

Tertiary Treatment at the Arroyo Culebro Waste Water Treatment Plant

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Location	Madrid
Developer	Canal de Isabel II
Starting Construction date	December 2009
Construction period	14 months
Capacity	12,400 m³/day
Technology	UF + RO

Tertiary treatment in the WWTP of Arroyo Culebro will allow the water regenerated in the plant to be reused for 100% of the manufacturing process consumption of the Holmen Paper factory. With the proposed advanced tertiary treatment regenerated water is obtained with a quality that means the drinking water consumption of the paper mill can be replaced.

The Arroyo Culebro WWTP is located in the municipal district of Fuenlabrada (Madrid) and it purifies the wastewater produced by several towns in the south of the Community of Madrid.

Description of the Works

The treatment is designed for a regenerated water production of 12,400 m³/day. The quality required in the treated water to be delivered to Holmen Paper requires a reverse osmosis process to be included in order to meet all the parameters imposed, some of them with limits that correspond to those established for drinking water quality.

The treatment has to be designed to produce a mean flow of 12,400 m³/d. For this the flow to be fed into our tertiary treatment is 23,400 m³/d.

The purified water is captured at the output from the existing WWTP, and conveyed to the tertiary treatment.

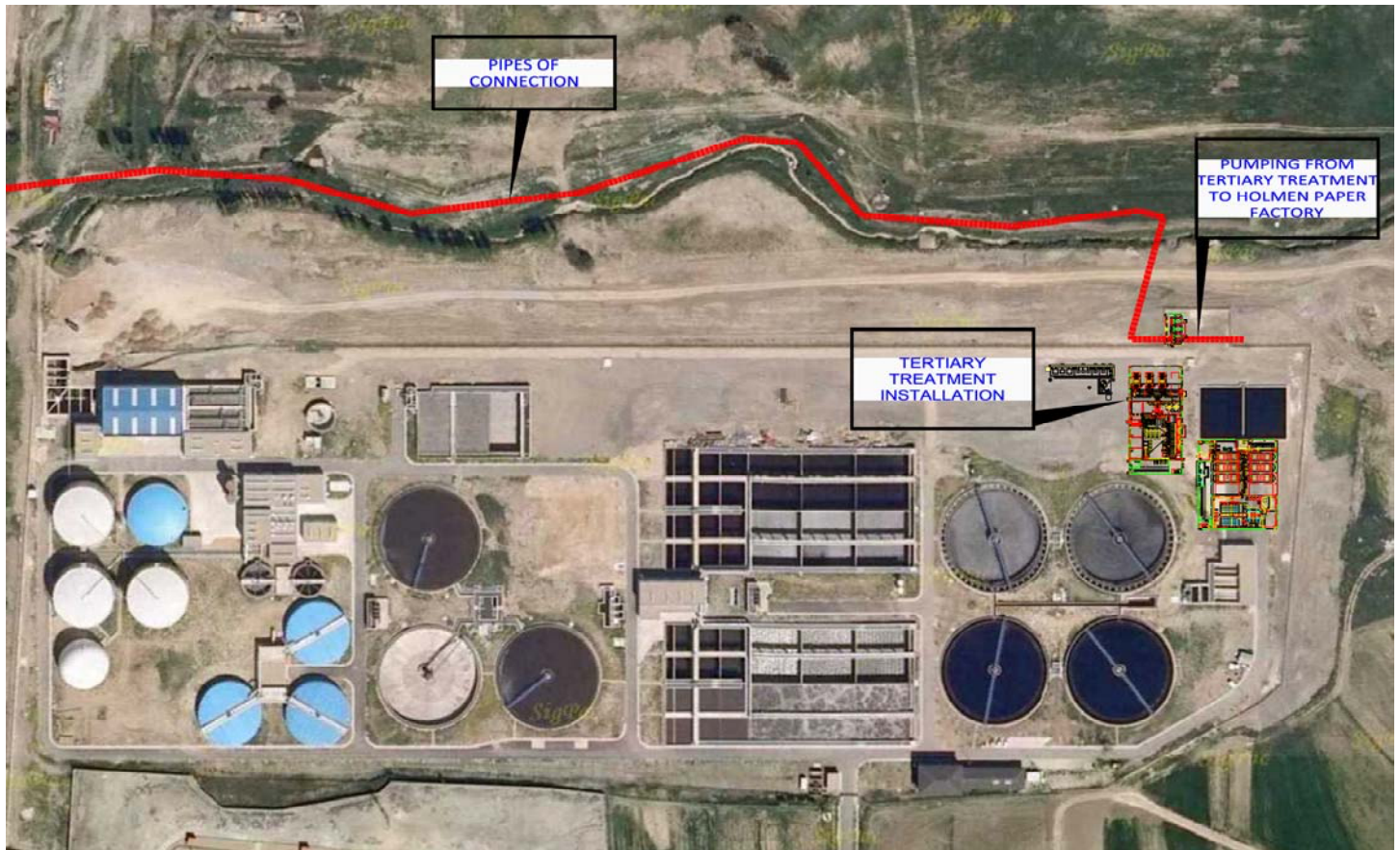
The treatment begins with a physical and chemical process, in which ferric chloride is added, followed by mixing and flocculation basins and a lamella settlement with sludge recirculation. The retained sludge is taken to the pre-treatment section of the existing WWTP.

From a water settling tank of 300 m³ it is pumped to 3 closed pressure sand filters that work at 7.84 m/h.

The filtered water is stored in a tank of 215 m³ from where it is pumped to active carbon filters, in the event that the hydrocarbon content of the water being treated exceeds a determined value that is detected in a hydrocarbon meter. At the output from this treatment the water is stored in another tank from where it is pumped to the ultrafiltration.

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The ultrafiltration facility is designed for a maximum intake flow of 945 m³/h and has an average conversion of 90%.

Ultrafiltration is the perfect pretreatment for the following reverse osmosis process because it guarantees ultrafiltrated water with an SDI less than 3, independently of quality variations in the water that undergoes ultrafiltration.

The ultrafiltration has the pertinent membrane cleaning and maintenance systems.

A chloramine dosing system has been designed to prevent bacterial growth. Two different dosage points have been foreseen, one at the ultrafiltration intake and the other in each of the two ultrafiltrated water storage tank chambers.

A reverse osmosis system is required to be able to obtain treated water with conductivity less than 500 µs/cm, as required for the industrial activity.

For the purpose of protecting the R.O. system, there are four 5µ-cartridge filters with an in-pipe ultraviolet disinfection system installed before them.

The reverse osmosis is designed for 100% of the flow and should produce 594 m³/h of osmotised water. The conversion has been set at 70%.

There are three high-pressure pumps feeding three frames in a two-stage arrangement, with a configuration of 32/16 pressure pipes and 7 elements per pipe.

All the necessary cleaning and displacement systems are designed for the Reverse Osmosis.

Slaked lime Ca(OH)₂ is used for remineralising the treated water, with the addition of CO₂.

The product water is stored in a reservoir of 611 m³. From this reservoir the regenerated water is pumped to the Holmen Paper mill through 2+1 pumps delivering 300 m³/h and 70 w.c.m. and a drive pipe of 500 mm in diameter and 4.5 km in length.