MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #268

Irrigation Management Worksheet:
Lawn In-Ground Sprinkler System Checkup

To complete this irrigation checkup, you will need the following items:
- Six identical straight-sided, flat bottom cans or cups.
- Watch/Timer.
- Ruler.
- Colored flags or other markers to mark sprinkler heads by zone (optional but helpful).
- Calculator.
- 10" Screwdriver and/or soil probe.

Why Do an Irrigation Checkup?

Of all the principles of water wise landscaping, attention to irrigation efficiency has the greatest potential for water conservation.

A lawn irrigation checkup is a systematic evaluation of the irrigation system design, maintenance, and management. It will identify areas where adjustments will make either a minor or major impact on water conservation and lawn quality. After performing the checkup you will be able to:
1. Recommend appropriate run times for each sprinkler zone, calculated based on the precipitation rate of each zone.
2. Recommend maintenance, such as replacing or adjusting nozzles, moving, or adding heads, or adjusting water pressure.
3. Recommend lawn care practices such as fertility management and core aeration to improve turf quality.

This checkup is only a tool to help identify where the system is working adequately and where adjustments need to be made. Knowing that action is required does not save water. Actual water conservation comes when findings are put into action!

Important Note: Perform a normal watering the day before doing the checkup.

Step 1. Evaluate the Lawn

A. **How does the lawn look?** Visual indicators of lawn quality show where to look for potential problems.

- ☐ Green (high input lawn)
- ☐ Green (moderate input lawn)
- ☐ Green (low input lawn)
- ☐ Dry spots: ______% of lawn
- ☐ Dry/Dormant
- ☐ Thick
- ☐ Thin
- ☐ Weed-free
- ☐ Few weeds
- ☐ Weedy

B. Check the soil conditions. Since the lawn was watered the day before the checkup, probing the soil can show where compaction or drought from uneven watering are issues.

1. Stick a screwdriver in the ground to get a sense of soil compaction. The ease or difficulty at which the screwdriver can be pushed into moist soil gives a grasp of soil compaction.

2. If possible, use a soil probe to get a sense of soil texture, compaction, soil layers, rooting depth, and thatch layer. Note: On compacted or rocky soil, it may be impossible to push a soil probe into the soil. On extremely compacted soils, it may even be impossible to push a screwdriver into the soil.

- **Soil compaction:**
  - ☐ Little to no compaction.
  - ☐ Moderate compaction (recommend core-aeration of three-inch centers).
  - ☐ Severe compaction (recommend core-aeration of three-inch centers or other remediation).

- **Soil texture (use the soil texture by feel method found in GardenNotes #214, *Estimating Soil Texture*). Based on the soil texture expected speed of soil water infiltration is:**
  - ☐ High.
  - ☐ Moderate.
  - ☐ Low.

- **Soil profile:**
  - ☐ Changes in soil texture evident.
  - ☐ Hardpan layer present at ______ depth.
  - ☐ Evidence of drainage problems (such as surface pooling).

- **Thatch layer:**
  - ☐ Less than ½ inch.
  - ☐ Greater than ½ inch (may require core-aeration on three-inch centers).

- **Runoff potential:**
  - ☐ Low potential.
  - ☐ High potential (use cycle and soak application).
    - ☐ Due to slope.
    - ☐ Due to soil conditions (compaction and clayey soils).
    - ☐ Due to heavy thatch.

C. Current irrigation pattern:

- During the summer, July/August, the lawn is typically watered ______ (days) for ______ minutes.
- During the typical July/August weather, the lawn can go ______ days between irrigation before getting dry.
  - Multiply the number of days (maximum) between summer irrigations by 0.20 to estimate the water holding capacity for the soil at rooting depth at this site. This is the maximum amount of water to apply per irrigation.
    ______ days x 0.20 inches = ______ inches per irrigation (maximum).

D. Notes & Recommendations:

Step 2. Current Controller Settings

Record the current settings from the controller including watering days, start time(s) and run times. Note: Precipitation rates and inches applied may be calculated later if unknown. This will be used to document water-saving potential from the checkup.

Controller is set for ____________________ (month).

Step 2. Current Setting and Inches Applied						
Zone	Zone Identity	Watering day(s)	Start time(s)	Run time	Precipitation Rate	Inches Applied
1						
2						
3						
4						
5						
6						

Step 3. Identify and Evaluate Irrigation Zones

A. **Identify the location of each sprinkler head in each zone (a group of sprinkler heads that come on at the same time).** Using different colors of landscape flags or other marking devices (like screwdrivers or sticks pushed in the ground near each head) is helpful. Sprinklers may need to be turned on to find and identify sprinkler heads by zone.

B. **Evaluate the following:**

Step 3. Irrigation Zones	**OK.** Concept incorporated.	**Minor**. Benefits with minor adjustments or implementation.	**Major**. Benefits with major adjustments or implementation.	**Not applicable** to site.
Irrigation Zones				
1. Lawn zones separate from flower and shrub bed zones.				
2. Lawn areas zoned by irrigation demand (e.g., high input, moderate input, and low input areas on separate irrigation zones).				
3. Zone by exposure (e.g., extreme exposures, full sun, partial shade, full shade, and slopes on separate irrigation zones).				
4. Drip or bubblers used in flowerbeds, shrub beds, small fruits, and vegetable gardens.				
5. Design avoids sprinkler irrigation on small, irregular shaped areas (generally areas less than 10 feet wide).				

If the current system design fails to meet one or more of the above criteria, consider upgrading the irrigation system.

C. **Notes:**

Step 4. Evaluate Sprinkler Performance

Turn on sprinklers and evaluate sprinkler performance as outlined below, repeating steps for each zone. Refer to GardenNotes #267, *Watering Efficiently* for more details.

A. **Design criteria for even water distribution.**

1. **Head-to-Head Coverage** – Does the water from each head reach neighboring heads?

Step 4A 1. Head-to-Head Coverage						
Zone	1	2	3	4	5	6
Yes = OK						
No = adjustments needed*						

* In some situations, adjusting heads or changing nozzles may correct the problem. In other situations, the system design may need to be upgraded for water conservation.

2. **Head Position** – Are sprinkler heads "lined-out" along the edge of non-irrigated areas (watering from the outside in)?

Step 4A 2. Lined-Out						
Zone	1	2	3	4	5	6
Yes = OK						
No = upgrade needed*						

* If "No," consider upgrading the sprinkler system for improved water conservation.

3. **Head Layout** – Are sprinkler heads arranged in even pattern, equal distance without gaps?

Step 4A 3. Head Layout						
Zone	1	2	3	4	5	6
Yes = OK						
No = upgrade needed*						

* If "No," consider upgrading the sprinkler system for improved water conservation.

4. **Zone Uniformity** – Are all heads/nozzles in a zone the same brand and type?

Step 4A 4. Zone Uniformity						
Zone	1	2	3	4	5	6
Yes = OK						
No = adjustments needed*						

* In some situations, replacing heads or nozzles may correct the problem. In other situations, the system design may need to be upgraded for water conservation.

5. **Pressure** – Is there a mist cloud around sprinkler heads? Refer to GardenNotes #267, *Watering Efficiently*.

Step 4A 5. Pressure / Mist Cloud						
Zone	1	2	3	4	5	6
Yes = OK						
No = adjustments needed*						

* A mist cloud indicates excessive pressure. Lower pressure to conserve water. In some situations, this may involve installation of an in-line pressure regulator.

6. **Notes:**

B. Maintenance criteria for even water distribution.

1. **Delivery Arc** – For each head, does the delivery angle need adjustment (to avoid spraying the sidewalk, driveway, or other areas outside the zone)?

Step 4B 1. Delivery Arc						
Zone	1	2	3	4	5	6
No = OK						
Yes = adjustments needed						
Identify heads needing adjustments						

2. **Vertical Adjustment** – Do heads need adjustment to vertical (are the heads and risers straight up and down)?

Step 4B 2. Vertical Adjustment						
Zone	1	2	3	4	5	6
No = OK						
Yes = adjustments needed*						
Identify heads needing adjustments						

* Heads off vertical will distort the delivery pattern. Adjust vertically to conserve water.

3. **Height** – Is nozzle releasing water above grass height and un-blocked by obstacles (trees, mailboxes, boulders, etc.)?

Step 4B 3. Height						
Zone	1	2	3	4	5	6
No = OK						
Yes = adjustments needed*						
Identify heads needing adjustments						

* When water doesn't clear grass height, distribution pattern may be distorted. Raise head.

4. **Worn Nozzles** – Look at the fan created by the water spray for each head. Is it uniform around the arc? Rotating nozzles can become stuck in place.

Step 4B 4. Worn Nozzles						
Zone	1	2	3	4	5	6
No = OK						
Yes = adjustments needed*						
Identify heads needing adjustments						

* Replace worn nozzles to improve distribution pattern.

5. **Replace Leaky Valves** – In the irrigation valve, the rubber diaphragm that turns water on and off, degrades over time. Valves that do not shut-off completely need the diaphragm or entire valve replaced. Valves may also fail to open fully, reducing available water pressure for the system.

Step 4B 5. Leaky Valves						
Zone	1	2	3	4	5	6
No = OK						
Yes = adjustments needed*						
Identify heads needing adjustments						

6. **Evaluate Dry Spots** – If the lawn has obvious dry spots, place five to ten identical containers on the lawn, in the dry spot and on the green areas. After running the sprinkler for their normal time, compare the amount of water collected in each can (measure to at least 1/10-inch accuracy if measuring by depth).

Step 4B 6. Evaluate Dry Spots						
Zone	1	2	3	4	5	6
No dry spots						
Dry spot(s) receiving less water than the green areas[1]						
Dry spot(s) receiving similar amounts of water as green areas[2]						

1. When the amount of water received in dry area cans is significantly less than the green area cans, poor water distribution is a primary contributor. Evaluate irrigation design and maintenance issue.
2. When the amount of water received in both the green area cans and dry area cans are similar, the problem is not directly related to sprinkler performance. Evaluate other growth factors, including soil compaction, thatch, run-off, insect or disease problems, etc.

Adjustments identified in Step 4 need to be performed before continuing to step 5.

Step 5. Perform Precipitation Rate (Catch Can) Test

Perform a precipitation rate test (catch can test) for each zone, recording the precipitation rates in Table **6A, *Run Times***.

Precipitation Rate (Catch Can Test)

To do the calculations you will need six identical, straight-sided, flat bottom containers, such as soup cans, fruit or vegetable cans, or even coffee mugs. (Do not use short cans like tuna cans as they are too shallow, and water may splash out.) You will need a ruler, a watch, and paper/pen to record your findings.

Steps:

- Place six identical, straight-sided, flat bottom containers randomly around the area between sprinkler heads in the zone.
- Turn on the sprinklers for exactly ten minutes.
- Pour all that water into one container.
- With a ruler, measure the depth of the water in the can. This is your precipitation rate in inches per hour.
- Write down the rate for each zone in ***Step 8***.
- Repeat the first five steps for each irrigation zone.

Note: if the amount of water in some containers is significantly more or less than others, it indicates that the system is poorly designed, or head(s) are malfunctioning.

Step 5. Precipitation Rate						
1. Zone	1	2	3	4	5	6
2. Precipitation Rate (inches/hour)						

Step 6. Calculate System Run Times for Each Zone

A. Working down through the table, calculate the run time per irrigation.

Step 6A. Run Times						
Zone	1	2	3	4	5	6
1. Historical Summer ET. Amount of water to apply.	1.5 inches weekly					
2. Precipitation Rate – inches/hour.						
3. Run time per week (July/August) Based on Precipitation Rate for the zone.						
4. Number of Irrigations/Week Refer to Step 1-3 above.						
5. Run Time Per Irrigation Convert the Run Time per Week (line 4) to Run Time per irrigation.						

Note: ET, or evapotranspiration, is a term used to describe the amount of water consumed by plants over a period of time. In landscapes that provide complete ground cover, like lawns, ET is almost entirely made up of water that is transpired through plants as they pull water through the soil and release it into the air through stomates on leaves. For up-to-date and local ET data throughout Colorado, visit coagmet.colostate.edu.

B. Adding cycle and soak.

Most clayey and/or compacted soils cannot absorb water as quickly as pop-up spray sprinkler nozzles apply it. Many clayey soils, typical of the Front Range, absorb about ¼ inch of water per hour. Therefore, the most effective watering schedule on these soils would be to set each zone to deliver no more than ¼ inch per cycle with multiple cycles. For example, if the lawn is to have ½ inch of water, set controller to apply ¼ inch and cycle back an hour later to apply the second ¼ inch. If the lawn were to have ¾ inch, set the controller to apply ¼ inch per cycle with three cycles.

Cycle and soak are particularly helpful on slopes to avoid wasteful surface runoff.

Step 6B. Cycle and Soak						
Zone	1	2	3	4	5	6
1. Need for Cycle and Soak? Yes or No						
2. Run Time Per Irrigation from Step 6A, line 5.						
3. Number of Cycles.						
4. Run Time Per Cycle Divide Run Time (line 2) per Irrigation by Number of Cycles (line 3).						

Step 7. Start Time(s)

A. Determine the first start time.

Most communities suggest nighttime irrigation, between 9 p.m. and 9 a.m. Winds are typically less in the early morning, and evaporation loss will be lower. However, many communities experience peak water use from 4 a.m. to 6 a.m. as many sprinklers come on. If you have low-pressure issues, take advantage of the whole watering window and use a less popular time.

Enter your first start time into the table for **Step 7A & B. Start Time(s)**, row #1.

B. Add additional start times for Cycle and Soak (if needed).

1. Add all the Run Times per CYCLE together.
2. Cycle Time – Round this up to the next ¼ or ½ hour (depending on what start time intervals are used in your controller start options). This is the time to run through all the zones. Add this to table **Step 7A & B. Start Time(s)**, Rows 2 and 3. Or add one hour if the total run time is less than 60 minutes.
3. Add this to the first start time for the second start time. Record your second start time in table **Step 7A & B. Start Time(s)**, Start Time 2.
4. Likewise, if a third cycle is needed, add this to the second start time to get the third start time. Record this in the table **Step 7A & B. Start Time(s)**, Start Time 3.

Step 7A & B. Start Time(s)	
1. Start time 1	
Total cycle time	
2. Start time 2 (if needed, add line 1 to line 2.)	
Total cycle time	
3. Start time 3 (if needed, add line 3 to line 4.)	
Total cycle time	

Step 8. Set the Controller for July/August Run Time

A. Set the run times for each zone as listed in table **Step 6B. Cycle and Soak**, if Cycle and Soak is not used, or **Step 6B. Cycle and Soak**, line 4 if Cycle and Soak is used.

B. Set the start time(s) as given in table **Step 7A & B. Start Time(s)**.

Step 9. Seasonal Adjustment

A simple way to adjust for the season is to use the **Percent Key** found on most controllers.

- For Late April and early October, set the percentage to 50%.
- For May/June and September, set the percentage to 67%.

An alternative method is to repeat **Steps 6 to 8** for the spring/fall season.

Step 10. Fine-Tune to Match Site Specific Needs

These textbook figures are a good starting point in irrigation management. However, any scheduling method will need fine-tuning to match the actual water need of the site based on the exposure, wind, heat, and shade. This is done by careful observation of the lawn.

- **When adjusting all zones**, using the *Percent Key* on most controllers is an easy method to fine-tune for the water delivery by adjusting the percentage up/down in 10% increments. Adjustments can also be made by changing the run time of each zone up/down in 10% increments.
- **When adjusting a single zone**, adjust the run time for that zone up/down in 10% increments, as needed.

In typical summer weather, if the lawn starts to become dry between irrigations, increase the run time in 10% increments, as needed. With experience, it becomes easy to fine-tune each irrigation zone. During multiple days of unseasonably hot weather, dry spots should begin to pop up provided the controller has been precisely fine-tuned. Otherwise, if dry spots do not pop up during unseasonably hot weather, the lawn is overwatered. Cut back the time in 10% increments, until each zone has been fine-tuned.

The following guidelines may help you understand some needs for adjustments:

- In full shade (not under a large tree), water use (ET) could be 30% less.
- In hot and/or windy sites, water use (ET) could be 20% to over 50% higher.
- In the rooting area of large shade trees, water use (ET) could be 30% to 50% higher.

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Reviewed August 2023