

Fort William Water Treatment Works

improved water treatment in the West Highlands

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The existing treatment works at Fort William serves the bustling Highland town and surrounding areas, providing an output of 9.1Ml/d. The existing works was constructed under Scottish Water's Q & S11 programme in 2005 and is located 5 miles north of Fort William on the eastern bank of the Caledonian Canal and the River Lochy.



Membrane treatment process at Fort William

courtesy Enpure Ltd

The works is fed by raw water abstracted from the River Lochy gravels by seven borehole pumps located in a nearby wellfield. The existing treatment process consists of cascade aeration, chlorine contact, disinfection by chloramination, pH correction by lime addition and orthophosphoric acid dosing for plumbo solvency control. The treated water is pumped to a treated water tank on the hillside above the works from which it feeds the distribution network by gravity.

The current £2.7 million upgrade scheme, under Scottish Water's Q & S111 programme, is providing a cryptosporidium barrier by means of an ultrafiltration membrane treatment stage and improvements to the existing chlorination control system. The scheme also includes for the integration of the new plant into the existing site control SCADA and telemetry systems.

Membrane Treatment Process

The new membrane treatment stage is situated between the existing aeration cascade and the existing chlorine contact stages. It utilises the sump of the existing cascade as the suction reservoir for a set of pumps which provide the required pressure to drive the water through the membrane plant and into the existing stages of treatment. A new

control valve is provided to allow flow delivered by the borehole pumps to be matched to the plant throughput and works output.

The membrane plant is being provided by *Memcor Limited* and is based on their proven hollow fibre membrane technology. The membrane plant consists of four separate modules each of which accommodates 48 tubes in which the individual membrane fibres are contained. The system operates by introducing untreated water into the outer tube under pressure and driving the water through into the membrane fibres and out through collection headers and pipework. The plant is designed to achieve a turbidity of less than 0.1 NTU in the filtrate and will provide a 4 log removal of cryptosporidium. The filtrate then passes from the membrane plant and into the existing treatment process.

The design of the plant has been based on limited data gathered during the period July-October, which is not expected to be representative of the worst case water quality which is more likely to occur during the winter months. A conservative membrane flux has been used in the design to allow the higher viscosity water conditions experienced in the colder winter weather to be accommodated whilst maintaining the required plant output.



View from site

courtesy Enpure Ltd

Membrane Cleaning Process

During operation there will be a gradual build up of particulate solids on the outer surfaces of the membranes. This will be removed by a regular backwash where clean backwash water is passed back through the membrane fibres accompanied by air scour on the outside of the fibres, which dislodges any particulate accumulation and flushes particles clear of the membrane tubes. The dirty water arising from this backwash, which has not been dosed with any chemicals, is discharged to a local burn and on to the River Lochy. The initiation of the backwash process is by measurement of the differential membrane pressure which gradually rises as solids accumulate on the membranes.

The regular backwash process does not remove all traces of solids and there is a gradual build up of fouling materials over time. Periodically a chemical 'clean in place' membrane clean is undertaken with a heated soak and wash with sulphuric acid and then with sodium hypochlorite. The provision for a citric acid wash is also included for the removal of more stubborn foulants, which is expected to have a frequency of typically twice a year.

The spent chemical solution from the chemical clean in place is collected in a balance tank and discharged at a controlled rate through a neutralisation system to the same local burn as the regular backwash.

Civil Construction

The civil construction works have been provided by *Morrison Enpure*, Joint Venture. The membrane plant, membrane cleaning systems and associated plant are housed in a new building, constructed within the boundary of the existing works adjacent to the existing building. The new building is designed to be identical in appearance to the existing to comply with Planning Permission conditions. The civil works also includes modifications to the existing below ground pipework to deliver water into and out of the new treatment plant and various service diversions to allow the new building to be constructed.

Existing plant improvements

The filtrate from the membrane units passes to the existing treatment plant and is subjected to the same treatment as currently exists on the site. The existing chlorination system has been subjected to minor modifications to the control software which has improved control of the secondary chlorine trim and brings it into line with Scottish Water standard arrangement for chloramination systems.

The new plant is provided with a dedicated control system and PLC but key signals from the new plant are relayed to the existing plant PLC has allowed the integrated operation of the new membrane treatment stage with the operation of the whole works. The information from the new plant PLC is also transmitted into the existing site SCADA system and the existing system extended such that the entire works is monitored from a single system. The existing works telemetry system is being replaced as part of the scheme and a new integrated system for the whole of the works will be provided.

Progress and Completion

At the time of writing (early May 2008) the civil works are nearing completion, with the building available for commencement of the mechanical and electrical installation works. The commencement of building services installation is imminent and the membrane plant installation is due to commence in the middle of May.

The installation works are programmed to be complete by mid-August 2008 followed immediately by commencement of the commissioning and testing work. The commissioning and testing work will progress through the autumn of 2008 and will be complete by Christmas 2008.

Note: The Editor & Publishers wish to thank Craig Siviter, M & E Project Manager and Alistair Fraser, Project Manager both with the Morrison Enpure Joint Venture, for producing this article for publication. ■