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Using Reclaimed Water

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Reclaimed water, sometimes referred to as "water reuse" or "recycled water," is water recovered from domestic, municipal, or industrial wastewater treatment plants that has been treated to standards that allow it to be safely used for designated purposes. Reclaimed water should not be confused with "**wastewater,**" untreated liquid industrial waste or domestic sewage. However, "**gray water**," untreated water from bathing or washing, is considered one form of wastewater (Water Reuse, VCE Publication 452-014).

The level of treatment and disinfection reclaimed water receives is dictated by its intended (and permitted) use. Many states encourage and promote the use of reclaimed water to conserve freshwater supplies and preserve rivers, streams, lakes, and aquifers.

Why use reclaimed water?

While many states in the southeast receive large amounts of annual rainfall, periodic droughts still occur. This was starkly demonstrated by a severe drought in 2007 when Lake Lanier, the main water supply for the city of Atlanta, dropped to record low levels. Combined with the increased demand for fresh, clean surface and groundwater for public water supply, more widespread and prolonged water shortages are expected if the current use of potable (drinking quality) water for non-potable needs continues. Conservation measures, such as using reclaimed water for landscape irrigation, is one way of reducing our use of existing potable water supplies.

Reusing water helps to conserve drinking water supplies by replacing the use of potable water with reclaimed water for uses such as irrigation and vehicle washing. Reusing water also helps reduce environmental degradation by reducing the amount of reclaimed water discharged to lakes, rivers, streams, and coastal waters. Reclaimed water often contains plant-available nutrients at higher levels than are typically found in natural waters. High levels of nutrients can cause eutrophication when discharged to fresh and coastal waters, which results in reduced water quality and adverse impacts on aquatic life. When applied to the landscape, these same nutrients can be beneficial, and reduce the need for additional fertilizers (U.S. EPA, 2004). However, landscape irrigation with reclaimed water can still cause eutrophication of water bodies, when nutrients are applied in excess of plant needs, or by over-irrigation.

Traditionally viewed as a waste to be disposed of, reclaimed water is now being viewed as a valuable resource whose use can conserve surface and groundwater.

What is reclaimed water and how is it produced?

There are three stages of wastewater treatment: primary, secondary, and advanced, sometimes called tertiary (Figure 1, next page). During primary treatment screening and settling remove suspended solids. Next is secondary treatment, where biological

decomposition is used to decompose complex organic material into simpler forms. The water is then separated from the decomposed organic material and is either disinfected—often by chlorination—and discharged, reused, or subjected to advanced treatment. Advanced treatment may be used to further remove solids, organic material, nutrients, or other chemicals using physical, chemical, or biological processes. After advanced treatment the water is disinfected before being reused or discharged (typically to rivers, lakes, or coastal waters). Reclaimed water is treated wastewater that has received, at a minimum, secondary-level treatment and basic disinfection at a wastewater treatment facility. The level of treatment affects the amount of nutrients in reclaimed water (secondary-treated water typically has significantly higher nutrient content than advanced-treated water). However, the exact content will vary from utility to utility.

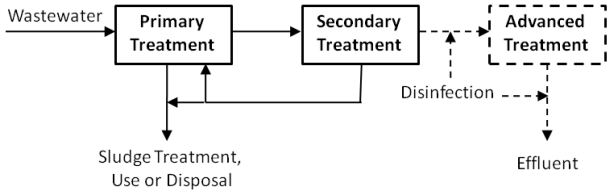

Figure 1. The wastewater treatment process. Some or all of the effluent (reclaimed water) can be reused. Advanced treatment is an optional step in the treatment process. Disinfection occurs after advanced treatment in facilities that use this step, otherwise disinfection occurs after secondary treatment.

How can reclaimed water be used?

There are no federal regulations governing the use of reclaimed water. However, the U.S. Environmental Protection Agency has established guidelines to encourage states to establish reuse programs. Many states have their own regulations that specify how reclaimed water may be used and the treatment and disinfection requirements for each type of use. Reclaimed water that may come into direct human contact is typically required to have the most stringent treatment and disinfection, to eliminate potential exposure to human pathogens.

Opportunities for using reclaimed water include irrigation, industrial cooling, and in some locations groundwater recharge. The most common use is irrigating public access areas, including residential areas, golf courses, athletic fields, and parks. Reclaimed water used for public access area irrigation is supplied by a distribution system that is separate from drinking water systems, so there is no danger of cross contamination. This is sometimes referred to as a dual-pipe system where both reclaimed and potable water are supplied by separate pipes. Some reclaimed water is used for agricultural irrigation to grow feed, fiber, or other crops that are not for human consumption. In some locations reclaimed water is permitted for irrigation of crops for human consumption but must meet stringent treatment and disinfection requirements and is usually not allowed to come in direct contact with the edible portion of the crop. While these are examples of how reclaimed water is used in some locations, each state has its own permitted uses and treatment and disinfection requirements.

Considerations for using reclaimed water for landscape irrigation

Reclaimed water used for landscape irrigation must meet stringent treatment and disinfection requirements, since it has the potential to come into direct human contact. However, these requirements are focused on human health, not the health of the environment. Reclaimed water can contain other pollutants such as trace amounts of heavy metals, pharmaceuticals, and personal care products that were not removed in the treatment process. From the perspective of landscape health and environmental

protection, the two main issues that should be considered are the potential for salt buildup in the soil and for over-application of nutrients, which could migrate to surface water bodies in runoff or leach to groundwater.

Salinity

Salinity, the amount of salt contained within the water, may be the single most important parameter in determining the suitability of reclaimed water for irrigation (U.S. EPA, 2004). Applying large amounts of high-salinity reclaimed water can affect the salt content of the soil, which could then affect landscape plants. Locations which receive large amounts of rainfall (which is very low in salinity) are less affected for two reasons: large and frequent rainfall events 1) reduce the need for irrigation and 2) periodically leach salts from the soil, preventing accumulation. Evapotranspiration, the rate that water is removed from the soil by plant transpiration and soil evaporation, can affect soil salinity by allowing salts to concentrate as water is removed. The effect of evapotranspiration is more important in arid or semi-arid regions, where natural leaching rains are infrequent. Another important factor is soil texture. Sandy soils typically leach readily, while silty or clayey soils do not.

Plants differ in their sensitivity to salinity, so the salt content of reclaimed water should be evaluated for appropriate use. For example, crape myrtle (Lagerstroemia sp.), azaleas (Rhododendron sp.), and Chinese privet (Ligustrum sinense) have fairly low salt tolerance (Crook, 2005), while several turfgrasses grown in the southeastern US have moderate to high salt tolerance. Over irrigation of salt-sensitive plants should be avoided, and periodic intentional leaching should be done to prevent salt buildup.

Nutrients

An often-overlooked aspect of reclaimed water is the nutrients it contains, particularly nitrogen and phosphorus. These nutrients can be detrimental when used for industrial purposes such as cooling water, since nutrients can encourage biological growth, which can cause fouling. In these situations, an additional treatment process is often used to remove nutrients and avoid any problems. On the other hand, such nutrients can be beneficial when reclaimed water is used for irrigation and can supply a significant portion of plant needs (U.S. EPA, 2004). This can reduce the amount of applied fertilizer. Note that supplemental fertilization may still be required depending on the desired results.

The nutrient content of reclaimed water varies depending on the treatment processes used. In general, treatment plants using advanced treatment typically produce reclaimed water with lower nutrient levels than those using secondary treatment. However, reclaimed water from plants using advanced treatment often contains higher nutrient levels than potable water. The nutrient content of reclaimed water varies from utility to utility and even day to day. Check with your local treatment plant before using reclaimed water for irrigation.

Several turf grass experts have recommended incorporating nutrients supplied from reclaimed water into golf course fertility plans. These nutrients are believed to be efficiently used by turf grasses since they are applied by irrigation on a regular basis, even if they are only present in low concentrations. Depending on the concentrations, using reclaimed water has the potential to provide a significant portion of the nitrogen, and potentially all of the phosphorus, required by turf grass. Incorporating nutrients from reclaimed water into a nutrient budget would also allow for the reduction of high-dose applications in nitrogen, which in turn can increase nutrient uptake efficiency and decrease potential environmental impacts. The value of such nutrients

can be an important economic consideration. When planning fertilization schemes, it is important to account for the timing of application, since the relatively constant low dosage provided by irrigation with reclaimed water may not be optimal for a given plant. Landscape fertilizer application rates should account for the nutrients supplied in reclaimed water. This is of special importance in locations where nitrogen and phosphorus pollution of water is a concern. Special caution should be taken when using reclaimed water in soils that do not need phosphorus. As with other sources of plant nutrients, it is important to apply reclaimed water appropriately. Over irrigating with reclaimed water can contribute to salt accumulation and application of nutrients in excess of plant needs, particularly if other fertilizer sources are used. Care should be taken in eliminating over spray from irrigation systems using reclaimed water.

Summary and Conclusion

Using reclaimed water for uses that do not require drinking quality water is an effective method of conserving freshwater supplies. While reclaimed water can be used for a variety of uses, the most common is for landscape irrigation. When used for landscape irrigation special management may be required to prevent over application of nutrients in excess of plant needs and to prevent salt buildup in the soil.

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