Hazards Green WTW

UV cryptosporidium inactivation project - the last of the ten AMP5 DWI regulatory outputs successfully achieved by South East Water

by Brian Steventon CEng IET

Hazards Green WTW, which is located on the A269 between Battle and Herstmonceux, East Sussex, consists of two process streams which deliver a combined maximum pumped flow of 210l/s (18Ml/d) to the company's reservoirs near Hailsham and Ninfield before supplying approximately 43,000 South East Water customers with potable water. The first stream was built in the 1960s and the second stream in 2007. Raw water is abstracted from the Wallers Haven River as well as two on site boreholes. The site can also be supported from Darwell Reservoir.

Re-lift pumping station - Courtesy of Nomenca

Meeting the DWI regulatory outputs

Both streams are combined at the granulated activated carbon (GAC) adsorbers with the output chlorinated before being passed onto the contact tank. It was decided that in order to meet the DWI output that all flows out of the GAC filters would be intercepted and directed to a new re-lift pumping station before passing onto a duty/standby low pressure high output UV reactor.

The treated flow is then returned to the pipeline prior to the chlorination point. Initially, the re-lift pumping station was to be constructed to the rear of the GAC filter building; however as there was sufficient space within the GAC building, the new UV plant was accommodated within the existing building. This meant that there was no cost or planning permission required for a new building.

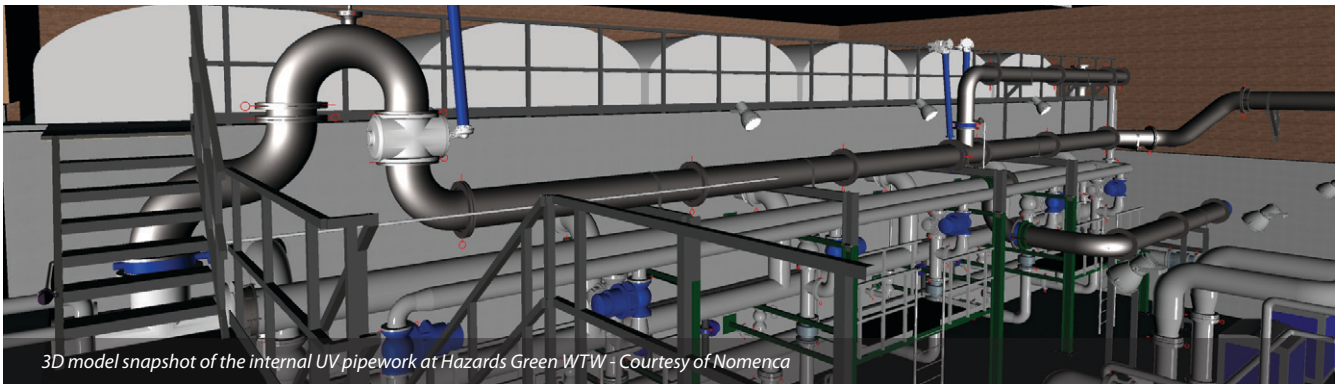
BIM technology

After a competitive tender period, a £1.2m NEC, Option C, Design and Build contract was awarded to Nomenca (who coincidentally achieved the first UV output of AMP5 in 2011) in June 2014. From the outset, effective use of BIM technology was used to design the UV system, not only in an efficient manner, but also paying due attention to the fact that the site itself is home to protected Great Crested Newts (GCN), a number of which would spend a proportion of their time in the grassed area designated for the location of the new re-lift pumping station.

It was decided to restrict the external works to a minimum in order to minimise any possible impact on the GCN population. In order to achieve this, the UV pipework system was designed to keep as much pipework as possible to within the existing building which also included the run to waste system, which instead of being returned to the GAC dirty backwash tank would instead be returned to the inlet of the GAC adsorbers thereby minimising any water loss.

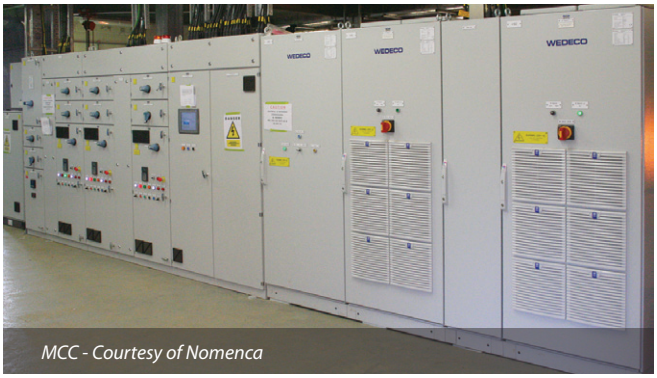
This solution of returning water to the GAC inlet also assisted in commissioning the new plant as it enabled the UV reactors and re-lift pumping station to be commissioned off-line whilst maintaining full operational output from the works.

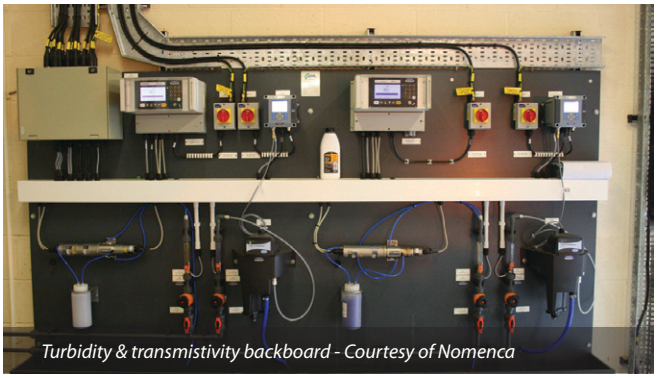
The use of the BIM technology demonstrated effectively how this could be achieved and showed that by using 600mm stainless steel pipework inside the building the amount of external and buried


3D model snapshot of the internal UV pipework at Hazards Green WTW - Courtesy of Nomenca


Reactors 1 and 2 - Courtesy of Nomenca


Re-lift pumps - Courtesy of Nomenca


MCC - Courtesy of Nomenca


Turbidity & transmistivity backboard - Courtesy of Nomenca

pipework was kept to a very short section from the building to the re-lift pumping station. The pumped return to the UV reactors was carried out at high level again using 600mm of stainless steel pipework.

Design considerations

It was further considered that having an elevated pumping station structure so the top water level (TWL) takes on the same TWL as the GAC filters the need for an overflow from the re-lift pumping station to the GAC dirty backwash tank could be avoided and further external pipework would be eliminated. The overall design progressed on this basis and additional environmental measures would be adopted to safeguard the grassed area, in particular the use of a grasscrete road system to form the foundation of the access approach road from the existing roadway up to the re-lift pumping station.

Procurement

After completing the Hazop, again utilising the BIM model, the design was effectively complete by the 'design freeze' key date as programmed for early October. During this period a number of key items were procured by Nomenca such as the control panels, the re-lift pumps and the UV Reactors, all of which would have a direct detrimental effect on achieving the DWI output if manufacturing delays were to be allowed to develop. In order to mitigate any delays from this aspect special expediting measures were put in place from the outset resulting in all these items of equipment being delivered to site either on time or ahead of programme.

Another aspect of the combined design and procurement stage was the initial decision to use off site precast concrete units to form the re-lift pumping station wet well. These units consisted of four sections and were built up off site by the manufacturer Kijlstra.

Great Crested Newts and the construction programme

Further consideration of the GCN population required the external works to be carried out during the winter months whilst the GCN would be in hibernation. The internal works however, would have no impacts on the newts and these began late September. The timing of the external construction was carefully managed so that no work would commence until after it could be certain that hibernation had begun.


Top of re-lift pumping station - Courtesy of Nomenca

The indicating test for this was to be five consecutive nights where the temperatures remain below 5ºC. For programming purposes this was taken to be 20 October 2014. In reality, however that particular winter period was unusually mild resulting in that condition not being met resulting in a delay to the start of the external works. This did not affect the internal works which began as planned.

Several assessments of the construction programme indicated the critical date for the construction programme would be the 8 December after which the completion date would be delayed from the contract sectional completion date of the 19 March. This in turn would put pressure on the DWI output of the 31 March 2015. The precast units were duly delivered at the end of October and with the external works were on hold, the internal works continued.

As December approached, other means to mitigate any further delays were identified which reduced the planned construction area to the minimum required to construct the works. The programme was also rescheduled to achieve some time enhancements.

Night time temperature readings were taken on a nightly basis and it was becoming clear late in November that it was getting colder and the indicating measure was observed by the 9 December. At this juncture, and in accordance with the environmental requirements, a fingertip search for the presence of any GCN was made of the construction area by an appointed ecologist. None were found and the external works began with the topsoil strip.

External works

As it happened, the precast units were put into place by the 17 January after carrying out four crane lifts over a two day period. The advantages of having the units pre-constructed were plain to see for a number of reasons.

Firstly, it was considered that traditional construction of the wet well would have meant that the pressure of achieving the DWI date would have increased. In addition, the use of the units meant there was no concrete curing time required and the mechanical installation could be started within two days of the wet well being built. Indeed the mechanical installation of the pumps and the follow on electrical work was ongoing at the same time as the wet testing and disinfection of the wet well.

The remaining external pipework was laid, the grasscrete road was constructed and the area landscaped by the end of February. During this time, and with the advantage of having the internal works completed as per the programme, the required site acceptance tests were successfully completed which in turn allowed the new UV facility to go into reliability and performance periods.

Completion

The Hazards Green WTW ultraviolet cryptosporidium inactivation project achieved its DWI regulatory output by the 17 March 2015, which was before the stated contract sectional completion date of the 19 March, and the final of the 12 remaining AMP5 DWI outputs was achieved.

Nomenca completed the works, carried out all the training requirements and produced all the final documentation and the contract was completed by the contract completion date of 22 April 2015.

TThe editor and publishers would like to thank Brian Steventon, Project Manager with South East Water, for providing the above article for publication.

The author would like to thank all the parties involved from South East Water, Jacobs, Nomenca and the supply chain, for contributing to the success of this project.