Loch Eck Water Treatment Works

£8.4 investment improves quality

by
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Loch Eck Water Treatment Works is located close to the banks of the loch which was once voted the most picturesque in Scotland and is widely acclaimed as one of the nation's finest inland waters. The loch was designated a Site of Special Scientific Interest in 1991, partly due to two rare species of fish - one a type of Char only found in Loch Eck and the other - powan - a freshwater herring also found in Loch Lomond. The existing works was built at the south end of the loch to replace the original supply to Dunoon, which was obtained from three old impounding reservoirs in series on the Balgie Burn, the combined yield of which was not sufficient to meet demand in a dry summer. Construction of the works was started in 1974 and commissioned in 1977 to provide a maximum flow of 10.9Ml/D. The remaining operational plant had a High Cryptosporidium Risk Score and failed to meet certain aspects of the Water Quality Regulations, Cryptosporidium Direction. The age and condition of the works was resulting in high maintenance requirements resulting in increased OPEX. The drivers were Cryptosporidium and Capital Maintenance.

Lock Eck WTW

courtesy Scottish Water Solutions

The upgrading scheme to be carried out as part of Scottish Water's Allocated Capital Investment Programme, was required to allow the plant to treat the raw water from Loch Eck and comply with relevant WQ standards at the best whole life costs.

The raw water supply has a very low colour and turbidity, which is difficult to remove in a sedimentation process. The existing precipitators were by nature a form of sedimentation, which when in operation failed to achieve the required water quality, and as a result of this, Scottish Water discontinued chemical dosing. Prior to the upgrade the precipitators acted only as coarse settlement tanks which also balanced the flow through the works owing to the very basic nature of the plant automation.
The existing rapid gravity filters continued to be washed manually every three days, but without effective coagulation and sedimentation did little to improve water quality. The filter automation was in poor condition with one filter inoperable. The final water was disinfected, conditioned with lime and orthophosphoric acid.

The final water quality had high, Colour, Iron, Manganese and THM, in part due to the performance of the existing assets, inability to dose with chemicals (which was aggravated because of no discharge consent) and high cryptosporidium risk.

During the upgrading close working with Scottish Water's Operations and Strategy & Planning staff was needed on a daily basis to enable the project to be carried out while the plant continued to serve customers.

Flexible working patterns introduced by different parts of the site team enabled quicker progress than planned.

Solution
A detailed value scoping and value analysis programme was undertaken to devise a suitable plant design to not only meet the required output for Lock Eck but also to account of all site constraints.

The agreed output from these exercises was a chemical coagulation plant, utilising direct filtration with an additional separate washwater recovery/sludge treatment system incorporating sludge thickeners, sludge storage and a recessed plate press.
Chemical systems handling and dosing systems were to be upgraded/provided. Where practical the upgrade was to integrate with and utilise existing assets.

The processes were to be fully automated with integral PLCs and SCADA systems.

Inlet works
The inlet works were designed to allow the water flowing forward to be of uniform quality, allowing further treatment of the raw water, plus any returned water, in the subsequent treatment processes. The return liquors from the sludge thickeners are fed into the raw water stream, just after the inlet-balancing tank.

The addition of chemicals is immediately upstream of the associated mixing facility with Lime, Alum and Polyelectrolyte (poly) dosed in that order. Duty and standby dosing points are provided for both Alum and Lime: duty only will be provided for the Poly as it is not deemed as critical to the overall process.

Two dosing points (duty/standby) were provided for each chemical. The design incorporated sufficient time to allow the coagulation process to be completed prior to downstream treatment over the expected range of temperatures,

Filtration
The filters, supplied by *AMT Systems,* were designed on the constant flowrate principle with filter inlet channel levels used to derive a filter flow set point, which is then used to maintain the same flow through all filters via the filter outlet control valve.

When preparing for backwash, filters drain to service at the same rate as the operating filters unless the increase in filter output jeopardises downstream processes. In such a case, the drain down rate is suitably limited.

The design allows for the backwashing of individual filters to be staggered over as long a period as possible. The backwashing system is designed to minimise the long-term loss of filter media to no more than 3% annually and minimise any increase in filter start up head loss.

Filtration system
The filtration system uses the existing six filters. The area of each filter is 16.775m^2 and the total media depth needed to meet the required water quality output is 1.3m made up of 800mm of sand with 500mm of grade 2 anthracite.

Dirty Washwater Recovery/Sludge Treatment
The normal washwater recovery system is through the thickeners directly from the washwater recovery tank. The flow to the head of the works will be continuous and controlled to less than 10% of the raw water intake. To meet the quality requirements there are two thickeners operating on a duty/standby basis. The sludge is thickened with polyelectrolyte. The thickeners are sized to take the maximum hydraulic load through the works.

There is also a facility to utilise in an emergency the existing sludge lagoons on site. If for any reason the thickener supernatant does not meet the required turbidity standard and after one fill cycle of the washwater recovery tank, the flow will be diverted to the existing sludge lagoons before the standby thickener is changed over to duty.

Thickened sludge from the duty thickener is transferred to a holding tank before being pressed in the recessed plate press. Sludge cake is emptied into a skip located under the press, supplied by *Andritz Ltd,* before being transferred off site to landfill.

Dirty Washwater Recovery/Sludge treatment system
The recovery system is designed on the basis that the existing backwash waste water recovery tank will also act as the buffering tank. The solids are kept in suspension by a mixer inside the tank.

Chemical storage & dosing
A new Aluminium sulphate storage system, coagulation and sludge poly storage, make-up & dosing systems were installed and the lime and chlorine dosing systems were upgraded.

IC&A
New water quality instrumentation was installed throughout the works including three PLC's with integrated HMI and SCADA package and a satellite telemetry package.

Timescale
Contractors *Galliford Try/Morgan Est Joint Venture (GMJV)* began on site in June 2005 and the project was completed in the summer of 2006. ■

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