Irrigation: Use of Recycled Water on Athletic Fields

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There are a number of terms that have been used to describe recycled water. These terms include: gray water, effluent water, secondary and tertiary treated water, treated wastewater, multiple use water, reclaimed water and nonpotable water. While these do not all describe the same type of water, they may all be lumped under the heading of recycled water.

Why should we use recycled water? Why is it gaining in popularity? First, it seems inevitable that the 80 to 85 percent of fresh water currently allocated for agriculture will be reduced and made available for other purposes. The states with the most widespread use of recycled water include Arizona, California, Florida, and Texas. Each person in Florida generates about 100 gallons of wastewater each day. In 1995, there were about 400 reuse systems in Florida. These systems provided about 360 million gallons of reclaimed water each day for beneficial purposes. Total capacity of these facilities was about 860 million gallons per day (mgd). In the past, discharging the treated water into a surface water was the most common form of wastewater management.

Rationale for recycled water use include:

- opportunity - location in proximity to recycled water sources
- need - increased freshwater demand with limited supplies
- conservation - reduce freshwater demand
- reliability of supply - may be more reliable in times of freshwater shortages than potable water
- well-established technology - well tested over time
- economics - may be cheapest source of water
- pollution abatement - if you did not use it, it may be discharged into environmentally sensitive areas
- public policy - public supports reuse and it may be mandated in your area
- successful experiences - literally hundreds of successful water reclamation and reuse operations in the U.S.

The applicability of recycled water for athletic field use depends on its physical, chemical, and microbiological quality. The effects of recycled water's physical parameters chemical constituents are, for the most part, well understood, and recommended criteria have been established by the U.S. EPA. Turfgrass managers should become familiar with federal, state, and local regulations to understand their own obligations, and to assure themselves that their supplier is in compliance. Some regulations include the following:

- identification of pipes, pumps, outlet, and valve boxes
- horizontal and vertical separation of potable and reclaimed water lines
- backflow protection devices on potable water lines
- pipeline design and construction criteria
- may require use of the color purple to denote reclaimed water
- Several states do not permit hose bibs on reclaimed water systems because of potential misuse.
- potable wells, eating and drinking facilities are a fixed distance from irrigation heads or spray patterns
- may be required to post notification on all points of entry and exit that recycled water is being used for irrigation purposes only

The immediate effects of using recycled water can be beneficial; however, turf can be stressed if high concentrations of some compounds are present or allowed to accumulate. If you are going to switch from potable water to recycled water, I

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suggest you establish baseline values when the turf is doing well and then watch for the development of undesirable trends before the turf shows signs of stress. Some recycled waters contain the right amount of many plant nutrients, others may have excess salts. A typical secondary treated sewage effluent will have sufficient nutrient levels to be considered fertigation and should be treated with the same care. Recycled water and potable water varies considerably by location and level of treatment. Secondarily treated municipals effluent can have considerable levels of plant nutrients, while tertiary treatment removes many of the compounds containing nitrogen and phosphorus.

Nutrients

Testing Laboratories will analyze a water sample and report nutrient and salt concentrations in parts per million (ppm). To estimate how many pounds of an element the irrigation system is applying per 1,000 square feet per month, simply multiply the ppm of that element by 0.0052 to obtain pounds of the element in every inch of water per 1,000 square feet. The amount of nutrient or salt added by irrigation can then be estimated by multiplying this value by the inches of water applied over the desired period of time.

Salts

Electrical conductivity (EC) and total dissolved salts (TDS or TSS) are a measure of salinity. As salt concentration increases, plant water uptake becomes less efficient. We also have some salt sensitive plants such as many of our ornamentals and trees. Salt-sensitive problems can occur when the TDS of irrigation water exceeds 480 ppm. Values greater than 1920 ppm causes severe restrictions for most plants ***(See chart).***

Damage signs

First signs of recycled water problems usually show up in broadleaf plants (trees, shrubs, flowers) that are not as tolerant to higher salt or higher nitrogen content of some recycled water. The first problems noted with grasses are usually during establishment of grasses, particularly the cool-season grasses. Permanent or overseeded ryegrass establishment will commonly show the first signs of a problem. A high level of salinity in irrigation water can reduce or delay seed germination and seedling development. The first sign of salinity problems on established turf is blue-green colored plants that appear to be drought stressed. But the drought is osmotic in origin and not due to lack of irrigation. As damage from salinity stress increases, the turf will wilt, leaf tips will die and turf density will decline.

Management of Saline Water

Several management techniques can be used to handle salinity in water. The first line of defense is to use a tolerant grass. The first cultural practice to incorporate is to improve drainage. Salts are usually carried away in excess water, either from irrigation or rainfall, below the rootzone. If salts do not move through the rootzone they will accumulate. Drainage may be improved from something as simple as regular aerification to more extensive installation of a subsurface drainage system.

In those parts of the country where annual precipitation exceeds evapotranspiration, salts are naturally leached from the soil profile. Where precipitation does not exceed evapotranspiration, salts will accumulate in the rootzone unless they are leached. Leaching is the intentional application of excess water beyond the needs of turf to transport salts below the root zone. The goal is to maintain a salinity level in soil that the turf species can tolerate. Of course there are limitations as to how much salt can be removed from the rootzone since irrigation water contains salts.

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Table 1. Hazardous salt concentrations. (Note: multiply dSm^{-1} by 640 to convert to ppm).

Salinity Hazard	Total dissolved solids (TDS) ppm or mg L^{-1}	Electrical conductivity (EC) dSm^{-1} or mmhos cm^{-1}
Low Water with little likelihood of boosting soil salinity	<160	<0.25
Medium Water which may have detrimental effects on sensitive plants	160 to 480	0.25 to 0.75
High Water which may have adverse effects on many plants and requires careful management	480 to 1,440	0.75 to 2.25
Very high Water generally not recommended for irrigation	>1,440	>2.25

taken from C. Throssel. 1996. Golf Course Management. 64:61-64