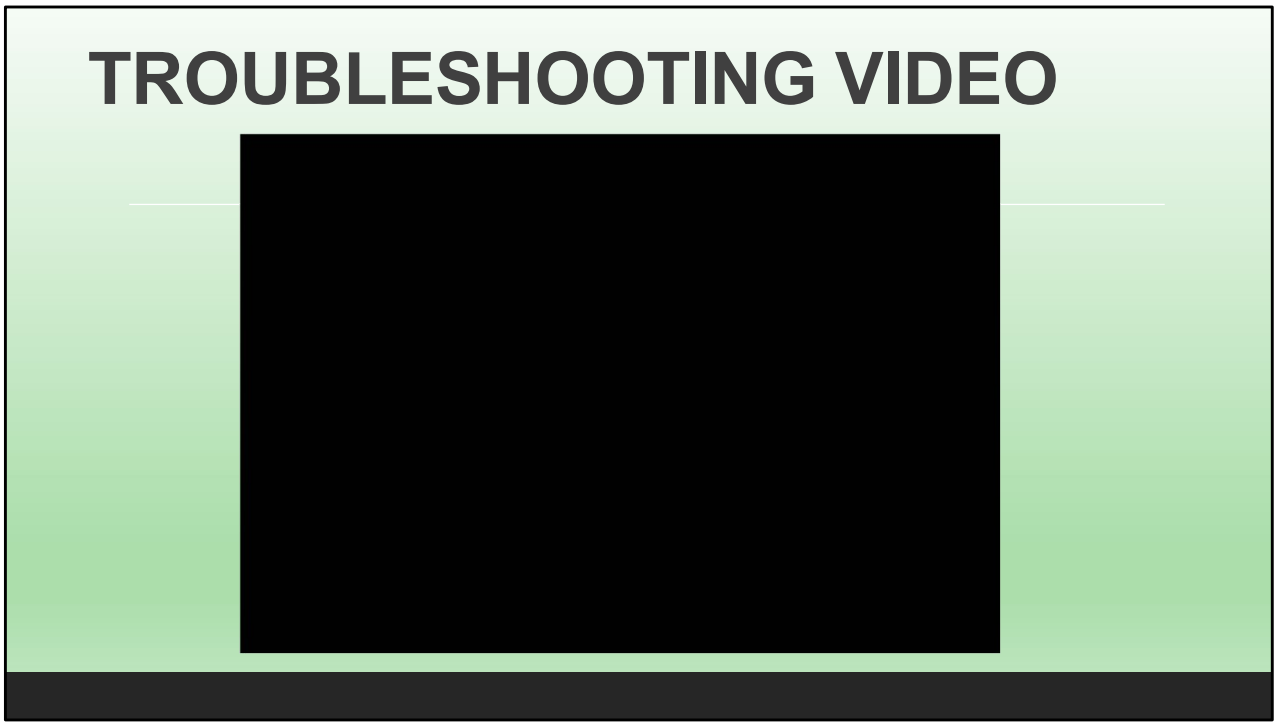
What is the big deal?

- **Large volumes of wasted water**
- **Increased water bills**
- **Increased demand for the resource**
- **Increased runoff and leaching**
- **Water supply is limited**

Water Application Efficiency and Irrigation Application Efficiency are two components of irrigation system efficiency. Water Application Efficiency indicates how well a system is providing water to the plant's root system. Irrigation Application Efficiency looks at how much of the water delivered to an area is beneficially used.

So what is the big deal? Left unchecked, irrigation systems can become inefficient, resulting in:

- Large volumes of wasted water
- Increased water bills
- Increased demand on the resource
- Increased runoff and leaching
- Water supply is limited!



VIDEO SCRIPT

Irrigation system installation, maintenance and troubleshooting usually require digging or removal of soil near utility lines. If you plan to install, renovate, repair underground irrigation components in the landscape, locate utility lines that may be buried before digging. It is your responsibility, as a business owner, contractor or supervisor, to prevent injury or damage to underground utility lines. Call 811, Sunshine State One Call service center to have underground utility lines marked for free.

Using proper irrigation system design, installation management and maintenance practices provides a multitude of benefits. These benefits include saving money, using irrigation efficiently, a healthy, more drought and pest-resistant landscape, and protecting the state's water resources. Therefore, it is important to understand how your client's irrigation system operates, to troubleshoot routinely and report problems immediately.

Common irrigation efficiency problems include leaks, sprinkler head plugging, poor irrigation uniformity caused by nozzle wear, and poor system

pressure. Some problems (such as repairing leaks and replacing nozzles) can be repaired at a minimal cost, while others (such as poor system design) might, at first glance, be very costly.

However, problems need to be corrected as soon as possible to prevent the leaching of fertilizers/chemicals and wasted water. Damaged/defective systems should be repaired as soon as possible. Replacement parts should always have the same characteristics as the original components regarding discharge-pressure, nozzle, jet size and color. The wrong replacement might cause more harm than the bad component.

Replace filters routinely to prevent pipe and emitter clogging and poor system performance. Irrigation contractors, according to Florida law, are required to repair defective sensors. Failure to report a client that refuses to repair such problems can result in fines and/or penalties. Also, it is important to remember that irrigation controllers and timers should be reset seasonally to account for plant growth requirements and local climatic conditions.

Plants should be grouped in irrigation zones based on similar water use requirements, known as Hydrozones. Irrigation systems designed to service both turf and landscape areas should have enough zones to meet each area's individual water needs. By properly managing the irrigation system, everyone wins: both the company and client save money; it helps protect surface and ground water quality and conserves supply.

Remember, if you see a problem with any part of the irrigation system, tell the client so they can have it fixed.

REVIEW TRAINING OBJECTIVES

1. **Explain how Florida laws regarding irrigation systems affect landscape professionals.**
2. **Describe the components of an irrigation system.**
3. **Explain irrigation effects on fertilizing practices.**
4. **Identify irrigation equipment maintenance needs.**
5. **Review irrigation BMPs to avoid nonpoint source pollution.**

Now that you have reviewed the irrigation module, you should now be able to:

- Explain how Florida laws regarding irrigation systems affect landscape professionals
- Describe the components of an irrigation system.
- Explain irrigation effects on fertilizing practices
- Identify irrigation equipment maintenance needs
- Review irrigation BMPs to avoid nonpoint source pollution

This concludes the irrigation module.