Getting the Best from Your Irrigation System

Prepared by Labosport for Brisbane Sustainability Agency

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Good understanding and correct management of your irrigation system is essential to both reduced watering costs and optimising turf performance. The following information is designed to aid operation of your sports turf watering system.

Consequences of under-watering

Using insufficient water may save on the water bill, but it is likely to damage turf health and surface performance in several ways, including:

- Creating a hard, potentially dangerous surface;
- Putting moisture stress on the turf and in turn reducing recovery/growth;
- Causing water repellent conditions that leads to localised dry spot.

Consequences of over-watering

The impact of over-watering is not just in terms of an added water bill, but also impact on turf health and surface performance. Over-watering can:

- Create softer surfaces which are more easily damaged during use;
- Encourage weed species;
- Increase the risks of turf disease;
- Reduce soil aeration and in turn damage turf roots and reducing turf resilience;
- Reduce the soil's natural ability to create structure and drainage.

Key information required to schedule irrigation

Information is needed on:

1. The evapotranspiration (ET) rate?
2. How much water the soil can store after irrigation or rain?
3. How much water is your system is applying (per application or per hour)?
4. How effective the irrigation system is (e.g. what is the distribution uniformity)?

Q1. What is your evapotranspiration (ET) rate?

The ET rate refers to how much water is lost from the turf on a daily basis. This rate will vary from season to season and even on a daily basis depending on factors such as temperature and wind run. There are several potential ways of finding out the daily or weekly evapotranspiration (ET) rate. For planning purposes the most practical option is to use long term records to work out the mean daily rate for different seasons.

Table 1. The average long term evapotranspiration data for Brisbane.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean daily ET (mm)	5.6	5	4.5	3.7	2.6	2.3	2.3	3.2	4.2	4.8	5.5	6.3	4.2

Note: 1 mm of evapotranspiration (or rainfall) = 1Litre per sq m, or 10 m^3 per ha.

Q2. How much water can soil store?

Turf root zones will vary in the amount of water able to be stored after rainfall or irrigation. Pure sand root zones tend to store less water than loamy soils. The rooting depth is also a key determinant of the water storage capacity.

Typically a sand topdressed sports field with an effective rooting depth of 125mm will store around 25 to 30mm of plant available water.

Q3 How much water is the system applying per hr?

In order to schedule the duration of a watering cycle we need to determine the effective application rate (in mm per watering cycle) of the watering system. This information can generally be obtained from the system installer, by the use of catch cans or by using water meter (or storage tank) data. For example, if a total of 250 000 litres of water is applied to a sports field of 8500 m^2 in size during a watering cycle this equates to approximately 30mm of water.

Q4. How effective is the watering system?

A well-designed irrigation system, operating in still conditions, would typically offer around 75-80% water use efficiency (The remaining 20-25% of water will be lost due to uneven application and or application outside the desired area). This means that we need to apply an additional amount of water to compensate for the loss.

Water use efficiency can be determined using a catch can test.

Catch can study.

Using a water balance to schedule irrigation

Using basic assumptions in conjunction with measured rainfall (need to have on-site rain gauge) we can get a relatively good estimate of when and how much to water. The process involves keeping a log book on soil moisture, along similar lines to keeping a bank account record.

For example:

- assuming the soil is capable of holding 25mm of plant available water;
- the irrigation systems can deliver 10mm per hour over 8,500sq m (3hrs of watering equals 250,000litres (mm X m^2 X time)
- a water use efficiency of 75%
- a daily ET rate for summer (Dec-Feb) of 5mm per day

We can now determine the frequency and duration of watering, accounting for any rainfall measured.

Date	Daily ET (mm)	Measured rainfall (mm)	Soil water deficit (mm)	Date & duration of watering (mins)
Jan 1	-5	40	0 *2	
Jan 2	-5	0	-5	
Jan 3	-5	0	-10	
Jan 4	-5	0	-15	
Jan 5	-5	0	-20	
Jan 6	-5	0	-25 → 0	3 hours, apply 30mm *1
Jan 7	-5	0	-5	
Jan 8	-5	0	-10	
Jan 9	-5	10	-5	
Jan 10	-5	0	-10	
Jan 11	-5	0	-15	
Jan 12	-5	0	-20	
Jan 13	-5	0	-25 → 0	3 hours, apply 30mm

Notes: *1 the application of 30mm of water accounts for the 25% water efficiency reduction
*2 The rainfall event on Jan 1st would have topped up the soil water storage (zero deficit)

Back up checks on soil moisture

Using a water balance approach as described above will provide a guide for water application. However, there is merit in using other tools to fine tune our scheduling. The two most appropriate tools to check soil moisture are:

- **A soil sampler.** Take plugs out from various locations across the field to identify moisture content; if sticky wet cut back on the watering; if powdery dry increase the watering duration.

- **A soil moisture probe.** A good soil moisture meter is going to cost in the order of $1000. However, the savings made through efficient water use will soon pay this off.

A third way to check on the accuracy of the water balance is to observe the turf. Any colour change in the turf, especially during the heat of the day, could mean moisture stress and a need to increase water application.

Example of soil moisture probe (left) and soil sampler (right).

Other points of note

1. Wind run has a major influence on the evapotranspiration rate and windy conditions will result in greater water requirements.

2. Shaded areas have significantly lower evapotranspiration losses (approximately 50%) and should be watered less.

3. The preferred time to apply water is generally of a night-time, early morning or evening when evaporation and wind are lower. This will help ensure better water use efficiency with less water loss by evapotranspiration and less distortion from wind.

4. Be aware of water repellence (dry spot). Dry patch is a condition that causes localised areas on turf to become water repellent resulting in the underlying soil becoming bone dry.

Soil water repellence (cores on right c.f. moist cores on left).

Simply applying more water may not fix dry patch; the extra water simply runs off the dry patch to the wet areas. Water repellent areas are likely to require use of a surfactant (wetting agent) in conjunction with coring/ spiking to improve water entry.