CASE STUDY

**PCI Membranes**
Achnasheen Water Treatment Works

MAKING THE WORLD
SAFER, HEALTHIER &
MORE PRODUCTIVE

# The Fyne Process - A Simple Single Stage Municipal Water Processing System For Poor and Variable Water Sources Using C10 Modules & Membranes

**ACHNASHEEN**

## INTRODUCTION

Achnasheen is a village community of 120 people in Wester Ross, 40 miles North of Inverness in the Highlands of Scotland. Water from the Achnasheen burn has traditionally been filtered and chlorinated before being supplied to the village. The existing treatment process has consistently failed to meet Scottish Water's drinking water quality standards due to high colour passage, with the subsequent chlorination causing carcinogenic disinfection by-products to be generated in the form of trihalomethanes.

## CHALLENGE

As with many Highland burn sources, the raw water at Achnasheen is both variable in quality and quantity, leading to peaks of colour and turbidity, particularly when the burn is in spate. Being an elevated site, cold temperatures and snow melt were design considerations, with water temperatures of less than 1ºC being common in winter months. An overview of the raw water quality and treatment required is tabulated below. Scottish Water's product water specification also included a requirement to remove micro organisms to safeguard against pathogens.

| Parmeter | Units | Raw Water | Product Water |
|---|---|---|---|
| Colour | °Hazen | 156 | 5 |
| Turbidity | FTU | 3 | 0.4 |
| pH | | 5.5-8.0 | 8.0-9.5 |
| Aluminum | µg/l | 168 | 50 |
| Iron | µg/l | 1030 | 50 |
| Manganese | µg/l | 164 | 20 |
| TOC | mg/l | 11 | 2 |

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## DESIGN

PCI Membranes broke new ground at Achnasheen in January 2004 with the installation of the first ever Fyne Package Membrane Plant (PMP). Developed to minimise cost and program duration, the PMP was constructed in a transportable building at PCI's production facility, where it was commissioned prior to shipment. A diagram of the process is below.

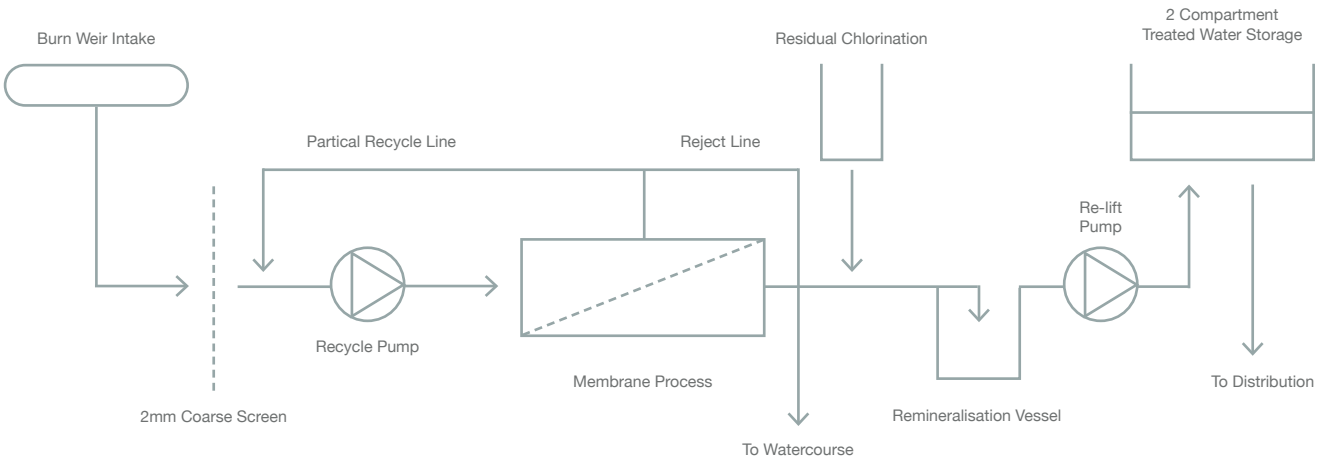
Raw water is conveyed 500m from the burn source to the PMP by gravity, with surge protection incorporated to protect against plant damage. At the core of the process are seven 3.6m long C10 tubular membranes each of which contains 72 membranes. Each module has a membrane surface area of 10.5m$^2$, giving an overall plant membrane area of 73.5m$^2$. the plant operates at a nominal flux rate of 24 litres/m$^2$/hr at 10ºC and a recovery rate of 85%. The reduction in the permeability of water that occurs when its temperature drops is overcome by incorporating variable speed pump drives into the design, thereby ensuring the required capacity can be produced throughout the year. Residual chlorination and pH correction is provided before the treated water is pumped to 70m$^3$ high level clear water storage tank, from where it is supplied into Achnasheen's distribution system.

## PERFORMANCE

Working in partnership with Scottish Water using a Value Based Product Development philosophy to establish the PMP concept, the approach ensured that the needs of the end users were fully addressed and the maximum benefit of PCI Membranes process expertise could be realised. The successful completion of the Achnasheen PMP contract within both time and budget is evidence of the effectiveness of this approach. The plant was constructed and commissioned in 24 weeks, with site installation and testing requiring a further 8 weeks. The project returned a saving of 30% in both cost and program duration compared to traditional design and construct style of contracts that preceded it.

Since going into production the plant has comfortably outperformed the required quality standards, providing very high quality drinking water to the residents. This is reflected in the comments PCI receives from Scottish Water's customer, with one resident having expressed the view, "it is reassuring to know that the residents of a small community such as ours are receiving water of a quality that is equal to or better than any in the entire country".

| Production Plant | |
|---|---|
| System | Fyne Package Membrane Plant (PMP) |
| Process | Nominal flux rate of 24 litres/m$^2$/hr at 10°C and a recovery rate of 85% |
| Modules | Seven 3.6m long C10 tubular membranes each of which contains 72 membranes |
| Filtration Area | 73.5m$^2$ |





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