The Complete Landscape Irrigation System

The essential 7.5 elements that every irrigation system should have to reduce costs of ownership, improve plant health and appearance, and apply water efficiently.

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Property ownership is a complicated act of balancing a desired appearance or function with financial considerations. This balancing act is no more prevalent that in the landscape. It is made more confusing because of the misinformation or the lack of information available on which a proper decision can be based.

When asked about the costs associated with the ownership of an irrigation system, most property owners think only about the costs of repairing broken components of the system. They never really consider the costs caused by an incomplete design or installation, nor the proactive maintenance and adjustments to the irrigation system. Both affect the amount of water that is used, the health of the plants, and the appearance of the landscape.

As an example, most residential property owners would not think that they could be using between 2,000 to 5,000 gallons in one irrigation cycle. If system is watering 2 times per week, that means it is applying 4,000 to 10,000 gallons of water. If an average swimming pool holds 18,000 gallons, then the irrigation system applies enough water to fill a swimming pool every two to three weeks!

What if there it were known that 30% to 50% of that water was not helping the plants? Or worse, what if this 30% to 50% is not only was wasted, but the poor application of the water increased the potential for harmful growing conditions for the plants such as disease, pests, and weeds? In fact, these are both true for most residential irrigation systems. It is the unfamiliarity with the irrigation piece of the landscape that leads to both of these conditions.

So what contributes to so much non-beneficial and poorly applied irrigation water? The answers are found in all three of the stages of an irrigation system:

1. Design and Installation – Sprinklers in the right place, at the right pressure, with the right nozzles
2. Maintenance – Repairing, raising, straightening, realigning, cleaning, etc. AND adjusting to the growing plants and ever-changing conditions in the landscape.
3. Management – Creating and adjusting an accurate and specific irrigation schedule for each zone, for each month or season. This includes the time each zone should operate, the number of times per day or week the zones should operate, the time of day the system should operate, etc.

The challenge for a property owner is to distill all of the available information into the very essential activities that could serve as the foundation for practical landscape irrigation installation and maintenance. The following are the seven simple elements of a complete landscape irrigation system that lead to conserving water in the landscape while creating healthy growing conditions for the plants and soil. There is one small additional element to help the property owner tie all of the elements together.

The Essential 7.5 Elements

1. Sprinklers watering landscape beds and turf are on separate zones (valves).
2. Rotating sprinklers and spray sprinklers are on separate zones (valves).
3. Operating pressures of the sprinklers are as close to the manufacturer's recommendations as practical.
4. Sprinklers are installed in corners and spaced to overlap each other.
5. Irrigation systems do not run when it is raining or has rained.
6. Irrigation schedules are changed to match the water needs of the season or month.
7. Components of the irrigation system are observed operating at least every season to ensure proper operation.

7.5 Utilize licensed and certified professional irrigation contractors.

Ignoring these essential seven elements of a complete irrigation system often leads to unhealthy plants and soils. The increase in landscape maintenance to fight the conditions created or made worse by poor irrigation practices requires a considerable increase of inputs such as water, fertilizer, pesticides, herbicides, manpower, equipment, etc. All of the inputs have a direct and sometimes significant dollar cost. An evaluation and correction to the irrigation system today can result in savings that can offset the cost of the adjustments and continue to pay dividends into the future.

1. Sprinklers watering landscape beds and turf are on separate zones (valves).

The frequency and the amount of irrigation required for healthy plants and soils in turf areas can be very different from what is required for landscape beds (trees, shrubs, and ground cover). Irrigation that is applied when not needed is the very definition of wasted water. Therefore it is imperative to control the timing of water application to the turf separately from the landscape beds.

The timing of water application is defined in two ways: How long to water (runtime) and how often to water (frequency). Both are guided by the amount of water that exists in the soil after the water has been removed by the plants and evaporation.

As a general rule, landscape plants (shrubs and trees) use the water at a different rate and quantity than turf. This is the result of several factors: the natural water use needs of the plants, the amount of leaf surface, and the cultivation practices. Therefore, the sprinklers watering the turf will need to have different runtimes than those watering the landscaped plants.

An additional difference is that landscape plants have larger root zones than turf. An individual turfgrass plant's roots are measured in inches of width and depth. But landscape plants have root zones that are measured in feet. It is not uncommon to have the roots of established shrubs or trees extend 1.5 to 3.0 times the plant's canopy. This equates to the landscape plants having more and significantly longer "straws" to access more water than a small turfgrass plant. Having more and longer roots typically means the landscape plants should get watered less frequently than the turf AND for different lengths of time.

When landscape beds are watered for the same time and frequency as the turf areas, the landscape beds can get more water than they need and/or the turf gets too little. In the first

case, the result is wasted water. In either case, the resulting excessively wet or dry soils lead to unhealthy soils and plants which can lead to conditions that can promote weeds and diseases.

This all points to the first element of the seven to minimize wasted water and promote healthy plants and soils*: Separate the landscape beds from the turf by putting their respective sprinklers on separate valves (zones).* This way they can have different runtime AND frequencies to meet their different plant water needs.

2. Rotating sprinklers and spray sprinklers are on separate zones (valves).

The two basic types of sprinklers used in landscape irrigation are rotating sprinklers (rotors or rotators) and spray sprinklers. Visually, the rotors and rotators have streams of water that move (rotate) and sprays have a fan-like spray that does not move. The principle difference between the two that can affect wasted water is the rate at which each applies water to the plants. The scientific term for this is called the precipitation rate.

On average, rotating sprinklers apply water at rates approximately 0.30 to 0.80 inches per hour. Compare that to the rate for spray sprinklers of approximately 1.2 to over 2.00 inches per hour. Both are good products, but when using them, it is important to know that sprays apply water 3 to 5 times FASTER than rotors or rotators.

In terms of controlling wasted water, when sprays and rotating sprinklers are on the same valve, the areas covered by the sprays will be 3 to 5 times WETTER! (Author's Note: There is one type of spray that is an exception.) This, too, creates either overly wet or dry areas and therefore unhealthy plants and soils.

This leads to the second element of the seven to minimize wasted water and promote healthy plants and soils: *Put rotors or rotators on separate valves (zones) from spray sprinklers*. This again allows the sprinkler types to be timed to match the different outputs of water.

3. Operating pressures of the sprinklers are as close to the manufacturer's recommendations as practical.

Manufacturers design and make nozzles for sprinklers to operate within a specific range of pressures (psi). Trained irrigation professionals use the nozzle performance charts from the manufacturers to give them the minimum and maximum pressures for a specific type of sprinkler with a specific nozzle.

The following table shows the generalized performance range for the basic sprinkler types.

Sprinkler Type	Operating Pressure Range (psi)	Recommended Pressure (psi)
Spray	20 - 35	30
Rotator	25 - 75	40 - 50
Rotor	25 - 75	40 - 50

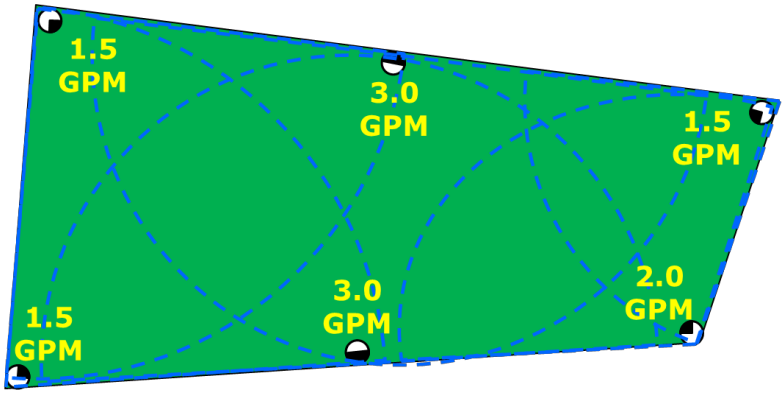
The left column shows the range of pressure in which the manufacturers show that the sprinkler types will actually work. This is different than the recommended pressures shown

in the right column. The difference is when the sprinklers are operating in the middle of the range (the recommended range) they are closer to optimum performance. When operating them towards either end of the range, the performance can be just adequate. The closer to optimum performance, the better the chances are to avoid poor coverage (wet or dry areas). When dry areas are noticed, the common remedy is to increase the runtimes to get the dry areas more water. This makes the sufficiently covered areas wet and the wet areas wetter. Addressing the cause of the pressure problems is the recommended action.

This is the basis for the third element of the seven to minimize wasted water and promote healthy plants and soils: *Design the water source and the piping system, along with sprinkler and nozzle selection, to ensure the sprinklers are operating as close to optimum pressures as practical (as defined by the manufacturers).* This will help to avoid overly wet or overly dry areas.

4. Sprinklers are installed in corners and spaced to overlap each other

All sprinkler nozzles are designed by all manufacturers to provide the most uniform coverage when overlapping each other. This requires that sprinklers be placed in all corners AND each sprinkler throws water all the way to the sprinklers next to them and across from them.



This does not have to be perfect as can be seen in the illustration above. Without sprinklers in the corners, the areas in the corners will not receive the same amount of water as the rest of the irrigated area. This will result in having to run the sprinklers longer to compensate, and then the middle areas will get too wet. Then the run times will have to be reduced, and the corners will be too dry. This constantly fluctuation between overly wet and overly dry wastes water and makes for stressed plants and poor growing conditions.

So the fourth element of the seven to minimize wasted water and promote healthy plants and soils: *Sprinklers are installed in corners and spaced to overlap each other.*

As a side note, all of the sprinklers need to have the correct nozzle installed. They almost NEVER all have the same nozzle in them, even if they come from the factory that way. Scientifically speaking, the gallons per minute of the nozzles need to be proportionate to the degree of arc they cover. The sprinklers also need be adjusted (and kept in adjustment) so that they do not water walkways, driveways, or other areas not intended to receive water from the sprinklers.

5. Irrigation systems do not run when it is raining or has rained.

At the very core of being responsible to avoid wasting water in the landscape is to ensure the irrigation system should only apply water when it is needed by the plants and NOT just when the controller is scheduled to operate. This means that when Mother Nature supplies adequate water to the plants in the form of rainfall, the irrigation system should not operate.

The scientific reasons for this can be understood by thinking about the needs of the plants for air and water in the soil containing their roots. Too much water means not enough air. So if tiny spaces within the soil have been filled with rainwater, applying irrigation during or too soon after the rainfall event can make the soils lack the right balance of air and water. Not enough air in the soil leads to any number of bad situations for the health of the plants.

To prevent the controller from operating as scheduled when there has been adequate rainfall, all controllers should have a rain shut-off device. The least costly type of rain shut-off device is a rain switch (also called a rain sensor). It can be attached to the controller using a hard-wired or wireless connection. It works by setting a series of rain-absorbing discs to block the controller's signal to the valves when adequate rainfall has occurred.

A second common type of rain shut-off device is a soil moisture sensor. A high-tech sensor is placed into the soil and it transmits (hard-wired or wirelessly) the level of moisture in the soil to a receiver that is wired to the controller. The receiver is set up to block the signal to the valves just like the rain sensor. A soil moisture sensor is complicated enough that a professional irrigation contractor should complete the installation and setup.

So the fifth element of the seven to minimize wasted water and promote healthy plants and soils is: *Every controller should have a rain shut-off device in order to prevent the irrigation system form applying water during or after it rains*. This helps keep the right balance of water and air in the soil.

Unknown to many end users, a rain shut-off device is required by law in many states and localities. At the very least, it is part of the Irrigation Association's best management practices, the EPA Water Sense program, and most all other minimum irrigation standards.

6. Irrigation schedules are changed to match the water needs of the season or month.

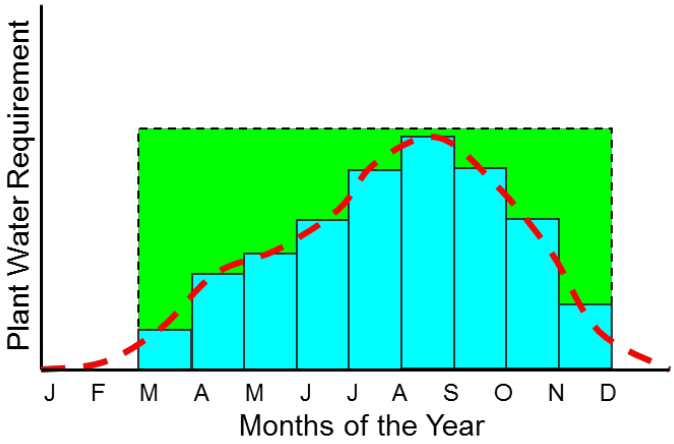
If the plant types and sprinkler types are controlled separately by being placed on different valves (zones), and there is a rain shut-off device installed on the controller, then the timing of the water application can effectively be regulated by the irrigation controller. This is typically accomplished by adjusting the amount and frequency of the irrigation based on the changing needs of the plants within each irrigation zone commonly referred to as the irrigation schedule.

The changes in water needs of the plants are driven by a number of ever-fluctuating conditions of the landscape within each zone:

- The size of the plants as they grow
- The time of the year (plant growth cycle – blooming, fruiting, etc.)
- The number of plants (adding or changing plants)
- The changes in the weather

At the basic level, the irrigation schedule should be adjusted seasonally. Unfortunately, it is typical that a schedule is entered into the controller at the beginning of the year intending to satisfy the highest water needs of the year. Then the schedule is never changed during the year. This causes too much water to be applied in the spring and fall (and winter if there is a 12 month irrigation year).

Looking at the graphic below, the dashed line represents an example amount of water the plants need during the year. (Remember, this water need can be satisfied by either rainfall or irrigation.) As the plants move through their annual growth cycle and the weather changes, so does the water need – more during the summer months and less in the spring and fall. Any water above that line does not benefit the plant and has the potential to contribute to the conditions for poor plant health caused by overly wet soils.



The dark-shaded area represents the amount of water wasted by setting the controller to satisfy the peak water needs of the plants at the beginning of the year and not adjusting it until the system is turned off for the winter. This demonstrates the common claim that when the first four rules of preventing wasted water are combined with adjusting the controller monthly, it typically reduces the irrigation water use by 20% to 50%.

Each lightly shaded area represents a monthly adjustment made to more closely meet the needs of the plants. While it would increase the amount of wasted water compared to monthly adjustments, these can be simplified into four seasonal adjustments: On (or adjusted) for the spring; Adjusted for the summer; Adjusted for the fall; Off (or adjusted) for the winter.

Therefore, the fifth element of the seven to minimize wasted water and promote healthy plants and soils is: *Adjust the irrigation schedule to meet the changing plant water needs at least seasonally, or better yet, monthly*.

This can be accomplished automatically by features found in some more advanced (but still very affordable) controllers or the even more advanced “Smart” controllers. For Smart controllers to be effective, the first three rules MUST be in place and a trained professional is needed to set up the controller with specific information about the sprinklers, the plants, the soils, and other conditions in the landscape, and only trained professionals are allowed to make adjustments.

7. Components of the irrigation system are observed operating at least two times per irrigation year to ensure proper operation.

Most landscape irrigation systems are scheduled to operate during times of the day when they will not interfere with the use of the landscape. This typically means they operate in the wee hours of the morning. The result: No one sees them and therefore does not know if they are operating correctly. The effect of things that might be out of adjustment or broken can often be invisible until the physical damage they cause becomes extreme or plants are dead. The sooner the problem is identified, the more the negative effects can be minimized.

The simplest of things can create significant amounts of wasted water or unhealthy conditions for the plants. Examples of sprinkler problems that regularly require adjustment regardless of the quality of installation are:

- Crooked or Tilted
- Misaligned – Water is not going where it is intended
- Sunken – Sprinkler does not pop up high enough
- Broken – Mower, vehicle, or vandalism damage
- Clogged – Debris in the system clogs the sprinkler filter or nozzle
- Overspray - Sprinkler throws onto the fence, building, roads, driveways, or sidewalks
- Blocked – Plants normal growth obstructs the water from getting to the intended areas
- Leaks – Aging seals in sprinklers, sprinkler connections to pipes, or the pipes themselves
- Changes in Pressure – As the development or community is built out, the demand for water increases and everyone is irrigating during the same hours causing the pressure to decrease

Thus the seventh element of the seven to minimize wasted water and promote healthy plants and soils is: *At least two times during the irrigation year, all sprinklers, valves, rain or soil moisture sensors, and other critical components should be observed in operations and maintained.* This may not be frequent enough for components like filters, lake screens, foot valves, or others.

An irrigation system is much like the braking and suspension systems in an automobile: they both are essential support systems which require regular preventative maintenance. Preventative maintenance beyond just regular observations may prevent catastrophic failures and lower the operational costs of the irrigation system. The items that are preplaced BEFORE they fail as part of a yearly preventative maintenance program should include items such as: valve solenoids or diaphragms, rain sensor discs, waterproof wire connectors at the valves, riser seals in sprinklers, and worn sprinkler nozzles. The frequency of these preventative maintenance actions ranges from between 3 and 5 years, depending on how often the system is used during the year.

7.5 Look for Licensed and Certified Professional Irrigation Contractors

The average person owner does not perform anything more than the most simple of maintenance activities on their automobile because of complexity, time, or a lack of understanding of how working on one component will affect the operation of other. An irrigation system is no different. But finding a professional who does understand these things about an irrigation system can be intimidating. This is where national trade

associations can help. Look for landscape and irrigation professionals with irrigation licenses (where required) and/or national certifications.

The Irrigation Association (IA) is the national certifying body for the irrigation industry that offers the following certifications that would benefit both residential and commercial property owners.

- **Certified Irrigation Contractor:** Experienced business owners who execute irrigation projects to install, maintain and repair irrigation systems.
- **Certified Irrigation Designer – Residential, Commercial, or Golf:** Establish specifications and design drawings for irrigation projects.
- **Certified Landscape Irrigation Auditor – Landscape or Golf:** Evaluate the irrigation system conditions and water-use data, as well as test and measure the components.
- **Certified Landscape Water Manager:** Evaluate, operate, manage and improve landscape irrigation systems to achieve the highest level of water conservation possible.
- **Certified Irrigation Technician:** Technicians that install, maintain, and repair irrigation systems.

Go to the Irrigation Association website (www.landcarenetwork.org) to find a certified professional in your area.

PLANET (the Professional Landcare Network) is the national certifying body for the landscape industry that offers the following certifications that would benefit both residential and commercial property owners.

- **Landscape Industry Certified Manager:** Landscape contractor business owners or managers.
- **Landscape Industry Certified Technician - Exterior:** Exterior technicians specializing in softscape installation, hardscape installation, turf maintenance, ornamental maintenance, or irrigation.
- **Landscape Industry Certified Interior Technician:** Interiorscape technicians with a foundation in interior maintenance best practices.
- **Landscape Industry Certified Horticultural Technician:** Green industry professionals with an expanded knowledge of landscape plant life.
- **Landscape Industry Certified Lawn Care Manager:** Lawn care professionals with a well-rounded foundation in warm- and cool-season turfgrass establishment, growth, maintenance, troubleshooting, and customer relations.
- **Landscape Industry Certified Lawn Care Technician - Cool Season:** Lawn care professionals focused on lawn and grounds management (in the northern United States), professionalism, and commitment to best practices.
- **Landscape Industry Certified Lawn Care Technician - National:** Lawn care professionals focused on lawn and grounds management (with a national focus), professionalism, and commitment to best practices.

Go to the PLANET website (www.landcarenetwork.org) to find a certified professional in your area.

The professionals who have achieved these credentials must complete continuing education to maintain them. Look for companies that are active in the state or local trade associations and community events. They have the industry and local knowledge that provide the best possible solutions to minimize wasted water and promote healthy plants and soils and focus on industry best practices to ensure high value for the money invested.