The Use of Effluent Water for Sports Turf Irrigation

Alex Campbell, On-Site Waste Management Specialist

Over the past five years, there has been a growing number of stories in the news relating the woes of towns, villages, and cities throughout Ontario, Canada, and North America undergoing water shortages. For Ontarians, it is often difficult to understand how a water shortage can result when much of the population lies within a one hour drive of Lake Ontario. In fact, Ontario has one of the largest freshwater supplies in the world when all its lakes are considered. The problem is not a source of raw water, but an ability to convert sufficient quantities of this water to drinking water quality. For many years, arid and semi-arid climatic areas have responded to a decreasing water supply by increasing the use of more non-potable water for irrigation. These waters include stormwater runoff, graywater discharge, and treated sewage effluent, which is often referred to as reclaimed water. In some states it is required that turfgrass facilities over a given size, usually 10 acres, must use treated sewage effluent for at least 50% of their irrigation needs. It is also estimated that by the year 2000, up to 75% of all golf courses will use non-potable water supplies for irrigation. While that may be optimistic, there is a growing number of golf courses utilizing stormwater and sewage effluent for irrigation, even in areas that do not have a potable water shortage.

The use of sewage effluent for irrigation brings mixed reactions. There is a general popular movement to support the use of sewage effluent by the public and approval authorities. But, there is also a reluctance on the part of approval authorities to allow effluent reuse without stringent controls and conditions. This is due to their concern over risks, perceived or real, to public health and the environment. Yet, as with many things, this too is changing. Approval authorities are not the only ones holding out. Some turfgrass facility designers and managers still prefer treated freshwater for use on their turf mainly because they can rely on a given quality of water being available with little fluctuation. The use of sewage effluent inherently requires more effort on the part of the manager to check the incoming water quality.

Sewage Treatment

Everyone has heard the term sewage treatment, but what does it really mean? How is sewage treated? Essentially, sewage treatment is a collection of physical, biological, and chemical processes which when grouped together in a given manner will produce a given quality of effluent. How the different processes are grouped is dependent on the level of treatment required. How environmentally sensitive an area is and where the sewage effluent will be discharged governs the level of treatment required. For example, a discharge of sewage effluent high in phosphorous would not be permitted into a cold water fishery because the high levels of phosphorous would ultimately be detrimental to fish habitat.

There are three levels of sewage treatment used throughout the world. These are primary, secondary, and tertiary or polished secondary. Primary sewage treatment is the removal of coarse solid material through screening, sedimentation, or a combination of these. Secondary treatment is a biological process through which complex organic compounds are broken down. Secondary treatment may follow primary treatment or the facility may combine the processes together. Tertiary treatment is a biological, chemical, or filter process in which a very high quality effluent is produced. After this process, the quality of the effluent is equal to drinking water. Normally, for use on turfgrass, the effluent must be of secondary quality, which means that the five day biological oxygen demand (BOD_5) and the total suspended solids (TSS) concentrations must be less than 20 ppm with an *E. coli* count of 200 MPN/100 ml, which is body contact disinfection for a public swimming area. Over the past 10 years, a number of innovative technologies for sewage treatment have emerged which utilize a variety of filtering media. These include sand filters, sphagnum peat filters, sponge foam media, geotextile media, micro-filtration units, as well as aerated media units (i.e. Nibbler™). The advantage of these units is that a very high quality of effluent can be obtained on a consistent basis without the need for high operational and maintenance requirements. Thus, sewage treatment for many facilities is very affordable.

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Why Use Reclaimed Water?

There are many benefits to using reclaimed water—not the least of which is that it conserves freshwater supplies and does not place a heavy demand on water treatment plants. For the sports turf manager, the first benefit is that turfgrass has the capability to absorb large amounts of nitrogen and phosphorous, the two major nutrients in sewage effluent. Removal of these nutrients prior to discharge can result in large capital costs to the sewage treatment plant. Thus, applying reclaimed water to turfgrass facilities "treats" the sewage effluent by filtering out and absorbing the nutrients within the wastewater before it enters the natural environment. Turfgrasses also require various amounts of micronutrients which are often abundant in sewage effluent depending on the source. Thus, fertilization costs can be reduced when using reclaimed water.

In rural areas, the disposal of effluent onto turfgrass areas can significantly minimize the impact on nearby surface water. Thus, creation of a "sewage treatment plant" could be made possible where it otherwise would not be. In all areas, the use of reclaimed water means an almost infinite supply of irrigation water even in drought periods. This is because wastewater is continuously produced in all municipal centres; thus, the sewage treatment plant always has an effluent stream which can be used. Furthermore, at the current time, most municipalities do not charge for effluent; thus, it is not only a continuous source of water, but it is a free or at least a low cost source of water.

It Sounds Great. What's the Catch?

There is no real catch, but there are some cautions which should be considered when using reclaimed water. First and foremost, remember that it was sewage when you started and by definition it still is when you're finished. The Ontario Water Resources Act defines sewage as all dirty water—since you cannot drink the effluent, it is still sewage. Also, while the sewage treatment plant would disinfect the effluent before delivery, it is not to drinking water standards and still carries a significant number of biological vectors. Where the wastewater is applied to the turf through the use of spray irrigation, airborne transmission of pathogens may be of concern, especially if near a residential facility. Second, the reclaimed water quality is a function of the sewage that has moved through the sewage treatment facility, the level of treatment received, and a number of other factors, all of which affect the concentrations of its constituents. Thus, more frequent analysis of the incoming water is required to ensure that fertilization requirements are met and that the incoming water does not contain contaminants that would be detrimental to turf quality.

The main problem with the use of reclaimed water on turfgrass is the potential to increase soil salinity. Wastewater effluent is typically high in sodium and other salts. In heavy soils, these salts may accumulate in the root zone and have a negative effect on turf quality. Flushing of the areas with freshwater may alleviate this problem but careful monitoring of the incoming water is more of a preventative measure. Reduced permeability, which is often related to the salt content of the reclaimed water, is often also a problem. This is especially true of wastewater high in sodium, carbonate, or bicarbonate. Finally, reclaimed water from a sewage treatment plant with a high industrial wastewater component may contain large concentrations of toxic contaminants which may be directly toxic to the turf or may accumulate to toxic levels. Thus, water quality sampling is required. Ironically, some substances which are found in wastewater and are problematic to the environment, are very beneficial to turfgrass. Trace elements such as copper and boron are often found in quantities beneficial to the turf to which they are applied.

Cost is also a factor when considering the use of reclaimed water. While the water itself may be available free or at a fraction of the cost of freshwater, the costs associated with sampling the water quality, additional sewage treatment (if necessary), or additional soil amendments to overcome salinity problems can outweigh the benefits. Delivery of irrigation water can also be costly. For example, in some areas where spray irrigation is used, nozzles which minimize aerosol production have to be employed. An alternative is drip irrigation technology, which is ideally suited for turfgrass application as it delivers the water directly to the root zone, but it may not be cost effective in cooler climatic areas. Drip irrigation also minimizes the potential for pathogenic bacteria contact with persons using the turfgrass facility.

Summary

It is clear that the future will bring more restrictive conditions for non-residential uses of freshwater. A greater reliance on reclamation and reuse of wastewater will result. At present, sewage effluent can be obtained very cheaply. However, in the future, it is likely that the cost of the resource will increase as more users attempt to obtain it. The most important benefits of using reclaimed water are that it preserves our freshwater reserves and minimizes demand on treatment plants. It is constantly available, even during drought periods, and has the potential to reduce fertilizer costs. Thus, it is highly recommended that turfgrass managers consider the use of reclaimed water for irrigation purposes for existing and new facilities. ♦

For more information, contact Alex at R. J. Burnside and Associates Limited, 15 Townline, Orangeville, Ontario, L9W 3R4. Phone: (519) 941-5331, fax (519) 941-8120, e-mail: acampbell@rjburnside.com.