

Turret WTW

£24m upgrade & refurbishment project

by
David Crawford

At 359 metres above sea level, Turret Water Treatment Works (WTW) is the highest in Scotland and sits deep in the picturesque Glen Turret, located approximately 3.5km to the North West of Crieff, a location popular with tourists and hill walkers. Commissioned in 1967, the original WTW serving central Scotland (pe 70,000) comprised of microstrainers and ozone treatment (the first of its kind in Scotland) followed by chlorination. The design included the construction of two hydroelectric generating stations, one at the WTW itself and one further down the valley. With a combined capacity of 1,725 megawatts this was enough to run the entire Plant and allow Scottish Water to sell surplus through the National Grid.



Multiflo Sludge Plant

Courtesy of Scottish Water Solutions & GMJV

Throughout its life however the Plant was to suffer from periods of very poor raw water quality, primarily due to rain flushes from the peat bogs contained within the catchment. These in turn affected the quality of the final water to supply and, as a result, the Ozonation plant was eventually replaced in 1971 by six Rapid Gravity Filters (RGFs).

In 2005 and after further upgrades including a second clear water tank and sludge handling facilities, it was recognised that the WTW

was due for an extensive upgrade in order to comply with future Water Quality Directives.

Scope

The remedial works proposed were designed to deal with various Drivers as laid out by the Water Industry Commission for Scotland and Scottish Parliament. In particular they should allow the Plant to achieve an output of 85MLD during colour/turbidity raw water peaks while continuing to comply with water regulations. The primary

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Chlorine Contact Tank

Courtesy of Scottish Water Solutions & GMJV

elements of the upgrading were: a two stream Actiflo Clarification stage; a new 10 million litre Chlorine Contact Tank & Chlorination system; Chemical building; Sludge Treatment Plant and the refurbishment of the existing six RGFs. In addition, the Turbine Hall at the WTW was replaced with the installation of a new more efficient 550KW turbine & new break pressure tank.

Scottish Water Solutions Project Managed the work, the Design was carried out by Faber Maunsell AECOM and the Construction work was delivered through a partnership of Galliford Try and Morgan EST (GMJV). Work commenced on site in February 2008 and was successfully completed at the end of March 2010.

Design

At the project's inception, it was recognised that successful delivery would be dependent upon effective pre-planning, cooperation and coordination of effort between members of the team and other stakeholders and a prompt start to the physical work in order to meet the tight time schedule. The strategic approach taken was to involve Scottish Water, Stakeholders and the Contractor in all stages of the project to deliver an asset that met the client's requirements in terms of quality; and build a highly effective Project Team that shared experience and expertise in order to achieve the project objectives. Key to the success of the project was the early appointments of a full time dedicated Senior Treatment Operator and Contractor to the Project Team to provide operator input and buildability at the design stage.

Faber Maunsell AECOM developed a two stage design programme that would allow the Scottish Water milestones to be met, whilst also progressing the detailed design to meet construction needs. The main challenge faced was the timescale to meet the legislative deadline for the upgrade work by the end of March 2010. It was therefore essential to start construction on site by early 2008 to achieve the deadline date, so the main elements on the project had to be designed in advance of this to allow the procurement process to progress while the civil work

started. At an early stage, packages of work were identified that would need to be developed in advance of the main design deliverables.

The project included the installation of an Actiflo clarification plant, the first major installation of such a plant in Scotland. It was clear that learning about the design, construction and operation of this technology was essential to the team. A series of learning visits to United Utilities existing Actiflo facility in Hodder, Lancashire was therefore arranged so that over the course of several months the designers, contractors and operators were all able to see the plant in operation and learn about the implication for design, building and operation of the facility.

Construction / Delivery Issues

The sole access to the Turret site is via a single 2km track road through the Glenturret estate. The access road was unsuitable for some large vehicles travelling to and from site during construction. After consultation with haulage contractors and Managers of the Estate some sections of road were extended in order to accommodate vehicles with a larger wheel base.

The roads are in constant use by workers on the Estate and members of the public who visit the area for a range of outdoor activities. As a result a detailed traffic management plan was instigated to minimise disturbance and delays. When a major concrete pour was due all the relevant parties were contacted in advance, including the Glenturret Estate and Scottish Water to alert them to increased heavy plant using the access roads. In addition to the public and construction traffic, Scottish Water required regular essential chemical deliveries to the WTW which required additional traffic management measures to limit impact upon any traffic.

To ensure the smooth running of these measures three traffic marshals were employed one on site and two at staging posts on the access roads, the marshals keeping in constant communication to ensure effective management of traffic.



Chemical building

Courtesy of Scottish Water Solutions & GMJV



Sludge Holding Tanks

Courtesy of Scottish Water Solutions & GMJV

Adverse weather conditions were identified as a risk factor due to the Turret site's elevation and exposed position. Many precautions were instigated on site including special wet weather gear; thermal gloves and tinted eye protection for operatives; a gritter and a tractor with snow plough to ensure the WTW and site were kept operational. The frequent high winds presented risk when operating the two large crawler cranes on site. Some days temperatures dropped to minus thirteen degrees Celsius on site and some work activities had to be suspended due to the high winds.

Limited space was available for the construction of the chlorine contact tank and 7,000m³ of rock was removed to create an area for construction of the building. Because of environmental sensitivities it was not possible to remove the rock by blasting. The most effective means of rock removal proved to be the use of a rock planer which broke the rock down into particle sizes. The material was taken out, tested and reused within the project for hard standing with minimal non-conformance winning both cost and environmental benefits.

A number of key pipework tie-ins had to be completed which were considered high risk activities due to the age, unknown condition and restricted time period to complete the installation to maintain the public supply to the mains network. The project team had recognised that the option of an under pressure tie-in would allow the client to continue uninterrupted service with no shut down. It was important to win the confidence of the Scottish Water's operational team, who had not previously experienced a live tie in of this nature, by demonstrating adequate planning had been

undertaken and the risks involved in the operation had been identified and managed. The operations were undertaken smoothly and the team were able to achieve the tie-ins in a shorter timescale than the planned conventional method.

Plant Commissioning

The testing, commissioning and handover of the works was an arduous operation and was carried out over a 6 month period, requiring meticulous planning and input from all parties. The main concern was some items of new plant could not be commissioned off line and therefore had potential to put the public water supply at risk. Accordingly, the commissioning plan had to be developed and the risks managed. When the new actiflo plant was brought into service this was completed in phased stages by introducing new elements (e.g. new chemical) and thoroughly testing, monitoring and proving the plant performance before moving on to the next stage of commissioning. To mitigate the risk, facilities were provided to bypass the actiflo plant and revert back to the original treatment process. Like many complex major process plants, the commissioning of the new plant did have challenges and several design amendments and site modifications were implemented. As such, the new plant successfully completed the process performance testing and was handed over to Scottish Water in time for compliance with the Legislative date of 31st March 2010.

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Turbine

Courtesy of Scottish Water Solutions & GMJV