

East Shefford STW

ultra-low phosphorus scheme

by Adrian Jack ChPP MAPM & Matthew Langdon

East Shefford Sewage Treatment Works (STW) discharges into the River Lambourn. This stretch of water is a classic example of a lowland chalk stream. It has been designated as the River Lambourn Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI). Water quality measurements show that although the East Shefford STW is meeting its current phosphorus consent, phosphorus concentrations from all sources are high in many stretches. The project was required to upgrade East Shefford STW to provide treatment capacity to achieve a tightened final effluent phosphorous consent of 0.25 mg/l as Total P (annual average) with a stretch target of 0.1 mg/l for the 2031 design horizon.



View overlooking the completed East Shefford STW Actiflo® plant - Courtesy of Thames Water

Background

The sewerage catchment experiences significant variations in the levels of groundwater infiltration into the network, and as such, there is a very wide seasonal range of flows that arrive at the works requiring treatment. The existing works provided preliminary screening of crude sewage, inlet flow balancing, primary settlement, and biological filtration, followed by settlement in humus tanks and nitrifying sand filters (NSF) for tertiary treatment. Ferric sulphate is dosed upstream of the primary settlement tanks (PSTs) for phosphorus removal. Records show that over the past 10 years the site has achieved an annual average Total P concentration of 0.4 mg/l against a permit limit of 1 mg/l in the final effluent.

In order to meet the new ultra-low phosphorus stretch target of 0.1 mg/l as Total P (annual average), Thames Water needed to provide secondary coagulant dosing and an additional tertiary treatment phosphorus removal process at the back-end of the existing treatment process.

Following its AMP7 Intelligent Client Model, Thames Water contracted delivery of the project to its regional framework contractor Tilbury Douglas Construction Ltd, with Arcadis as their designer.

Actiflo® selection

Thames Water considered a number of alternative processes to achieve the ultra-low phosphorus requirement, but ultimately selected Actiflo® from Veolia Water Technologies, as it was considered the only technology that was already proven to be capable of achieving Total P concentrations as low as 0.1 mg/l across the broad range of influent conditions. The chosen design comprised two Actiflo® AS3 units operating in parallel, new ferric coagulant and polymer dosing units from Aquazone, Actisand™ dosing plant from Veolia, as well as pumping and power upgrades.

Actiflo® has been used globally since the late 1990s operating on drinking and wastewater solutions. With over 150 Actiflo®

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plants used for phosphorus removal applications, the technology is well proven globally for meeting the ultra-low phosphorus requirements now coming into force in the UK. Thames Water have used Actiflo® (to meet a different operational need) since 2007, so are experienced with its operations and reliability.

East Shefford is the third site in the UK to utilise the packaged Actiflo® technology for ultra-low phosphorus in AMP7, with a fourth, larger concrete Actiflo® plant which will be commissioned in late 2024. Actiflo® has a proven track record in the UK of achieving ultra-low phosphorus with the two installations operating since the beginning of AMP7 achieving 0.08 mg/l and 0.1 mg/l Total P respectively. These are both packaged plants, with one of them being identical to that now installed at East Shefford. This gave Thames Water the ability to visit that site and review the technology, installation and operation first hand.

Thames Water worked closely with Veolia Water Technologies to ensure lessons were learnt from its existing Actiflo® and other UK installations. In particular, these focussed on automation of the whole package and tailoring the control philosophy to optimise performance to East Shefford's year-round specific flow conditions.



Close up view of the completed Actiflo® AS3 units - Courtesy of Thames Water



Actiflo® fits in a very restricted footprint - Courtesy of Thames Water



View overlooking the completed East Shefford STW Actiflo® plant
Courtesy of Thames Water

What is Actiflo®?

Actiflo® is a fully standardised modular design utilising off the shelf items such as mixers, lamellas, pumps, instruments and hydro-cyclones. This ensures items are readily available and reduces build times and delivery to site. Components such as actuators and valves were sourced from Thames Water framework suppliers to assure ease of maintenance and supply, and also provide Thames Water with a future-proof design.

Due to its patented design and Turbo Mix technology, Actiflo® is the smallest clarification technology available on the market, with a very small footprint when compared to other phosphorus removal solutions, allowing it to fit into space-constrained sites such as East Shefford, whilst still meeting the ultra-low phosphorus requirements. Received effluent flows vary significantly throughout the year. When flows are low, Thames Water alternate flows between units to ensure a 24/7 state of readiness for high flows which can occur quickly at East Shefford.

The Actiflo® vessels were assembled from a self-jigging design allowing the four stainless steel units to be easily fabricated off site, quality assured, fitted out and delivered in a substantially complete state to minimise site assembly. Due to the restricted nature of the site, the project had to temporarily divert the existing overhead power cable, so the modular design minimised supply interruptions to Thames Waters customers.

One of the most important factors in using a chemically assisted phosphorus removal system is that no adverse harm is caused to the environment. The East Shefford Actiflo® units discharge to a sensitive ecosystem and polymer/ferric in the effluent were of concern. However, due to the ballasted clarification process of Actiflo®, residual chemicals are bound with Actisand™, which is then recycled and reused rather than passing in the environment.

Veolia Water Technologies guarantee 2.5 mg/l for iron (95%ile), 20mg/l for TSS, and 0.08mg/l for phosphorus, which gave Thames confidence in the performance of the technology.

Thames Water have taken advantage of Veolia Water Technologies' remote digital support platform and integrated data collection into Thames Water's digital estate, allowing near real time monitoring of the performance of the Actiflo® plant at East Shefford.

This combined with a Performance Support Package means that Veolia and Thames Water will continue to work collaboratively over the next 12 months to further optimise the performance of the technology, reducing chemical usage, associated OPEX, improving compliance, and proactively identifying improvements that can be made to deal with the varying conditions.

East Shefford STW: Supply chain - key participants

- **Client:** Thames Water
- **Main contractor:** Tilbury Douglas Construction Ltd
- **Design consultant:** Arcadis
- **Actiflo® technology:** Veolia Water Technologies
- **Mechanical/electrical contractor:** Bridges Limited
- **Chemical dosing contractor:** Aquazone Limited
- **Pump supplier:** Xylem Water Solutions

Project progress

Installation of the East Shefford Actiflo® units was completed in June 2024 and are expected to be handed over in September 2024, three months ahead of the WINEP output regulatory date.

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CTM Systems Ltd designed, manufactured and installed a brand-new replacement grit screw to take the grit to a multi-skip loading area. The conveyor was installed and commissioned Q1 2024.

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