

## CASE HISTORY

### Anglian Water, Flag Fen Effluent Recovery Plant

<b>End User</b>	Anglian Water Services Ltd
<b>Process</b>	Microfiltration (MF) + Reverse Osmosis (RO)
<b>Application</b>	Generation of high quality effluent for re-use



Twin stream microfiltration system, with Reverse Osmosis Plant in the background and CIP facility in foreground.

#### Introduction

This project involved the mechanical and electrical design, installation and commissioning.

The Flag Fen High Purity Water Scheme was one of the first sites in Europe to use advanced membrane technology to treat sewage final effluent. The water produced is 10 times purer than normal tap water. This high purity water is piped to the power station to be further polished by Ion Exchange demineralisation units before being used to generate the steam required in the electricity generation process. The site is unmanned but operating data is continuously transmitted through the telemetry system to Anglian Water's operations staff.

#### Design Information

The following table indicates the Raw water quality received at the plant and the treated water quality discharged from the plant.

Description	Raw Water	Treated Water
Flow m <sup>3</sup> /day	1600	1200
TSS mg/l	Up to 70	Nil
Conductivity µs/cm	1200	<50
TDS mg/l	Up to 900	<25
BOD <sub>5</sub> mg/l	17	Nil
Ammonium mg/l	3	<0.1
Calcium mg/l	250	<5
Silica mg/l	15	<1
pH	7.4	6.0
Temperature °C	10-25	10-25

## Description

To prevent any physical damage to the MF membranes, all particles >500 microns are removed from the feed by means of a rotating drum filter followed by 500-micron basket strainers. Sulphuric acid is then dosed to reduce the pH to 7. This is necessary to prevent precipitation of Calcium Phosphate and Carbonate with the MF and (especially) the RO systems. Finally sodium hypochlorite is dosed to minimise bacterial growth within the membrane systems. A particle counter and turbidity meter monitor the condition of the feed to the MF.

The Micro-filtration plant incorporates the Pall 'Microza' USV6203 membrane and comprises two parallel streams of 13 modules. It is designed to remove all solids, bacteria and organisms from the feed water. The two streams are fully automatic and independent of each other. The membrane hollow fibres are manufactured from PVDF with a nominal pore size of 0.1µm. The membranes operate in tangential flow mode 'out to in' with a 10% reject flow. They are cleaned automatically by periodic reverse filtration, air scouring and the use of cleaning chemicals.

The filtrate from both streams combine and feed a break tank via a static mixer into which ammonium sulphate is dosed, converting any remaining free chlorine to chloramine which is compatible with the RO membranes (free chlorine is not!). A redox meter monitors the oxidation potential of the water and will raise alarms if necessary.

The break tank serves two purposes – a reservoir of clean backwash water for the MF plant; and stable suction conditions for the RO plant.

The fully automated Reverse Osmosis plant is also arranged in two parallel streams, mounted back-to-back on the same 316 stainless steel skid and each capable of producing 60% of the 1600 m<sup>3</sup>/day required output operating at 80% recovery.

The Koch thin film composite (TFC) ultra low-pressure RO membranes are designed to remove >95% of all the dissolved ions. Each stream has 6 pressure vessels (staged 4:2) each containing seven 40" x 8" spiral wound membrane elements.

The plant includes automatic clean in place (CIP) systems (serving both UF and RO) initiated from the SCADA system. To date the membranes have not been replaced despite constant running for 8 years.

