

Innovative “Package Membrane Plant”

Fyne membrane plant in a pre-fab building speeds installation

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When the Water Industry Commissioner for Scotland set a target in 2002 that capital programme costs be reduced by 30% from levels current at that time, Scottish Water responded to this challenge on numerous fronts including establishing a new method for delivering the capital programme (in Scottish Water Solutions) and challenging suppliers to seek methods to improve efficiency. With respect to Aquious –PCI Membranes (a part of ITT Industries), the challenge was met by the introduction of the Fyne “Package Membrane Plant” PMP concept.



A Fyne Package membrane plant being delivered to a remote site

courtesy: Aquious-PCI Membranes a part of ITT Industries.

The first step *Aquious* took in rising to the challenge was to work in partnership with Scottish Water to seek innovations that could provide the efficiency gains required, whilst still maintaining the high engineering standards and “user friendliness” of the *Fyne* process. The two principal innovations introduced were standardised process designs (including standard equipment specifications) and the installation of the plants into prefabricated buildings. Previously, all *Fyne* plants had largely been custom engineered and assembled on site within buildings erected using conventional building methods.

The *Fyne* process employs *Aquious –PCI Membranes’* proprietary 12mm diameter tubular membranes, operating in the Nanofiltration (NF) spectrum which provide a barrier to all pathogens and retain colour originating from organic carbonaceous materials (e.g.humic acid). The membranes are routinely cleaned mechanically and require no coagulants, thus chemical waste is negligible and the process is well suited to sensitive environmental settings. The NF filtration barrier yields drinking water of a very high quality regardless of large variations in raw water quality, and combined with plant automation, limits the need for operator involvement to periodic monitoring and maintenance. The membrane process is complemented by pH adjustment, water stabilisation using calcium carbonate and disinfection using sodium hypochlorite. Typical raw

and treated water qualities for the *Fyne* process in Scotland are presented in **Table 1:**

Parameter	Units	Raw Water	Treated Water
Colour	°Hazen	156	5
Turbidity	NTU	3	<0.1
pH		5.5 - 8.0	8.0 - 9.5
Aluminium	µg/l	168	<10
Iron	µg/l	1030	<17
Manganese	µg/l	164	<1

By agreeing standard designs with Scottish Water, the requirement for bespoke plant engineering was massively reduced. Installing the plants into prefabricated buildings enabled the entire process to be tested prior to shipping, reducing costly commissioning time on-site. Upon delivery the plants simply require positioning onto a foundation and connecting to site services before final commissioning can be completed and water is sent into distribution. Furthermore, the combination of these two innovations allows plant footprints to be minimised and also ensures that the certainty over costs and delivery times is significantly increased from a much earlier stage in the project.



Interior of a Fyne Package Membrane Plant

courtesy Aquious-PCI Membranes a part of ITT Industries

The PMP range

The production capacity of all PMP’s is dependent upon feed water characteristics (mainly temperature), however, based on the design parameters agreed with Scottish Water, the Mini Unit (MU- the smallest PMP) is rated at 3m³/day. Next is the Small Unit (SU) range rated at between 3m³/day and 30m³/day; then the Full Package Membrane Plant range which spans from 30-450m³/day in single and double span designs (the PMP1 and PMP2 products). Larger Fyne plants are custom engineered to order.

The plants can be installed in a wide range of enclosures, from basic GRP kiosks for the Mini Units, to “log cabins” split into two halves to allow for road delivery of the larger plants. This flexibility facilitates obtaining the approval of interested parties (local residents, planning authorities etc) by ensuring that the appearance of the finished installation fits its setting, and also enables the specific facilities (e.g. operator welfare, spares storage etc) required by the client to be incorporated. All PMPs employ Programmable Logic Controllers and thus provide the same advance functionality.

The installations

Scottish Water is currently reaching the end of an extensive capital investment programme period, part of which relates to the improvement of drinking water services for remote rural communities. To ensure timely delivery of this programme, Scottish Water Solutions recently ordered a total of 17 Fyne drinking water treatment plants from *Aquious – PCI Membranes* for completion within a period of approximately 12 months. Considering that hitherto Aquious had supplied no more than 6 plants in such a timeframe, this represented a significant challenge for the PMP concept.

Aquious is the sole Framework Agreement supplier to Scottish Water for membrane filtration plants that meet the applicable “Signature Design – plants treating <500m³/day of water with a colour above 80° Hazen. The 17 plants completed under the agreement since the summer of 2004 are detailed in Table 2 . The sites are principally located on the North Western mainland and the Islands of Harris and Skye.

Site accessibility was often a critical issue, with the only available access road often being narrow, steep, winding and unmade. The

larger plants were generally delivered by road haulage to the nearest point on the public highway, then towed/pushed into their final position by tractor. This was an important feature as crane access was often impossible.

Table 2. Summary of PMP Installations in Scotland

Site	Client	Capacity	Type
Achnasheen	Morgan-Babtie	30m ³ /day	PMP1
Strontian	Scottish Water	420m ³ /day	PMP2
Carbost	Tulloch	165m ³ /day	PMP1
Waternish	Tulloch	140m ³ /day	PMP1
Glendale	Tulloch	195m ³ /day	PMP1
South Hoy	GMJV	355m ³ /day	PMP1
Glenuig	GMJV	60m ³ /day	PMP1
Drimnin	GMJV	24m ³ /day	SU
Ardvourlie	Edmund Nuttall	16m ³ /day	SU
Cliasmol	Edmund Nuttall	8m ³ /day	SU
Govig	Edmund Nuttall	3m ³ /day	MU
Mevaig	Edmund Nuttall	3m ³ /day	MU
Rhenigidale	Edmund Nuttall	3m ³ /day	MU
Inchlaggan	GMJV	8m ³ /day	SU
Diabeg	Tulloch	30m ³ /day	PMP1
Aultbea	AWG	450m ³ /day	PMP2
Laid	AWG	24m ³ /day	SU

The future

The PMP installations are all covered by comprehensive guarantees, including membrane lifespan, production capacity, treated water quality, SEPA discharge consent (for the raw water concentrate) and power consumption.

Aquious believes that the advanced technology employed in the Fyne process, coupled with the efficiency of the PMP approach, will make this drinking water treatment solution an important element of the drive towards continuously improved service standards in Scotland for the foreseeable future. ■

Note: The author of this article Chris Howarth is Market Development Manager with Aquious-PCI Membranes part of ITT Industries



Wastewater which previously discharged into streams is now fed by pipeline to Lochgoilhead STW (*see page 119*)