

Testwood Water Supply Works

£5.8 million upgrade improves efficiency, safety, water quality

by Mike Dancy

Southern Water's water supply works at Testwood, situated 8km west of Southampton, is the largest in Hampshire and is licensed to abstract up to 136 million litres of water a day from the River Test. The works supply a population equivalent of 200,000 customers in Totton, Waterside and Southampton as well as parts of the Isle of Wight via two 200mm diameter pipes running under the Solent. Testwood also supplies the Esso oil refinery at Fawley for use in the refinery processes and related industries. Between 2001 - 2003 Southern Water invested £5.8 million to upgrade and modernise the treatment process at the works, improving efficiency, safety and water quality. The existing rapid gravity sand filters were refurbished and modernised, gaseous disinfection dosing systems were replaced by safer liquid systems and a large contact tank constructed to ensure final water quality.



Mike Dancy, Project Manager with new filter controls (courtesy Southern Water).

Filter refurbishment

The £1 million filter refurbishment project involved:

- * replacing old media with new;
- * removing asbestos materials;
- * adding outlet flowmeters;
- * replacing control valves/actuators;
- * providing safe access to equipment;
- * replacing control systems.

Testwood has a total of 12 conventional rapid gravity filters, each rated at 8MI/d, arranged in two sets of four and two further sets of two. There is also a combined clarifier/filter unit, 'Enelco', with a potential output of 50 MI/d.

Each set of filters was taken out of service for refurbishment in turn so that the new Supervisory Control and Data Acquisition system (SCADA) could be developed and tested alongside the old system. This provided an opportunity for the SW controllers to familiarise themselves with the system 'off-line', easing the logistics of training staff employed on a shift system. The main difficulty faced by the contractors during the works was to maintain the output capacity and quality of water, but the *Enelco* unit helped smooth out the process flows. The old media was removed and replaced with new media using modern pumped material transfer equipment.

Chemical storage

This £2.5 million project involved replacing gaseous disinfection dosing systems with liquid systems for an increased level of safety. The work included:

- * replacing redundant On Site ElectroChlorination plant (OSEC) with sodium hypochlorite storage and dosing and removing the gas chlorine dosing system;
- * replacing the gas sulphur dioxide dosing system and temporary sodium bisulphite;
- * providing a hardwired works shutdown system on final water quality and dosing equipment availability;
- * linking all new systems to SCADA facility provided for the filter refurbishment project.

Design issues

Main design issues were the discrepancy between the actual plant flow as opposed to design flows and type of dose. The original design concept of dosing using carrier water was abandoned in favour of neat dosing because there were potential complications regarding mixing techniques which would impact on the hydraulics of the contact tank project. It was decided to mix by rapid dispersion at point of dose. Plant flows were rationalised to reflect actual demands with provisions for upgrading the dosing equipment when the plant's throughput increases.



Phil Marshall, Assistant Project Manager with varying grades of gravel for filter media (courtesy Southern Water).

Civil works

Civil works included providing three large chambers for the dosing lances, two kiosks to house sampling/mixing pumps and analysers, extensive underground cable/pipe ducts and associated drawpits. Some landscaping and paving has been provided to give safe access to the more remote equipment.

Design of the dosing plant enabled the majority of work to be factory assembled in skid form or within the kiosks. Space within the works permitted some equipment to be accommodated pre-assembled on backboards. The ICA panel was extensively tested at the manufacturers in conjunction with the ICA suppliers. The new control system was easily linked to the existing filter control SCADA system and could be accessed off-line to facilitate training at an early stage.

Commissioning of the new dosing plant had to take place in parallel with the functioning of the gaseous systems so that the control algorithms could be adjusted to suit the variety of loop times and flow variations. When the systems had stabilised, the gaseous systems were turned off and redundant plant removed. Commissioning of the main disinfection dosing plant could not take place until flow was established into the new contact tank.

Disinfection improvements

The scope of this part of the project included:

- * designing and building a tank to ensure 30 minutes disinfection contact time to filtered water rates up to 150 MI/d;
- * providing interconnecting pipework and valves between all existing filters (including Enelco unit), new contact tank and existing reservoirs from where the water is pumped to supply.

The size (4,400m³) and shape of the tank (40m x 30m x 3.7m) had been subjected to design studies pre-tender and a computer model generated to prove the process. The original concept was that flow would gravitate from the filters, through the contact tank and into the existing reservoirs. However, it later became apparent that intermediate pumping would be necessary and this was confirmed by measurements on site.

Pumping

Pumping, initially intended to be undertaken by variable speed drives, is performed by fixed speed canister pumps simply controlled by tank level. The control philosophy of the pumping system is to maintain the level within close limits in the contact tank, so that whatever comes into the tank is passed forward. Pump control is by PLC also linked to the new site SCADA system.

Project team approach

A dedicated team, comprised of members of *Southern Water's Project Delivery Group and Operations* together with contractors, *Paterson Candy Refurbishments Ltd (now Black & Veatch Refurbishments Ltd)* and *JT Mackley and Co Ltd.*, managed the projects. Combined weekly review meetings were instigated on site from the outset to ensure a full understanding of each individual group's needs and to promote a team working approach. At these meetings members of the team were able to identify the risks associated with each other's activities. These included issues such as the impact of chemical deliveries, the effect on the existing works infrastructure and process shutdowns.

The most difficult aspects of construction were the poor ground conditions with high water table. A sheet pile cofferdam was therefore installed to seal off the construction site from the environment and minimise de-watering. Logistics of the connections into the existing filter/reservoir pipework were complex and comprehensive risk assessments were carried out at every stage in order to maintain water supply. ■

Note: The author of this article, Mike Dancy, is Project Technical Manager with Southern Water.



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