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The Push for Effluent Irrigation

Editor's Note: This article—part one of a three-part series—originally appeared in the July/August issue of *The Grass Roots*, the official publication of the Wisconsin GCSA. Our thanks to the WGCSA for permission to reprint this discussion of a very timely topic.

Fights and arguments over water rights and water quality are as ancient as civilization. In Wisconsin we think of water quality and quantity issues as being remote: confined to the Middle East, or perhaps in our own Western states. In reality the truth is much closer to home. In today's newspaper two articles were devoted to the need to preserve water quantity and quality right here in Wisconsin. Over 70% of Wisconsin's citizens depend on groundwater for drinking, bathing, washing and other uses (Seely, 2001). Yet private wells are going dry, and aquifers beneath municipalities are being drawn down at an alarming rate. Part of the trouble is we are using water faster than the aquifers can be replenished. The other aspect is that of contamination: as water quantities diminish, pollution rates increase. Pollutants can come from natural causes like arsenic from the soil or from human by-products such as agrichemicals. While research has yet to document golf courses as being genuine polluters of water supplies, the public generally does not know of the results or does not believe the data.

FIGURE 1.

WATER USE IN THE U.S.
(Ratcliff, 1999)

Agriculture	79.6%
Industry power	8.5%
Domestic	4.3%
Livestock	3.2%
Landscape	2.9%
Golf	1.5%

Nearly 80% of water use in our country goes towards irrigation (Figure 1: Ratcliff, 1999). In 1995, 134,000 million gallons of water were used daily for irrigation. Fifty million acres of agriculture land and over 20 million acres of residential ad commercial landscapes were irrigated. On a hot summer day, an 18-hole golf course may use up to 300,000 gallons of water. Golf course irrigation, though, accounts for less than 2% of water use in the U.S. One of the advantages of golf courses being run by increasingly educated and professional superintendents is the intelligent water use practices that have been developed and that are increasingly refined. Indeed, golf course irrigation is typically highly efficient. Nighttime or early morning irrigation results in minimal evaporative losses. Irrigation is monitored to avoid runoff. Since golf courses are nearly 100% pervious surface, the water that is not used by plants for growth will eventually percolate back to an aquifer, cleansed and filtered by the foliage and root systems of the turf and other plants. In addition, many golf courses have their own water supplies (e.g., ponds). Yet golf courses are highly visible to the public and are constantly under scrutiny. The homeowner who has had his water turned off by the city due to a drought, or the environmentalist who questions the very right of a golf course to exist, view golf course irrigation as an obscene waste of a valuable resource.

Theoretically our water can come from four sources: precipitation, surface water, ground water and effluent water. For nearly 20 years golf courses in the western U.S. have increasingly turned to effluent water as a way to skirt the rapidly shrinking availability of fresh water. The economics can be favorable as well: effluent water costs can be 80% or less of potable water costs (Huck et al., 2000). Potable water is, of course, fresh, i.e., drinking water. Effluent water has been through at least one cycle of domestic use (McCarty, 2001). It is sometimes referred to as gray, reclaimed, recycled or even wastewater. According to the National Golf Foundation, 13% of U.S. golf courses used effluent water for irrigation in 1999 (NGF, 1999). The majority of these golf courses were located in the Southwest, but an increasing number of golf courses in the Southeast are turning to effluent water. Lately, a sprinkling of golf courses along the East Coast have begun using effluent water. Mounting public pressure has forced the use of effluent water in some locations. For example, California passed legislation in 1992 requiring effluent water to be used, where available, for irrigation.

Effluent water is usually subjected to three levels of treatment before being discharged for reuse: primary, secondary and tertiary (McCarty, 2001). In primary treatment, screening and sedimentation are used to remove organic and inorganic solid materials. This includes sand, stones and other material which may be washed and placed in a landfill. Approximately 60-70% of suspended solids and 25-40% of biological oxygen demand (BOD) are removed by the primary treatment. (BOD is biodegradable organic material such as proteins, carbohydrates and fats. Untreated, their decomposition uses oxygen dissolved in water, which is necessary for most aquatic life and creates septic conditions.) Primary effluent may be chlorinated to kill bacteria and decrease odor problems. It is NOT intended for irrigation as it can contain harmful human pathogens and other undesirable compounds.

Secondary treatment consists of trickling primary effluent water through vats of bacteria designed to remove up to 90% of the organic matter. Afterwards, the water is chlorinated to kill pathogens. The primary pathogen that engineers are concerned with is coliform bacteria. After treatment, secondary effluent water must have less than 23 coliform bacteria per 100 ml water. Secondary effluent water is a

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principal source of water for agricultural irrigation in some areas. Although it can be used for turf in some instances, it generally is not recommended due to the high level of nutrients and other compounds it can contain.

Tertiary treatment produces water that is most suitable for turf irrigation if potable water is not available. Seondary effluent is filtered over beds of charcoal to remove non-biodegradable organic material and most nutrients such as nitrogen and phosphorus. Properly treated tertiary effluent should be relatively odorless and must have less than 2.2 coliform bacteria per 100 ml water.

While wastewater engineers are concerned primarily (or only) with pathogen levels in effluent, superintendents must also consider the many management issues associated with use of effluent for golf course irrigation. From an agronomic stance, effluent can have effects on both turf and soil qualities. There are often additional financial considerations that must be met—effluent water is not necessarily "free." Many regulatory issues must be met before effluent can be brought onto a golf course and used for irrigation.

The four main characteristics of effluent water that dictate its utility for any situation are 1) Biological components, 2) Organic components, 3) Dissolved salts and nutrients (including heavy metals) and 4) Dissolved and suspended solids. Wastewater treatment facilities generally reduce the concentration of biological and organic components to a minimum. The potential for problems and remedies associated with dissolved salts, nutrients and solids will be discussed in a future issue.

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