Reusing wastewater for irrigation
Guía-Galdar Wastewater Treatment Plant

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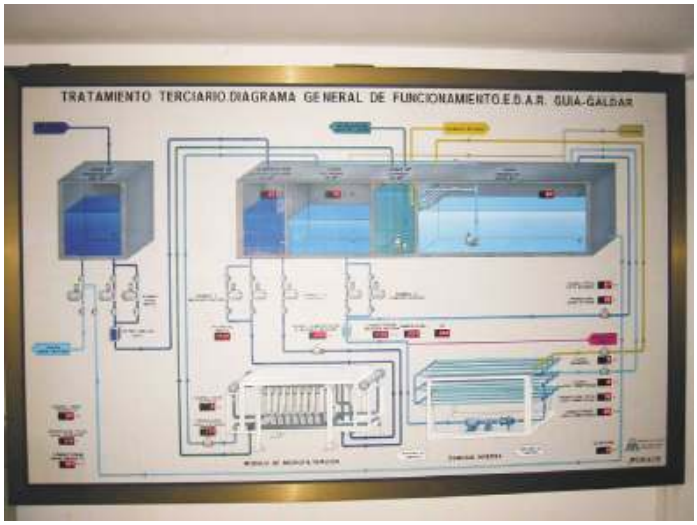

Reusing municipal wastewater for irrigating fruit groves is normal practice in the Canary Islands because of the progressive decrease in subterranean water flow, the constant increase in the need for irrigation and the progressive rise in the demand for water in the tourist sector. This installation is a pioneer in Spain in the field of municipal wastewater reuse.

Location	**Guía (Gran Canaria)**
Customer	**Consejería de Obras Públicas, Vivienda y Aguas del Gobierno de Canarias**
Construction period	**19 months**
Capacity	**2.500 m^3/ day**

The plant, built by **DRACE *Medioambiente***, has the capacity to produce 2,500 m^3/day of regenerated water containing less than 450 ppm of dissolved solids. The raw water is obtained from the Guía-Galdar Municipal Wastewater Treatment Plant at a rate of 3,500 m^3/day has between 20 and 50 ppm of suspended solids and an average content of 1,120 ppm of dissolved solids.

Due to the high percentage of dissolved solids in the water to be treated, a final desalination stage had to be added to the wastewater reutilization process consisting of a multi-unit filtering system continuously washed with air and water.

For this reason, an advanced treatment process was chosen formed of an Integrated Membrane System (IMS) that combines continuous microfiltration technology (MF) as a preliminary reverse osmosis (R.O.) process prior to the desalination treatment.

The installation is a pioneer in Spain in the field of urban wastewater reuse.

Description of the facility

Sistema de alimentación y desbaste de agua bruta

The roughing system for raw water prior to feeding the microfiltration unit is done by self-cleaning 500 micra filters installed in the impulsion pipe through which the water is pumped from the initial regulation tank to the reutilization plant.

Feed tank to microfiltration

A tank located on the ground floor of the general treatment building guarantees a constant supply to the MF system.

Microfiltration system

The system is designed to produce an average daily net flow of 2,950 m^3/day. The continuous microfiltration facility uses polypropylene membranes with a pore size of 0.2 micras that separate suspended solids, organic and inorganic colloids, microorganisms and all particles larger than the 0.2 micras specified.

The water is pumped to the microfiltration modules, feeding the membranas from the exterior to the interior of the hollow fibers, obtaining the microfiltered permeate.

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La microfiltración asegura un correcto funcionamiento del dispositivo de ósmosis inversa, existente a continuación, dado que evita la colmatación de las membranas, producida por elementos coloidales y microbianos.

The air and water backwash is done automatically every 18 minutes in order to eliminate the particles retained on the outside of the capillaries of the membranes of the microfiltration system. The duration varies between approximately two and three minutes.

Periodically, the membranes are cleaned chemically with sodium hydroxide in the adequate concentration and, eventually, with sulphuric acid to assure that the surface of microfiltration membranes is adequately clean.

Microfiltration assures that the reverse osmosis process that follows will work correctly since it prevents colmatation of the membranes caused by colloidal and microbial elements.

Filtered water tank

The microfiltered water is conveyed through a pipe to the storage and disinfection tank located on the ground floor of the general treatment building near the raw water tank. This water is finally chlorinated for disinfection.

Desalination by Reverse Osmosis

The reverse osmosis process was chosen and the plant's capacity is 2,500 m^3/day being fed by a flow of 2,952 m^3/day of raw water and working at an 85% conversion rate.

The osmosis module actually has a production capacity of 1,698 m^3/day with water with 50 ppm working at a conversion rate of 79%. The facility's total production is obtained by mixing the desalted water flow mentioned above with 802 m^3/day of microfiltered water. The reverse osmosis process consists of forcing water against a semi-permeable membrane with sufficient pressure to pass the osmotic pressure and allow water to pass to the other side of the membrane while retaining the salts.

Prior to this step though, the water must be submitted to a preliminary treatment to eliminate all the substances that would harm the membranes (suspended solids, colloidal silica, organic matter, etc.). Furthermore, the characteristics of the water must be corrected to avoid precipitation of salts in the membranes, mainly bicarbonates and calcium and magnesium sulphates using a strong anti-scalant agent.

- **Pumping of the feed water**

The untreated water is supplied directly from the regulating tank by a pump unit.

- **Preliminary treatment**

The correct operation of the reverse osmosis module is assured because the facility has a chemical dosing system that consists of dechlorination by sodium bisulphite and the addition of an anti-scalant agent that prevents salts from precipitating in the membranes. The preliminary treatment is completed with a 5 micra safety filtering system formed of cartridge filters.

- **High pressure pump and membranes system**

After passing through the cartridge filters, the water is pumped to the reverse osmosis module by the high pressure multi-stage centrifugal pump working at 17 bars.

Once filtered, treated and pumped by the pump unit as described above, the water goes to the reverse osmosis membranes in the pressure tubes attached to the metallic racks.

The membranes proposed are polyamide 8" spiral wound membranes, arranged in groups of six units in series, within the pressure tubes.

The membrane module is laid out in double stage with disposition 10:5 totalling 15 pressure boxes and 90 membranes.

The raw water penetrates through one of the end of the tube and axially crosses through the first element, then the second and so on until it crosses the sixth one. The permeated passes to a central pipe located in the geometric axis of the membranes. The reject, approximately 21% of the total, goes to a common collector and from there to the pipeline through which the brine is eliminated.

Storage and regulation tank for the final water

Finally, there is a storage and regulation tank with 5,000 m working capacity. This is enough to regulate distribution following the curve of demand for water for irrigation purposes. In the interior of the tank there is a labyrinth like chamber that is necessary to mix the microfiltered and osmotized waters as well as to chlorinate the final product.