WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

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Using Recycled Water for Groundwater Recharge in the Central and West Coast Basins – A Successful History

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Since 1962, WRD has been using recycled water for groundwater recharge in the Montebello Forebay. And, in 1995, 2005, and 2006, the District began injecting recycled water into the West Coast, Alamitos, and Dominguez Gap seawater intrusion barriers, respectively. To date, nearly 1.5 million acre feet (490 billion gallons) of recycled water has been recharged into the Central and West Coast Basin aquifers, replenishing the basins with a cost effective, reliable, and high quality water to help make up the pumping overdraft that exists.

And we aren't the only ones. Recycled water recharge projects are occurring all over the world as regions try to meet their water supply needs in the face of growing populations and shrinking alternative water supply sources. Locally, the Orange County Water District started its Groundwater Replenishment System in January 2008. The City of Los Angeles and the Upper San Gabriel Valley Municipal Water District have each recently announced plans to use recycled water for recharge. Inland Empire / Chino Basin recently expanded their recycled water recharge project. Oxnard is applying for a groundwater recharge project using recycled water. And many more projects are expected in the future as traditional water sources become harder to find or escalate in cost.

WRD's nearly 50-year history of safe and successful replenishment using recycled water has set the stage for increasing its use in the future to make up for imported water losses. Recycled water is a great alternative because of its surplus availability and long track record of safety and reliability. Extensive monitoring, testing, and research are continually performed to ensure that the recycled water remains safe for groundwater replenishment.

But what is recycled water and how is it treated for groundwater recharge? Simply put, recycled water (or reclaimed water) is water that was used and discarded, but is collected and treated for reuse. Typical sources are from households (i.e. kitchen, laundry room, bathroom) and from commercial / industrial / agricultural businesses (i.e. restaurants, car washes, factories). Any water that is drained to the sewer can potentially be recovered, treated, and recycled for uses such as golf course irrigation, industrial process water, habitat restoration, groundwater recharge, and in some cases, direct potable reuse.

In the Central and West Coast Basins, wastewater gets extensive treatment at water reclamation plants to convert it to recycled water for groundwater recharge (**Figure 1**). The treatment process replicates and accelerates nature's way of recycling. The water comes out of the plants typically meeting all drinking water standards, but then is placed into the ground via recharge ponds or injection wells to receive additional geopurification through Soil Aquifer Treatment (SAT). It then mixes with other groundwater as it slowly moves through the aquifers, and can eventually get pumped out of production wells for potable or other uses. So, by the time the recycled water reaches any wells, it has undergone numerous treatment steps to clean, polish, blend, and purify the water.

Primary Treatment: This is the first stage in the wastewater treatment process. The water is routed slowly through long, narrow, covered tanks where the heavier solids sink to the bottom and the lighter materials (like oil and grease) float to the top. Both are removed and disposed of as primary sludge. The remaining wastewater contains only dissolved and suspended material (mostly organic) and is routed to the next treatment phase.

Secondary Treatment: The purpose of this stage is to remove most of the dissolved and suspended organic material from the wastewater. Aeration tanks bubble air

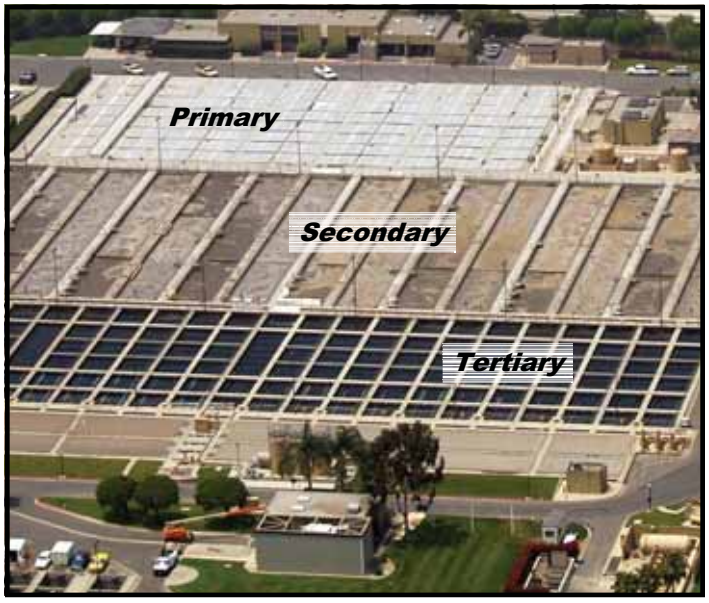

Figure 1: Wastewater Treatment at the LA County Sanitation Districts' San Jose Creek East Plant. The finished tertiary water is used for groundwater recharge in the Montebello Forebay.

through the water to oxygenate it so that microorganisms can feed on the organic materials and destroy them. Then the microorganisms lump together and drop to the bottom of settling tanks where they are removed.

Tertiary Treatment: Finally, the water is filtered by layers of coal, sand, and gravel to remove any remaining suspended material, chlorinated/de-chlorinated to kill any harmful bacteria and viruses, and nitrified/de-nitrified to remove ammonia. The final water is suitable for human contact, irrigation, groundwater recharge, and other uses.

Advanced Treatment: Some agencies are now adding advanced treatment to their treated wastewater as an extra purification step before recharge (**Figure 2**). The three main components include microfiltration (MF), reverse osmosis (RO) and in some cases, advanced oxidation processes (AOP) which can include ultraviolet light (UV) and hydrogen peroxide (H_2O_2). These are state-of-the-art, extremely high levels of treatment that are energy intensive and expensive, but produce a very pure water that in some parts of the world is used directly as drinking water. In the Central and West Coast Basins, this advanced treated water is injected into the three seawater barrier projects, and plans are being considered to use advanced treatment for additional recycled water reuse at the spreading grounds.

Soil Aquifer Treatment: SAT is a natural process that has been cleaning up the earth's water for millions of years. It treats the percolating surface water through physical, biological and chemical processes. Physical treatment occurs through filtration which removes particles that may still be present in the water. Biological treatment takes place as natural microorganisms in the soil consume or break down any degradable organic material that may be present in the water. Chemical treatment occurs through processes such as neutralization, reduction, and oxidation. The SAT process has proven to be sustainable and reliable in recharge projects all over the world, with no diminishing effects on the earth's ability to clean up the water.

To ensure safety for humans and the environment, recycled water recharge projects in California are regulated by the California Department of Public Health (CDPH) and the Regional Water Quality Control Board (RWQCB). These regulations ensure safe projects by requiring multiple protection barriers along the entire treatment process; from source water control on the upstream sewer dischargers to the treatment plant processes to the spreading grounds and injection well operations to the residence time in the aquifers to the nearest drinking water wells. At each step, extensive monitoring, testing, and reporting are required for permit compliance. If any violations are found, then corrective actions must be quickly implemented. A link to the draft CDPH regulations are at the end of this bulletin.

The end result of all the treatment and oversight is a high quality recycled water that can be used for a multitude of applications, including groundwater recharge. By using current and additional amounts of this water for recharge, the Central and West Coast basins will be self sufficient for its local groundwater supply and will be less susceptible to drought and water shortages.

Figure 2: Advanced Treatment Components at WRD's Leo J. Vander Lans Water Treatment Facility for the Alamitos Barrier.

For more information, please contact the author or the following web sites used for this publication:

For Primary, Secondary, and Tertiary Treatment:
www.lacsd.org/about/wastewater_facilities/moresanj/default.asp

For Advanced Treatment:
gwrsystem.com/about/overview.html

For Soil Aquifer Treatment, including a short video:
watersmartproject.org/default.htm

For CDPH Draft Recharge Regulations:
www.cdph.ca.gov/HealthInfo/environhealth/water/Pages/Waterrecycling.aspx

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