

Layer de la Haye WTW, Essex

£3.8m primary filter conversion for Essex & Suffolk Water

by
Daniel Wilson

Layer de la Haye Water Treatment Works, located to the south of Colchester, supplies potable water to North Essex and into NE London. The treatment works serves a population of approximately 490,000 people. Raw water is supplied to the works from Abberton Reservoir and the process stream consists of Primary Filters, both Boby and Paterson streams, Slow Sand Filters (SSFs) and Final Chlorination. Seasonal algal blooms have significantly reduced the works output from an average of 100MI/d to, in the worst cases, 47MI/d. This output reduction has been caused by either poor algal removal through the primary filters and subsequent penetration onto the SSFs, or under bed pressure build up within the 'upflow' Boby style primary filters. Essex & Suffolk Water identified the need to modify these Boby filters from upflow to downflow and incorporate the installation of a dual media type construction to reduce algal related problems on site and aid filter throughput.



Layer de la Haye WTW

Photo courtesy Essex & Suffolk Water & Mowlem PLC

Process description and problem

The process stream at Layer is such that raw water supplied to the site from the P.Stn at Abberton Reservoir is fed primarily to two separate primary filter streams. The Paterson stream consists of 16 filters that were constructed in 1935. Refurbishment work was carried out in 2004 which included nozzle replacement, media replacement and structural repair. The Paterson filters have a design capacity of 82MI/d, although typically these filters operate at 75MI/d. The Boby stream consists of 12 filters constructed in 1971. These filters were originally upflow filters and combine their output with that of the Paterson stream to supply water onto the secondary SSFs. These SSFs comprise Granular Activated Carbon (GAC) sandwich formation for pesticide removal.

The Boby primary filters, prior to this conversion project, consisted

of a common high level inlet channel distributing water through a series of chambers and pipework to the underside of the filter floor. The water, driven by the head of water in the inlet channel was pushed up through the media. The original construction of these filters comprised support media in layers of 40-50mm gravel, 8-12mm gravel and 2-3mm gravel totalling 0.6m in depth on top of which a layer of 1.7m of sand was placed.

During the operational life of these filters the sand media had gradually penetrated down through the support media and caused significant blockages within the pipe laterals and nozzles. These blockages caused three key problems:-

- * cracking of the floor slabs within each filter due to pressure build up within the laterals;

- * blocking of nozzles and pipework increased the velocity of water through the unblocked nozzles causing fluidisation of the media during routine operations;
- * this caused significant breakthrough of suspended solids and, when present in the raw water - algae;
- * poor washing patterns resulting in areas of the filter remaining unwashed and subsequently increasing pressures beneath the bed during routine operation;
- * the breakthrough of suspended solids and algae onto the SSFs generated an intensive skimming programme on the site which in turn led to a decrease in the works output during this recovery period.

Design & Construction

Essex & Suffolk Water worked closely with both Mowlem and Leopold when designing a solution to the problems. The existing structure of the Bobby Filters provided ample space for the installation of the Leopold floors, with the added benefit that the existing backwash pipework could be utilised and would, therefore, not require modification. The proposed design to utilise a dual media arrangement combining an anthracite cap on top of sand, and reversing the filter flow from upflow to downflow provided the following advantages:-

- * the filters would no longer be subjected to underfloor pressures that had previously caused significant structural defects;
- * the dual media arrangement would provide an element of tolerated blinding within the anthracite layer prior to triggering headloss generated washes;
- * the anthracite layer would enable contact filtration to be added at a later date if pilot trials proved successful for both NTU reduction and increased performance in terms of algal removal.

The Bobby filters were to remain operational throughout the entire construction and commissioning period which spanned the months of high demand. To achieve this, the project was carried out in three stages, enabling handover of packages of filters to the construction team. As each package, typically consisting of 5 or 6 filters, was completed these were brought online to work with the remaining filters. This method, however, required very close communication between all parties and required the operation of two PLC's, one controlling the refurbished filters and one controlling the existing filters.

The Bobby primary filter conversion project was completed ahead of schedule and under budget. This was largely due to effective construction procedures identified by Mowlem and a dedicated project team based on site. The filters continue to operate under varying raw water quality conditions and flow rates. The filters are providing a robust barrier to algal penetration onto the SSFs and the reduced backwash frequency across the filters, as a result of the anthracite cap, has subsequently reduced process losses on site. ■

Note: The author of this article, Daniel Wilson, is Project Manager with Essex & Suffolk Water.



Media installation to Filter No.7 courtesy Essex & Suffolk Water & Mowlem PLC

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Aquazone are pleased to be associated with the Primary Filter Conversion Project at the Layer de la Haye WTW.

Our involvement in this work was as a sub-contract to Mowlem for the installation of Leopold Underdrain Systems.

Aquazone have a good reputation for Quality, Safety, Value and Delivery of a cost effective programme on all our work and as a result of this we have recently been awarded two 5 year Framework contracts with Northumbrian Water Group for the AMP4 period. These are Minor Works Civil South and Minor Works Process & Mechanical South. We have a high level of understanding of the CDM regulations and the proposed changes. We are accredited with the Achilles Verify scheme and are currently working towards the New ISO Integrated Management System for Quality, Environment and Health & Safety.

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