

Importance of Reclaimed Water in Florida

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Abstract. *Florida is the largest producer of reclaimed water in the U.S., and this water has become an important alternate water source for Florida. The purpose of this paper is to discuss several issues related to reclaimed water use in Florida. While agriculture was initially the largest user of reclaimed water, golf courses and landscape irrigation are now its largest users. Initially, growers refused to accept reclaimed water because of concerns over salinity, heavy metals, and potential disease organisms. These fears were proved to be unfounded, and most citrus growers and residential users now accept reclaimed water. Studies have shown that reclaimed water promotes excellent citrus tree growth. Reclaimed water has an excellent safety record, and has been used successfully in Florida for more than 40 years with no reported incidents of illness. While citrus trees can extract adequate amounts of some micronutrients, they are not able to take up sufficient nitrogen from reclaimed water. Hence, fertilization is still necessary when using reclaimed water. While not usually a problem, salinity can sometimes be an issue in coastal areas. Periodic droughts since 2000 and fewer restrictions on reclaimed water for irrigation have increased demand for this water. Reclaimed water has become an important source to help meet growing urban water needs. With increasing population, reclaimed water will continue to play a significant role in overall Florida water management.*

Keywords. Recycled water, irrigation, reuse, wastewater

Introduction

Florida has less than half the population of California. Statewide, Florida receives an average of 54 inches of rainfall, while much of southern California receives less than half that amount. Yet Florida is the leading state in the nation in terms of reclaimed water production. Why is this?

Issues relating to water quality, population growth, and saltwater intrusion are some of the primary reasons that Florida currently produces more reclaimed water than other states. Florida's population increased five-fold from 1950 to 2000, and it is now the fourth largest state in the nation with a 2008 estimated population of 18.3 million.

Several major reclaimed water projects in Florida were started for water quality reasons. The City of St. Petersburg developed its reclaimed water system in 1972 after passage of the Wilson-Grizzle Act. This act mandated that "wastewater treatment plants discharging to Tampa Bay and its tributaries treat their wastewater to that of drinking water standards..." (Tchobanoglous et al., 2003). St. Petersburg became the first major city in the U.S. to reach zero discharge of wastewater effluent into nearby surface

waters. By reducing demand for well water near the coast, this project helped slow saltwater intrusion. Another project, Water Conserv II, was started in 1986 to stop discharge of treated wastewater from Orlando and Orange County into Lake Tohopekaliga, an important recreational bass-fishing lake. Now, water shortages (or lack of water quantity) in Florida are helping drive the increased production of reclaimed water.

Recent spring droughts from 2000 through 2009 have increased demand for reclaimed water. Severe restrictions were placed on residential irrigation with potable water in Tampa in 2009, while there were fewer restrictions on reclaimed water irrigation. Most of the Water Management Districts in Florida are actively promoting the use of reclaimed water as a way to save potable water.

Uses of Reclaimed Water

As of 2007, Florida produced an estimated 242.1 billion gallons of reclaimed water per year. Current inventory data on California could not be found, but estimated reclaimed water production in California in 2002 was 171.22 billion gallons (Fig. 1). Production of reclaimed water in Texas was 40.96 billion gallons in 2003 and is estimated to increase to 141.57 billion gallons by 2010.

In 1992, Florida produced 290 million gallons of reclaimed water per day (mgd) and this more than doubled to 663.3 mgd by 2007 (FDEP, 2009). In 1992, agriculture was the largest user of reclaimed water in Florida and golf course irrigation was the second largest user. By 2007, Florida agriculture used only 12% while golf courses used 21% of the total reclaimed water (Fig. 2). In contrast, agriculture was still the dominant user of recycled water in 2002 in California (Fig. 2) and accounted for 46% of the total recycled water use.

The U.S. Environmental Protection Agency (EPA) established guidelines for water reuse. Rather than establishing national water reuse standards, the EPA decided that comprehensive federal guidelines, along with state regulations, would increase implementation of water reuse projects. Hence, states have established their own water reuse regulations.

In Florida, the Florida Department of Environmental Protection (FDEP) established these water quality standards and regulates reclaimed water. Florida has been a leader in the production and use of reclaimed water for several decades.

Reclaimed water helps extend water supplies and helps meet Florida's growing demand for water. Reclaimed water is used for many purposes in Florida, including the following:

- Lawn and landscape irrigation;
- Water for decorative fountains, lakes, or ponds;
- Industrial uses, such as cooling towers;

- Wetlands restoration or enhancement;
- Irrigation of edible crops (citrus and vegetable) that will be peeled or cooked before eating; and
- Indirect irrigation of edible crops that will not be peeled or cooked (by using drip or other forms of irrigation where there is no direct contact of the reclaimed water with the edible part of the plant).

Although reclaimed water meets more than 95% of drinking water standards, reclaimed water is not intended to be used for drinking. Hence, in Florida, reclaimed water cannot be used for the following purposes:

- Drinking or cooking;
- Filling swimming pools or hot tubs;
- Interconnecting with a drinking water pipeline; and
- Playing in water that involves continuous contact with reclaimed water (SWFWMD, 2009).

Safety of Reclaimed Water

Reclaimed water has an excellent safety record. Reclaimed water has been used in Florida for more than 40 years with no incidence of illness. Because reclaimed water is disinfected (usually by chlorination), it can be better than some other irrigation sources from a health-and-safety point of view. In fact, reclaimed water undergoes more testing than most irrigation waters. Water quality standards for reclaimed water are more strict than standards for recreational water. Because of these strict water quality standards, there is essentially no risk to humans or animals from periodic contact with reclaimed water.

Reclaimed water can meet drinking water standards for many elements, but reclaimed water is not required to meet all the drinking water standards. (Reclaimed water is not currently intended to be directly used for drinking.)

Irrigation of Edible Crops

For crops that are “peeled, cooked, or thermally processed,” reclaimed water can be directly applied to the edible part of the crop. Hence, reclaimed water can be used with overhead irrigation for citrus and other crops that are peeled or cooked.

For crops that are eaten raw (called the “salad crops”), FDEP regulations currently require that there be no direct contact of the reclaimed water with the edible part of the crop. This means that growers of salad crops who irrigate with reclaimed water should use drip, bubbler, or furrow irrigation, which does not spray water directly on the crop.

This regulation also means that reclaimed water cannot be used in Florida for overhead frost protection sprays onto crops such as blueberries or strawberries.

The regulation prohibiting direct contact of reclaimed water with salad crops was created in the 1980s to encourage acceptance of reclaimed water. At the time, there were not sufficient studies to determine whether such a precaution was necessary. Since then, studies conducted in California have shown that salad crops can be directly sprayed with reclaimed water with no health, safety, or marketing problems. This finding was expected because reclaimed water is disinfected, usually by chlorination. Sunshine is also a good disinfectant. Currently, reclaimed water can be sprayed onto the edible portion of salad crops in California, but this practice is not allowed by regulations in Florida.

Nutrients in Reclaimed Water

Reclaimed water contains small amounts of elements that are beneficial for plant growth, such as nitrogen, phosphorus, potassium, calcium, and magnesium. Reclaimed water can also contain low levels of other essential elements, such as manganese, zinc, and boron. Boron is an element that is essential for plant growth in small quantities, but it can cause plant damage if too much is applied.

Nutrient concentration in reclaimed water, particularly advanced treated reclaimed water, is usually low. Important macronutrients include nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), and magnesium (Mg). For example, the concentrations of N, P, and K in some reclaimed water sources are less than 30, 10, and 30 mg/liter, respectively.

Along with other environmental factors, the amount of nutrient uptake from reclaimed water by plants depends on the concentration of nutrients, amount of reclaimed water applied, and residence time of the reclaimed water in the root zone. With regular irrigation, several turf grasses can extract some N and P from reclaimed water. In those cases, reclaimed water can supply a significant amount of these nutrients. With other crops such as citrus, commonly practiced irrigation with reclaimed water provides less than 16% of the normal nitrogen requirement for mature trees. While reclaimed water can provide some essential elements, the concentrations of N and K are usually too low to meet plant needs completely. Hence, additional applications of nitrogen, potassium, and other fertilizer elements are necessary to ensure good plant growth.

Salinity

When reclaimed water is created, the process can increase the salt concentration in the water. This increase in salts is usually not of great importance. However, in coastal areas, the incoming source water used to produce reclaimed water may already be salty. Also, the transmission pipes for the reclaimed water may go through areas of salty water. Additionally, as pipes age, they can develop cracks and leaks, which allow some outside water to penetrate the pipes. This process is called infiltration. If salty

water infiltrates into the reclaimed water pipes, the level of salt in the reclaimed water can further increase.

In inland Florida locations, salt in reclaimed water is not usually a problem. However, in coastal regions, whether due to infiltration or the incoming water source, salts in reclaimed water can sometimes be a problem for salt-sensitive plants such as azaleas or Chinese privet. If salinity is too high, the reclaimed water may be acceptable for most lawn irrigation, but not for irrigation of salt-sensitive plants.

Some water reclamation facilities that produce reclaimed water monitor salts. If the salt concentration gets too high, they will reprocess or divert the salty reclaimed water to another discharge point.

Perception of Reclaimed Water

When using reclaimed water for irrigation was presented to citrus growers for the Water Conserv II project in the 1980s, they initially rejected the idea of using such water. Growers were concerned about possible tree damage due to heavy metals, salinity, disease organisms, or excessive water (Parsons et al., 2001a). After much negotiation, water quality standards were established and several growers decided to take a chance with the reclaimed water. At the request of growers, research was carried out on this water by scientists at the University of Florida. The research showed that excessive quantities of this water could be applied to citrus on well-drained soils with no negative effects (Parsons et al., 2001b). Tree growth and fruit production was greater at the high irrigation rate. Even though the concentration of soluble solids was lowered by the high irrigation rate, total soluble solids per acre were significantly higher due to the greater fruit production.

Quality standards of the reclaimed water were maintained, and more growers agreed to accept the water. Now, citrus growers that initially opposed the idea of using reclaimed water are enthusiastic supporters of this water. Nearly 800 parks and 477 golf courses are currently irrigated with reclaimed water (FDEP, 2009); and with fewer irrigation restrictions on reclaimed water, public acceptance has increased noticeably.

However, perception issues still exist. For example, many Florida tomato growers do not want to use reclaimed water because of perceived, but scientifically unfounded, concerns over food safety. This attitude developed because Florida tomato growers were economically hurt by a *Salmonella* incident. Because of a *Salmonella* outbreak, the Food and Drug Administration initially recommended that people not eat certain types of raw tomatoes in 2008. It was later found that tomatoes were not the source of *Salmonella*, but Florida growers lost an estimated \$50 to \$100 million because of the negative publicity. Even though reclaimed water has no association with *Salmonella*, Florida tomato growers are afraid to use it because of imagined issues related to food safety.

Conclusion

Reclaimed water use has increased steadily since the 1980s, and Florida is now the largest producer of this water in the U.S. This water has an excellent safety record and has been used successfully for more than 40 years. While reclaimed water in Florida was initially promoted to improve surface water quality, it has now become an important alternate source of water to help meet water shortages and urban demand.

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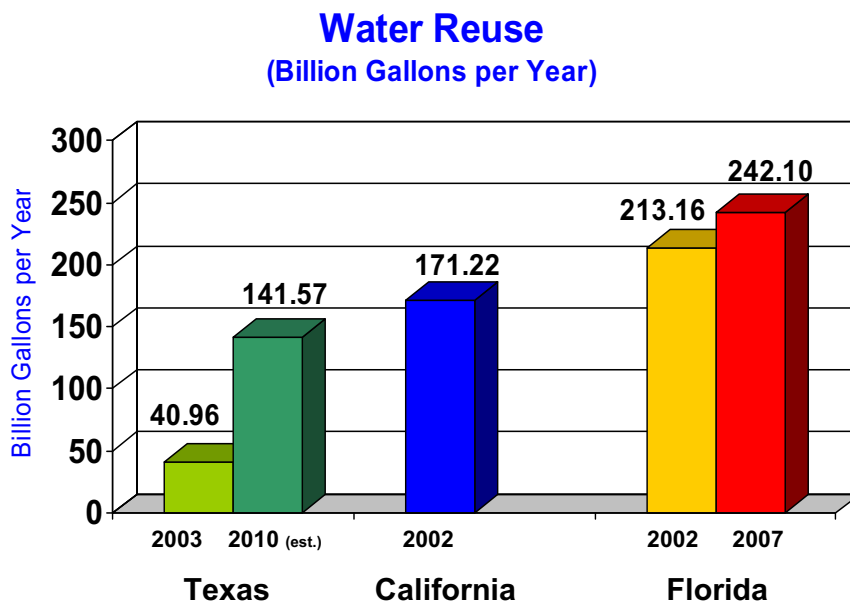
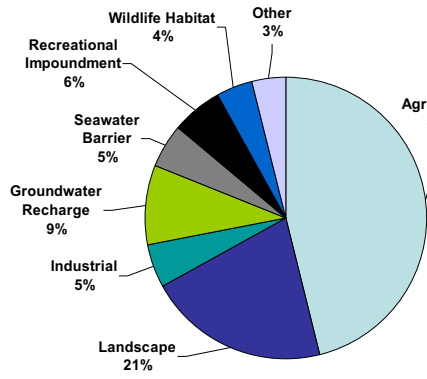


Figure 1. Water reuse in different states.

California Recycled Water Use - 2002



Florida Recycled Water Use - 2007

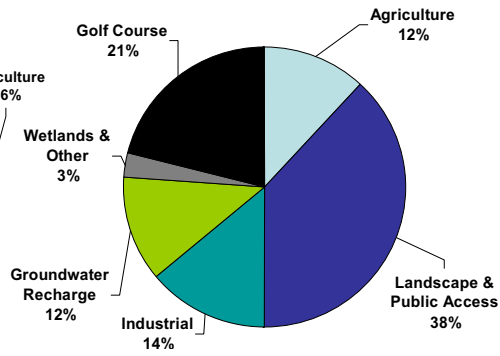


Figure 2. Water reuse in California and Florida.