Recycling Water Plant at the Altona Treatment Plant in Melbourne, Australia.

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The Altona Recycled Water Plant is possibly the most complex recycling scheme in Australia. In peak demand periods the scheme will recover all of the available effluent from the Altona Wastewater Treatment Plant (AWTP) to produce 2 grades of recycled water for irrigation and industrial use.

Location	**Melbourne, Australia**
Developer	**City West Water**
Design and Construction period	**18 months**
Operation and Maintenance	**5 years**
Capacity	**13,000 m^3/day**
Technology	**UF and RO**
Contract Awarded	**August 2009**

The available effluent contains up to 5,500 mg/l of total dissolved solids as a result of saltwater ingress in the catchment of the Altona WTP. Production of recycled water for irrigation requires demineralisation through a single pass reverse osmosis system, while production of industrial grade recycled water necessitates treatment through a two pass reverse osmosis system.

City West Water owns and operates a wastewater treatment plant located to the south-west of Melbourne's central business district. The plant is located in Altona and treats mostly domestic wastewater from a catchment containing a population equivalent of 50,000. The Altona WTP treats 13,000 m^3/d of sewage and discharges its treated effluent to the sea by a submerged outfall.

The Altona WTP sewage system has infiltration problems, which result in a saline effluent approaching a TDS of 5,500 mg/l. Due to the severe drought being experienced in South-Eastern Australia it was decided to supply the first recycled water from the Altona WTP to irrigation and to industrial customers.

In order to remove the salt to permit the recycling of the effluent, it was decided to construct a reverse osmosis desalination plant to treat up to 13,000 m^3/d of effluent, supplying 5,900 m^3/d to the industry and 3,100 m^3/d to irrigate two local golf courses and nearby local government recreational areas. The waste stream from the RO plant was discharge back into the submerged outfall form the Altona WTP.

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The total project requires the construction of the RO and attendant pre-treatment plant, the construction of several water storage tanks, pumping stations and pipelines. The whole system will operate under SCADA control with minimal operator intervention.

The evaluation of these objectives and the determining factors have led **DRACE *medioambiente*** to choose as a solution the process ultrafiltration for the pre-treatment. Production of recycled water for irrigation requires demineralisation through a single pass reverse osmosis system, while production of industrial grade recycled water involves treatment through a two pass reverse osmosis system.

DRACE *medioambiente* design is fully prepared for an easy expansion to the full plant capacity of 9,000 m^3/d of industrial grade recycled water. This is not simply a matter of providing enough space for the enlargement of the second pass of the RO. It is also about designing all of the plant's current and future processes keeping in mind the planned expansion. The water flow throughout the plant will increase with the expansion.

In addition the design takes account of the need for the plant to function in accordance with the available seasonal flows form the AWTP, which condition the modulation of the Plant.

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Pre-treatment

The raw water for the recycling Plant is taken from the feed water reservoir. The feed pumping station is designed with four centrifuge pumps that have to deliver the water to the ultrafiltrated water tanks after passing through the strainer filter and the pressurized ultrafiltration modules. Each pump works at 220 m^3/h and 25 w.c.m.

Although raw water is being treated with UV disinfection, biological contamination is still possible and this can generate fouling problems at membrane stages. To keep a bactericide effect through pre-treatment stages a residual dose of 3 ppm as monochloramine is implemented before the inlet to the raw water feed reservoir. A complete system of monochloramine generation is installed.

For extreme biological contamination situations a biocide dosing system is implemented.

In order to protect the ultrafiltration system, an automated backwash filter of 250 microns is installed, and another unit is also on stand by.

The major benefit of the ultrafiltration as a RO pre-treatment is the consistent quality of the filtrate no matter the variations on the water feed quality. Using the UF system as a pre-treatment to the RO guarantees that the SDI values of the RO feed water are always below 3.

Four pressurized ultrafiltration modules from Memcor have been designed, to achieve 100% of the required flow to the RO trains. Each module has 108 cartridges over a maximum capacity of 120. Membranes installed are L20V. The design is based on an overall recovery of 93%.

Memcor UF low-pressure membrane system utilizes hollow fibres with outside to inside filtration to remove particles greater than 0.04 microns from a feed stream. It is a self-cleaning system where a low pressure air scour and liquid backwash remove the solids built up on the membrane surface at regular intervals. Periodically a chemical cleaning procedure is used to fully restore the membrane performance.

The UF permeate is driven to two buffer tanks, with a total capacity of 200 m^3. This two tank layout allows the cleaning and disinfection of one of them without stopping the production.

There have been installed all the chemicals needed for cleaning purposes, for neutralization, for PH control and for inhibition.

Reverse Osmosis

In order to ensure complete removal of suspended solids before the RO membranes, cartridge filtration with 5 microns selectivity has been implemented. Three pumps of 195 m^3/h and 33 w.m.c. and three cartridge filters are on duty, and another pump and cartridge filter are on stand by. Three high pressure pumps on duty and one on stand by, of 145 m^3/h and 204 w.c.m. drive the water to the first pass of the RO.

The first pass RO trains are designed to produce 405 m^3/h permeated water. There are three lines on a two stages configuration, with 17/9 pressure vessels, 7 membranes per pressure vessel and a booster pump. The first pass recovery is 75%.

A first pass permeate flow of 3,100 m^3/d, has to be conditioned for irrigation. In order to increase the PH a NaOH addition is designed and also the system for the final disinfection of the permeate flow for irrigation reuse is considered. The rest of the permeate flow must go through a second pass RO to be able to reach the industrial water quality.

From the first pass permeate tank two pumps send the permeate to the second pass RO trains. The two second pass trains are designed to produce 125 m3/h each. These trains contain 14/5 pressure vessels in a two-stages configuration design with 7 elements per vessel. The second pass recovery is 90%.

Looking for sustainability, the selected device for energy recovery is a pressure exchanger device from ERI. One PX element per RO first pass train has been installed, so they are able to recover more than the 90% of the reject residual energy.

All the auxiliary systems of flushing, displacement and cleaning have been designed and installed.

To reduce the amount of CO2 in the second pass permeate it has been designed a degassing system made of two towers with forced ventilation and a special filling material for air – water contact. Due to the need to mineralise the permeate flow a lime milk addition has been considered.

There is also a system for industrial water disinfection with sodium hypochlorite.