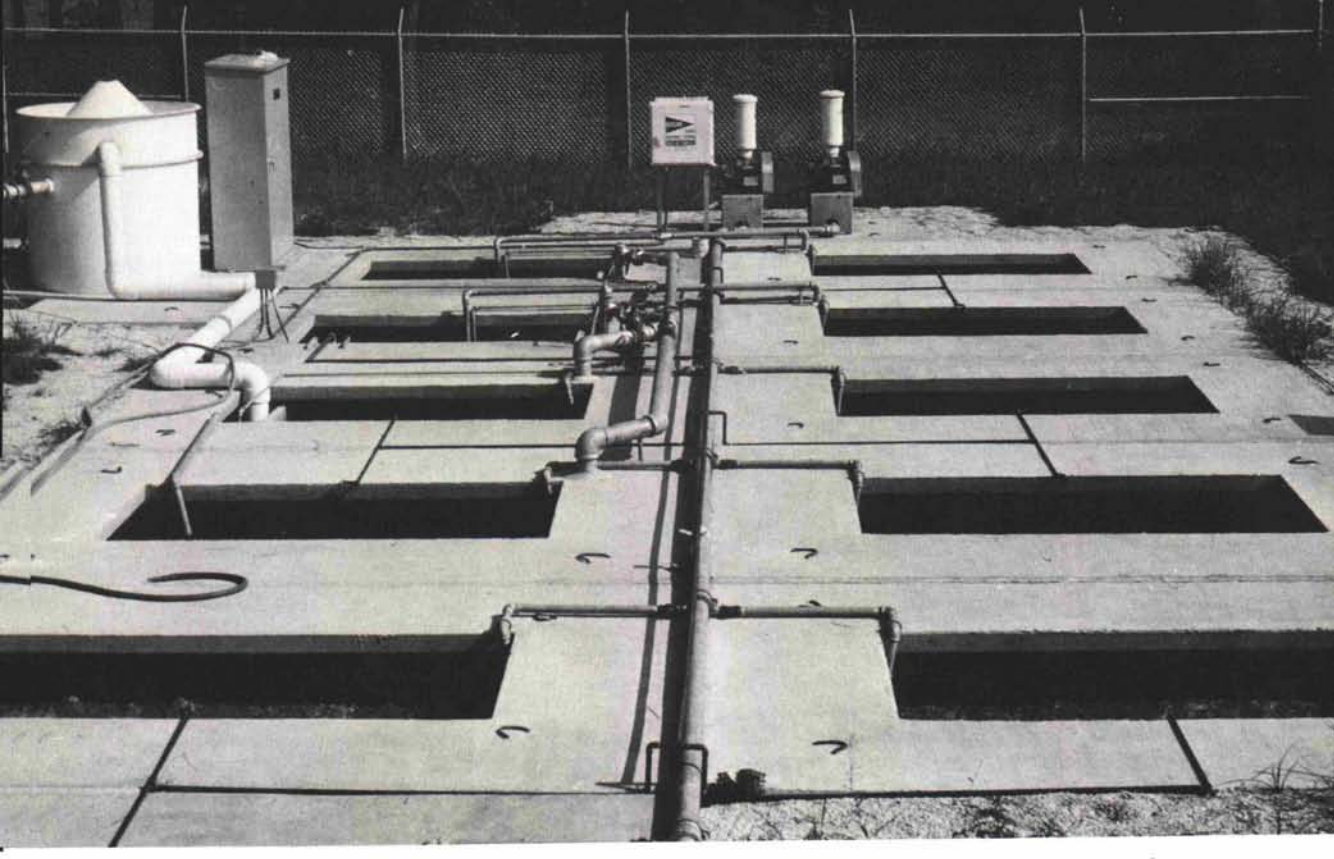


Pre-cast concrete modular units with 5,000 gpd capacity. Additional units can be connected to provide sewage treatment up to 140,000 gpd.

From the Affluent to the Effluent

by **JAMES B. MONCRIEF,** Southern Director, USGA Green Section

"Don, do you smell something, or is it my imagination?"
"It's a smell all right and I've been catching it for the past five or six minutes."

Don and Margaret are from New Zealand and were visiting the United States this summer. He is in the home-building business. Both are golfers, and they were combining business and pleasure this day, visiting a new housing development and planning to play the new golf course. They were early risers, and after having a cup of tea—two bags please—were on their way to the first tee. It was then they noticed the irrigation system in operation and the slight but definite odor of effluent water in the air.

"Now I know," said Don. "I've heard about land-locked sewage systems installed in the United States for housing developments around golf courses. That's what we smell, and we've got to find out more about such operations before we leave for home." At the time, little did Don realize how much was involved in "such operations." In the following story, we will record some of the facts uncovered by our friends from New Zealand on the subject of effluent water for golf course irrigation purposes.

During the past 10 years there has been a tremendous movement to rural areas and to complexes built around golf courses. They are wonderful places to retire or bring up a family. However, many of the new residents do not realize that their domestic water is reprocessed and then used for agricultural purposes, including irrigation of their golf course and landscape areas. Some projects start out as golf course developments, and then additional housing is

developed beyond the golf course limit and is tied in with the sewage disposal system. More sewage units are added and waste gallonage climbs.

Effluent water has been used for centuries, but it has not always been properly treated. Indeed, in the early days of the city of Pompeii, it received no treatment at all! Even today there are still problems being researched, because the recycled water poses disinfectant problems. But as population increases force expansion (particularly into low rainfall areas), more emphasis must be placed on the use of recycled water. I have visited courses in New Mexico that have used effluent water for the past 20 years and are still growing excellent turf. At that time, the main problem I recall was odor from the water and a noticeable amount of algae in poorly drained areas. It seems that then, as now, the most pressing problem is how to disinfect recycled water adequately.

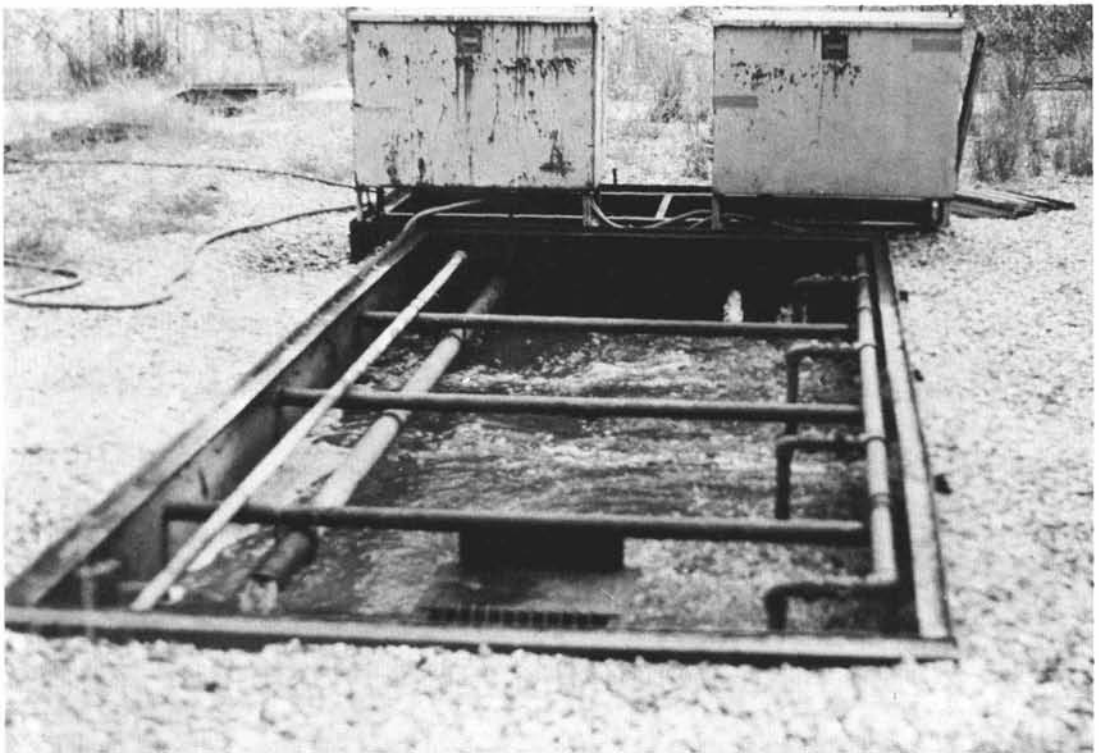
One problem lies in the hazard of a golfer being thirsty and drinking from irrigation outlets. This is extremely hazardous, because viruses can survive with the present method of water treatment and there is the possibility of an individual becoming sick from bacteria, virus, or cysts. It is essential for the golf course operator in charge of the area being irrigated with effluent water to emphasize the danger of drinking it, even though it has gone through the most strict recycling process. The Superintendent of the municipal golf courses in Austin, Texas, is printing on score cards of the new municipal course to be opened soon, the danger of drinking water from irrigation outlets.

The long term effect of people being exposed to recycled water is being studied and a comparison is to be made with European countries where the practice has existed for centuries. Some of the major rivers there have a high percentage of sewage effluent during the low flow stages. It has been estimated that the Rhine River in West Germany is as much as 40 per cent waste effluent at the low flow of the river. A comparison of population along the Rhine River with a river in the United States under the same or similar conditions with a population that has been drinking relatively clean water should indicate if there have been any effects from recycled water.

New laws are being passed to improve the rural water supply. The latest is the "Rural Drinking Water Assistance Act." This does not pertain specifically to golf courses but is an effort being directed toward improving rural water supplies. As population moves into rural areas—housing developments, trailer parks—water treatment considerations must be met. Rural areas have been neglected and many people are living without a safe drinking water supply. This is known to contribute to impairment of health by incipient organic diseases which may cause lethargy and inhibit productivity.

We all have a right to be concerned over water purity. Some diseases associated with

Very little foam from new soft detergent use.



Definace Sewage Treatment Plant with filtration system located at Atlanta Athletic Club where filtered effluent is used in the golf course irrigation water.

effluent water before it is treated for example are *Pseudomonas aerujinosa, Salmonella newport, Escherichia coli,* poliovirus, and *Ascaris lumbricoides.* Sounds bad and is bad if the sewage is not properly treated.

Dr. Mark A. McClanahan, of Georgia Institute of Technology, has made a study of the problem of adequate disinfection. Recycled water is not widely used for human consumption. The increasing regulations of water use by Government Agencies and the militancy of environmentalists occasionally causes some alarm with the adequacies of present methods of disinfection. He feels before use of recycled effluent water becomes a reality we will need to know its effects on human beings after long-time use. Fortunately, use on turfgrass areas does not create a hazard unless a golfer actually drinks effluent water. Apparently the hazards are not all due to bacteria. Viruses, as non-living molecules such as mutagens, carcinagens, teratogens, and toxicants can also be a problem.

Among the best and most common disinfectant we have today is chlorine, and it probably will remain so for some time. According to Dr. McClanahan, ozone has shown promise as a disinfectant. It has been shown to be effective against bacteria, viruses and cysts. Ozone is instable, which may make it an excellent synergistic partner with chlorine. Research will give us this information. The type of organism, soil moisture, temperature, pH, and the presence of antagonistic organisms in the soil influence survival time.

We hear much about biodegradable material and it is frequently associated with detergents. You also may soon be seeing the letters BOD (Biological Oxygen Demand). Where waste treatment has BOD, it can be treated by an appropriately designed biological treatment system, and can be very efficient for domestic sewage treatment where most of the biodegradable detergents are consumed.

Some people associated with golf course maintenance are very interested in effluent water as a means of reducing fertilizer use and costs. They may be disappointed and actually find it necessary to supervise the fertilizer program more closely. Nutrients in the water may accumulate in the soil, creating plant toxicity. This can be influenced by the source of water, the soil it is applied to, rainfall, and other environmental factors. Recent research has led to the following conclusions:

Increased levels of exchangeable and water soluble manganese resulted from

Several million gallons per day sewage plant at Austin, Texas with a 40-acre lake in left background. New golf course will be entirely irrigated by effluent water from this plant.

> the low pH caused by a sludge application rather than from large amounts of manganese supplied by the sludge itself. The source of maximum available zinc for crop uptake was the sludge crust rather than the soil. Reduced growth of rye associated with increased copper levels and high zinc levels in the forage indicate that a disposal area should be limed and otherwise managed to reduce the possibility of toxicities, since the build-up of micronutrient and non-nutrient heavy metals to toxic levels may ultimately limit the effective life of a disposal area. Rye was a less suitable crop for the disposal area than was coastal bermudagrass.[1]

As Don and Margaret progressed in their tour across the United States, they began to realize some of the problems an affluent society can be confronted with in disposing of effluent water. "You know, Margaret, this is a perplexing subject. Let's digest some of the information we have gathered while visiting golf courses and real estate developments on our tour. And oh yes, let's go have another cup of tea—two bags please.

"When we arrived in California, we were shown some beautiful housing developments. During this time, someone mentioned the Lake Tahoe area and the fabulous job they have done with their effluent water problem. I understand the water is good enough to drink, but psychologically, people aren't quite ready for the idea just yet. Nevertheless, the water does meet standards approved for drinking water.

"We went to the Open Championship at Oakmont, Pa., and I recall someone mentioning that we should see the film made on the use of sewage. I'm sorry we missed that, but wasn't the Open exciting! I hope we see another soon. Those Green Section fellows were down to earth and with a lot of turfgrass tips too. I hope that Maori good luck charm we gave Monty will work for him.

"After the Open, we drove down to Virginia and the International Turfgrass Conference at VPI. There was an abundance of research reported but we didn't hear much about sewage until we went to Georgia. That Dr. Ralph Smith in the agricultural engineering department at the University of Georgia knows a lot about influent and effluent. His studies cover the entire field of agricultural sewage and waste products. I recall his statement that effluent water usually has such a small amount of nutrients in it, it should not be of concern when fertilizing golf courses. And then, when we drove down to Florida, you recall those miles of dry land where lack of adequate irrigation water is a problem.